Aruba 2930 M/F
Management and Configuration Guide
for AOS-S Switch 16.10

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This guide provides information on how to configure, manage, and monitor basic switch operation.

Applicable products

This guide applies to these products:

- Aruba 2930F Switch Series (JL253A, JL254A, JL255A, JL256A, JL258A, JL259A, JL260A, JL261A, JL262A, JL263A, JL264A, JL557A, JL558A, JL559A, JL692A, JL693A)
- Aruba 2930M Switch Series (JL319A, JL320A, JL321A, JL322A, JL323A, JL324A, R0M67A, R0M68A)

Switch prompts used in this guide

Examples in this guide are representative and may not match your particular switch/environment. Examples use simplified prompts as follows:

Prompt	Explanation
`switch#`	`#` indicates manager context (authority).
`switch>`	`>` indicates operator context (authority).
`switch(config)#`	`(config)` indicates the config context.
`switch(vlan-x)#`	`(vlan-x)` indicates the vlan context of config, where *x* represents the VLAN ID. For example: `switch(vlan-128)#`.
`switch(eth-x)#`	`(eth-x)` indicates the interface context of config, where `x` represents the interface. For example: `switch(eth-48)#`.
`switch-Stack#`	`Stack` indicates that stacking is enabled.
`switch-Stack(config)#`	`Stack(config)` indicates the config context while stacking is enabled.
`switch-Stack(stacking)#`	`Stack(stacking)` indicates the stacking context of config while stacking is enabled.
`switch-Stack(vlan-x)#`	`Stack(vlan-x)` indicates the vlan context of config while stacking is enabled, where *x* represents the VLAN ID. For example: `switch-Stack(vlan-128)#`.

Prompt	Explanation
`switch-Stack(eth-x/y)#`	`Stack(eth-x/y)` indicates the interface context of config, in the form `(eth-<member-in-stack>/<interface>)`. For example: `switch(eth-1/48)#`

NOTE

For successful time protocol setup and specific configuration details, you may need to contact your system administrator regarding your local configuration.

General steps for running a time protocol on the switch

Using time synchronization ensures a uniform time among interoperating devices. This helps you to manage and troubleshoot switch operation by attaching meaningful time data to event and error messages.

The switch offers TimeP, SNTP (Simple Network Time Protocol), NTP, and a `timesync` command for changing the time protocol selection (or turning off time protocol operation).

Although you can create and save configurations for all time protocols without conflicts, the switch allows only one active time protocol at any time.

In the factory-default configuration, time synchronization is disabled by default.

NOTE

Because the Aruba 2930F Switch does not contain an RTC (real time clock) chip, Hewlett Packard Enterprise recommends configuring one of the time synchronization protocols supported. Failure to do so could result in the switch time being reset to the factory default of 01/01/1990 00:00:00 in the case of a switch reload, software upgrade, or power cycle.

Because the Aruba 2540 Switch Series does not contain an RTC (real time clock) chip, Hewlett Packard Enterprise recommends configuring one of the time synchronization protocols supported. Failure to do so could result in the switch time being reset to the factory default of 01/01/1990 00:00:00 in the case of a switch reload, software upgrade, or power cycle.

SNTP time synchronization

SNTP provides three operating modes:

- **Broadcast mode**

  The switch acquires time updates by accepting the time value from the first SNTP time broadcast detected. (In this case, the SNTP server must be configured to broadcast time updates to the network broadcast address; see the documentation provided with your SNTP server application.) Once the switch detects a particular server, it ignores time broadcasts from other SNTP servers unless the configurable Poll Interval expires three consecutive times without an update received from the first-detected server.

  NOTE

  To use Broadcast mode, the switch and the SNTP server must be in the same subnet.

- **DHCP mode**

DHCP mode is enabled by default. In DHCP mode, the SNTP server address and the timezone are provided in the DHCP address reply.

- **Unicast mode**

  The switch requests a time update from the configured SNTP server. (You can configure one server using the menu interface, or up to three servers using the CLI sntp server command.) This option provides increased security over the Broadcast mode by specifying which time server to use instead of using the first one detected through a broadcast.

NTP time synchronization

The Network Time Protocol (NTP) synchronizes the time of day among a set of distributed time servers and clients in order to correlate events when receiving system logs and other time-specific events from multiple network devices. NTP uses the User Datagram Protocol (UDP) as its transport protocol.

timesync Command

This command is used to configure the protocol used for network time synchronization.

Syntax

```
no timesync { timep | sntp | timep-or-sntp | ntp }
```

Parameters

`no`

Deletes all timesync configurations on the device.

`timep`

Updates the system clock using TIMEP.

`sntp`

Updates the system clock using SNTP.

`timep-or-sntp`

Updates the system clock using TIMEP or SNTP (default).

`ntp`

Updates the system clock using NTP

Example

```
switch(config)# timesync
sntp                    Update the system clock using SNTP.
timep                   Update the system clock using TIMEP.
timep-or-sntp           Update the system clock using TIMEP or SNTP.
ntp                     Update the system clock using NTP.
```

Selecting a time synchronization protocol

Procedure

1. Select the time synchronization protocol: `TimeP`, `SNTP`, or `NTP`.
2. Enable the protocol; the choices are:

a. TimeP: `DHCP` or `Manual`

b. SNTP: `Broadcast` or `Unicast`

c. NTP: `Broadcast` or `Unicast`

3. Configure the remaining parameters for the time protocol you selected.

   The switch retains the parameter settings for both time protocols even if you change from one protocol to the other. Thus, if you select a time protocol, the switch uses the parameters you last configured for the selected protocol.

Simply selecting a time synchronization protocol does not enable that protocol on the switch unless you also enable the protocol itself (step 2, above). For example, in the factory-default configuration, TimeP is the selected time synchronization method. However, because TimeP is disabled in the factory-default configuration, no time synchronization protocol is running.

Disabling time synchronization

You can execute `no timesync` (global config level of the CLI) to disable time synchronization without changing the TimeP, SNTP, or NTP configuration.

TimeP: Selecting and configuring

The following table shows TimeP parameters and their operations.

Table 1: *TimeP parameters*

TimeP parameter	Operation
Time Sync Method	Used to select either TIMEP, SNTP, NTP, or None as the time synchronization method.
TimeP Mode	
Disabled	TimeP does not operate, even if specified by the Menu interface **Time Sync Method** parameter or the CLI `timesync` command.
DHCP	When TimeP is selected as the time synchronization method, the switch attempts to acquire a TimeP server IP address via DHCP. If the switch receives a server address, it polls the server for updates according to the TimeP poll interval. If the switch does not receive a TimeP server IP address, it cannot perform time synchronization updates.
Manual	When TimeP is selected as the time synchronization method, the switch attempts to poll the specified server for updates according to the TimeP poll interval. If the switch fails to receive updates from the server, time synchronization updates do not occur.
Server Address	Used only when the **TimeP Mode** is set to **Manual**. Specifies the IP address of the TimeP server that the switch accesses for time synchronization updates. You can configure one server.

Viewing the current TimeP configuration (CLI)

Using different `show` commands, you can display either the full TimeP configuration or a combined listing of all TimeP, SNTP, and VLAN IP addresses configured on the switch.

Syntax

`show timep`

Lists both the time synchronization method (TimeP, SNTP, or None) and the TimeP configuration, even if SNTP is not the selected time protocol. (If the TimeP Mode is set to `Disabled` or `DHCP`, the Server field does not appear.)

If you configure the switch with TimeP as the time synchronization method, then enable TimeP in DHCP mode with the default poll interval, `show timep` lists the following:

TimeP configuration when TimeP is the selected Time synchronization method

```
switch(config)# show timep

 Timep Configuration

  Time Sync Mode: Timep
  TimeP Mode [Disabled] : DHCP    Server Address : 10.10.28.103
  Poll Interval (min) [720] : 720
```

If SNTP is the selected time synchronization method, `show timep` still lists the TimeP configuration even though it is not currently in use. Even though, in this Example:, SNTP is the current time synchronization method, the switch maintains the TimeP configuration:

TimeP configuration when TimeP is not the selected time synchronization method

```
switch(config)# show timep

 Timep Configuration

  Time Sync Mode: Sntp
  TimeP Mode [Disabled] : Manual   Server Address : 10.10.28.100
  Poll Interval (min) [720] : 720
```

Syntax

`show management`

Helps you to easily examine and compare the IP addressing on the switch. It lists the IP addresses for all time servers configured on the switch plus the IP addresses and default gateway for all VLANs configured on the switch.

Display showing IP addressing for all configured time servers and VLANs

```
switch(config)# show management

 Status and Counters - Management Address Information

  Time Server Address : 10.10.28.100

  Priority SNTP Server Address                          Protocol Version
  -------- ------------------------------------------- ----------------
  1        10.10..28.101                                3
  2        10.255.5.24                                  3
  3        fe80::123%vlan10                             3
```

```
Default Gateway : 10.0.9.80

VLAN Name    MAC Address         | IP Address
------------ ------------------- + -------------------
DEFAULT_VLAN 001279-88a100       | 10.30.248.184
VLAN10 001279-88a100             | 10.0.10.17
```

Configuring (enabling or disabling) the TimeP mode

Enabling the TimeP mode means to configure it for either broadcast or unicast mode. Remember to run TimeP as the switch's time synchronization protocol, you must also select TimeP as the time synchronization method by using the CLI `timesync` command.

Syntax

`timesync timep`

Selects TimeP as the time synchronization method.

Syntax

`ip timep {<dhcp | manual>}`

Enables the selected TimeP mode.

Syntax

`no ip timep`

Disables the TimeP mode.

Syntax

`no timesync`

Disables the time protocol.

Enabling TimeP in manual mode (CLI)

Like DHCP mode, configuring TimeP for `manual` mode enables TimeP. However, for manual operation, you must also specify the IP address of the TimeP server. (The switch allows only one TimeP server.)

Syntax

`timesync timep`

Selects TimeP.

Syntax

`ip timep manual <ip-addr>`

Activates TimeP in manual mode with a specified TimeP server.

Syntax

`no ip timep`

Disables TimeP.

Enabling TimeP in DHCP Mode

Because the switch provides a TimeP polling interval (default:720 minutes), you need only these two commands for a minimal TimeP DHCP configuration:

Syntax

```
timesync timep
```

Selects TimeP as the time synchronization method.

Syntax

```
ip timep dhcp
```

Configures DHCP as the TimeP mode.

For example, suppose:

- Time Synchronization is configured for SNTP.
- You want to:
  - View the current time synchronization.
  - Select TimeP as the synchronization mode.
  - Enable TimeP for DHCP mode.
  - View the TimeP configuration.

Enabling TimeP in Manual Mode

Like DHCP mode, configuring TimeP for Manual Mode enables TimeP. However, for manual operation, you must also specify the IP address of the TimeP server. (The switch allows only one TimeP server.) To enable the TimeP protocol:

Syntax

```
timesync timep
```

Selects TimeP.

Syntax

```
ip timep manual <ip-addr>
```

Activates TimeP in manual mode with a specified TimeP server.

Syntax

```
no ip timep
```

Disables TimeP.

To change from one TimeP server to another, you must use the `no ip timep` command to disable TimeP mode, the reconfigure TimeP in manual mode with the new server IP address.

Example

To select TimeP and configure it for manual operation using a TimeP server address of 10.28.227.141 and the default poll interval (720 minutes, assuming the TimeP poll interval is already set to the default):

```
switch(config)# timesync time
```

Selects TimeP.

```
switch(config)# ip timep manual 10.28.227.141
```

Activates TimeP in Manual mode.

Configuring TimeP for manual operation

```
switch(config)# timesync timep
switch(config)# ip timep manual 10.28.227.141
switch(config)# show timep
 Timep Configuration
  Time Sync Mode: Timep
  TimeP Mode :  Manual              Server Address : 10.28.227.141
  Poll Interval (min) : 720
```

Changing from one TimeP server to another (CLI)

Procedure

1. Use the `no ip timep` command to disable TimeP mode.
2. Reconfigure TimeP in Manual mode with the new server IP address.

Changing the TimeP poll interval (CLI)

Syntax

`ip timep {< dhcp | manual >} interval <1-9999>`

Specifies how long the switch waits between time polling intervals. The default is 720 minutes and the range is 1 to 9999 minutes. (This parameter is separate from the `poll interval` parameter used for SNTP operation.)

Example

To change the poll interval to 60 minutes:

```
switch(config)# ip timep interval 60
```

Disabling time synchronization without changing the TimeP configuration (CLI)

Syntax

`no timesync`

Description

Disables time synchronization by changing the `Time Sync Mode` configuration to `Disabled`. This halts time synchronization without changing your TimeP configuration.The recommended method for disabling time synchronization is to use the `timesync` command.

Example

Suppose TimeP is running as the switch's time synchronization protocol, with `DHCP` as the TimeP mode, and the factory-default polling interval. You would halt time synchronization with this command:

```
switch(config)# no timesync
```

If you then viewed the TimeP configuration, you would see the following:

TimeP with time synchronization disabled

```
switch(config)# show timep

 Timep Configuration
 Time Sync Mode: Disabled
 TimeP Mode : DHCP Poll Interval (min): 720
```

Disabling the TimeP mode

Syntax

`no ip timep`

Disables TimeP by changing the TimeP mode configuration to `Disabled` and prevents the switch from using it as the time synchronization protocol, even if it is the selected `Time Sync Method` option.

Example

If the switch is running TimeP in DHCP mode, `no ip timep` changes the TimeP configuration as shown below and disables time synchronization. Even though the TimeSync mode is set to TimeP, time synchronization is disabled because `no ip timep` has disabled the TimeP mode parameter.

Disabling time synchronization by disabling the TimeP mode parameter

```
switch(config)# no ip timep

switch(config)# show timep

 Timep Configuration
  Time Sync Mode: Timep
  TimeP Mode : Disabled
```

SNTP: Selecting and configuring

The following table shows the SNTP parameters and their operations.

Table 2: *SNTP parameters*

SNTP parameter	Operation
Time Sync Method	Used to select either SNTP, TIMEP, NTP, or None as the time synchronization method.
SNTP Mode	
`Disabled`	The Default. SNTP does not operate, even if specified by the Menu interface **Time Sync Method** parameter or the CLI `timesync` command.
`Unicast`	Directs the switch to poll a specific server for SNTP time synchronization. Requires at least one server address.
`Broadcast`	Directs the switch to acquire its time synchronization from data broadcast by any SNTP server to the network broadcast address. The switch uses the first server detected and ignores any others. However, if the Poll Interval expires three times without the switch detecting a time update from the original server, the switch accepts a broadcast time update from the next server it detects.
Poll Interval (seconds)	**In Unicast Mode:** Specifies how often the switch polls the designated SNTP server for a time update. **In Broadcast Mode:** Specifies how often the switch polls the network broadcast address for a time update. Value is between 30 to 720 seconds.

SNTP parameter	Operation
Server Address	Used only when the **SNTP Mode** is set to `Unicast`. Specifies the IP address of the SNTP server that the switch accesses for time synchronization updates. You can configure up to three servers; one using the menu or CLI, and two more using the CLI.
Server Version	Specifies the SNTP software version to use and is assigned on a per-server basis. The version setting is backwards-compatible. For example, using version 3 means that the switch accepts versions 1 through 3. Default: 3; range: 1 to 7.
Priority	Specifies the order in which the configured servers are polled for getting the time. Value is between 1 and 3.

Viewing and configuring SNTP (CLI)

Syntax

`show sntp`

Lists both the time synchronization method (`TimeP`, `SNTP`, or `None`) and the SNTP configuration, even if SNTP is not the selected time protocol.

If you configure the switch with SNTP as the time synchronization method, then enable SNTP in broadcast mode with the default poll interval, `show sntp` lists the following:

SNTP configuration when SNTP is the selected time synchronization method

```
switch(config)# show sntp

 SNTP Configuration

  Time Sync Mode: Sntp
  SNTP Mode : Unicast
  Poll Interval (sec) [720] : 719


  Priority SNTP Server Address            Protocol Version
  -------- ------------------------------ ----------------
  1        2001:db8::215:60ff:fe79:8980   7
  2        10.255.5.24                    3
  3        fe80::123%vlan10               3
```

In the factory-default configuration (where TimeP is the selected time synchronization method), `show sntp` still lists the SNTP configuration, even though it is not currently in use. In SNTP configuration when SNTP is not the selected time synchronization method on page 19, even though TimeP is the current time synchronous method, the switch maintains the SNTP configuration.

SNTP configuration when SNTP is not the selected time synchronization method

```
switch(config)# show sntp

 SNTP Configuration

  Time Sync Mode: Timep
  SNTP Mode : Unicast
  Poll Interval (sec) [720] : 719
```

```
  Priority SNTP Server Address            Protocol Version
  -------- ------------------------------ ----------------
  1        2001:db8::215:60ff:fe79:8980   7
  2        10.255.5.24                    3
  3        fe80::123%vlan10               3
```

Syntax

```
show management
```

This command can help you to easily examine and compare the IP addressing on the switch. It lists the IP addresses for all time servers configured on the switch, plus the IP addresses and default gateway for all VLANs configured on the switch.

Display showing IP addressing for all configured time servers and VLANs

```
switch(config)# show management

 Status and Counters - Management Address Information

  Time Server Address : fe80::215:60ff:fe7a:adc0%vlan10

  Priority  SNTP Server Address            Protocol Version
  --------- ------------------------------ ----------------
  1         2001:db8::215:60ff:fe79:8980   7
  2         10.255.5.24                    3
  3         fe80::123%vlan10               3


  Default Gateway   :10.0.9.80

  VLAN Name    MAC Address     | IP address
  ------------ --------------- + ---------------
  DEFAULT_VLAN 001279-88a100   | Disabled
  VLAN10       001279-88a100   | 10.0.10.17
```

Configuring (enabling or disabling) the SNTP mode

Enabling the SNTP mode means to configure it for either broadcast or unicast mode. Remember that to run SNTP as the switch's time synchronization protocol, you must also select SNTP as the time synchronization method by using the CLI `timesync` command.

Syntax

```
timesync sntp
```

Selects SNTP as the time protocol.

```
sntp {<broadcast | unicast>}
```

Enables the SNTP mode.

Syntax

```
sntp server <ip-addr>
```

Required only for unicast mode.

Syntax

```
sntp server priority <1-3>
```

Specifies the order in which the configured servers are polled for getting the time. Value is between 1 and 3.

Syntax

`sntp <30-720>`

Configures the amount of time between updates of the system clock via SNTP.

Default: 720 seconds

Enabling SNTP in Broadcast Mode

Because the switch provides an SNTP polling interval (default: 720 seconds), you need only these two commands for minimal SNTP broadcast configuration:

Syntax

`timesync sntp`

Selects SNTP as the time synchronization method.

Syntax

`sntp broadcast`

Configures broadcast as the SNTP mode.

Example

Suppose that time synchronization is in the factory-default configuration (TimeP is the currently selected time synchronization method.) Complete the following:

Procedure

1. View the current time synchronization.
2. Select **SNTP** as the time synchronization mode.
3. Enable **SNTP** for Broadcast mode.
4. View the SNTP configuration again to verify the configuration.

The commands and output would appear as follows:

```
switch(config)# show sntp [1]
 SNTP Configuration
  Time Sync Mode: Timep
  SNTP Mode : disabled
  Poll Interval (sec) [720] :720

switch(config)# timesync sntp

switch(config)# sntp broadcast

switch(config)# show sntp [2]
 SNTP Configuration
  Time Sync Mode: Sntp
  SNTP Mode : Broadcast
  Poll Interval (sec) [720] :720
```

[1] `show sntp` displays the SNTP configuration and also shows that TimeP is the currently active time synchronization mode.

[2] `show sntp` again displays the SNTP configuration and shows that SNTP is now the currently active time synchronization mode and is configured for broadcast operation.

Enabling SNTP in unicast mode (CLI)

Like broadcast mode, configuring SNTP for unicast mode enables SNTP. However, for unicast operation, you must also specify the IP address of at least one SNTP server. The switch allows up to three unicast servers.

You can use the Menu interface or the CLI to configure one server or to replace an existing unicast server with another. To add a second or third server, you must use the CLI. For more on SNTP operation with multiple servers, see SNTP unicast time polling with multiple SNTP servers on page 31.

Syntax

`timesync sntp`

Selects SNTP as the time synchronization method.

Syntax

`sntp unicast`

Configures the SNTP mode for unicast operation.

Syntax

`no sntp server priority < 1-3 > < ip-address > [version]`

Use the `no` version of the command to disable SNTP.

`priority`

Specifies the order in which the configured SNTP servers are polled for the time.

`ip-address`

An IPv4 or IPv6 address of an SNTP server.

`version`

The protocol version of the SNTP server. Allowable values are 1 through 7; default is 3.

Syntax

`no sntp server priority <1-3><ip-addr>`

Deletes the specified SNTP server.

`priority <1-3>` value must match what server is configured with. Deleting an SNTP server when only one is configured disables SNTP unicast operation.

Example

To select SNTP and configure it with unicast mode and an SNTP server at 10.28.227.141 with the default server version (3) and default poll interval (720 seconds):

```
switch(config)# timesync sntp
```

Selects SNTP.

```
switch(config)# sntp unicast
```

Activates SNTP in unicast mode.

```
switch(config)# sntp server priority 1 10.28.227.141
```

Specifies the SNTP server and accepts the current SNTP server version (default: 3).

Configuring SNTP for unicast operation

```
switch(config)# show sntp

 SNTP Configuration
```

```
  Time Sync Mode: Sntp
  SNTP Mode : Unicast
  Poll Interval (sec) [720] : 720


  Priority SNTP Server Address                              Protocol Version
  -------- ---------------------------------------------- ----------------
  1        2001:db8::215:60ff:fe79:8980                        7
  2        10.255.5.24                                         3
  3        fe80::123%vlan10                                    3
```

In this Example, the **Poll Interval** and the **Protocol Version** appear at their default settings.

Both IPv4 and IPv6 addresses are displayed.

Protocol Version appears only when there is an IP address configured for an SNTP server.

If the SNTP server you specify uses SNTP v4 or later, use the `sntp server` command to specify the correct version number. For example, suppose you learned that SNTP v4 was in use on the server you specified above (IP address 10.28.227.141). You would use the following commands to delete the server IP address , re-enter it with the correct version number for that server.

Specifying the SNTP protocol version number

```
switch(config)# no sntp server 10.28.227.141 1
switch(config)# sntp server 10.28.227.141 4 2
switch(config)# show sntp

 SNTP Configuration

  Time Sync Mode: Sntp
  SNTP Mode : Broadcast
  Poll Interval (sec) [720] : 600

  IP Address     Protocol Version
  -------------  -----------------
  10.28.227.141  4 3
```

[1]Deletes unicast SNTP server entry.

[2]Re-enters the unicast server with a non-default protocol version.

[3]`show sntp` displays the result.

Changing the SNTP poll interval (CLI)

Syntax

`sntp <30..720>`

Specifies the amount of time between updates of the system clock via SNTP. The default is 720 seconds and the range is 30 to 720 seconds. (This parameter is separate from the poll interval parameter used for Timep operation.)

Example

To change the poll interval to 300 seconds:

```
switch(config)# sntp 300
```

Changing the SNTP server priority (CLI)

You can choose the order in which configured servers are polled for getting the time by setting the server priority.

Syntax

`sntp server priority <1-3> <ip-address>`

Specifies the order in which the configured servers are polled for getting the time Value is between 1 and 3.

You can enter both IPv4 and IPv6 addresses. For more information about IPv6 addresses, see the IPv6 configuration guide for your switch.

Example

To set one server to priority 1 and another to priority 2:

```
switch(config)# sntp server priority 1 10.28.22.141

switch(config)# sntp server priority 2
                 2001:db8::215:60ff:fe79:8980
```

Disabling time synchronization without changing the SNTP configuration (CLI)

The recommended method for disabling time synchronization is to use the `timesync` command.

Syntax

`no timesync`

Halts time synchronization without changing your SNTP configuration.

Example

Suppose SNTP is running as the switch's time synchronization protocol, with `broadcast` as the SNTP mode and the factory-default polling interval. You would halt time synchronization with this command:

```
switch(config)# no timesync
```

If you then viewed the SNTP configuration, you would see the following:

SNTP with time synchronization disabled

```
switch(config)# show sntp
SNTP Configuration
Time Sync Mode: Disabled
SNTP Mode : Broadcast
Poll Interval (sec) [720] : 720
```

Disabling the SNTP Mode

If you want to prevent SNTP from being used even if it is selected by `timesync`, configure the SNTP mode as disabled.

Syntax

`no sntp`

Disables SNTP by changing the SNTP mode configuration to `Disabled`.

Example

If the switch is running SNTP in unicast mode with an SNTP server at 10.28.227.141 and a server version of 3 (the default), `no sntp` changes the SNTP configuration as shown below and disables time synchronization on the switch.

Disabling time synchronization by disabling the SNTP mode

```
switch(config)# no sntp
switch(config)# show sntp

 SNTP Configuration

  Time Sync Mode: Sntp
  SNTP Mode : disabled
  Poll Interval (sec) [720] : 600

  IP Address      Protocol Version
  -------------   -----------------
  10.28.227.141   3
```

Note that even though the **Time Sync Mode** is set to **Sntp**, time synchronization is disabled because `no sntp` has disabled the **SNTP Mode** parameter.

SNTP client authentication

Enabling SNTP authentication allows network devices such as switches to validate the SNTP messages received from an NTP or SNTP server before updating the network time. NTP or SNTP servers and clients must be configured with the same set of authentication keys so that the servers can authenticate the messages they send and clients (switches) can validate the received messages before updating the time.

This feature provides support for SNTP client authentication on switches, which addresses security considerations when deploying SNTP in a network.

Requirements

You must configure the following to enable SNTP client authentication on the switch.

SNTP client authentication support

- TTimesync mode must be SNTP. Use the `timesync sntp` command. (SNTP is disabled by default).
- SNTP must be in unicast or broadcast mode. See Configuring unicast and broadcast mode for authentication.
- The MD5 authentication mode must be selected.
- An SNTP authentication key-identifier (`key-id`) must be configured on the switch and a value (`key-value`) must be provided for the authentication key. A maximum of 8 sets of `key-id` and `key-value` can be configured on the switch.
- Among the keys that have been configured, one key or a set of keys must be configured as trusted. Only trusted keys are used for SNTP authentication.
- If the SNTP server requires authentication, one of the trusted keys has to be associated with the SNTP server.
- SNTP client authentication must be enabled on the Switch. If client authentication is disabled, packets are processed without authentication.

All of the above steps are necessary to enable authentication on the client.

SNTP server authentication support

SNTP server is not supported on Switch products.

You must perform the following on the SNTP server:

- The same authentication key-identifier, trusted key, authentication mode and key-value that were configured on the SNTP client must also be configured on the SNTP server.
- SNTP server authentication must be enabled on the server.

If any of the parameters on the server are changed, the parameters have to be changed on all the SNTP clients in the network as well. The authentication check fails on the clients otherwise, and the SNTP packets are dropped.

Configuring the key-identifier, authentication mode, and key-value (CLI)

This command configures the `key-id`, `authentication-mode`, and `key-value`, which are required for authentication. It is executed in the global configuration context.

Syntax

`sntp authentication key-id <key-id> authentication-mode <md5> key-value <key-string> [trusted]`
`no sntp authentication key-id <key-id>`

Configures a key-id, authentication-mode (MD5 only), and key-value, which are required for authentication.

The `no` version of the command deletes the authentication key.

Default: No default keys are configured on the switch.

`key-id`

A numeric key identifier in the range of 1-4,294,967,295 (2^{32}) that identifies the unique key value. It is sent in the SNTP packet.

`key-value <key-string>`

The secret key that is used to generate the message digest. Up to 32 characters are allowed for *`key-string`*.

`encrypted-key <<key-string>>`

Set the SNTP authentication key value using a base64-encoded aes-256 encrypted string.

Setting parameters for SNTP authentication

```
switch(config)# sntp authentication key-id 55 authentication-mode md5
key-value secretkey1
```

Configuring a trusted key

Trusted keys are used in SNTP authentication. In unicast mode, you must associate a `trusted` key with a specific NTP/SNTP server. That key is used for authenticating the SNTP packet.

In unicast mode, a specific server is configured on the switch so that the SNTP client communicates with the specified server to get the date and time.

In broadcast mode, the SNTP client switch checks the size of the received packet to determine if it is authenticated. If the broadcast packet is authenticated, the key-id value is checked to see if the same key-id value is configured on the SNTP client switch. If the switch is configured with the same key-id value, and the key-id value is configured as "trusted," the authentication succeeds. Only trusted key-id value information is

used for SNTP authentication. For information about configuring these modes, see Configuring unicast and broadcast mode for authentication on page 28.

If the packet contains key-id value information that is not configured on the SNTP client switch, or if the received packet contains no authentication information, it is discarded. The SNTP client switch expects packets to be authenticated if SNTP authentication is enabled.

When authentication succeeds, the time in the packet is used to update the time on the switch.

Configuring a key-id as trusted (CLI)

Enter the following command to configure a key-id as trusted.

Syntax

```
sntp authentication key-id <key-id> trusted
no sntp authentication key-id <key-id> trusted
```

Trusted keys are used during the authentication process. You can configure the switch with up to eight sets of key-id/key-value pairs. One specific set must selected for authentication; this is done by configuring the set as `trusted`.

The `key-id` itself must already be configured on the switch. To enable authentication, at least one `key-id` must be configured as `trusted`.

The `no` version of the command indicates the key is unreliable (not trusted).

Default: No key is trusted by default.

For detailed information about trusted keys, see Configuring a trusted key on page 26.

Associating a key with an SNTP server (CLI)

Syntax

```
no sntp server priority <1-3> {< ip-address | ipv6-address >} <version-num> [key-id <1-4,294,967,295>]
```

Configures a `key-id` to be associated with a specific server. The key itself must already be configured on the switch.

The `no` version of the command disassociates the key from the server. This does not remove the authentication key.

Default: No key is associated with any server by default.

`priority`

Specifies the order in which the configured servers are polled for getting the time.

`version-num`

Specifies the SNTP software version to use and is assigned on a per-server basis. The version setting is backwards-compatible. For example, using version 3 means that the switch accepts versions 1 through 3. Default: 3; range: 1 - 7.

`key-id`

Optional command. The key identifier sent in the SNTP packet. This `key-id` is associated with the SNTP server specified in the command.

Associating a key-id with a specific server

```
switch(config)# sntp server priority 1 10.10.19.5 2 key-id 55
```

Enabling SNTP client authentication

The `sntp authentication` command enables SNTP client authentication on the switch. If SNTP authentication is not enabled, SNTP packets are not authenticated.

Syntax

`no sntp authentication`

Enables the SNTP client authentication.

The `no` version of the command disables authentication.

Default: SNTP client authentication is disabled.

Configuring unicast and broadcast mode for authentication

To enable authentication, you must configure either unicast or broadcast mode. When authentication is enabled, changing the mode from unicast to broadcast or vice versa is not allowed; you must disable authentication and then change the mode.

To set the SNTP mode or change from one mode to the other, enter the appropriate command.

Syntax

`sntp unicast`
`sntp broadcast`

Enables SNTP for either broadcast or unicast mode.

Default: SNTP mode is disabled by default. SNTP does not operate even if specified by the CLI `timesync` command.

`Unicast`	Directs the switch to poll a specific server periodically for SNTP time synchronization.The default value between each polling request is 720 seconds, but can be configured.At least one manually configured server IP address is required.

At least one `key-id` must be configured as `trusted`, and it must be associated with one of the SNTP servers. To edit or remove the associated `key-id` information or SNTP server information, SNTP authentication must be disabled.

`Broadcast`	Directs the switch to acquire its time synchronization from data broadcast by any SNTP server to the network broadcast address. The switch uses the first server detected and ignores any others. However, if the Poll Interval (configurable up to 720 seconds) expires three times without the switch detecting a time update from the original server, the switch accepts a broadcast time update from the next server it detects.

Viewing SNTP authentication configuration information (CLI)

The `show sntp` command displays SNTP configuration information, including any SNTP authentication keys that have been configured on the switch.

SNTP configuration information

```
switch(config)# show sntp
```

```
SNTP Configuration

 SNTP Authentication : Enabled
 Time Sync Mode: Sntp
 SNTP Mode : Unicast
 Poll Interval (sec) [720] : 720

 Priority SNTP Server Address                  Protocol Version KeyId
 -------- ------------------------------------ ---------------- -----
 1        10.10.10.2                           3                55
 2        fe80::200:24ff:fec8:4ca8             3                55
```

Viewing all SNTP authentication keys that have been configured on the switch (CLI)

Enter the `show sntp authentication` command, as shown in Show sntp authentication command output on page 29.

Show sntp authentication command output

```
switch(config)# show sntp authentication

  SNTP Authentication Information

  SNTP Authentication : Enabled

  Key-ID  Auth Mode  Trusted
  ------- ---------- --------
  55      MD5        Yes
  10      MD5        No
```

Viewing statistical information for each SNTP server (CLI)

To display the statistical information for each SNTP server, enter the `show sntp statistics` command.

The number of SNTP packets that have failed authentication is displayed for each SNTP server address, as shown in SNTP authentication statistical information on page 29.

SNTP authentication statistical information

```
switch(config)# show sntp statistics
SNTP Statistics

  Received Packets : 0
  Sent Packets : 3
  Dropped Packets : 0

  SNTP Server Address                    Auth Failed Pkts
  -------------------------------------- ----------------
  10.10.10.1                                 0
  fe80::200:24ff:fec8:4ca8                   0
```

Saving configuration files and the include-credentials command

You can use the `include-credentials` command to store security information in the running-config file. This allows you to upload the file to a TFTP server and then later download the file to the switches on which you want to use the same settings. For more information about the `include-credentials` command, see "Configuring Username and Password Security" in the access security guide for your switch.

The authentication key values are shown in the output of the `show running-config` and `show config` commands only if the `include-credentials` command was executed.

When SNTP authentication is configured and `include-credentials` has not been executed, the SNTP authentication configuration is not saved.

Configuration file with SNTP authentication information

```
switch(config) # show config
Startup configuration:
.
.
.
timesync sntp
sntp broadcast
sntp 50
sntp authentication
sntp server priority 1 10.10.10.2.3 key-id 55
sntp server priority 2 fe80::200:24ff:fec8:4ca8 4 key-id 55
```

SNTP authentication has been enabled and a key-id of 55 has been created.

In this Example:, the `include-credentials` command has not been executed and is not present in the configuration file. The configuration file is subsequently saved to a TFTP server for later use. The SNTP authentication information is not saved and is not present in the retrieved configuration files, as shown in the following Example:.

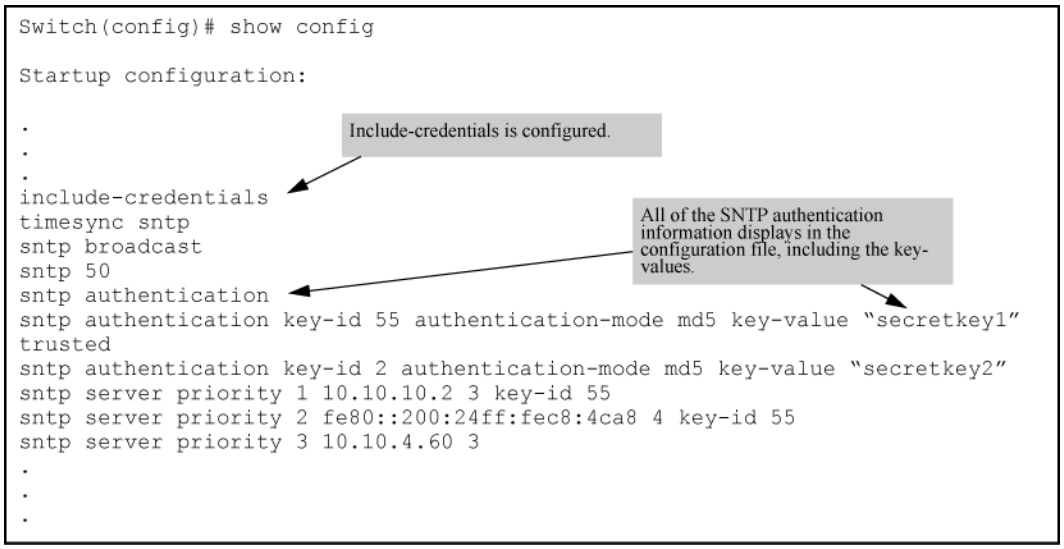
Retrieved configuration file when include credentials is not configured

```
switch(config) # copy tftp startup-config 10.2.3.44 config1
.
.
.
Switch reboots ...
.
Startup configuration
.
.
.
timesync sntp
sntp broadcast
sntp 50 sntp server priority 1 10.10.10.2.3
sntp server priority 2 fe80::200:24ff:fec8:4ca8 4
.
.
.
```

The SNTP authentication line and the Key-ids are not displayed. You must reconfigure SNTP authentication.

If `include-credentials` is configured, the SNTP authentication configuration is saved in the configuration file. When the `show config` command is entered, all of the information that has been configured for SNTP authentication displays, including the key-values.

Figure 1 *Saved SNTP Authentication information when include-credentials is configured*



SNTP unicast time polling with multiple SNTP servers

When running SNTP unicast time polling as the time synchronization method, the switch requests a time update from the server you configured with either the `Server Address` parameter in the menu interface, or the primary server in a list of up to three SNTP servers configured using the CLI. If the switch does not receive a response from the primary server after three consecutive polling intervals, the switch tries the next server (if any) in the list. If the switch tries all servers in the list without success, it sends an error message to the Event Log and reschedules to try the address list again after the configured `Poll Interval` time has expired.

If there are already three SNTP server addresses configured on the switch, and you want to use the CLI to replace one of the existing addresses with a new one, you must delete the unwanted address before you configure the new one.

Displaying all SNTP server addresses configured on the switch (CLI)

The System Information screen in the menu interface displays only one SNTP server address, even if the switch is configured for two or three servers. The CLI `show management` command displays all configured SNTP servers on the switch.

How to list all SNTP servers configured on the switch

```
switch(config)# show management

 Status and Counters - Management Address Information

  Time Server Address : fe80::215:60ff:fe7a:adc0%vlan10

  Priority SNTP Server Address                          Protocol Version
  -------- ------------------------------------------- ----------------
  1 2001:db8::215:60ff:fe79:8980                        7
  2 10.255.5.24                                         3
  3 fe80::123%vlan10                                    3


  Default Gateway : 10.0.9.80

  VLAN Name     MAC Address         | IP Address
```

```
------------ ------------------- + -------------------
DEFAULT_VLAN 001279-88a100       | Disabled
VLAN10       001279-88a100       | 10.0.10.17
```

Adding and deleting SNTP server addresses

Adding addresses

As mentioned earlier, you can configure one SNTP server address using either the Menu interface or the CLI. To configure a second and third address, you must use the CLI. To configure the remaining two addresses, you would do the following:

Creating additional SNTP server addresses with the CLI

```
switch(config)# sntp server priority <1-3> 2001:db8::215:60ff:fe79:8980
switch(config)# sntp server 10.255.5.24
```

If there are already three SNTP server addresses configured on the switch, and you want to use the CLI to replace one of the existing addresses with a new one, you must delete the unwanted address before you configure the new one.

Deleting addresses

Syntax

`no sntp server <ip-addr>`

Deletes a server address. If there are multiple addresses and you delete one of them, the switch re-orders the address priority.

Example

To delete the primary address in the above example and automatically convert the secondary address to primary:

```
switch(config)# no sntp server 10.28.227.141
```

SNTP messages in the Event Log

If an SNTP time change of more than three seconds occurs, the switch's Event Log records the change. SNTP time changes of less than three seconds do not appear in the Event Log.

Network Time Protocol (NTP)

All NTP communications use Coordinated Universal Time (UTC). An NTP server usually receives its time from an authoritative time source, such as a radio clock or an atomic clock attached to a time server, and then distributes this time across the network. NTP is extremely efficient; no more than one packet per minute is necessary to synchronize two machines to within a millisecond of each other.

NTP uses a stratum to describe the distance between a network device and an authoritative time source:

- A stratum 1 time server is directly attached to an authoritative time source (such as a radio or atomic clock or a GPS time source).
- A stratum 2 NTP server receives its time through NTP from a stratum 1 time server.

Before synchronizing, NTP compares the time reported by several network devices and does not synchronize with one that is significantly different, even if it is a stratum 1.

The security features of NTP can be used to avoid the accidental or malicious setting of incorrect time. One such mechanism is available: an encrypted authentication mechanism.

Though similar, the NTP algorithm is more complex and accurate than the Simple Network Time Protocol (SNTP).

Enabling this feature results in synchronizing the system clock; therefore, it may affect all sub-systems that rely on system time.

Commands

The following commands allow the user to configure NTP or show NTP configurations.

timesync ntp

This command is used to update the system clock using NTP.

Syntax

```
timesync ntp
```

Description

Update the system clock using NTP.

ntp

This command selects the operating mode of the NTP client.

Syntax

```
ntp [broadcast|unicast]
```

Parameters

`broadcast`

Sets ntp client to operate in broadcast mode.

`unicast`

Sets ntp client to operate in unicast mode.

Usage

The default mode is broadcast.

ntp

Syntax

```
ntp [authentication <key-id>
 | broadcast | enable | max-association
<integer> | server
<IP-ADDR> | trap
<trap-name> | unicast]

no ntp [authentication <key-id>
 | broadcast | enable | max-association
<integer> | server
```

```
<IP-ADDR> | trap
<trap-name> | unicast]
```

Description

This command selects the operating mode of the NTP client. Defaults to broadcast. The `no` form of the command disables NTP and removes the entire NTP configuration.

Parameters

authentication

Configure NTP authentication.

broadcast

Operate in broadcast mode.

enable

Enable/disable NTP.

max-association

Maximum number of Network Time Protocol (NTP) associations.

server

Configure a NTP server to poll for time synchronization.

trap

Enable/disable NTP traps.

unicast

Operate in unicast mode.

Example

```
switch(config)# no ntp
This will delete all NTP configurations on this device. Continue [y/n]?
```

ntp enable

This command is used to enable or disable NTP on the switch.

Syntax

```
ntp enable
```

Example

```
switch(config)# ntp
enable       Enable/disable NTP.
```

Description

Enable or disable NTP. Use no to disable NTP.

Restrictions

Validation	Error/Warning/Prompt
If timeSync is in SNTP or Timep when NTP is enabled.	`Timesync is not configured to NTP.`
When timesync is NTP and ntp is enabled and we try to change timesync to SNTP.	`Disable NTP before changing timesync to SNTP or TIMEP`

ntp authentication

This command is used for authentication of NTP server by the NTP client.

Syntax

```
ntp authentication key-id <KEY-ID> [authentication-mode <MODE> key-value <KEY-STRING>]
[trusted]
```

Parameters/Options

`key-id <id>`

Sets the key-id for the authentication key.

Subcommands

`authentication-mode`

Sets the NTP authentication mode

`key-value <KEY-STRING>`

Sets the key-value for the authentication key.

`[trusted]`

Sets the authentication key as trusted.

Example

```
switch(config)# ntp
Authentication      Configure NTP authentication.


switch(config)# ntp authentication
key-id              Set the key-id for this authentication key.


switch(config)# ntp authentication key-id
<1-4294967295>      Set the authentication key-id.


switch(config)# ntp authentication key-id 1
authentication-mode  Set the NTP authentication mode.
trusted              Set this authentication key as trusted.


switch(config)# ntp authentication key-id 1
authentication-mode|trusted md5
Authenticate using MD5.


switch(config)# ntp authentication key-id 1
```

```
authentication-mode|trusted md5key-value  Set the NTP authentication key.


switch(config)# ntp authentication key-id 1
authentication-mode|trusted md5 key-value
KEY           Enter a string to be set as the NTP authentication key.
```

ntp authentication key-id

Syntax

```
ntp authentication key-id
<key-id> [authentication-mode [md5 | sha1]
 key-value <key-value>] [trusted]
```

Description

The NTP client authenticates the NTP server.

Parameters

authentication-mode

Set the NTP authentication mode.

- md5: Authenticate using MD5.
- sha1: Authenticate using SHA1.

trusted

Set this authentication key as trusted.

ntp max-association

This command is used to configure the maximum number of servers associated with this NTP client.

Syntax

```
ntp max-association
<number>
```

Parameters

```
max-association <number>
```

Sets the maximum number of NTP associations.

Description

Configure maximum number of servers associated with the client. Up to eight servers can be configured as the maximum.

Restrictions

The range for a maximum number of NTP associations is 1-8.

Example

```
switch(config)# ntp
max-associations      Maximum number of NTP associations.

switch(config)# ntp max-associations
<1-8>                  Enter the number.
```

Restrictions

Validation	Error/Warning/Prompt
When the number of configured NTP servers is more than the max-associations value.	`The maximum number of NTP servers allowed is <number>.`
When the max-associations value is less than the (n) number of configured NTP servers.	`Max-associations value cannot be less than the number of NTP servers configured.`

ntp server

This command is used to configure the NTP servers.

Syntax

```
no ntp server
ntp server <IP-ADDR|IPv6-ADDR> [key <key-id>] [oobm] [max-poll <max-poll-val>][min-poll <min-poll-val>][burst | iburst]
```

Parameters/Options

`no`

Removes the unicast NTP configurations on the device.

Subcommands

`IP-ADDR`

Sets the IPv4 address of the NTP server.

`IPV6-ADDR`

Sets the IPv6 address of the NTP server.

`key <key-id>`

Specifies the authentication key.

`max-poll <max-poll-val>`

Configures the maximum time intervals in power of 2 seconds. Range is 4-17 (e.g., 5 would translate to 2 raised to 5 or 32).

`min-poll <min-poll-val>`

Configures the minimum time intervals in seconds. Range is 4-17.

`burst`

Enables burst mode.

`iburst`

Enables initial burst mode.

Usage

A maximum of 8 NTP servers can be configured.

Example

```
switch(config)# ntp
server          Allow the software clock to be synchronized by an NTP
time server.
broadcast       Operate in broadcast mode.
unicast         Operate in unicast mode.


switch(config)# ntp server
IP-ADDR         IPv4 address of the NTP server.
IPV6-ADDR       IPv6 address of the NTP server.

switch(config)# ntp server <IP-ADDR>
Key             Specify the authentication key.


switch(config)# ntp server <IP-ADDR> key key-id
Max-poll        Configure the maximum time intervals in seconds.

switch(config)# ntp server <IP-ADDR> key key-id max-poll
<4-17>          Enter an integer number.


switch(config)# ntp server <IP-ADDR> key key-id
Min-poll        Configure the minimum time intervals in seconds.


switch(config)# ntp server <IP-ADDR> key key-id min-poll
<4-17>          Enter an integer number.


switch(config)# ntp server <IP-ADDR> key key-id prefer max-poll
<max-poll-val> min-poll <min-poll-val>
iburst          Enable initial burst (iburst) mode.
burst           Enable burst mode.


switch(config)# ntp server IP-ADDR key key-id prefer maxpoll <number>
minpoll <number> iburst
```

Restrictions

Validation	Error/Warning/Prompt
If authentication key-id not configured	`Authentication key-id has not been configured.`
If Key-id is not marked as trusted	`Key-id is not trusted.`
When min poll value is more than max poll value	`NTP max poll value should be more than min poll value.`

ntp server key-id

Syntax

```
ntp server <IP-ADDR |IPV6-ADDR>
key–id <key-id> [max-poll
<max-poll-val>] [min-poll
<min-poll-val>] [burst | iburst]
```

Description

Configure the NTP server. *<IP-ADDR>* indicates the IPv4 address of the NTP server. *<IPV6-ADDR>* indicates the IPv6 address of the NTP server.

Parameters

burst

Enables burst mode.

iburst

Enables initial burst (iburst) mode.

key-id

Set the authentication key to use for this server.

max-poll *<max-poll-val>*

Configure the maximum time intervals in seconds.

min-poll *<min-poll-val>*

Configure the minimum time intervals in seconds.

ntp ipv6-multicast

This command is used to configure NTP multicast on a VLAN interface.

Syntax

```
ntp ipv6-multicast
```

Description

Configure the interface to listen to the NTP multicast packets.

Example

```
Switch(vlan-2)# ntp
ipv6-multicast       Configure the interface to listen to the NTP multicast packets.
```

Restrictions

Validation	Error/Warning/Prompt
If ipv6 is not enabled on vlan interface	`IPv6 address not configured on the VLAN.`

debug ntp

This command is used to display debug messages for NTP.

Syntax

```
debug ntp <event|packet>
```

Parameters

`event`

Displays event log messages related to NTP.

`packets`

Displays NTP packet messages.

Description

Enable debug logging. Use no to disable debug logging.

Example

```
switch(config)# debug ntp
event                Display event log messages related to NTP.
packet               Display NTP packet messages.
```

ntp trap

This command is used to configure NTP traps.

Syntax

`ntp trap <trap-name>`

Description

Enable NTP traps. Use no to disable NTP traps.

Parameters

`ntp-mode-change`

Trap name resulting in `send notification when the NTP entity changes mode, including starting and stopping (if possible).`

`ntp-stratum-change`

Trap name resulting in `send notification when stratum level of NTP changes.`

`ntp-peer-change`

Trap name resulting in `send notification when a (new) syspeer has been selected.`

`ntp-new-association`

Trap name resulting in `send notification when a new association is mobilized.`

`ntp-remove-association`

Trap name resulting in `send notification when an association is demobilized.`

`ntp-config-change`

Trap name resulting in `send notification when the NTP configuration has changed.`

`ntp-leapsec-announced`

Trap name resulting in `send notification when a leap second has been announced.`

`ntp-alive-heartbeat`

Trap name resulting in `send notification periodically (as defined by ntpEntHeartbeatInterval) to indicate that the NTP entity is still alive.`

`all`

Enable all traps.

Usage

The traps defined below are generated as the result of finding an unusual condition while parsing an NTP packet or a processing a timer event. Note that if more than one type of unusual condition is encountered while parsing the packet or processing an event, only the first one will generate a trap. Possible trap names are:

- 'ntpEntNotifModeChange'

The notification to be sent when the NTP entity changes mode, including starting and stopping (if possible).

- 'ntpEntNotifStratumChange'

The notification to be sent when stratum level of NTP changes.

- 'ntpEntNotifSyspeerChanged'

The notification to be sent when a (new) syspeer has been selected.

- 'ntpEntNotifAddAssociation'

The notification to be sent when a new association is mobilized.

- 'ntpEntNotifRemoveAssociation'

The notification to be sent when an association is demobilized.

- 'ntpEntNotifConfigChanged'

The notification to be sent when the NTP configuration has changed.

- 'ntpEntNotifLeapSecondAnnounced'

The notification to be sent when a leap second has been announced.

- 'ntpEntNotifHeartbeat'

The notification to be sent periodically (as defined by ntpEntHeartbeatInterval) to indicate that the NTP entity is still alive.

- 'ntpEntNotifAll'

The notification to be sent when all traps have been enabled

show ntp statistics

This command is used to show NTP statistics.

Syntax

```
show ntp statistics
```

Description

Show information about NTP packets.

Example

switch(config)# show ntp statistics

```
switch(config)# show ntp statistics

NTP Global statistics information

NTP In Packets                : 100
NTP Out Packets               : 110
NTP Bad Version Packets       : 4
NTP Protocol Error Packets    : 0
```

show ntp status

Syntax

```
show ntp status
```

Description

Show the status of NTP.

Example

```
switch(config)# show ntp status

NTP Status information
NTP Status              : Disabled              NTP Mode        : Broadcast
Synchronization Status  : Synchronized          Peer Dispersion : 8.01 sec
Stratum Number          : 2                     Leap Direction  : 1
Reference Assoc Id      : 1                     Clock Offset    : 0.0000 sec
Reference               : 192.0.2.1             Root Delay      : 0.00 sec
Precision               : 2**7                  Root Dispersion : 15.91 sec
NTP Uptime              : 01d 09h 15m           Time Resolution : 1
Drift                   : 0.000000000 sec/sec

System Time             : Tue Aug 25 04:59:11 2015
Reference Time          : Mon Jan  1 00:00:00 1990
```

show ntp associations

Syntax

```
show ntp associations [detail <IP-ADDR>]
```

Description

Shows the status of configured NTP associations.

Parameters

detail

Shows the detailed status of NTP associations configured for the system.

switch(config)# show ntp associations

```
                    NTP Associations Entries

Address          St   T  When Poll  Reach   Delay    Offset   Dispersion
--------------   ---  -- ---- ----- ------ -------   -------  ----------
121.0.23.1       16   u    -  1024    0     0.000     0.000     0.000
231.45.21.4      16   u    -  1024    0     0.000     0.000     0.000
55.21.56.2       16   u    -  1024    0     0.000     0.000     0.000
23.56.13.1        3   u 209  1024  377     54.936   -6.159     12.688
91.34.255.216     4   u 132  1024  377     1.391     0.978     3.860
```

switch(config)# show ntp associations detail <IP ADDR>

```
NTP association information

IP address       : 172.31.32.2                  Peer Mode       : Server
Status           : Configured, Insane, Invalid  Peer Poll Intvl : 64
Stratum          : 5                            Root Delay      : 137.77 sec
```

```
Ref Assoc ID     : 0                            Root Dispersion : 142.75
Association Name : NTP Association 0            Reach           : 376
Reference ID     : 16.93.49.4                   Delay           : 4.23 sec
Our Mode         : Client                       Offset          : -8.587 sec
Our Poll Intvl   : 1024                         Precision       : 2**19

Dispersion       : 1.62 sec
Association In Packets    : 60
Association Out Packets   : 60
Association Error Packets : 0
Origin Time      : Fri Jul 3 11:39:40 2015
Receive Time     : Fri Jul 3 11:39:44 2015
Transmit Time    : Fri Jul 3 11:39:44 2015

-------------------------------------------------------------------------------
Filter Delay =   4.23    4.14    2.41    5.95    2.37    2.33    4.26    4.33
Filter Offset = -8.59   -8.82   -9.91   -8.42  -10.51  -10.77  -10.13  -10.11
```

show ntp authentication

Syntax

```
show ntp authentication
```

Description

Shows the authentication status and other information about the authentication key.

Example

```
switch(config)# show ntp authentication
NTP Authentication Information

Key-ID     Auth Mode   Trusted
--------   ----------  -------
67            md5        yes
7             md5        no
1             sha1       yes
2             sha1       no
```

Precision Time Protocol (PTP)

ptp

Syntax

```
ptp {enable | disable}
no ptp {enable | disable}
```

Description

Enable updating of IEEE 1588 PTP packets.

- The feature is disabled by default.
- The `no` form of this command is the same as `ptp disable`.

This feature is available on the 2930M and only in standalone. It is disabled for stacks.
PTP is supported in the following models:

- JL319A
- JL320A
- JL321A
- JL322A

PTP is not supported in the following models:

- JL323A
- JL324A
- R0M67A
- R0M68A

Command context

`interface`

Parameters

`enable`

When the `ptp` command is enabled, ports that support IEEE 1588 will operate in end-to-end transparent mode and will update the correction field of forwarded PTP packets.

`disable`

When the `ptp` command is disabled, PTP packets are forwarded unchanged.

Restrictions

- IEEE 1588 end-to-end transparent mode cannot be enabled when there are flexible modules or transceiver ports in the system that do not support IEEE 1588. If a user attempts this, an error message like the following displays: `Port A1 does not support IEEE 1588 end-to-end transparent mode`. Use the command `show ptp` to identify the unsupported ports.
- IEEE 1588 end-to-end transparent mode cannot be enabled on a stack. If the user attempts this, an error message like the following displays: `IEEE 1588 end-to-end transparent mode cannot be enabled when stacking is enabled.`
- IEEE 1588 end-to-end transparent mode must be enabled or disabled on all ports at the same time.
- MACsec cannot be enabled when IEEE 1588 end-to-end transparent mode is enabled.
- IEEE 1588 end-to-end transparent mode cannot be enabled when MACsec is enabled.

show ptp

Syntax

`show ptp [<port-list>]`

Description

Show IEEE 1588 PTP status.

Command context

Operator

Parameters

port-list

Specifies the ports for which to show PTP status.

Example

```
switch# show ptp
 Status and Counters - Precision Time Protocol

  Port   | PTP Config PTP Status   RX Count TX Count
  ------ + ---------- ------------ -------- --------
  1/1    | Disabled   Inactive     0        0
  1/2    | Disabled   Inactive     0        0
  1/3    | Disabled   Inactive     0        0
  1/4    | Disabled   Inactive     0        0
  1/5    | Disabled   Inactive     0        0
  1/6    | Disabled   Inactive     0        0
  1/7    | Disabled   Inactive     0        0
  1/8    | Disabled   Inactive     0        0
  1/9    | Disabled   Inactive     0        0
  1/10   | Disabled   Inactive     0        0
  1/11   | Disabled   Inactive     0        0
  1/12   | Disabled   Inactive     0        0
  1/13   | Disabled   Inactive     0        0
  1/14   | Disabled   Inactive     0        0
  1/15   | Disabled   Inactive     0        0
  1/16   | Disabled   Inactive     0        0
  1/17   | Disabled   Inactive     0        0
  1/18   | Disabled   Inactive     0        0
```

Monitoring resources

Displaying current resource usage

To display current resource usage in the switch, enter the following command:

Syntax

```
show {<qos | access-list | policy> resources}
```

Displays the resource usage of the policy enforcement engine on the switch by software feature. For each type of resource, the amount still available and the amount used by each software feature is shown.

`show resources`	This output allows you to view current resource usage and, if necessary, prioritize and reconfigure software features to free resources reserved for less important features.
`qosaccess-listopenflowpolicy`	Display the same command output and provide different ways to access task-specific information. See “Viewing OpenFlow Resources” in the OpenFlow administrators guide for your switch.

Displaying current resource usage on page 45 shows the resource usage on a switch configured for ACLs, QoS, RADIUS-based authentication, and other features:

The "Rules Used" columns show that ACLs, VT, mirroring, and other features (For example, Management VLAN) have been configured globally or per-VLAN, because identical resource consumption is displayed for each port range in the switch. If ACLs were configured per-port, the number of rules used in each port range would be different.

Displaying current resource usage

```
switch(config)# show access-list resources

 Resource usage in Policy Enforcement Engine

        | Rules       | Rules Used
  Ports | Available   | ACL | QoS | IDM | Other |
  ------+-------------+-----+-----+-----+-------|
  1-48  |        2006 |  10 |   5 |   0 |    6  |

        | Meters      | Meters Used
  Ports | Available   | ACL | QoS | IDM | Other |
  ------+-------------+-----+-----+-----+-------|
  1-48  |         255 |     |   5 |     |     0 |

        | Application |
        | Port Ranges |  Application Port Ranges Used
  Ports |  Available  | ACL | QoS | IDM | Other |
  ------+-------------+-----+-----+-----+-------|
  1-48  |          31 |   1 |   0 |   0 |     0 |

2 of 16 Policy Engine management resources used.

Key:
ACL = Access Control Lists
QoS = Device & Application Port Priority
IDM = Identity Driven Management
Other = Management VLAN, DHCP Snooping, ARP Protection, RA Guard.

Resource usage includes resources actually in use, or reserved for future
use by the listed feature. Internal dedicated-purpose resources, such as
port bandwidth limits or VLAN QoS priority, are not included.
```

Viewing information on resource usage

The switch allows you to view information about the current usage and availability of resources in the Policy Enforcement engine, including the following software features:

- Access control lists (ACL)
- Quality-of-service (QoS), including device and application port priority, ICMP rate-limiting, and QoS policies
- Dynamic assignment of per-port or per-user ACLs and QoS through RADIUS authentication designated as “IDM”.
- Virus throttling (VT) using connection-rate filtering
- Mirroring policies, including switch configuration as an endpoint for remote intelligent mirroring
- Other features, including:
  - Management VLAN
  - DHCP snooping
  - Dynamic ARP protection
  - Jumbo IP-MTU

Policy enforcement engine

The policy enforcement engine is thehardware element in the switch that manages QoS, mirroring, and ACL policies, as well as other software features, using the rules that you configure. Resource usage in the policy enforcement engine is based on how these features are configured on the switch:

- Resource usage by dynamic port ACLs is determined as follows:

  Dynamic port ACLs configured by a RADIUS server for an authenticated client determine the current resource consumption for this feature on a specified slot. When a client session ends, the resources in use for that client become available for other uses.
- When the following features are configured globally or per-VLAN, resource usage is applied across all port groups or all slots with installed modules:
  - ACLs
  - QoS configurations that use the following commands:
    - QoS device priority (IP address) through the CLI using the `qos device-priority` command
    - QoS application port through the CLI using `qos tcp-port` or `qos udp-port`
    - VLAN QoS policies through the CLI using `service-policy`
  - Management VLAN configuration
  - DHCP snooping
  - Dynamic ARP protection
  - Remote mirroring endpoint configuration
  - Mirror policies per VLAN through the CLI using `monitor service`
  - Jumbo IP-MTU
- When the following features are configured per-port, resource usage is applied only to the slot or port group on which the feature is configured:
  - ACLs or QoS applied per-port or per-user through RADIUS authentication
  - ACLs applied per-port through the CLI using the `ip access-group` or `ipv6 traffic-filter` commands
  - QoS policies applied per port through the CLI using the `service-policy` command
  - Mirror policies applied per-port through the CLI using the `monitor all service` and `service-policy`commands
  - ICMP rate-limiting through the CLI using the `rate-limit icmp` command

Usage notes for show resources output

- A 1:1 mapping of internal rules to configured policies in the switch does not necessarily exist. As a result, displaying current resource usage is the most reliable method for keeping track of available resources. Also, because some internal resources are used by multiple features, deleting a feature configuration may not increase the amount of available resources.
- Resource usage includes resources actually in use or reserved for future use by the listed features.
- "Internal dedicated-purpose resources" include the following features:
  - Per-port ingress and egress rate limiting through the CLI using `rate-limit in/out`
  - Per-port or per-VLAN priority or DSCP through the CLI using `qos priority` or `qos dscp`
  - Per protocol priority through the CLI using `qos protocol`

- The "Available" columns display the resources available for additional feature use.
- The "IDM" column shows the resources used for RADIUS-based authentication.
- "Meters" are used when applying either ICMP rate-limiting or a QoS policy with a rate-limit class action.

When insufficient resources are available

The switch has ample resources for configuring features and supporting RADIUS-authenticated clients (with or without the optional IDMapplication).

If the resources supporting these features become fully subscribed:

- The current feature configuration, RADIUS-authenticated client sessions, and VT instances continue to operate normally.
- The switch generates anevent log notice to say that current resources are fully subscribed.
- Currently engaged resources must be released before any of the following actions are supported:
  - Modifying currently configured ACLs, IDM, VT, and other software features, such as Management VLAN, DHCP snooping, and dynamic ARP protection.You can modify currently configured classifier-base QoS and mirroring policies if a policy has not been applied to an interface. However, sufficient resources must be available when you apply a configured policy to an interface.
  - Acceptance of new RADIUS-based client authentication requests (displayed as a new resource entry for IDM).Failure to authenticate a client that presents valid credentials may indicate that insufficient resources are available for the features configured for the client in the RADIUS server. To troubleshoot, check the event log.
  - Throttling or blocking of newly detected clients with high rate-of-connection requests (as defined by the current VT configuration).The switch continues to generate Event Log notifications (and SNMP trap notification, if configured) for new instances of high-connection-rate behavior detected by the VT feature.

Viewing port status and configuring port parameters

Connecting transceivers to fixed-configuration devices

If the switch either fails to show a link between an installed transceiver and another device or demonstrates errors or other unexpected behavior on the link, check the port configuration on both devices for a speed and/or duplex (mode) mismatch.

- To check the mode setting for a port on the switch, use either the Port Status screen in the menu interface or `show interfaces brief` in the CLI (see Viewing port status and configuration (CLI) on page 51 .
- To display information about the transceivers installed on a switch, enter the `showtech receivers` command in the CLI (The show tech transceivers command on page 55).

Table 3: *Status and parameters for each port type*

Status or parameter	Description
Enabled	`Yes` (default): The port is ready for a network connection. `No`: The port will not operate, even if properly connected in a network. Use this setting, For example, if the port needs to be shut down for diagnostic purposes or while you are making topology changes.
Status (read-only)	`Up`: The port senses a link beat. `Down`: The port is not enabled, has no cables connected, or is experiencing a network error. For troubleshooting information, see the installation and getting started guide you received with the switch. See also to Appendix C, "Troubleshooting" (in this manual).
Mode	The port's speed and duplex (data transfer operation) setting. `10/100/1000Base-T Ports:` ■ `Auto-MDIX` (default): Senses speed and negotiates with the port at the other end of the link for port operation (MDI-X or MDI).To see what the switch negotiates for the auto setting, use the CLI `show interfaces brief` command. ■ `MDI`: Sets the port to connect with a PC using a crossover cable (manual mode–applies only to copper port switches using twisted-pair copper Ethernet cables) ■ `MDIX`: Sets the port to connect with a PC using a straight-through cable (manual mode–applies only to copper port switches using twisted-pair copper Ethernet cables) ■ `Auto-10`: Allows the port to negotiate between half-duplex (HDx) and full-duplex (FDx) while keeping speed at 10 Mbps. Also negotiates flow control (enabled or disabled). Hewlett Packard Enterprise recommends auto-10 for links between 10/100 auto-sensing ports connected with Cat 3 cabling. (Cat 5 cabling is required for 100 Mbps links.). ■ `10HDx`: 10 Mbps, half-duplex

Status or parameter	Description
	■ `10FDx`: 10 Mbps, full-duplex ■ `Auto-100`: Uses 100 Mbps and negotiates with the port at the other end of the link for other port operation features. ■ `Auto-10-100`: Allows the port to establish a link with the port at the other end at either 10 Mbps or 100 Mbps, using the highest mutual speed and duplex mode available. Only these speeds are allowed with this setting. ■ `Auto-1000`: Uses 1000 Mbps and negotiates with the port at the other end of the link for other port operation features. ■ `100Hdx`: Uses 100 Mbps, half-duplex. ■ `100Fdx`: Uses 100 Mbps, full-duplex **Gigabit Fiber-Optic Ports (Gigabit-SX, Gigabit-LX, and Gigabit-LH):** ■ `1000FDx`: 1000 Mbps (1 Gbps), full-duplex only ■ `Auto` (default): The port operates at 1000FDx and auto-negotiates flow control with the device connected to the port. **Gigabit Copper Ports:** ■ `1000FDx`: 1000 Mbps (1 Gbps), full-duplex only ■ `Auto` (default): The port operates at 1000FDx and auto-negotiates flow control with the device connected to the port. **10-Gigabit CX4 Copper Ports:10-Gigabit SC Fiber-Optic Ports (10-GbE SR, 10-GbE LR, 10-GbE ER):** ■ Auto: The port operates at 10 gigabits FDx and negotiates flow control. Lower speed settings or half-duplex are not allowed. **NOTE:** Conditioning patch cord cables are not supported on 10-GbE.
Auto-MDIX	The switch supports Auto-MDIX on 10Mb, 100Mb, and 1 Gb T/TX (copper) ports. (Fiber ports and 10-gigabit ports do not use this feature.) ■ `Automdix`: Configures the port for automatic detection of the cable type (straight-through or crossover). ■ `MDI`: Configures the port to connect to a switch, hub, or other MDI-X device with a straight-through cable. ■ `MDIX`: Configures the port to connect to a PC or other MDI device with a straight-through cable.
Flow control	■ `Disabled` (default): The port does not generate flow control packets, and drops any flow control packets it receives. ■ `Enabled`: The port uses 802.3x link layer flow control, generates flow-control packets, and processes received flow-control packets. With the port mode set to `Auto` (the default) and flow control enabled, the switch negotiates flow control on the indicated port. If the port mode is not set to `Auto`, or if flow control is disabled on the port, flow control is not used. Note that flow control must be enabled on both ends of a link.
Broadcast limit	Specifies the percentage of the theoretical maximum network bandwidth that can be used for broadcast traffic. Any broadcast traffic exceeding that limit will be dropped. Zero (0) means the feature is disabled. The broadcast-limit command operates at the port context level to set the broadcast limit for a port on the switch.

Status or parameter	Description
	NOTE: This feature is not appropriate for networks that require high levels of IPX or RIP broadcast traffic.

Viewing port status and configuration (CLI)

Use the following commands to display port status and configuration data.

Syntax

`show interfaces [brief | config | < port-list >]`

`brief`

Lists the current operating status for all ports on the switch.

`config`

Lists a subset of configuration data for all ports on the switch; that is, for each port, the display shows whether the port is enabled, the operating mode, and whether it is configured for flow control.

`<port-list>`

Shows a summary of network traffic handled by the specified ports.

The show interfaces brief command listing

```
switch(config)# show interfaces brief
Status and Counters - Port Status

                | Intrusion                              MDI   Flow  Bcast
Port  Type      | Alert     Enabled Status Mode         Mode  Ctrl  Limit
----- --------- + --------- ------- ------ ---------- ----- ----- ------
B1    100/1000T | No        Yes     Down   Auto-10-100 Auto  off   0
B2    100/1000T | No        Yes     Down   1000FDx     Auto  off   0
B3    100/1000T | No        Yes     Down   1000FDx     Auto  off   0
B4    100/1000T | No        Yes     Down   1000FDx     Auto  off   0
B5    100/1000T | No        Yes     Down   1000FDx     Auto  off   0
B6    100/1000T | No        Yes     Down   1000FDx     Auto  off   0
```

The show interfaces config command listing

```
switch(config)# show interfaces config

 Port Settings


  Port  Type      | Enabled Mode         Flow Ctrl MDI
  ----- --------- + ------- ------------ --------- ----
  B1    100/1000T | Yes     Auto-10-100  Disable   Auto
  B2    100/1000T | Yes     Auto         Disable   Auto
  B3    100/1000T | Yes     Auto         Disable   Auto
  B4    100/1000T | Yes     Auto         Disable   Auto
  B5    100/1000T | Yes     Auto         Disable   Auto
  B6    100/1000T | Yes     Auto         Disable   Auto
```

Dynamically updating the show interfaces command (CLI/Menu)

Syntax

`show interfaces display`

Uses the `display` option to initiate the dynamic update of the `show interfaces` command, with the output being the same as the `show interfaces` command.

NOTE

Select **Back** to exit the display.

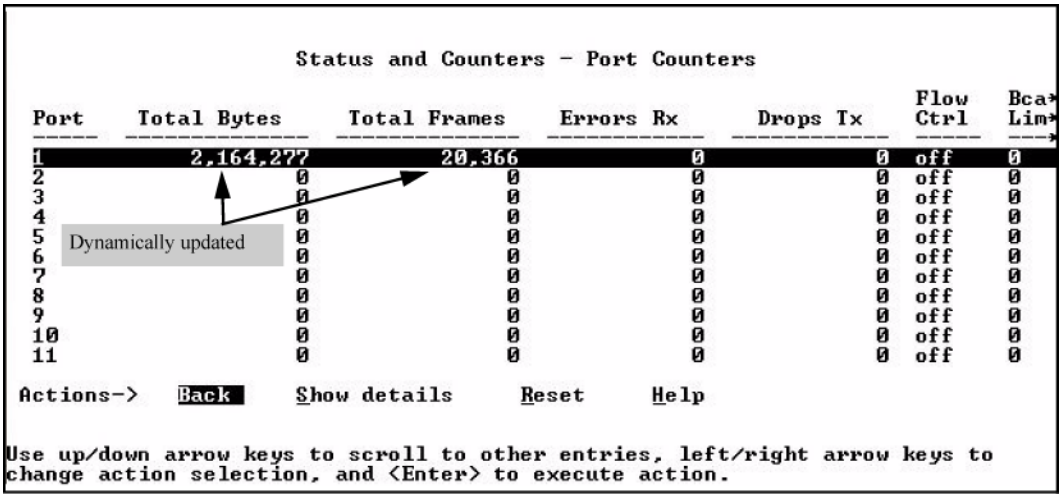
Example

```
switch# show interfaces display
```

When using the **display** option in the CLI, the information stays on the screen and is updated every 3 seconds, as occurs with the display using the menu feature. The update is terminated with **Cntl-C**.

You can use the arrow keys to scroll through the screen when the output does not fit in one screen.

Figure 2 *show interfaces display command with dynamically updating output*



Customizing the show interfaces command (CLI)

You can create `show` commands displaying the information that you want to see in any order you want by using the `custom` option.

Syntax

`show interfaces custom [port-list]`*`column-list`*

Select the information that you want to display. Supported columns are shown in the table below.

Table 4: *Supported columns, what they display, and examples:*

Parameter column	Displays	Examples
port	Port identifier	A2
type	Port type	100/1000T
status	Port status	up or down
speed	Connection speed and duplex	1000FDX
mode	Configured mode	auto, auto-100, 100FDX
mdi	MDI mode	auto, MDIX

Parameter column	Displays	Examples
flow	Flow control	on or off
name	Friendly port name	
vlanid	The vlan id this port belongs to, or "tagged" if it belongs to more than one vlan	4tagged
enabled	port is or is not enabled	yes or nointrusion
intrusion	Intrusion alert status	no
bcast	Broadcast limit	0

The custom show interfaces command

```
switch(config)# show int custom 1-4 port name:4 type vlan intrusion speed enabled mdi

 Status and Counters - Custom Port Status

                                  Intrusion
  Port Name       Type       VLAN  Alert     Speed   Enabled MDI-mode
  ---- ---------- ---------- ----- --------- ------- ------- --------
  1    Acco       100/1000T  1     No        1000FDx Yes     Auto
  2    Huma       100/1000T  1     No        1000FDx Yes     Auto
  3    Deve       100/1000T  1     No        1000FDx Yes     Auto
  4    Lab1       100/1000T  1     No        1000FDx Yes     Auto
```

You can specify the column width by entering a colon after the column name, then indicating the number of characters to display. In the above example, the Name column displays only the first four characters of the name. All remaining characters are truncated.

Each field has a fixed minimum width to be displayed. If you specify a field width smaller than the minimum width, the information is displayed at the minimum width. For example, if the minimum width for the Name field is 4 characters and you specify Name:2, the Name field displays 4 characters.

You can enter parameters in any order. There is a limit of 80 characters per line; if you exceed this limit an error displays.

Error messages associated with the show interfaces command

The following table provides information on error messages associated with the `show interfacescustom` command.

Error	Error message
Requesting too many fields (total characters exceeds 80)	Total length of selected data exceeds one line
Field name is misspelled	Invalid input: <*input*>
Mistake in specifying the port list	Module not present for port or invalid port: <*input*>
The port list is not specified	Incomplete input: custom

Note on using pattern matching with the show interfaces custom command

If you have included a pattern matching command to search for a field in the output of the `show int custom` command, and the `show int custom` command produces an error, the error message may not be visible and the output is empty. For example, if you enter a command that produces an error (such as vlan is misspelled) with the pattern matching `include` option, the output may be empty:

```
switch(config)# show int custom 1-3 name vlun  |  include vlan1
```

It is advisable to try the `show int custom` command first to ensure there is output, and then enter the command again with the pattern matching option.

Note that in the above command, you can substitute `int` for `interface`; that is: show `int custom`.

show interface smartrate

Syntax

`show interface <PORT-LIST> smartrate`

Description

The option `smartrate` has been added to the `show interface <PORT-LIST>` command. This option is used to display port diagnostics on a Smart Rate port only. If the command is run on a non-Smart Rate port, a message similar to `Port A1: This command is only applicable to Smart Rate ports` is displayed.

The `show interface <PORT-LIST> smartrate` command can be used to retrieve the physical layer link diagnostics information for the smartrate ports. As part of 802.3bz implementation, the CLI information has been updated with the latest BASE-T modes.

Viewing port utilization statistics (CLI)

Use the `show interface port-utilization` command to view a real-time rate display for all ports on the switch. The example below shows a sample output from this command.

A show interface port-utilization command listing

```
switch(config)# show interfaces port-utilization
 Status and Counters - Port Utilization

                             Rx                            Tx
 Port  Mode     | -------------------------- | --------------------------
                | Kbits/sec  Pkts/sec  Util  | Kbits/sec  Pkts/sec  Util
 ----- -------- + ---------- --------- ----- + ---------- --------- -----
 B1    1000FDx  | 0          0         0     | 0          0         0
 B2    1000FDx  | 0          0         0     | 0          0         0
 B3    1000FDx  | 0          0         0     | 0          0         0
 B4    1000FDx  | 0          0         0     | 0          0         0
 B5    1000FDx  | 0          0         0     | 0          0         0
 B6    1000FDx  | 0          0         0     | 0          0         0
 B7     100FDx  | 624        86        00.62 | 496        0         00.49
```

Operating notes for viewing port utilization statistics

- For each port on the switch, the command provides a real-time display of the rate at which data is received (Rx) and transmitted (Tx) in terms of kilobits per second (KBits/s), number of packets per second (Pkts/s), and utilization (Util) expressed as a percentage of the total bandwidth available.

- The `show interfaces<port-list>` command can be used to display the current link status and the port rate average over a 5 minute period. Port rates are shown in bits per second (bps) for ports up to 1 Gigabit; for 10 Gigabit ports, port rates are shown in kilobits per second (Kbps).

Viewing transceiver status (CLI)

The `show interfaces transceivers` command allows you to:

- Remotely identify transceiver type and revision number without having to physically remove an installed transceiver from its slot.
- Display real-timestatus information about all installed transceivers, including non-operational transceivers.

The example shows sample output from the `show tech transceivers` command.

Part # column below enables you to determine the manufacturer for a specified transceiver and revision number.

The show tech transceivers command

```
switch# show tech transceivers

Transceiver Technical Information:
 Port # |   Type     | Prod # | Serial #          | Part #
 -------+------------+--------+-------------------+----------
 21     | 1000SX     | J4858B | CN605MP23K        |
 22     | 1000LX     | J4859C | H11E7X            | 2157-2345
 23     | ??         | ??     | non operational   |
 25     | 10GbE-CX4  | J8440A | US509RU079        |
 26     | 10GbE-CX4  | J8440A | US540RU002        |
 27     | 10GbE-LR   | J8437B | PPA02-2904:0017   | 2157-2345
 28     | 10GbE-SR   | J8436B | 01591602          | 2158-1000
 29     | 10GbE-ER   | J8438A | PPA03-2905:0001   |

The following transceivers may not function correctly:
 Port #         Message
 --------       ------------------------
 Port 23        Self test failure.
```

Operating Notes

The following information is displayed for each installed transceiver:

- Port number on which transceiver is installed.
- Type of transceiver.
- Product number – Includes revision letter, such as A, B, or C. If no revision letter follows a product number, this means that no revision is available for the transceiver.
- Part number – Allows you to determine the manufacturer for a specified transceiver and revision number.
- For non-Aruba switches installed transceiver, no transceiver type, product number, or part information is displayed. In the Serial Number field, `non-operational` is displayed instead of a serial number.
- The following error messages may be displayed for a non-operational transceiver:
  - `Unsupported Transceiver. (SelfTest Err#060)`
  - `This switch only supports revision B and above transceivers.`
  - `Self test failure.`

- `Transceiver type not supported in this port.`
- `Transceiver type not supported in this software version.`
- `Not an Switch Transceiver.`

Enabling or disabling ports and configuring port mode (CLI)

You can configure one or more of the following port parameters.

See Connecting transceivers to fixed-configuration devices.

Syntax

`no interface <port-list> [<disable|enable>]`

Disables or enables the port for network traffic. Does not use the `no` form of the command. (Default: `enable`.)

`speed-duplex [<auto-10|10-full|10-half|100-full|100-half|auto|auto-100|1000-full>]`

Note that in the above Syntax, you can substitute `int` for `interface` (for example, `int <port-list>`).

Specifies the port's data transfer speed and mode. Does not use the `no` form of the command. (Default: `auto`.)

The 10/100 auto-negotiation feature allows a port to establish a link with a port at the other end at either 10 Mbps or 100 Mbps, using the highest mutual speed and duplex mode available. Only these speeds are allowed with this setting.

10 Mbps and 100 Mbps is supported on half duplex mode when link parameter is configured as `100-full` and local as `auto`.

Examples

To configure port C5 for auto-10-100, enter this command:

```
switch(config)# int c5 speed-duplex auto-10-100
```

To configure ports C1 through C3 and port C6 for 100Mbps full-duplex, enter these commands:

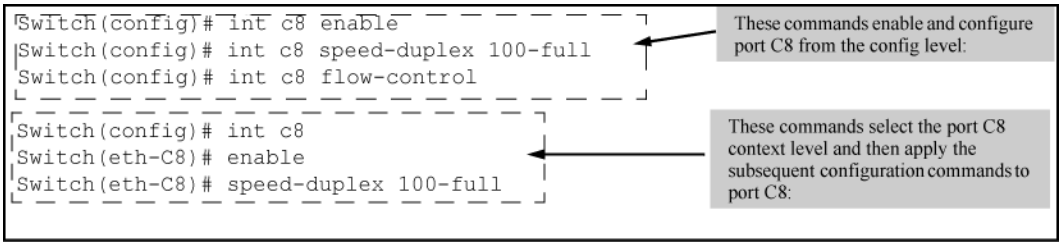
```
switch(config)# int c1-c3,c6 speed-duplex 100-full
```

Similarly, to configure a single port with the above command settings, you could either enter the same command with only the one port identified or go to the context level for that port and then enter the command. For example, to enter the context level for port C6 and then configure that port for 100FDx:

```
switch(config)# int e c6
switch(eth-C6)# speed-duplex 100-full
```

If port C8 was disabled, and you wanted to enable it and configure it for 100FDx with flow-control active, you could do so with either of the following command sets:

Figure 3 *Two methods for changing a port configuration*



For more on flow control, see Enabling or disabling flow control (CLI) on page 57.

Enabling or disabling flow control (CLI)

You must enable flow control on both ports in a given link. Otherwise, flow control does not operate on the link and appears as `Off` in the `show interfaces brief` port listing, even if flow control is configured as enabled on the port in the switch. (See The show interfaces brief command listing on page 51 example.) Also, the port (speed-duplex) mode must be set to `Auto` (the default).

To disable flow control on some ports, while leaving it enabled on other ports, just disable it on the individual ports you want to exclude.

(You can find more information on flow control in the Connecting transceivers to fixed-configuration devices table.)

Syntax

`no interface <port-list> flow-control`

Enables or disables flow control packets on the port. The `no` form of the command disables flow control on the individual ports. (Default: Disabled.)

Examples

Suppose that:

1. You want to enable flow control on ports A1-A6.
2. Later, you decide to disable flow control on ports A5 and A6.
3. As a final step, you want to disable flow control on all ports.

Assuming that flow control is currently disabled on the switch, you would use these commands:

```
switch(config)# int a1-a6 flow-control

switch(config)# show interfaces brief

 Status and Counters - Port Status

                   | Intrusion                              MDI  Flow Bcast
  Port   Type      | Alert     Enabled Status Mode          Mode Ctrl Limit
  ------ --------- + --------- ------- ------ ----------- ---- ---- -----
  A1     10GbE-T   | No        Yes     Up     1000FDx     NA   on   0
  A2     10GbE-T   | No        Yes     Up     10GigFD     NA   on   0
  A3     10GbE-T   | No        Yes     Up     10GigFD     NA   on   0
  A4     10GbE-T   | No        Yes     Up     10GigFD     NA   on   0
  A5     10GbE-T   | No        Yes     Up     10GigFD     NA   on   0
  A6     10GbE-T   | No        Yes     Up     10GigFD     NA   on   0
  A7     10GbE-T   | No        Yes     Down   10GigFD     NA   off  0
  A8     10GbE-T   | No        Yes     Up     10GigFD     NA   off  0

switch(config)# no int a5-a6 flow-control

switch(config)# show interfaces brief

 Status and Counters - Port Status

                   | Intrusion                              MDI  Flow Bcast
  Port   Type      | Alert     Enabled Status Mode          Mode Ctrl Limit
  ------ --------- + --------- ------- ------ ----------- ---- ---- -----
  A1     10GbE-T   | No        Yes     Up     1000FDx     NA   on   0
  A2     10GbE-T   | No        Yes     Down   10GigFD     NA   on   0
  A3     10GbE-T   | No        Yes     Down   10GigFD     NA   on   0
```

```
  A4     10GbE-T   | No        Yes     Down   10GigFD    NA   on   0
  A5     10GbE-T   | No        Yes     Down   10GigFD    NA   off  0
  A6     10GbE-T   | No        Yes     Down   10GigFD    NA   off  0
  A7     10GbE-T   | No        Yes     Down   10GigFD    NA   off  0
  A8     10GbE-T   | No        Yes     Down   10GigFD    NA   off  0

switch(config)# no int a1-a4 flow-control

switch(config)# show interfaces brief

 Status and Counters - Port Status

                   | Intrusion                              MDI  Flow Bcast
  Port   Type      | Alert     Enabled Status Mode          Mode Ctrl Limit
  ------ --------- + --------- ------- ------ ----------- ---- ---- -----
  A1     10GbE-T   | No        Yes     Down   1000FDx     NA   off  0
  A2     10GbE-T   | No        Yes     Down   10GigFD    NA   off  0
  A3     10GbE-T   | No        Yes     Down   10GigFD    NA   off  0
  A4     10GbE-T   | No        Yes     Down   10GigFD    NA   off  0
  A5     10GbE-T   | No        Yes     Down   10GigFD    NA   off  0
  A6     10GbE-T   | No        Yes     Down   10GigFD    NA   off  0
  A7     10GbE-T   | No        Yes     Down   10GigFD    NA   off  0
  A8     10GbE-T   | No        Yes     Down   10GigFD    NA   off  0
```

Port shutdown with broadcast storm

A LAN broadcast storm arises when an excessively high rate of broadcast packets flood the LAN. Occurrence of LAN broadcast storm disrupts traffic and degrades network performance. To prevent LAN traffic from being disrupted, an enhancement of fault-finder commands adds new options, and the corresponding MIBs, that trigger a port disablement when a broadcast storm is detected on that port.

Under this enhancement, the CLI commands given only supports broadcast traffic and not multicast and unicast types of traffic.

The waiting period range for re-enabling ports is 0 to 604800 seconds. The default waiting period to re-enable a port is zero which prevents the port from automatic re-enabling.

Avoid port flapping when choosing the waiting period by considering the time to re-enable carefully.

Use the following commands to configure the broadcast-storm on a port.

Syntax

```
no fault-finder broadcast-storm [ethernet] <port-list> action [warn|warn-and-disable
<seconds>] [percent <percent>|pps <rate>]
```

To remove the current configuration of broadcast-storm on a port, use:

Syntax

```
no fault-finder broadcast-storm [ethernet] <port-list>
```

broadcast-storm

Configure broadcast storm control.

pps

Rising threshold level in number of broadcast packets per second.

percent

Rising threshold level as a percentage of bandwidth of the port. The percentage is calculated on 64 byte packet size.

warn

Log the event only.

warn-and-disable

Log the event and disable the port.

seconds

Re-enable the port after waiting for the specified number of seconds. Default is not to re-enable.

Configuration Examples

```
switch(config)# fault-finder broadcast-storm [ethernet] <A1> action [warn-and-disable
<65535>]< percent 10>
switch(config)# fault-finder broadcast-storm [ethernet] <A2> action [warn-and-disable
<pps 100>
switch(config)# fault-finder broadcast-storm [ethernet] <A22> action [warn] <pps 100>
```

Viewing broadcast storm

Use the following command to display the broadcast-storm-control configuration.

Syntax

```
show fault-finder broadcast-storm [[ethernet] port-list]
```

Examples

```
switch# show fault-finder broadcast-storm [A1]
```

Port	Bcast Storm	Port Status	Rising Threshold	Action	Disable Timer	Disable Timer Left
A1	Yes	Down	10%	warn-and-disable	65535	–

```
switch (config)# show fault-finder broadcast-storm
```

Port	Bcast Storm	Port Status	Rising Threshold	Action	Disable Timer	Disable Timer Left
A1	Yes	Down	200 pps	warn-and-disable	10	9

```
switch (config)# show fault-finder broadcast-storm A1
```

Port	Bcast Storm	Port Status	Rising Threshold	Action	Disable Timer	Disable Timer Left
A1	No	Up	–	none	–	–

```
switch (config)# show fault-finder broadcast-storm
```

Port	Bcast Storm	Port Status	Rising Threshold	Action	Disable Timer	Disable Timer Left
A1	Yes	Up	75%	warn	–	–

SNMP MIB

SNMP support will be provided through the following MIB objects:

hpicfFfBcastStormControlPortConfig OBJECT IDENTIFIER

:: = { hpicfFaultFinder 5 }

hpicfFfBcastStormControlPortConfigTable OBJECT-TYPE

- syntax sequence: **HpicfFfBcastStormControlPortConfigEntry**
- max-access: not-accessible
- status: current
- description: This table provides information about broadcast storm control configuration of all ports.**::= {hpicfFfBcastStormControlPortConfig 1}**

hpicfFfBcastStormControlPortConfigEntry OBJECT-TYPE

- syntax **HpicfFfBcastStormControlPortConfigEntry**
- max-access: not-accessible
- status: current
- description: This object provides information about broadcast storm control configuration of each port.
- index: {**hpicfffbcaststormcontrolportindex**}**::= {hpicfFfBcastStormControlPortConfigTable 1}**

hpicfFfBcastStormControlPortConfigEntry ::=

- Syntax sequence:**hpicfFfBcastStormControlPortIndex** InterfaceIndex,
  hpicfFfBcastStormControlMode Integer,
  hpicfFfBcastStormControlRisingpercent Integer32,
  hpicfFfBcastStormControlRisingpps Integer32,
  hpicfFfBcastStormControlAction Integer,
  hpicfFfBcastStormControlPortDisableTimer Unsigned32

hpicfFfBcastStormControlPortIndex OBJECT-TYPE

- Syntax Interfaceindex
- max-access: not-accessible
- status: current
- description: The Index Value Which Uniquely Identifies A Row In The Interfaces Table.
  ::= {hpicfFfBcastStormControlPortConfigEntry 1}

hpicfFfBcastStormControlMode OBJECT-TYPE

- Syntax Integer: disabled(1), **Bcastrisinglevelpercent**(2), **Bcastrisinglevelpps**(3)
- max-access: read-write
- status: current

- description: The broadcast storm control mode of a port. A value of disable (1) indicates that no rising threshold value is set for broadcast storm traffic on this port. A value of **bcastrisinglevelpercent** (2) indicates that the rising threshold rate for broadcast storm traffic is configured in percentage of port bandwidth. A value of **bcastrisinglevelpps** (3) indicates that the rising threshold rate for broadcast storm traffic is configured in packets per second.
- DEFVAL: disabled

  ::= {hpicfFfBcastStormControlPortConfigEntry 2}

hpicfFfBcastStormControlRisingpercent OBJECT-TYPE

- Syntax Integer32 (1..100)
- max-access: read-write
- status: current
- description: This Is The Rising Threshold Level in percent of bandwidth of the port. **hpicfFfBcastStormControlAction** occurs when broadcast traffic reaches this level.

  ::= {hpicfFfBcastStormControlPortConfigEntry 3}

hpicfFfBcastStormControlRisingpps OBJECT-TYPE

- Syntax Integer32 (1..10000000)
- max-access: read-write
- status: current
- description: This object indicates the rising threshold for broadcast storm control. This value is in packets-per-second of received broadcast traffic. **hpicfffbcaststormcontrolaction** object takes action when broadcast traffic reaches this level.

  ::= {**hpicfFfBcastStormControlPortConfigEntry 4}**

hpicfFfBcastStormControlAction OBJECT-TYPE

- Syntax integer: none(1), warn(2), warnanddisable(3)
- max-access: read-write
- status: current
- Description: This object defines the action taken by the switch when a broadcast storm occurs on a port. A value of none (1) indicates that no action is performed. A value of warn (2) indicates that an event is logged when broadcast traffic crosses the threshold value set on that port. A value of warn-and-disable (3) indicates that the port is disabled and an event is logged as soon as the broadcast traffic reaches the threshold value set on that port.
- DEFVAL: none

  ::= {hpicfFfBcastStormControlPortConfigEntry 5}

hpicfFfBcastStormControlPortDisableTimer OBJECT-TYPE

- Syntax Unsigned32 (0..604800)
- Units: seconds
- max-access: read-write
- status: current
- Description: This object specifies the time period for which the port remains in disabled state. A port is disabled when broadcast traffic reaches the threshold value set on that port. This time period is specified in seconds. The default value is zero which means that the port remains disabled and is not enabled again.

- DEFVAL {0}

  ::= {hpicfFfBcastStormControlPortConfigEntry 6}

hpicfBasicSNMPConfig OBJECT IDENTIFIER ::= { hpicfBasic 18 }

hpicfSwitchSnmpEnabledTrapEventList OBJECT-TYPE

- Syntax OCTET STRING (SIZE (876))
- max-access: read-create
- status: current
- Description: This object is used to configure the event-list that needs to be send as trap together with RMON logging.
- By default, all the events will be sent as a SNMP trap together with RMON logging. But once this object is configured, trap will be sent for only the specified events and RMON logging will be continued for all events.

  ::= { hpicfBasicSNMPConfig 5 }

Multicast Storm Control

Overview

A multicast storm arises when excessive multicast traffic is exchanged on network ports. Excessive traffic includes more than expected traffic, or which exceeds a limit value or some percentage of network traffic, or a percentage of network channel capacity.

To prevent this, a warning message, along with port-shutdown option, is displayed to the user when the network detects similar multicast packets. At this time, the user can disable the port temporarily and enable it again, or permanently disable it.

fault-finder multicast-storm

Syntax

```
fault-finder multicast-storm <PORT-LIST> action {warn | warn-and-disable <Seconds>}
{percent <Percent> | pps <Rate>}
no fault-finder multicast-storm <PORT-LIST> action {warn | warn-and-disable <Seconds>}
{percent <Percent> | pps <Rate>}
```

Description

Per-port command to configure multicast-storm. The `no` form of the command disables multicast-storm configuration on the port.

Parameters

PORT-LIST

Enable multicast storm control on a list of ports.

Seconds

Configure the number of seconds for which the port remains disabled.

Percent

Rising threshold level as a percentage of bandwidth of the port. The percentage is calculated on 64 byte packet size.

Rate

Rising threshold level in number of multicast packets per second

Command context

`config`

Examples

```
switch(config)# fault-finder multicast-storm
action                Configure the action taken when a fault is detected.
[ethernet] PORT-LIST  The ports on which to enable Multicast Storm Control.
sensitivity           Configure the fault sensitivity level.

switch(config)# fault-finder multicast-storm ethernet
PORT-LIST             Enter a port number, a list of ports or 'all' for all
                      ports.

switch(config)# fault-finder multicast-storm ethernet 1/1
action                Configure the action taken when a multicast storm is
                      detected.

switch(config)# fault-finder multicast-storm ethernet 1/1 action
warn                  Log an event only.
warn-and-disable      Log an event and disable the port.


switch(config)# fault-finder multicast-storm ethernet 1/1 action warn-and-disable

SECONDS               Configure the number of seconds for which the port
                      remains disabled. A value of 0 means that the port will
                      remain disabled until manually re-enabled.

switch(config)# fault-finder multicast-storm ethernet 1/1 action warn-and-disable 10

percent               Configure the number of inbound multicast packets per
                      second that is considered a multicast storm. This
                      threshold is computed assuming a size of 64 bytes per
                      incoming multicast packet.
pps                   Configure the number of inbound multicast packets per
                      second that is considered a multicast storm.

switch(config)# fault-finder multicast-storm ethernet 1/1 action warn-and-disable 10
percent

<1-100>               The percentage that is considered a multicast storm.

switch(config)# fault-finder multicast-storm ethernet 1/1 action warn-and-disable 10
percent 40
```

Per port `show fault-finder` output:

```
switch(config)# show fault-finder multicast-storm 1/1

        Mcast | Port   Rising                      Disable    Disable Time
  Port  Storm | Status Threshold Action           Timer      Left
  ----- ----- + ------ --------- ---------------- ---------- ------------
  1/1   Yes   | Down   40%       warn-and-disable 10          -


switch(config)# show fault-finder multicast-storm

        Mcast | Port   Rising                      Disable    Disable Time
  Port  Storm | Status Threshold Action           Timer      Left
  ----- ----- + ------ --------- ---------------- ---------- ------------
```

```
  1/1   Yes   | Down   40%       warn-and-disable 10          -
  1/2   Yes   | Down   50%       warn-and-disable 10          -
  1/3   Yes   | Down   50%       warn-and-disable 10          -
  1/4   Yes   | Down   50%       warn-and-disable 10          -
  1/5   Yes   | Down   50%       warn-and-disable 10          -
  1/6   Yes   | Down   50%       warn-and-disable 10          -
  1/7   Yes   | Down   50%       warn-and-disable 10          -
  1/8   Yes   | Down   50%       warn-and-disable 10          -
  1/9   Yes   | Down   50%       warn-and-disable 10          -
  1/10  Yes   | Down   50%       warn-and-disable 10          -
  1/11  Yes   | Down   50%       warn-and-disable 10          -
  1/12  Yes   | Down   50%       warn-and-disable 10          -
```

Configure ports 1/1 to 1/5 for multicast storm control, and warn and disable the ports after 100 seconds, with a rising threshold of 20%:

```
switch(config)# fault-finder multicast-storm ethernet 1/1-1/5 action
warn-and-disable 100 percent 20

switch(config)# show fault-finder multicast-storm ethernet 1/1-1/5

        Mcast | Port   Rising                      Disable    Disable Time
  Port  Storm | Status Threshold Action            Timer      Left
  ----- ----- + ------ --------- ----------------  ---------- ------------
  1/1   Yes   | Down   20%       warn-and-disable  100         -
  1/2   Yes   | Down   20%       warn-and-disable  100         -
  1/3   Yes   | Down   20%       warn-and-disable  100         -
  1/4   Yes   | Down   20%       warn-and-disable  100         -
  1/5   Yes   | Down   20%       warn-and-disable  100         -
```

Disable multicast storm control on port 1/1:

```
switch(config)# no fault-finder multicast-storm ethernet 1/1
switch(config)# show fault-finder multicast-storm ethernet 1/1

        Mcast | Port   Rising                     Disable    Disable Time
  Port  Storm | Status Threshold Action           Timer      Left
  ----- ----- + ------ --------- ---------------- ---------- ------------
  1/1   No    | Down      -       none             -          -
```

fault-finder multicast-storm action

Syntax

```
fault-finder multicast-storm [action {warn | warn-and-disable}] [sensitivity {low |
medium |high}]
no fault-finder multicast-storm [action {warn | warn-and-disable}] [sensitivity {low |
medium |high}]
```

Description

Global command to configure multicast-storm. The `no` form of the command disables multicast-storm configuration on the port. The default sensitivity is `medium` and the default action is `warn`.

Parameters

warn

Log an event only

warn-and-disable

Log an event and disable the port

low

Low sensitivity

medium

Medium sensitivity

high

High sensitivity

Command context

`config`

Examples

```
switch(config)# fault-finder multicast-storm action warn
sensitivity     Configure the fault sensitivity level.

switch(config)# fault-finder multicast-storm action warn sensitivity
low             Low sensitivity.
medium          Medium sensitivity.
high            High sensitivity.

switch(config)# fault-finder multicast-storm action warn-and-disable
sensitivity     Configure the fault sensitivity level.

switch(config)# fault-finder multicast-storm action warn-and-disable sensitivity
low             Low sensitivity.
medium          Medium sensitivity.
high            High sensitivity.

switch(config)# fault-finder multicast-storm action warn-and-disable sensitivity high
```

Global `show` command for auto-100 duplex Smart Rate port:

```
switch(config)# show fault-finder

Fault Finder

Fault ID              Sensitivity  Action
--------------------  -----------  ----------------
bad-driver            medium       warn
bad-transceiver       medium       warn
bad-cable             medium       warn
too-long-cable        medium       warn
over-bandwidth        medium       warn
broadcast-storm       medium       warn
loss-of-link          medium       warn
duplex-mismatch-hdx   medium       warn
duplex-mismatch-fdx   medium       warn
multicast-storm       high         warn-and-disable
link-flap             medium       warn
```

show running-config

Syntax

`show running-config`

Description

Displays information about the current configuration.

Command context

Manager

Example

```
switch(config)# show running-config

Running configuration:

; hpStack_WC Configuration Editor; Created on release #WC.16.06.0000x
; Ver #13:03.f8.1c.9b.3f.bf.bb.ef.7c.59.fc.6b.fb.9f.fc.ff.ff.37.ef:49

stacking
   member 1 type "JL320A" mac-address 941882-dccf00
   member 1 flexible-module A type JL081A
   exit
hostname "switch"
fault-finder multicast-storm sensitivity high action warn-and-disable
fault-finder multicast-storm 1/1 action warn-and-disable 100 percent 20
fault-finder multicast-storm 1/2 action warn-and-disable 100 percent 20
fault-finder multicast-storm 1/3 action warn-and-disable 100 percent 20
fault-finder multicast-storm 1/4 action warn-and-disable 100 percent 20
fault-finder multicast-storm 1/5 action warn-and-disable 100 percent 20
fault-finder multicast-storm 1/7 action warn-and-disable 10 pps 100
fault-finder multicast-storm 1/8 action warn-and-disable 10 percent 20
fault-finder multicast-storm 1/9 action warn-and-disable 10 percent 20
snmp-server community "public" unrestricted
oobm
   ip address dhcp-bootp
   member 1
      ip address dhcp-bootp
      exit
```

show logging

Syntax

```
show logging
```

Description

Checks the FFI multicast-storm logging message.

Command context

Manager

Example

```
switch# show logging
Keys:   W=Warning   I=Information
        M=Major     D=Debug E=Error

----  Event Log listing: Events Since Boot  ----
I 01/07/90 20:22:55 00076 ports: port 3 is now on-line
M 01/07/90 20:22:52 02677 FFI: port 3-Port enabled by Fault-finder.
I 01/07/90 20:22:33 00077 ports: port 3 is now off-line
M 01/07/90 20:22:33 02676 FFI: port 3-Re-enable after 20 seconds.
M 01/07/90 20:22:33 02673 FFI: port 3-Port disabled by Fault-finder.
M 01/07/90 20:22:33 02675 FFI: port 3-Excessive Multicast-storm control threshold 10 %
exceeded.
```

Restrictions

Multicast storm control is not supported in the following scenarios:

- Unicast packet traffic
- If the port is configured as a VSF port
- If the port is configured as a trunk port

Configuring auto-MDIX

Copper ports on the switch can automatically detect the type of cable configuration (MDI or MDI-X) on a connected device and adjust to operate appropriately.

This means you can use a "straight-through" twisted-pair cable or a "crossover" twisted-pair cable for any of the connections—the port makes the necessary adjustments to accommodate either one for correct operation. The following port types on your switch support the IEEE 802.3ab standard, which includes the "Auto MDI/MDI-X" feature:

- 10/100-TX xl module ports
- 100/1000-T xl module ports
- 10/100/1000-T xl module ports

Using the above ports:

- If you connect a copper port using a straight-through cable on a switch to a port on another switch or hub that uses MDI-X ports, the switch port automatically operates as an MDI port.
- If you connect a copper port using a straight-through cable on a switch to a port on an end node—such as a server or PC—that uses MDI ports, the switch port automatically operates as an MDI-X port.

Auto-MDIX was developed for auto-negotiating devices, and was shared with the IEEE for the development of the IEEE 802.3ab standard. Auto-MDIX and the IEEE 802.3ab Auto MDI/MID-X feature are completely compatible. Additionally, Auto-MDIX supports operation in forced speed and duplex modes.

For more information on this subject, see the IEEE 802.3ab standard reference. For more information on MDI-X, the installation and getting started guide for your switch.

Manual override

If you require control over the MDI/MDI-X feature, you can set the switch to either of these non-default modes:

- Manual MDI
- Manual MDI-X

The table below shows the cabling requirements for the MDI/MDI-X settings.

Table 5: *Cable types for auto and manual MDI/MDI-X settings*

Setting	MDI/MDI-X device type	
	PC or other MDI device type	Switch, hub, or other MDI-X device
Manual MDI	Crossover cable	Straight-through cable
Manual MDI-X	Straight-through cable	Crossover cable
Auto-MDI-X (the default)	Either crossover or straight-through cable	

The AutoMDIX features apply only to copper port switches using twisted-pair copper Ethernet cables.

Configuring auto-MDIX (CLI)

The auto-MDIX features apply only to copper port switches using twisted-pair copper Ethernet cables. For information about auto-MDIX, see Configuring auto-MDIX on page 67.

Syntax

`interface <port-list> mdix-mode < {auto-mdix | mdi | mdix>}`

`auto-mdix`	The automatic,default setting. This configures the port for automatic detection of the cable (either straight-through or crossover).
`mdi`	The manual mode setting that configures the port for connecting to either a PC or other MDI device with a crossover cable, or to a switch, hub, or other MDI-X device with a straight-through cable.
`mdix`	The manual mode setting that configures the port for connecting to either a switch, hub, or other MDI-X device with a crossover cable, or to a PC or other MDI device with a straight-through cable.

Syntax

`show interfaces config`

Lists the current per-port Auto/MDI/MDI-X configuration.

Syntax

`show interfaces brief`

- Where a port is linked to another device, this command lists the MDI mode the port is currently using.
- In the case of ports configured for `Auto` (`auto-mdix`), the MDI mode appears as either `MDI` or `MDIX`, depending upon which option the port has negotiated with the device on the other end of the link.
- In the case of ports configured for `MDI` or `MDIX`, the mode listed in this display matches the configured setting.
- If the link to another device was up, but has gone down, this command shows the last operating MDI mode the port was using.
- If a port on a given switch has not detected a link to another device since the last reboot, this command lists the MDI mode to which the port is currently configured.

The `show interfaces config` displays the following data when port A1 is configured for `auto-mdix`, port A2 is configured for `mdi`, and port A3 is configured for `mdix`:

Displaying the current MDI configuration

```
switch(config)# show interfaces config

 Port Settings

  Port   Type       | Enabled Mode         Flow Ctrl MDI
  ------ ---------- + ------- ------------ --------- ----
  A1     10GbE-T    | Yes     Auto         Disable   Auto
```

```
  A2     10GbE-T   | Yes     Auto         Disable   MDI
  A3     10GbE-T   | Yes     Auto         Disable   MDIX
  A4     10GbE-T   | Yes     Auto         Disable   Auto
  A5     10GbE-T   | Yes     Auto         Disable   Auto
  A6     10GbE-T   | Yes     Auto         Disable   Auto
  A7     10GbE-T   | Yes     Auto         Disable   Auto
  A8     10GbE-T   | Yes     Auto         Disable   Auto
```

Displaying the current MDI operating mode

```
switch(config)# show interfaces brief

 Status and Counters - Port Status

                   | Intrusion                              MDI   Flow Bcast
  Port   Type      | Alert     Enabled Status Mode          Mode  Ctrl Limit
  ------ --------- + --------- ------- ------ ----------    ----  ---- -----
  A1     10GbE-T   | No        Yes     Up     1000FDx       MDIX  off  0
  A2     10GbE-T   | No        Yes     Down   10GigFD       MDI   off  0
  A3     10GbE-T   | No        Yes     Down   10GigFD       MDIX  off  0
  A4     10GbE-T   | No        Yes     Down   10GigFD       Auto  off  0
  A5     10GbE-T   | No        Yes     Down   10GigFD       Auto  off  0
  A6     10GbE-T   | No        Yes     Down   10GigFD       Auto  off  0
  A7     10GbE-T   | No        Yes     Down   10GigFD       Auto  off  0
  A8     10GbE-T   | No        Yes     Down   10GigFD       Auto  off  0
```

Using friendly (optional) port names

This feature enables you to assign alphanumeric port names of your choosing to augment automatically assigned numeric port names. This means you can configure meaningful port names to make it easier to identify the source of information listed by some `show` commands. (Note that this feature **augments** port numbering, but **does not replace** it.)

Configuring and operating rules for friendly port names

- At either the global or context configuration level, you can assign a unique name to a port. You can also assign the same name to multiple ports.
- The friendly port names you configure appear in the output of the `show name` [*port-list*], `show config`, and `show interface` <*port-number* > commands. They do not appear in the output of other `show` commands or in Menu interface screens. (See Displaying friendly port names with other port data (CLI).)
- Friendly port names are not a substitute for port numbers in CLI commands or Menu displays.
- Trunking ports together does not affect friendly naming for the individual ports. (If you want the same name for all ports in a trunk, you must individually assign the name to each port.)
- A friendly port name can have up to 64 contiguous alphanumeric characters.
- Blank spaces within friendly port names are not allowed, and if used, cause an **invalid input** error. (The switch interprets a blank space as a name terminator.)
- In a port listing, **not assigned** indicates that the port does not have a name assignment other than its fixed port number.
- To retain friendly port names across reboots, you must save the current running-configuration to the startup-config file after entering the friendly port names. (In the CLI, use the `write memory` command.)

Configuring friendly port names (CLI)

For detailed information about friendly port names, see Using friendly (optional) port names on page 69.

Syntax

`interface <port-list> name <port-name-string>`

Assigns a port name to port-list.

Syntax

`no interface <port-list> name`

Deletes the port name from <*port-list*>.

Configuring a single port name (CLI)

Suppose that you have connected port A3 on the switch to Bill Smith's workstation, and want to assign Bill's name and workstation IP address (10.25.101.73) as a port name for port A3:

Configuring a friendly port name

```
switch(config)# int A3 name
Bill_Smith@10.25.101.73
switch(config)# write mem
switch(config)# show name A3

 Port Names
  Port : A3
   Type : 10/100TX
```

Configuring the same name for multiple ports (CLI)

Suppose that you want to use ports A5 through A8 as a trunked link to a server used by a drafting group. In this case you might configure ports A5 through A8 with the name "Draft-Server:Trunk."

Configuring one friendly port name on multiple ports

```
switch(config)# int a5-a8 name Draft-Server:Trunk
switch(config)# write mem
switch(config)# show name a5-a8

 Port Names

  Port : A5
   Type : 10GbE-T
   Name : Draft-Server:Trunk

 Port : A6
   Type : 10GbE-T
   Name : Draft-Server:Trunk

 Port : A7
   Type : 10GbE-T
   Name : Draft-Server:Trunk

  Port : A8
   Type : 10GbE-T
   Name : Draft-Server:Trunk
```

Displaying friendly port names with other port data (CLI)

You can display friendly port name data in the following combinations:

Syntax

`show name`

Displays a listing of port numbers with their corresponding friendly port names and also quickly shows you which ports do not have friendly name assignments. (`show name` data comes from the running-config file.)

Syntax

`show interface <port-number>`

Displays the friendly port name, if any, along with the traffic statistics for that port. (The friendly port name data comes from the running-config file.)

Syntax

`show config`

Includes friendly port names in the per-port data of the resulting configuration listing. (`show config` data comes from the start-up-config file.)

Parameters

status

Shows whether the running configuration differs from the start-up configuration.

structured

Shows the running configuration in a grouped format.

oobm

Shows the running configuration for Out-of-band management (OOBM) used for remote management switch.

change-history [<NUMBER> | detail]

Shows the change-history logs of the running configuration.

Interface [<PORT-LIST> | loopback | tunnel]

Shows the running configuration for interfaces.

router [bgp | ospf | ospf3 | pim | rip | vrrp]

Shows the running configuration for layer 3 routing protocols.

Vlan [<VLAN-LIST>]

Shows the running configuration for VLANs.

hash [recalculate]

Shows the hash calculated for the running configuration.

concise

Lists the running configuration in a consolidated format for the specified port-list. This feature categorically consolidates port-access and spanning-tree attributes.

- This feature is not available for cfg-restore, REST execution, SNMP and web UI interfaces.
- Do not use the `show config concise` output with `cfg-restore` feature.
- Do not download the `show config concise` output as a template or configuration file to a switch.

Listing all ports or selected ports with their friendly port names (CLI)

Syntax

`show name [port-list]`

Lists the friendly port name with its corresponding port number and port type. The `show name` command without a port list shows this data for all ports on the switch.

Friendly port name data for all ports on the switch

```
switch(config)# show name
Port Names
  Port   Type       Name
  ------ ---------- ---------------------------
  A1     10GbE-T
  A2     10GbE-T
  A3     10GbE-T    Bill_Smith@10.25.101.73
  A4     10GbE-T
  A5     10GbE-T    Draft-Server:Trunk
  A6     10GbE-T    Draft-Server:Trunk
  A7     10GbE-T    Draft-Server:Trunk
  A8     10GbE-T    Draft-Server:Trunk
```

Friendly port name data for specific ports on the switch

```
switch(config)# show name A3-A5
 Port Names
  Port : A3
  Type : 10GbE-T
  Name : Bill_Smith@10.25.101.73
 Port : A4
  Type : 10GbE-T
  Name :
 Port : A5
  Type : 10GbE-T
  Name : Draft-Server:Trunk
```

Including friendly port names in per-port statistics listings (CLI)

Syntax

`show interface <port-number>`

Includes the friendly port name with the port's traffic statistics listing. A friendly port name configured to a port is automatically included when you display the port's statistics output.

If you configure port A1 with the name "O'Connor_10.25.101.43," the `show interface` output for this port appears similar to the following:

A friendly port name in a per-port statistics listing

```
switch(config)# show interface a1
 Status and Counters - Port Counters for port A1

  Name   : O'Connor@10.25.101.43
  MAC Address     : 001871-b995ff
  Link Status     : Up
  Totals (Since boot or last clear) :
   Bytes Rx       : 2,763,197          Bytes Tx       : 22,972
   Unicast Rx     : 2044               Unicast Tx     : 128
   Bcast/Mcast Rx  : 23,456            Bcast/Mcast Tx : 26
  Errors (Since boot or last clear) :
   FCS Rx         : 0                  Drops Tx       : 0
   Alignment Rx    : 0                 Collisions Tx  : 0
   Runts Rx       : 0                  Late Colln Tx  : 0
   Giants Rx      : 0                  Excessive Colln : 0
   Total Rx Errors : 0                 Deferred Tx    : 0
  Others (Since boot or last clear) :
   Discard Rx     : 0                  Out Queue Len  : 0
   Unknown Protos  : 0
  Rates (5 minute weighted average) :
   Total Rx (bps) : 3,028,168          Total Tx  (bps) : 1,918,384
   Unicast Rx (Pkts/sec) : 5           Unicast Tx (Pkts/sec) : 0
   B/Mcast Rx (Pkts/sec) : 71          B/Mcast Tx (Pkts/sec) : 0
   Utilization Rx  : 00.30 %           Utilization Tx : 00.19 %
```

For a given port, if a friendly port name does not exist in the running-config file, the Name line in the above command output appears as:

`Name :`

Searching the configuration for ports with friendly port names (CLI)

This option tells you which friendly port names have been saved to the startup-config file. (`show config` does not include ports that have only default settings in the startup-config file.)

Syntax

`show config`

Includes friendly port names in a listing of all interfaces (ports) configured with non-default settings. Excludes ports that have neither a friendly port name nor any other non-default configuration settings.

See Listing of the startup-config file with a friendly port name configured (and saved) on page 73 to configure port A1 with a friendly port name. Notice that the command sequence saves the friendly port name for port A1 in the startup-config file. The name entered for port A2 is not saved because it was executed after `write memory`.

Listing of the startup-config file with a friendly port name configured (and saved)

```
switch(config)# int A1 name Print_Server@10.25.101.43
switch(config)# write mem
switch(config)# int A2 name Herbert's_PC

switch(config)# show config

 Startup configuration:
; J9091A Configuration Editor; Created on release xx.15.05.xxxx
hostname "Switch"
 interface A0
  name "Print_Server@10.25.101.43
 exit

snmp-server community "public" Unrestricted
```

.
.
.

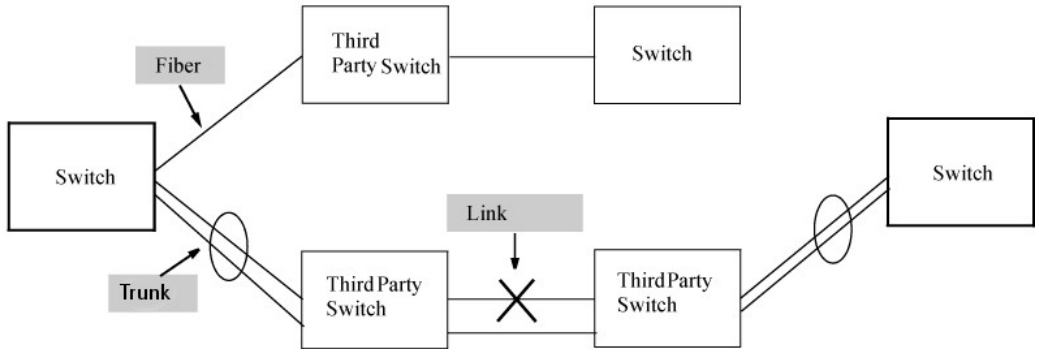
Uni-directional link detection (UDLD)

Uni-directional link detection (UDLD) monitors a link between two switches and blocks the ports on both ends of the link if the link fails at any point between the two devices. This feature is particularly useful for detecting failures in fiber links and trunks. Figure 4: UDLD Example: shows an example.

Figure 4 *UDLD Example:*

Scenario 1 (No UDLD): Without UDLD, the switch ports remain enabled despite the link failure. Traffic continues to be load-balanced to the ports connected to the failed link.

Scenario 2 (UDLD-enabled): When UDLD is enabled, the feature blocks the ports connected to the failed link.



In this example, each switch load balances traffic across two ports in a trunk group. Without the UDLD feature, a link failure on a link that is not directly attached to one of the switch remains undetected. As a result, each switch continue to send traffic on the ports connected to the failed link. When UDLD is enabled on the trunk ports on each switch, the switches detect the failed link, block the ports connected to the failed link, and use the remaining ports in the trunk group to forward the traffic.

Similarly, UDLD is effective for monitoring fiber optic links that use two uni-direction fibers to transmit and receive packets. Without UDLD, if a fiber breaks in one direction, a fiber port may assume the link is still good (because the other direction is operating normally) and continue to send traffic on the connected ports. UDLD-enabled ports; however, will prevent traffic from being sent across a bad link by blocking the ports in the event that either the individual transmitter or receiver for that connection fails.

Ports enabled for UDLD exchange health-check packets once every five seconds (the link-keepalive interval). If a port does not receive a health-check packet from the port at the other end of the link within the keepalive interval, the port waits for four more intervals. If the port still does not receive a health-check packet after waiting for five intervals, the port concludes that the link has failed and blocks the UDLD-enabled port.

When a port is blocked by UDLD, the event is recorded in the switch log or via an SNMP trap (if configured); and other port blocking protocols, like spanning tree or meshing, will not use the bad link to load balance packets. The port will remain blocked until the link is unplugged, disabled, or fixed. The port can also be unblocked by disabling UDLD on the port.

Configuring UDLD

When configuring UDLD, keep the following considerations in mind:

- UDLD is configured on a per-port basis and must be enabled at both ends of the link. See the note below for a list of switches that support UDLD.
- To configure UDLD on a trunk group, you must configure the feature on each port of the group individually. Configuring UDLD on a trunk group's primary port enables the feature on that port only.
- Dynamic trunking is not supported. If you want to configure a trunk group that contains ports on which UDLD is enabled, you must remove the UDLD configuration from the ports. After you create the trunk group, you can re-add the UDLD configuration.

Configuring uni-directional link detection (UDLD) (CLI)

For detailed information about UDLD, see Uni-directional link detection (UDLD) on page 74.

Syntax

`no interface <port-list> link-keepalive`

Enables UDLD on a port or range of ports.

To disable this feature, enter the `no` form of the command.

Default: UDLD disabled

Syntax

`link-keepalive interval <interval>`

Determines the time interval to send UDLD control packets. The *`interval`* parameter specifies how often the ports send a UDLD packet. You can specify from 10 to 100, in 100-ms increments, where 10 is 1 second, 11 is 1.1 seconds, and so on.

Default: 50 (5 seconds)

Syntax

`link-keepalive retries <num>`

Determines the maximum number of retries to send UDLD control packets. The `num` parameter specifies the maximum number of times the port will try the health check. You can specify a value from 3 to 10.

Default: 5

Syntax

`no interface <port-list> link-keepalive vlan <vid>`

Assigns a VLAN ID to a UDLD-enabled port for sending tagged UDLD control packets.Under default settings, untagged UDLD packets can still be transmitted and received on tagged only ports; however, a warning message is logged.

The `no` form of the command disables UDLD on the specified ports.

Default: UDLD packets are untagged; tagged-only ports transmit and receive untagged UDLD control packets

Enabling UDLD (CLI)

UDLD is enabled on a per-port basis.

Example

To enable UDLD on port a1, enter:

```
switch(config)#interface a1 link-keepalive
```

To enable the feature on a trunk group, enter the appropriate port range. For example:

```
switch(config)#interface a1-a4 link-keepalive
```

When at least one port is UDLD-enabled, the switch will forward out UDLD packets that arrive on non-UDLD-configured ports out of all other non-UDLDconfigured ports in the same vlan. That is, UDLD control packets will “pass through” a port that is not configured for UDLD. However, UDLD packets will be dropped on any blocked ports that are not configured for UDLD.

Changing the keepalive interval (CLI)

By default, ports enabled for UDLD send a link health-check packet once every 5 seconds. You can change the interval to a value from 10 to 100 deciseconds, where 10 is 1 second, 11 is 1.1 seconds, and so on.

Example

To change the packet interval to seven seconds, enter the following command at the global configuration level:

```
switch(config)# link-keepalive interval 70
```

Changing the keepalive retries (CLI)

By default, a port waits 5 seconds to receive a health-check reply packet from the port at the other end of the link. If the port does not receive a reply, the port tries four more times by sending up to four more health-check packets. If the port still does not receive a reply after the maximum number of retries, the port goes down.

You can change the maximum number of keepalive attempts to a value from 3 to 10.

Example

To change the maximum number of attempts to four, enter the following command at the global configuration level:

```
switch(config)# link-keepalive retries 4
```

Configuring UDLD for tagged ports

The default implementation of UDLD sends the UDLD control packets untagged, even across tagged ports. If an untagged UDLD packet is received by a non-HPE switch, that switch may reject the packet. To avoid such an occurrence, you can configure ports to send out UDLD control packets that are tagged with a specified VLAN.

To enable ports to receive and send UDLD control packets tagged with a specific VLAN ID, enter a command such as the following at the interface configuration level:

```
switch(config)#interface link-keepalive vlan 22
```

- You must configure the same VLANs that will be used for UDLD on all devices across the network; otherwise, the UDLD link cannot be maintained.
- If a VLAN ID is not specified, UDLD control packets are sent out of the port as untagged packets.
- To re-assign a VLAN ID, re-enter the command with the new VLAN ID number. The new command overwrites the previous command setting.
- When configuring UDLD for tagged ports, you may receive a warning message if there are any inconsistencies with the VLAN configuration of the port.

Viewing UDLD information (CLI)

Syntax

`show link-keepalive`

Displays all the ports that are enabled for `link-keepalive`.

Syntax

`show link-keepalive statistics`

Displays detailed statistics for the UDLD-enabled ports on the switch.

Syntax

`clear link-keepalive statistics`

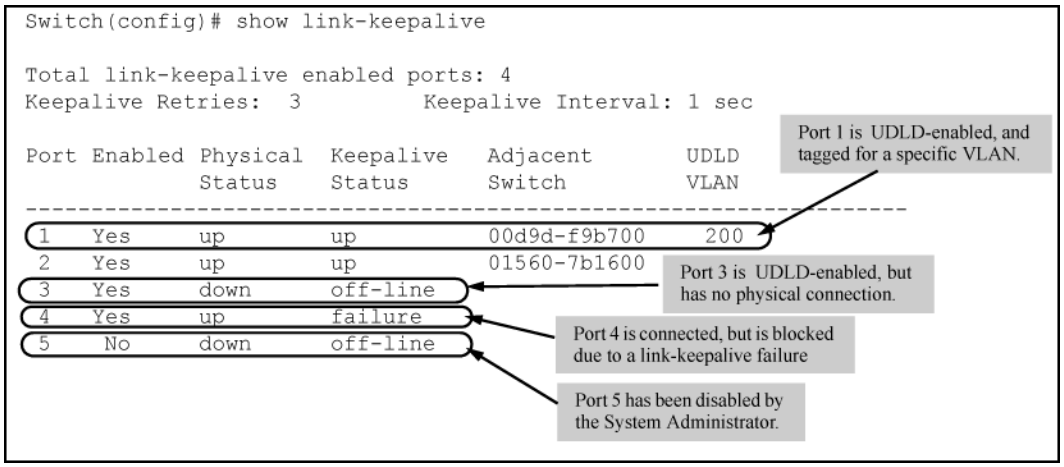
Clears UDLD statistics. This command clears the packets sent, packets received, and transitions counters in the `show link-keepalive statistics` display.

Viewing summary information on all UDLD-enabled ports (CLI)

Enter the `show link-keepalive` command.

Example

Figure 5 *Example: show link-keepalive command*

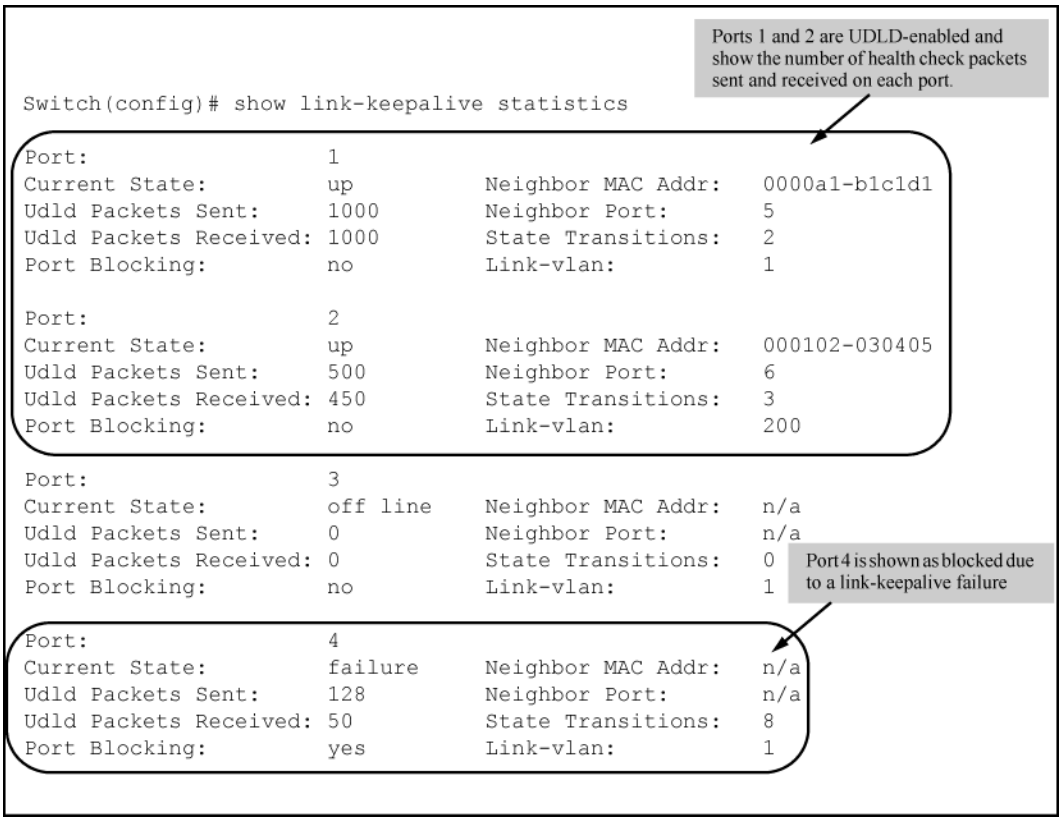


Viewing detailed UDLD information for specific ports (CLI)

Enter the `show link-keepalive statistics` command.

Example

Figure 6 *Example: show link-keepalive statistics command*




```
Switch(config)# show link-keepalive statistics

Port:                  1
Current State:         up          Neighbor MAC Addr:   0000a1-b1c1d1
Udld Packets Sent:     1000        Neighbor Port:       5
Udld Packets Received: 1000        State Transitions:   2
Port Blocking:         no          Link-vlan:           1

Port:                  2
Current State:         up          Neighbor MAC Addr:   000102-030405
Udld Packets Sent:     500         Neighbor Port:       6
Udld Packets Received: 450         State Transitions:   3
Port Blocking:         no          Link-vlan:           200

Port:                  3
Current State:         off line    Neighbor MAC Addr:   n/a
Udld Packets Sent:     0           Neighbor Port:       n/a
Udld Packets Received: 0           State Transitions:   0
Port Blocking:         no          Link-vlan:           1

Port:                  4
Current State:         failure     Neighbor MAC Addr:   n/a
Udld Packets Sent:     128         Neighbor Port:       n/a
Udld Packets Received: 50          State Transitions:   8
Port Blocking:         yes         Link-vlan:           1
```

Clearing UDLD statistics (CLI)

Enter the following command:

```
switch# clear link-keepalive statistics
```

This command clears the packets sent, packets received, and transitions counters in the `show link keepalive statistics` display (see Figure 6: Example: show link-keepalive statistics command for an example).

Uplink Failure Detection

Uplink Failure Detection (UFD) is a network path redundancy feature that works in conjunction with NIC teaming functionality. UFD continuously monitors the link state of the ports configured as links-to-monitor (LtM), and when these ports lose link with their partners, UFD will disable the set of ports configured as links-to-disable (LtD.) When an uplink port goes down, UFD enables the switch to auto-disable the specific downlinks connected to the NICs. This allows the NIC teaming software to detect link failure on the primary NIC port and fail over to the secondary NIC in the team.

NIC teams must be configured for switch redundancy when used with UFD, that is, the team spans ports on both Switch A and Switch B. The switch automatically enables the downlink ports when the uplink returns to service. For an example of teamed NICs in conjunction with UFD, see Figure 7: Teamed NICs in conjunction with UFD.) For an example of teamed NICs with a failed uplink, see Figure 8: Teamed NICs with a failed uplink.

For UFD functionality to work as expected, the NIC teaming must be in Network Fault Tolerance (NFT) mode.

Figure 7 *Teamed NICs in conjunction with UFD*

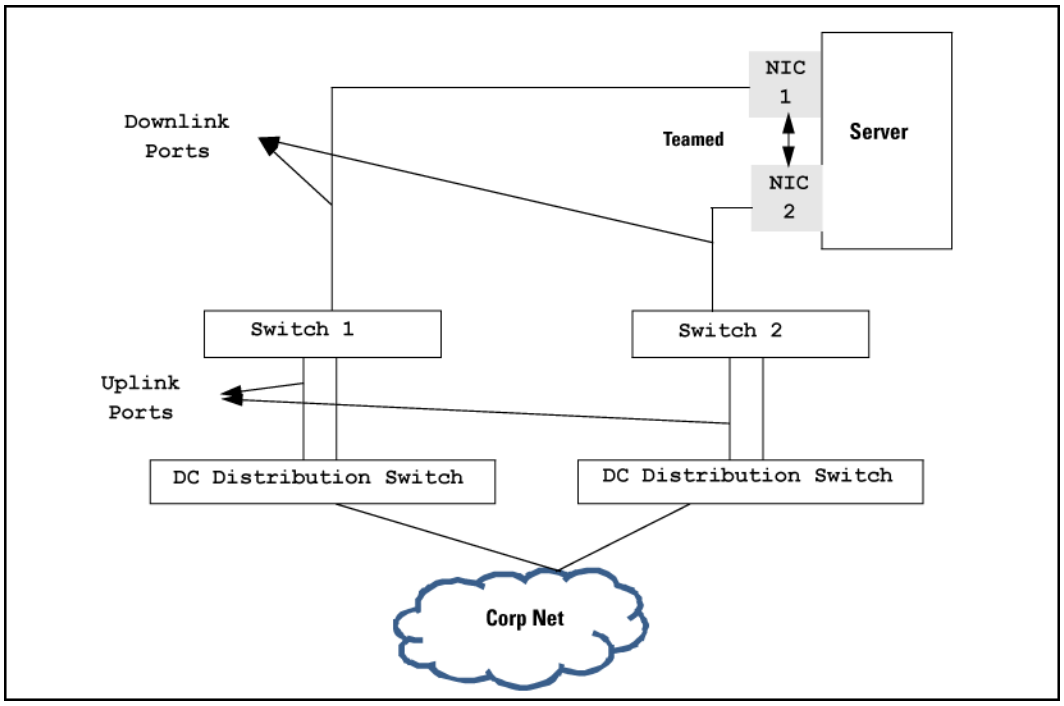
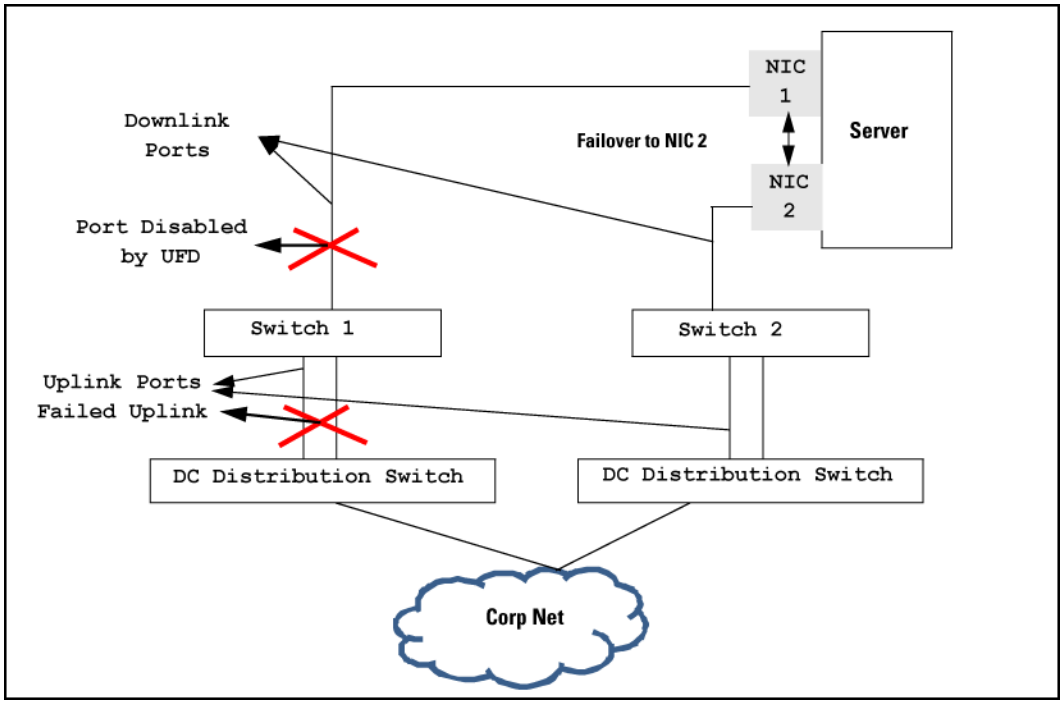


Figure 8 *Teamed NICs with a failed uplink*



NOTE

The state of the LtD is purely governed by the state of the LtM, and is independent of the physical state of the ports in the LtD.

Configuration Guidelines for UFD

Below is a list of configuration guidelines to be followed for UFD. These are applicable only to blade switches where there is a clear distinction between downlink and uplink ports.

1. UFD is required only when uplink-path redundancy is not available on the blade switches.
2. An LtM can be either one or more uplink ports or one or more multi-link trunk group of uplink ports.
3. Ports that are already members of a trunk group are not allowed to be assigned to an LtM or LtD.
4. A trunk group configured as an LtM can contain multiple uplink ports, but no downlink ports or ISL (Inter-Switch-Link) ports.
5. A port cannot be added to a trunk group if it already belongs to an LtM or LtD.
6. An LtD can contain one or more ports, and/or one or more trunks
7. A trunk group configured as an LtD can contain multiple downlink ports, but no uplink ports or ISL (Inter-Switch-Link) ports.

A common API will be provided for higher layers, like CLI and SNMP, which will determine if a port-list can be an LtM or LtD. The API will handle the platform specific details and ensure a uniform code flow for blade and other switch families.

Switches do not have a clear distinction between uplink and downlink ports so some of the points listed above may not be applicable.

UFD enable/disable

uplink-failure-detection

Syntax

```
uplink-failure-detection
```

Description

Used to globally enable UFD. The `no` option globally disables UFD.

UFD configuration

uplink-failure-detection track

Syntax

```
uplink-failure-detection track <track_ID> links-to-monitor <port-list> links-to-disable <port-list> delay <delay_value>

no uplink-failure-detection track <track_ID> links-to-monitor <port-list> links-to-disable <port-list> delay <delay_value>
```

Description

Configures LtM and LtD ports for track-id. UFD delay is configured in seconds until when uplink must remain in a stable state before restoring the downlink. UFD delay is configurable between 0 to 300 seconds. The default delay value is 0.

The `no` form of this command resets the parameter.

Command context

`config`

Parameters

`<track_ID>`

Specifies the track id.

`<Port-List>`

Specifies the port list.

`<delay_value>`

Specifies the delay value.

Examples

Configure port A8 as LtM, port A6 as LtD, and delay value as 100 for track 1:

```
Switch(config)# uplink-failure-detection track 1 links-to-monitor A8
links-to-disable A6 delay 100
switch(config)# show running-config

Running configuration:

; J9851A Configuration Editor; Created on release #KB.16.08.0001
; Ver #14:01.4f.f8.1d.fb.7f.bf.bb.ff.7c.59.fc.7b.ff.ff.fc.ff.ff.3f.ef:4e
hostname "switch"
module A type j9993a
module L type j9992a
snmp-server community "public" unrestricted
oobm
   ip address dhcp-bootp
   exit
uplink-failure-detection
uplink-failure-detection track 1 links-to-monitor A8 links-to-disable A6 delay 100
vlan 1
   name "DEFAULT_VLAN"
   untagged A1-A8,L1-L21
   ip address dhcp-bootp
   ipv6 enable
   ipv6 address dhcp full
   exit
```

To set delay value to 2:

```
switch(config)# uplink-failure-detection track 1 delay 2
```

To set delay value to 0:

```
switch(config)#no uplink-failure-detection track 1 delay 2
```

Alternately, to set delay value to 0, a user can also use the following command:

```
switch(config)#uplink-failure-detection track 1 delay 0
```

show uplink-failure-detection

Syntax

`show uplink-failure-detection`

Description

Shows the uplink failure detection information.

Command context

`manager`

Examples

```
switch# show uplink-failure-detection

Uplink Failure Detection Information


  UFD Enabled   : Yes

  Track | Monitored   Links to    LtM      LtD      LtM       LtD         Delay
  ID    | Links       Disable     State    State    Lacp Key  Lacp Key    (sec)
  ------+----------   ----------- -------- -------  --------- ----------  ------
  1     | Dyn1        Dyn2        Up       Up       1         2           0
  32    | Trk1        Trk3        Up       Up                             300
  50    | Trk2        Trk4        Up       Up                             120
  64    | 2/12        2/14        Up       Up                             150
```

If there is a failure, and one track is in Down/Auto-Disabled state, the `show uplink-failure-detection` command displays:

```
switch(config)# show uplink-failure-detection

Uplink Failure Detection Information


  UFD Enabled   : Yes

  Track | Monitored    Links to     LtM    LtD           LtM      LtD      Delay
  ID    | Links        Disable      State  State         Lacp Key Lacp Key (sec)
  ----- + ------------ ------------ ------ ------------- -------- -------- -----
  1     | Trk1         A4           Up     Up                             100
  2     | A5           A6           Down   Auto-Disabled                  0
```

Error log

Cause

UFD will log messages in the following scenarios:

- Admin status change.
- When an UFD LtD delay expires, as a result the LtD link is brought up.
- When the UFD Link transition delay is triggered, an LtM returns to service, and as a result the UFD delay is triggered.

Invalid port error messages

Cause

- When a user specifies an invalid LtM port, a message similar to the following is displayed.

  `Invalid port(s) specified as links-to-monitor.`

- When a user specifies an invalid LtD port, a message similar to the following is displayed.

  `Invalid port(s) specified as links-to-disable.`

- When a user specifies an incorrect delay value, an error message similar to the following is displayed:

  ```
  Delay specified does not match with the configured value of <delay value>.
  ```

Basic USB port commands

The USB port is available only on the 2930M Switch Series.

usb-port

Syntax

```
usb-port

no usb-port
```

Description

Enables the USB port.

The `no` form of the command disables the USB port and any access to the device.

Command context

```
Config
```

show usb-port

Syntax

```
show usb-port
```

Description

Displays the status of the USB port. It can be enabled, disabled, or not present.

Command context

```
operator
```

Usage

One of the following messages indicates the presence or absence of a USB device:

- `Not able to sense device in USB port`
- `USB device detected in port`
- `no USB device detected in port`

Example

Display USB port status.

```
switch# show usb-port

  USB port status: enabled
  USB port power status: power on    (USB device detected in port)
```

Introduction to PoE

PoE technology allows IP telephones, wireless LAN access points, and other appliances to receive power and transfer data over existing ethernet LAN cabling. For more information about PoE technology, see the *PoE/PoE+ planning and implementation guide*, which is available on the Networking website at http://www.hpe.com/networking. Enter your Switch number.

Additionally, PoE+ provides more power-management capability, allowing the switch to have more power available for more PDs. Power can be allocated exactly and automatically according to what the PD actually requires at a given time.

PoE terminology

PoE and PoE+ operate similarly in most cases. Any differences between PoE and PoE+ operation are noted; otherwise, the term "PoE" is used to designate both PoE and PoE+ functionality.

Planning and implementing a PoE configuration

This section provides an overview of some considerations for planning a PoE application. For additional information on this topic, refer to the PoE/PoE+ planning and implementation guide which is available on the Networking web site at http://www.hpe.com/networking.

Some of the elements you may want to consider for a PoE installation include:

- Port assignments to VLANs
- Use of security features
- Power requirements

This section can help you to plan your PoE installation. If you use multiple VLANs in your network, or if you have concerns about network security, you should read the first two topics. If your PoE installation comes close to (or is likely to exceed) the system's ability to supply power to all devices that may request it, then you should also read the third topic. (If it is unlikely that your installation will even approach a full utilization of the PoE power available, then you may find it unnecessary to spend much time on calculating PoE power scenarios.)

Power requirements

To get the best PoE performance, you should provide enough PoE power to exceed the maximum amount of power that is needed by all the PDs that are being used.

By connecting an external power supply you can optionally provision more PoE wattage per port and or supply the switch with redundant 12V power to operate should an internal power supply fail.

See the PoE/PoE+ planning and implementation guide for detailed information about the PoE/PoE+ power requirements for your switch.

Assigning PoE ports to VLANs

If your network includes VLANs, you may want to assign various PoE-configured ports to specific VLANs. For example, if you are using PoE telephones in your network, you may want to assign ports used for telephone access to a VLAN reserved for telephone traffic.

Applying security features to PoE configurations

You can use the port security features built into the switch to control device or user access to the network through PoE ports in the same way as non-PoE ports. Using Port Security, you can configure each switch port with a unique list of MAC addresses for devices that are authorized to access the network through that port. For more information, refer to the titled “Configuring and Monitoring Port Security” in the access security guide for your switch.

Assigning priority policies to PoE traffic

You can use the configurable QoS (Quality of Service) features in the switch to create prioritization policies for traffic moving through PoE ports. The table below lists the available classifiers and their order of precedence.

Table 6: *Classifiers for prioritizing outbound packets*

Priority	QoS classifier
1	UDP/TCP application type (port)
2	Device priority (destination or source IP address)
3	IP type of service (ToS) field (IP packets only)
4	VLAN priority
5	Incoming source-port on the switch
6	Incoming 802.1 priority (present in tagged VLAN environments)

For more on this topic, refer to the “Quality of Service: Managing Bandwidth More Effectively” topic in the *Advanced Traffic Management Guide* for your switch.

PoE operation

Using the commands described in this chapter, you can:

- Enable or disable PoE operation on individual ports.
- Monitor PoE status and performance.
- Configure a non-default power threshold for SNMP and Event Log reporting of PoE consumption on either all PoE ports on the switch or on all PoE ports.
- Specify the port priority you want to use for provisioning PoE power in the event that the PoE resources become oversubscribed.

A PSE detects the power needed by a connected PD before supplying that power via a phase referred to as "searching". If the PSE cannot supply the required amount of power, it does not supply any power. For PoE using a Type 1 device, a PSE will not supply any power to a PD unless the PSE has at least 17 watts available.

For example, if a PSE has a maximum available power of 382 watts and is already supplying 378 watts, and is then connected to a PD requiring 10 watts, the PSE will not supply power to the PD.

For PoE+ using Type 2 devices, the PSE must have at least 33 watts available.

Configuration options

In the default configuration, all ports in a switch covered in this guide are configured to support PoE operation. You can:

- Disable or re-enable per-port PoE operation on individual ports to help control power usage and avoid oversubscribing PoE resources.
- Configure per-port priority for allocating power in case a PoE device becomes oversubscribed and must drop power for some lower-priority ports to support the demand on other, higher-priority ports.
- Manually allocate the amount of PoE power for a port by usage, value, or class.
- Allocate PoE power based on the link-partner's capabilities via LLDP.

The ports support standard networking links and PoE links. You can connect either a non-PoE device or a PD to a port enabled for PoE without reconfiguring the port.

PD support

To best utilize the allocated PoE power, spread your connected PoE devices as evenly as possible. Depending on the amount of power the power supply device delivers to a PoE switch, there may or may not always be enough power available to connect and support PoE operation on all the ports. When a new PD connects to a PoE switch and the switch does not have enough power left for that port:

- If the new PD connects to a port "X" having a **higher** PoE priority than another port "Y" that is already supporting another PD, then the power is removed from port "Y" and delivered to port "X". In this case the PD on port "Y" loses power and the PD on port "X" receives power.
- If the new PD connects to a port "X" having a **lower** priority than all other PoE ports currently providing power to PDs, then power is not supplied to port "X" until one or more PDs using higher priority ports are removed.

In the default configuration (`usage`), when a PD connects to a PoE port and begins operating, the port retains only enough PoE power to support the PD's operation. Unused power becomes available for supporting other PD connections. However, if you configure the `poe-allocate-by` option to either `value` or `class`, all of the power configured is allocated to the port.

For PoE (not PoE+), while 17 watts must be available for a PoE module on the switch to begin supplying power to a port with a PD connected, 17 watts per port is not continually required if the connected PD requires less power. For example, with 20 watts of PoE power remaining available on a module, you can connect one new PD without losing power to any connected PDs on that module. If that PD draws only 3 watts, 17 watts remain available, and you can connect at least one more PD to that module without interrupting power to any other PoE devices connected to the same module. If the next PD you connect draws 5 watts, only 12 watts remain unused. With only 12 unused watts available, if you then connect yet another PD to a higher-priority PoE port, the lowest-priority port on the module loses PoE power and remains unpowered until the module once again has 17 or more watts available.

For PoE+, there must be 33 watts available for the module to begin supplying power to a port with a PD connected.

Disconnecting a PD from a PoE port makes that power available to any other PoE ports with PDs waiting for power. If the PD demand for power becomes greater than the PoE power available, power is transferred from the lower-priority ports to the higher-priority ports. (Ports not currently providing power to PDs are not affected.)

Power priority operation

When is power allocation prioritized?

If a PSE can provide power for all connected PD demand, it does not use its power priority settings to allocate power. However, if the PD power demand oversubscribes the available power, then the power allocation is prioritized to the ports that present a PD power demand. This causes the loss of power from one or more lower-priority ports to meet the power demand on other, higher-priority ports. This operation occurs regardless of the order in which PDs connect to the switch's PoE-enabled ports.

How is power allocation prioritized?

There are two ways that PoE power is prioritized:

- Using a **priority class** method, a power priority of **Low** (the default), **High**, or **Critical** is assigned to each enabled PoE port.
- Using a **port-number priority** method, a lower-numbered port has priority over a higher-numbered port within the same configured priority class, For example, port A1 has priority over port A5 if both are configured with **High** priority.

Configuring PoE operation

In the default configuration, PoE support is enabled on the ports in a PoE switch. The default priority for all ports is **Low** and the default power notification threshold is **80** (%).

Using the CLI, you can:

- Disable or re-enable PoE operation on individual PoE ports
- Enable support for pre-standard devices
- Change the PoE priority level on individual PoE ports
- Change the threshold for generating a power level notice
- Manually allocate the amount of PoE power for a port by usage, value, or class
- Allocate PoE power based on the link-partner's capabilities via LLDP

Disabling or re-enabling PoE port operation

Syntax

`no interface <port-list> power-over-ethernet`

Re-enables PoE operation on <*port-list*> and restores the priority setting in effect when PoE was disabled on <*port-list*>.

The `no` form of the command disables PoE operation on <*port-list*>.

Default: All PoE ports are initially enabled for PoE operation at **Low** priority. If you configure a higher priority, this priority is retained until you change it.

Enabling support for pre-standard devices

The switches covered in this guide also support some pre-802.3af devices. For a list of the supported devices, see the FAQ for your switch model.

Syntax

`no power-over-ethernet pre-std-detect`

Detects and powers pre-802.3af standard devices.

The default setting for the `pre-std-detect` PoE parameter changed. In earlier software the default setting is “on”. The default setting is “off”.

Configuring the PoE port priority

Syntax

`interface <port-list> power-over-ethernet [critical | high | low]`

Reconfigures the PoE priority level on <*port-list*>. For a given level, ports are prioritized by port number in ascending order. For example, if ports A1-A24 have a priority level of critical, port A1 has priority over ports A2-A24.

If there is not enough power available to provision all active PoE ports at a given priority level, the lowest-numbered port at that level is provisioned first. PoE priorities are invoked only when all active PoE ports cannot be provisioned (supplied with PoE power)

`Critical`	Specifies the highest-priority PoE support for <*port-list*>. The active PoE ports at this level are provisioned before the PoE ports at any other level are provisioned.
`High`	Specifies the second priority PoE support for <*port-list*>. The active PoE ports at this level are provisioned before the `Low` priority PoE ports are provisioned.
`Low`	(Default) Specifies the third priority PoE support for <*port-list*>. The active PoE ports at this level are provisioned only if there is power available after provisioning any active PoE ports at the higher priority levels.

Controlling PoE allocation

The default option for PoE allocation is `usage`, which is what a PD attached to the port is allocated. You can override this value by specifying the amount of power allocated to a port by using the `class` or `value` options.

Syntax

`no int <port-list> poe-allocate-by [usage | class | value]`

Allows you to manually allocate the amount of PoE power for a port by either its class or a defined value.

`usage`	The automatic allocation by a PD
`class`	Uses the power ramp-up signature of the PD to identify which power class the device will be in. Classes and their ranges are shown in the table below.
`value`	A user-defined level of PoE power allocated for that port.

The allowable PD requirements are lower than those specified for PSEs to allow for power losses along the Cat-5 cable.

Table 7: *Power classes and their values*

Power class	Value
0	Depends on cable type and PoE architecture. Maximum power level output of 15.4 watts at the PSE.This is the default class; if there is not enough information about the load for a specific classification, the PSE classifies the load as class 0 (zero).
1	Requires at least 4 watts at the PSE.
2	Requires at least 7 watts at the PSE.
3	15.4 watts
4	For PoE+Maximum power level output of 30 watts at the PSE.

Example

To allocate by class for ports 6 to 8:

```
switch(config)# int 6-8 PoE-allocate-by class
```

Manually configuring PoE power levels

You can specify a power level (in watts) allocated for a port by using the `value` option. This is the maximum amount of power that will be delivered.

To configure a port by value:

Procedure:

1. Set the PoE allocation by entering the `poe-allocate-by value` command:
   `switch(config) # int A6 poe-allocate-by value`
2. or in interface context:
   `switch(eth-A6) # poe-allocate-by value`
3. Select a value:
   `switch(config) # int A6 poe-value 15`
4. or in interface context:
   `switch(eth-A6) # poe-value 15`

To view the settings, enter the `show power-over-ethernet` command, shown in PoE allocation by value and the maximum power delivered on page 89.

PoE allocation by value and the maximum power delivered

```
switch(config)# show power-over-ethernet A6

 Status and Counters - Port Power Status for port A6

  Power Enable     : Yes
                                    LLDP Detect     : enabled
  Priority         : low            Configured Type :
  AllocateBy       : value          Value           : 15 W 1[1]
  Detection Status : Delivering     Power Class     : 2

  Over Current Cnt : 0              MPS Absent Cnt  : 0
```

```
  Power Denied Cnt : 0                 Short Cnt       : 0

  Voltage          : 55.1 V            Current         : 154 mA
  Power            : 8.4 W
```

If you set the PoE maximum value to less than what the PD requires, a fault occurs, as shown in PoE power value set too low for the PD on page 90 .

PoE power value set too low for the PD

```
switch(config)# int A7 poe-value 4

switch(config)# show power-over-ethernet A7

 Status and Counters - Port Power Status for port A7

  Power Enable     : Yes
                                       LLDP Detect     : enabled
  Priority         : low               Configured Type :
  AllocateBy       : value             Value           : 4 W
  Detection Status : fault 2             Power Class     : 2

  Over Current Cnt : 1                 MPS Absent Cnt  : 0
  Power Denied Cnt : 2                 Short Cnt       : 0

  Voltage          : 55.1 V            Current         : 154 mA
  Power            : 8.4 W
```

[1]Maximum power delivered.

[2]'Fault' appears when the PoE power value is set too low.

Configuring PoE redundancy

When PoE redundancy is enabled, PoE redundancy occurs automatically. The switch keeps track of power use and will not supply PoE power to additional PoE devices trying to connect if that results in the switch not having enough power in reserve for redundancy if one of the power supplies should fail.

Syntax

```
no power-over-ethernet redundancy [n+1 | full]
```

Allows you to set the amount of power held in reserve for redundancy.

`no`	Means that all available power can be allocated to PDs. Default: No PoE redundancy enforced.
`n+1`	One of the power supplies is held in reserve for redundancy. If a single power supply fails, no powered devices are shut down. If power supplies with different ratings are used, the highest-rated power supply is held in reserve to ensure full redundancy.
`full`	Half of the available power supply is held in reserve for redundancy. If power supplies with different ratings are used, the highest-rated power supply is held in reserve to ensure full redundancy.

For more information about PoE redundancy and power supplies, see the PoE/PoE+ planning and implementation guide, available on the website at http://www.hpe.com/networking. Auto search the model

number for your switch, For example, “Aruba switch 2930”, then select the device from the list, and click on **Product manuals**. Click on the “Setup and install – general” link under **Manuals**.

Changing the threshold for generating a power notice

You can configure one of the following thresholds:

- A global power threshold that applies to all ports on the switch. This setting acts as a trigger for sending a notice when the PoE power consumption on any PoE port installed in the switch crosses the configured global threshold level. (Crossing the threshold level in either direction–PoE power usage either increasing or decreasing– triggers the notice.) The default setting is 80%.
- A per-slot power threshold that applies to an individual PoE module installed in the designated slot. This setting acts as a trigger for sending a notice when the module in the specified slot exceeds or goes below a specific level of PoE power consumption.

Some switches covered by this manual provide a single fixed slot.

Syntax

`power-over-ethernet [slot < slot-id-range >] threshold <1-99>`

This command specifies the PoE usage level (as a percentage of the PoE power available on a module) at which the switch generates a power usage notice. This notice appears as an SNMP trap and a corresponding Event Log message and occurs when a PoE module's power consumption crosses the configured threshold value. That is, the switch generates a notice whenever the power consumption on a module either exceeds or drops below the specified percentage of the total PoE power available on the module.

This command configures the notification threshold for PoE power usage on either a global or per-module (slot) basis.

Without the `[slot PoE <slot-id-range>]` option, the switch applies one power threshold setting on all PoE modules installed in the switch.

Example

Suppose slots A, B, and C each have a PoE module installed. In this case, executing the following command sets the global notification threshold to 70% of available PoE power:

```
switch(config)# power-over-ethernet threshold 70
```

With this setting, if module B is allocated 100 watts of PoE power and is using 68 watts, and then another PD is connected to the module in slot B that uses 8 watts, the 70% threshold of 70 watts is exceeded. The switch sends an SNMP trap and generates this Event Log message:

```
Slot B POE usage has exceeded threshold of 70%.
```

If the switch is configured for debug logging, it also sends the Event Log message to the configured debug destination(s).

On any PoE module, if an increasing PoE power load (1) exceeds the configured power threshold (which triggers the log message and SNMP trap), and then (2) later decreases and drops below the threshold again, the switch generates another SNMP trap, plus a message to the Event Log and any configured Debug destinations.

To continue the preceding Example:, if the PoE power usage on the PoE module in slot B drops below 70%, another SNMP trap is generated and you will see this message in the Event Log:

```
Slot B POE usage is below threshold of 70%.
```

For a message listing, please see the event log message reference guide for your switch. Go to http://www.hpe.com/networking; auto search the model number for your switch, for example, “Aruba Switch 2920”, then select the device from the list and click on **Product manuals**. Click on the “User guide” link under **Manuals**.

(Default Global PoE Power Threshold: **80**). By using the `[slot <slot-id-range>]` option, you can specify different notification thresholds for different PoE modules installed in the switch. For example, you could set the power threshold for a PoE module in slot “A” to 75% and the threshold for the module in slot “B” to 68% by executing the following two commands:

```
switch(config)# power-over-ethernet slot a threshold 75
switch(config)# power-over-ethernet slot b threshold 68
```

The last `threshold` command affecting a given slot supersedes the previous threshold command affecting the same slot. Thus, executing the following two commands in the order shown sets the threshold for the PoE module in slot “D” to 75%, but leaves the thresholds for any PoE modules in the other slots at 90%.

```
switch(config)# power-over-ethernet threshold 90
switch(config)# power-over-ethernet slot d threshold 75
```

If you reverse the order of the above two commands, all PoE modules in the switch will have a threshold of 90%.

PoE/PoE+ allocation using LLDP information

LLDP with PoE

When using PoE, enabling `poe-lldp-detect` allows automatic power configuration if the link partner supports PoE. When LLDP is enabled, the information about the power usage of the PD is available, and the switch can then comply with or ignore this information. You can configure PoE on each port according to the PD (IP phone, wireless device, and so on) specified in the LLDP field. The default configuration is for PoE information to be ignored if detected through LLDP.

Detecting PoE information via LLDP affects only power delivery; it does not affect normal Ethernet connectivity.

Enabling or disabling ports for allocating power using LLDP

Syntax

`int <port-list> poe-lldp-detect [enabled | disabled]`

Enables or disables ports for allocating PoE power based on the link-partner's capabilities via LLDP.

Default: Disabled

Example

You can enter this command to enable LLDP detection:

```
switch(config) # int A7 poe-lldp-detect enabled
```

or in interface context:

```
switch(eth-A7) # poe-lldp-detect enabled
```

Enabling PoE detection via LLDP TLV advertisement

Use this command and insert the desired port or ports:

```
switch(config) # lldp config <port-number> medTlvenable poe
```

LLDP with PoE+

Overview

The data link layer classification DLC for PoE provides more exact control over the power requirement between a PSE and PD. The DLC works in conjunction with the physical layer classification PLC and is mandatory for any Type-2 PD that requires more than 12.95 watts of input power.

DLC is defined as part of the IEEE 802.3 at standard.

The power negotiation between a PSE and a PD can be implemented at the physical layer or at the data link layer. After the link is powered at the physical layer, the PSE can use LLDP to repeatedly query the PD to discover the power needs of the PD. Communication over the data link layer allows finer control of power allotment, which makes it possible for the PSE to supply dynamically the power levels needed by the PD. Using LLDP is optional for the PSE but mandatory for a Type 2 PD that requires more than 12.95 watts of power.

If the power needed by the PD is not available, that port is shut off.

PoE allocation

LLDP can negotiate power with a PD by using LLDP MED TLVs (disabled by default). This can be enabled using the `int <port-list> PoE-lldp-detect [enabled|disabled]` command, as shown below. LLDP MED TLVs sent by the PD are used to negotiate power only if the LLDP PoE+ TLV is disabled or inactive; if the LLDP PoE+ TLV is sent as well (not likely), the LLDP MED TLV is ignored.

Enabling `PoE-lldp-detect` allows the data link layer to be used for power negotiation. When a PD requests power on a PoE port, LLDP interacts with PoE to see if there is enough power to fulfill the request. Power is set at the level requested. If the PD goes into power-saving mode, the power supplied is reduced; if the need for power increases, the amount supplied is increased. PoE and LLDP interact to meet the current power demands.

Syntax

`int <port-list> poe-lldp-detect [enabled | disabled]`

Allows the data link layer to be used for power negotiation between a PD on a PoE port and LLDP.

Default: Disabled

Example

You can enter this command to enable LLDP detection:

```
switch(config) # int 7 PoE-lldp-detect enabled
```

or in interface context:

```
switch(eth-7) # PoE-lldp-detect enabled
```

Detecting PoE information via LLDP affects only power delivery; it does not affect normal Ethernet connectivity.

You can view the settings by entering the `show power-over-ethernet brief` command, as shown in Port with LLDP configuration information obtained from the device on page 94.

Port with LLDP configuration information obtained from the device

```
switch(config)# show power-over-ethernet brief

 Status and Counters - Port Power Status

  System Power Status  : No redundancy
  PoE Power Status     : No redundancy

  Available: 300 W Used: 0 W Remaining: 300 W

  Module A Power
  Available: 300 W Used: 5 W Remaining: 295 W

  POE    | Power   Power     Alloc Alloc  Actual Configured  Detection   Power
  Port   | Enable  Priority  By    Power  Power  Type        Status      Class
  ------ + ------- --------- ----- ------ ------ ----------- ----------- ----
  A1     | Yes     low       usage 17 W   0.0 W  Phone1      Delivering  1
  A2     | Yes     low       usage 17 W   0.0 W              Searching   0
  A3     | Yes     low       usage 17 W   0.0 W              Searching   0
  A4     | Yes     low       usage 17 W   0.0 W              Searching   0
  A5     | Yes     low       usage 17 W   0.0 W              Searching   0
  A6     | Yes     low       usage 17 W   0.0 W              Searching   0
```

Viewing PoE when using LLDP information

Viewing LLDP port configuration

To view information about LLDP port configuration, use the `show lldp config` command.

Syntax

`show lldp config <port-list>`

Displays the LLDP port configuration information, including the TLVs advertised.

LLDP port configuration information with PoE

```
switch(config)# show lldp config 4

 LLCP Port Configuration Detail

  Port : 4
  AdminStatus [Tx_Rx] : Tx_Rx
  NotificationsEnabled [False] : False
  Med Topology Trap Enabled [False] : False


  TLVS Advertised:
   * port_descr
   * system_name
   * system_descr
   * system_cap

   * capabilities
   * network_policy
   * location_id
   * poe
```

```
   * macphy_config
   * poeplus_config

  IpAddress Advertised:
```

Local power information on page 95 shows an example of the local device power information using the `show lldp info local-device <port-list>` command.

Local power information

```
switch(config)# show lldp info local-device A1

 LLCP Local Port Information Detail

  Port     : A1
  PortType : local
  PortId   : 1
  PortDesc : A1
  Pvid     : 1

 Poe Plus Information Detail

     Poe Device Type           : Type2 PSE
     Power Source              : Primary
     Power Priority            : low
     PD Requested Power Value  : 20 Watts
     PSE Actual Power Value    : 20 Watts
```

Remote power information on page 95 shows an example of the remote device power information using the `show lldp info remote-device <port-list>` command.

Remote power information

```
switch(config)# show lldp info remote-device A3

 LLCP Remote Device Information Detail

  Local Port   : A3
  ChassisType  : mac-address
  ChassisId    : 00 16 35 ff 2d 40
  PortType     : local
  PortId       : 23
  SysName      : Switch
  System Descr : Switch, revision W.14.xx
  PortDescr    : 23
  Pvid         : 55

  System Capabilities Supported  : bridge, router
  System Capabilities Enabled    : bridge

  Remote Management Address
     Type    : ipv4
     Address : 10.0.102.198

  Poe Plus Information Detail

     Poe Device Type           : Type2 PD
     Power Source              : Only PSE
     Power Priority            : low
     PD Requested Power Value  : 20 Watts
     PSE Actual Power Value    : 20 Watts
```

Operating note

The advertisement of power with TLVs for LLDP PoE+ is enabled by default. If LLDP is disabled at runtime and a PD is using PoE+ power that has been negotiated through LLDP, there will be a temporary power drop. The port will begin using PoE+ power through the PLC. This event is recorded in the event log. An example message would look like the following:

```
W 08/04/13 13:35:50 02768 ports: Port A1 PoE power dropped.
Exceeded physical classification for a PoE Type1 device
(LLDP process disabled)
```

When LLDP is enabled again, it causes a temporary power drop. This event is also recorded in the event log. An example message looks like the following:

```
W 08/04/13 13:36:31 02771 ports: Port A1 PoE power dropped.
Exceeded physical classification due to change in
classification type (LLDP process enabled)
```

Viewing the global PoE power status of the switch

Syntax

`show power-over-ethernet [brief | [[ethernet] <port-list>] | [slot <slot-id-range> | all>]]`

Displays the switch's global PoE power status, including:

- **Total Available Power**

  Lists the maximum PoE wattage available to provision active PoE ports on the switch. This is the amount of usable power for PDs.

- **Total Failover Power**

  Lists the amount of PoE power available in the event of a single power supply failure. This is the amount of power the switch can maintain without dropping any PDs.

- **Total Redundancy Power**

  Indicates the amount of PoE power held in reserve for redundancy in case of a power supply failure.

- **Total Remaining Power**

  The amount of PoE power still available.

`brief`	Displays PoE information for each port. See Viewing PoE status on all ports on page 97.
<port-list>	Displays PoE information for the ports in port-list. See Viewing the PoE status on specific ports on page 98.
<slot-id-range>	Displays PoE information for the selected slots. See Showing the PoE information by slot on page 98). Enter the `all` option to display the PoE information for all slots.

The `show power-over-ethernet` displays data similar to that shown in show power-over-ethernet command output on page 96.

show power-over-ethernet command output

```
switch(config)# show power-over-ethernet

 Status and Counters - System Power Status

  Pre-standard Detect  : On
  System Power Status  : No redundancy
  PoE Power Status     : No redundancy

 Chassis power-over-ethernet

  Total Available Power  :  600 W
  Total Failover Power   :  300 W
  Total Redundancy Power :    0 W
  Total Used Power       :    9 W +/- 6W
  Total Remaining Power  :  591 W

 Internal Power
        1  300W/POE  /Connected.
        2  300W/POE  /Connected.
        3  Not Connected.
        4  Not Connected.
 External Power
        EPS1  /Not Connected.
        EPS2  /Not Connected.
```

Viewing PoE status on all ports

Syntax

```
show power-over-ethernet brief
```

Displays the port power status:

PoE Port	Lists all PoE-capable ports on the switch.
Power Enable	Shows **Yes** for ports enabled to support PoE (the default) and **No** for ports on which PoE is disabled.
Power Priority	Lists the power priority (**Low**, **High**, and **Critical**) configured on ports enabled for PoE. (For more information on this topic, see Configuring PoE operation.)
Alloc by	Displays how PoE is allocated (**usage**, **class**, **value**).
Alloc Power	The maximum amount of PoE power allocated for that port (expressed in watts).Default: 17 watts for PoE; 33 watts for PoE+.
Actual Power	The power actually being used on that port.
Configured Type	If configured, shows the user-specified identifier for the port. If not configured, this field is empty.
Detection Status	■ **Searching:** The port is trying to detect a PD connection. ■ **Delivering:** The port is delivering power to a PD. ■ **Disabled:** On the indicated port, either PoE support is disabled or PoE power is enabled but the PoE module does not have enough power available to supply the port's power needs. ■ **Fault:** The switch detects a problem with the connected PD. ■ **Other Fault:** The switch has detected an internal fault that prevents it from supplying power on that port.

Power Class	Shows the 802.3af power class of the PD detected on the indicated port. Classes include: ■ **0:** 0.44 to 12.95 watts can be drawn by the PD. Default class. ■ **1:** 0.44 to 3.84 watts ■ **2:** 3.84 to 6.49 watts ■ **3:** 6.49 to 12.95 watts ■ **4:** For PoE+; up to 25.5 watts can be drawn by the PD

The `show power-over-ethernet brief` displays this output:

show power-over-ethernet brief command output

```
switch(config)# show power-over-ethernet brief

 Status and Counters - System Power Status

  System Power Status  : No redundancy
  PoE Power Status     : No redundancy

  Available: 600 W Used: 9 W Remaining: 591 W

  Module A Power
  Available: 408 W Used: 9 W Remaining: 399 W

  POE    | Power   Power     Alloc Alloc  Actual Configured  Detection  Power
  Port   | Enable  Priority  By    Power  Power  Type        Status     Class
  ------ + ------- --------- ----- ------ ------ ----------- ---------- ----
  A1     | Yes     low       usage 17 W   0.0 W              Searching  0
  A2     | Yes     low       usage 17 W   0.0 W              Searching  0
  A3     | Yes     low       usage 17 W   0.0 W              Searching  0
  A4     | Yes     low       usage 17 W   0.0 W              Searching  0
  A5     | Yes     low       usage 17 W   0.0 W              Searching  0
  A6     | Yes     low       usage 17 W   8.4 W              Delivering 2
  A7     | Yes     low       usage 17 W   0.0 W              Searching  0
  A8     | Yes     low       usage 17 W   0.0 W              Searching  0
  A9     | Yes     low       usage 17 W   0.0 W              Searching  0
```

You can also show the PoE information by slot:

Showing the PoE information by slot

```
switch(config)# show power-over-ethernet slot A

 Status and Counters - System Power Status for slot A

  Maximum Power      : 408 W          Operational Status  : On
  Power In Use       :   9 W +/- 6 W  Usage Threshold (%) : 80
```

Viewing the PoE status on specific ports

Syntax

`show power-over-ethernet <port-list>`

Displays the following PoE status and statistics (since the last reboot) for each port in `<port-list>` :

Power Enable	Shows **Yes** for ports enabled to support PoE (the default) and **No** for ports on which PoE is disabled. For ports on which power is disabled, this is the only field displayed by `show power-over-ethernet <port-list>`.
Priority	Lists the power priority (**Low**, **High**, and **Critical**) configured on ports enabled for PoE. (For more on this topic, see Configuring PoE operation.)
Allocate by	How PoE is allocated (**usage**, **class**, **value**).
Detection Status	■ **Searching:** The port is trying to detect a PD connection. ■ **Delivering:** The port is delivering power to a PD. ■ **Disabled:** On the indicated port, either PoE support is disabled or PoE power is enabled but the PoE module does not have enough power available to supply the port's power needs. ■ **Fault:** The switch detects a problem with the connected PD. ■ **Other Fault:** The switch has detected an internal fault that prevents it from supplying power on that port.
Over Current Cnt	Shows the number of times a connected PD has attempted to draw more than 15.4 watts for PoE or 24.5 watts for PoE+. Each occurrence generates an Event Log message.
Power Denied Cnt	Shows the number of times PDs requesting power on the port have been denied because of insufficient power available. Each occurrence generates an Event Log message.
Voltage	The total voltage, in volts, being delivered to PDs.
Power	The total power, in watts, being delivered to PDs.
LLDP Detect	Port is enabled or disabled for allocating PoE power, based on the link-partner's capabilities via LLDP.
Configured Type	If configured, shows the user-specified identifier for the port. If not configured, the field is empty.
Value	The maximum amount of PoE power allocated for that port (expressed in watts). Default: **17 watts** for PoE; **33 watts** for PoE+
Power Class	Shows the power class of the PD detected on the indicated port. Classes include: ■ **0:** 0.44 to 12.95 watts ■ **1:** 0.44 to 3.84 watts ■ **2:** 3.84 to 6.49 watts ■ **3:** 6.49 to 12.95 watts ■ **4:** For PoE+; up to 25.5 watts can be drawn by the PD
MPS Absent Cnt	Shows the number of times a detected PD has no longer requested power from the port. Each occurrence generates an Event Log message. ("MPS" refers to the "maintenance power signature.")
Short Cnt	Shows the number of times the switch provided insufficient current to a connected PD.
Current	The total current, in mA, being delivered to PDs.

If you want to view the PoE status of ports A6 and A7, you would use `show power-over-ethernet A6-A7` to display the data:

show power-over-ethernet port-list output

```
switch(config)# show power-over-ethernet slot A6-A7

 Status and Counters - Port Power Status for port A6

  Power Enable      : Yes
                                      LLDP Detect     : enabled
  Priority          : low             Configured Type :
  AllocateBy        : value           Value           : 17 W
  Detection Status  : Delivering      Power Class     : 2

  Over Current Cnt  :0                MPS Absent Cnt  : 0
  Power Denied Cnt  :0                Short Cnt       : 0

  Voltage           : 55.1 V          Current         : 154 mA
  Power             : 8.4 W

 Status and Counters - Port Power Status for port A7

  Power Enable      : Yes
                                      LLDP Detect     : disabled
  Priority          : low             Configured Type :
  AllocateBy        : value           Value           : 17 W
  Detection Status  : Searching       Power Class     : 0

  Over Current Cnt  :0                MPS Absent Cnt  : 0
  Power Denied Cnt  :0                Short Cnt       : 0

  Voltage           : 0 V             Current         : 0 mA
  Power             : 0 W
```

802.3bt support

IEEE 802.3bt standard enables delivering up to 90W of power across a network cable supporting all standardized copper link speeds of up to 10G-BaseT, commonly referred to as Power over Ethernet (PoE) or 4-Pair PoE. Earlier IEEE 802.3af and IEEE 802.3at PoE specifications permit Type 1 and 2 PSEs to deliver power over 2-pairs of a 4-pair Ethernet cable. The IEEE 802.3bt specifications permit Type 3 and 4 PSEs to deliver power over all 4-pairs of the Ethernet cable enabling higher efficiency and power delivery to remote devices.

IEEE 802.3bt standard devices are backwards compatible with previous PoE standard devices, IEEE 802.3at and IEEE 802.3af, allowing existing PoE devices to deliver or receive power up to their maximum IEEE 802.3 PoE classification.

The 2930M switches provide modular stacking, modular 10GbE, 40GbE, or Smart Rate multi-gigabit ports, and hot-swappable power supplies for redundancy, up to 60W PoE per port (up to 1440W PoE total**) for powering APs, cameras, and IoT devices.

** The front panel ports are able push up to 60W of PoE per port. For 1440W PoE, 2x JL087A Aruba X372 54VDC 1050W 110-240VAC Power Supplies must be installed.
The 802.3bt support is available only on two switch models of 2930M, R0M67A and R0M68A.

The following Aruba 2930M models provide up to 60W PoE per port** and are compatible with IEEE 802.3bt standard (Class 6):

- Aruba 2930M 40G 8 Smart Rate PoE Class 6 1-slot Switch (R0M67A) - 36 1GbE ports; 8 Smart Rate ports (1, 2.5, 5, 10GbE); 4 dual personality ports (1SFP, 1G BASE-T - includes PoE)
- Aruba 2930M 24 Smart Rate PoE Class 6 1-slot Switch (R0M68A) - 24 Smart Rate ports (1, 2.5, 5GbE)

Some of the advantages of 802.3bt support includes:

- Reduced power loss since power is transferred from PSE to PD over all 4 pairs of wires.
- Backward compatible with 802.3af and 802.3at PDs.
- Support for Dual Signature PDs.
- Require the PD to draw a minimum amount of power to keep the connection active, 10mA minimum load. 802.3bt allows for smaller MPS pulse current and larger interval between pulses. With these changes, significant power savings is possible in large deployments involving tens of thousands of PoE ports where both the PSE and PD are 802.3bt compliant. The power savings that can be accomplished is big for the industrial lighting.

Definition of Terms

Term	Definition
Detection Signature	Resistance of PD during detection.
Classification Signature	Used by PSE to identify the PD device type and vice versa.
MPS	Maintain Power Signature
Dual Signature (DS) PD	Has independent detection signatures, classification signatures, and MPS on each pair set.
Single Signature (SS) PD	Shares the same detection signature, classification signature, and MPS between both pair sets.
PLC	Physical Layer Classification
DLC	Data Link Layer Classification

Table 8: *PoE types, classes, standards, power needs for SS PDs*

Classes	Associated PoE types	Associated IEEE standard	Maximum power at PD port Minimum power at PSE port
Class 0	1	802.3at	13 W / 15.4 W
Class 1	1 or 3	802.3at or 802.3bt	3.84 W / 4 W
Class 2	1 or 3	802.3at or 802.3bt	6.49 W / 7 W
Class 3	1 or 3	802.3at or 802.3bt	13 W / 15.4 W
Class 4	2 or 3	802.3at or 802.3bt	25.5 W / 30 W
Class 5	3	802.3bt	40 W / 45 W
Class 6	3	802.3bt	51 W / 60 W
Class 7	4	802.3bt	62 W / 75 W
Class 8	4	802.3bt	71.3 W / 90 W

Table 9: *PoE types, classes, standards, power needs for DS PDs*

Classes	Associated PoE types	Associated IEEE standard	Maximum power at each PD pairset
Class 1	3 or 4	802.3bt	3.84 W
Class 2	3 or 4	802.3bt	6.49 W
Class 3	3 or 4	802.3bt	13 W
Class 4	3 or 4	802.3bt	25.5 W
Class 5	4	802.3bt	35.5 W

Configuring the switch

A 802.3bt PD will be detected and powered with default switch configuration. CLI configuration is not required when the PDs are 802.3bt compliant or 802.3af or 802.3at compliant.

Troubleshooting non-compliant PDs

If the new Class 5-8 PDs support LLDP power negotiation, the default switch configuration does not require additional CLI configuration changes. However, if the new .Class 5-8 PDs do not support LLDP or need the maximum PoE power at initial power up, then switch CLI config changes are required on a port basis to disable dot3Tlvs which provide Class 6 (60W) power delivery.

```
no lldp config <port> dot3TlvEnable poeplus_config
```

DLC enabled

When DLC is enabled, a Class 4 and above PD can draw up to 15.4W power at the PSE side. Essentially a Class 4 or above PD is demoted to Class 3 to maintain the legacy functionality of switches where a PD can draw 15.4W at PLC. The PD must use LLDP to negotiate for higher power. For Dual Signature PD, each channel can draw up to 15.4W of power to ensure each port can draw a total of 30W.

- The default switch configuration always power demotes all Class 4-8 SS PDs to Class 3 power and requires successful LLDP dot3Tlv 29 octet power negotiation for Class 5-8 PDs or 12 octet power negotiation for Class 4 PDs before increasing the power delivery to above 16W.
- The default switch configuration always power demotes all Class 4 and above DS PDs to Class 3 power at PLC. It requires successful LLDP dot3Tlv 29 octet power negotiation through DLC.
- The switch requires the PD to negotiate through LLDP for any power request above 13W. In this case, the switch class demotes the PD to Class 3 power.
- The switch does not have enough available power in its reserve to supply the full power requested by the PD. In this case, the switch offers a lower Class level of power to the PD. For example, the switch offers Class 4 power (25.4 W) or class 3 power (13 W) to a Class 5 PD or a Class 6 PD.

DLC disabled

When DLC is disabled, a PD can draw full power as requested at the PLC. This can go up to a maximum of Class 6 for Single Signature and Class 4 for Dual Signature PD.

Recommendations

- IEEE standards do not require Class 4/Type 2 PSE to interoperate with Class 5-8 PDs. However, the PLC mutual identification in the beginning of power-up cycle will indicate to a class 5-8 PD that it is connected to PSE capable of only 30W. If required, a class 5-8 PD can power up with 30W and operate in reduced functionality modes.
- Some Class 5-8 PDs may require their full requested power. The PD can power up and shut down when exceeding iCut ~33W in Class4/Type 2 switches.
- Ensure that the PSE port supports the same or higher Class than the connected PD Class for interoperability.

You can continue to use Cat5e cable deployments to deliver power. Operating at link speeds of 5Gbps or greater may require you to limit the cable length to less than 100 meter. This limitation is imposed by the Ethernet physical capabilities and not by the PoE standard.

Show commands

The show commands display the following:

- Dual Signature Indicator (#) which denotes the PD connected to the port is a Dual Signature PD.
- Power Delivery Indicator (*) which indicate loss of power to a port in the event of loss of a PSU powering the port.
- Power Demotion Indicator (^) which appears when the switch is unable to supply the entire power requested by the PD. The scenarios include:

Example of show pow br

```
switch(config)# show pow br
Status and Configuration Information
  System Power Status          : No redundancy
  PoE Power Status             : No redundancy
  Operational Power Status     : No redundancy
  Available: 1440 W  Used: 89 W  Remaining: 1351 W
 PoE    Pwr    Pwr      Pre-std Alloc Alloc  PSE Pwr PD Pwr PoE Port    PLC PLC
 Port   Enab   Priority Detect  Cfg   Actual Rsrvd   Draw   Status      Cls Type
 ------ ---- -------- ------- ----- ------ ------- ------- ----------- --- ----
 #1     Yes    low      off    usage usage  57.3 W  49.1 W  Delivering  4   3
 2      Yes    low      off    usage usage  0.0 W   0.0 W   Searching   0   -
#10     Yes    low      on     usage usage  2.0 W   1.9 W   Delivering  3^  3
 14     Yes    low      off    usage usage  9.0 W   8.4 W   Delivering  3^  3
 24     Yes    low      off    usage lldp   7.3 W   6.9 W   Delivering  4   2
 # - Dual signature power delivery
 ^ - Power demoted ports
```

Example of show pow port

Example show command output at a port where LLDP is enabled for a Dual Signature PD.

```
switch(config)$ show pow 1/28

  Status and Configuration Information for port 1/28

  Power Enable      : Yes                  PoE Port Status    : Delivering
  PLC Class/Type    : 5/4                  Priority Config    : critical
  DLC Class/Type    : 5/4                  Pre-std Detect     : on
  Alloc By Config   : usage                Configured Type    :
```

```
  Alloc By Actual   : lldp                  PoE Value Config   : n/a


  PoE Counter Information

  Over Current Cnt  : 284                   MPS Absent Cnt     : 5
  Power Denied Cnt  : 0                     Short Cnt          : 0


  LLDP Information

  PSE Allocated Power Value : 0.0 W           PSE TLV Configured : dot3, MED
  PD Requested Power Value  : 0.0 W           PSE TLV Sent Type  : dot3
  MED LLDP Detect           : Enabled         PD TLV Sent Type   : dot3


  LLDP Dual Signature Information

  PSE Allocated Power Value A : 20.0 W      PSE Allocated Power Value B : 20.0 W
  PD Requested Power Value A  : 20.0 W      PD Requested Power Value B  : 20.0 W


  Power Information

  PSE Voltage       : 54.0 V                PSE Reserved Power : 3.2 W
  PD Amperage Draw  : 57 mA                 PD Power Draw      : 3.2 W
```

Example show command output at a port where LLDP is disabled.

```
switch(slot 1)$ show pow 1
 Status and Configuration Information for port 1
  Power Enable      : Yes                   PoE Port Status    : Delivering
  PLC Class/Type    : 4/3                   Priority Config    : low
  DLC Class/Type    : 0/-                   Pre-std Detect     : off
  Alloc By Config   : usage                 Configured Type    :
  Alloc By Actual   : usage                 PoE Value Config   : n/a
  PoE Counter Information
  Over Current Cnt  : 0                     MPS Absent Cnt     : 0
  Power Denied Cnt  : 0                     Short Cnt          : 0

  LLDP Information
  PSE Allocated Power Value : 0.0 W         PSE TLV Configured : MED
  PD Requested Power Value  : 0.0 W         PSE TLV Sent Type  : MED
  MED LLDP Detect           : Disabled      PD TLV Sent Type   : n/a

  LLDP Dual Signature Information
  PSE Allocated Power Value A : 25.5 W      PSE Allocated Power Value B : 25.5 W
  PD Requested Power Value A  : 0.0 W       PD Requested Power Value B  : 0.0 W

  Power Information
  PSE Voltage       : 55.0 V                PSE Reserved Power : 57.4 W
  PD Amperage Draw  : 890 mA                PD Power Draw      : 49.2 W
```

Example show command output at a port for a Single Signature PD.

```
switch(slot 1)$ show pow 14
 Status and Configuration Information for port 14
  Power Enable      : Yes                   PoE Port Status    : Delivering
  PLC Class/Type    : 3/3                   Priority Config    : low
  DLC Class/Type    : 0/-                   Pre-std Detect     : off
  Alloc By Config   : usage                 Configured Type    :
  Alloc By Actual   : usage                 PoE Value Config   : n/a
```

```
  PoE Counter Information
  Over Current Cnt   : 0                    MPS Absent Cnt     : 0
  Power Denied Cnt   : 0                    Short Cnt          : 0

  LLDP Information
  PSE Allocated Power Value : 8.3 W         PSE TLV Configured : dot3, MED
  PD Requested Power Value  : 0.0 W         PSE TLV Sent Type  : dot3
  MED LLDP Detect           : Disabled      PD TLV Sent Type   : n/a

  Power Information
  PSE Voltage       : 54.0 V                PSE Reserved Power : 9.0 W
  PD Amperage Draw  : 151 mA                PD Power Draw      : 8.4 W
```

Example of show lldp info loc/remote port

A Dual Signature PD is connected to the 2930M .3bt switch:

```
 LLDP Local Port Information Detail
 Port     : 1/1
 PortType : local
 PortId   : 1
 PortDesc : 1/1
 Pvid     : 1

Poe Plus Information Detail

 Poe Device Type            : Type2 PSE
 Power Source               : Primary
 Power Priority             : Low
 PD Requested Power value   : 25.5 Watts
 PSE Allocated  Power Value : 0.0 Watts
 PD Requested Power value Mode A   :  25.5 Watts
 PSE Allocated  Power Value Alt A  :  12.7 Watts
 PD Requested Power value Mode B   :  25.5 Watts
 PSE Allocated  Power Value Alt B  :  12.7 Watts
```

Power Mode Enhancement

This new enhancement in the power mode, enables 2-pair power delivery mechanism on 2930M switches.

Overview

The IEEE 802.3bt specification permits a switch to deliver power over all 4-pairs of an Ethernet cable, enabling higher efficiency and power delivery to remote devices. All Powered Devices (PD) cannot handle 4-pair power mode and it can lead to hardware damage. To avoid hardware damage, you can configure a port to deliver power over 2-pairs of a 4-pair Ethernet cable using the following command. By default, PDs work in 4-pair power mode.

force-2-pair mode

Syntax

```
power-over-ethernet force-2pair-mode ports <port-list>

no power-over-ethernet force-2pair-mode ports <port-list>
```

Description

Enables the force-2-pair mode for all ports listed in the command.

The `no` form of the command disables the force-2-pair mode.

Command context

```
Config
```

Parameter

`<port-list>`

Specifies the port number.

Upgrading the Switch to Enable Force-2-Pair Mode

To enable the force-2-pair mode on a specific port or a list of ports, upgrade the switch software to version 16.10.0013 or later version. To upgrade the switch software, refer to "Updating the Switch Software to a New Version" section in the Aruba Basic Operation Guide for ArubaOS-Switch 16.10.

Read "Best practices, Recommendations and Precautions" section in the Aruba Basic Operation Guide for ArubaOS-Switch 16.10, before upgrading the switch to a new version.

Follow the below steps to enable the force-2-pair mode on the applicable ports:

1. Disable PoE on the applicable ports.
2. Upgrade the switch to 16.10.0013 or later version and reboot.
3. Enable the force-2-pair mode on the applicable ports.
4. Enable PoE on the ports, and save the configuration.

The enabled force-2-pair mode works only after PoE is reset on the port. Enabling force-2-pair mode when the port is powered will not affect the default 4-pair power mode.

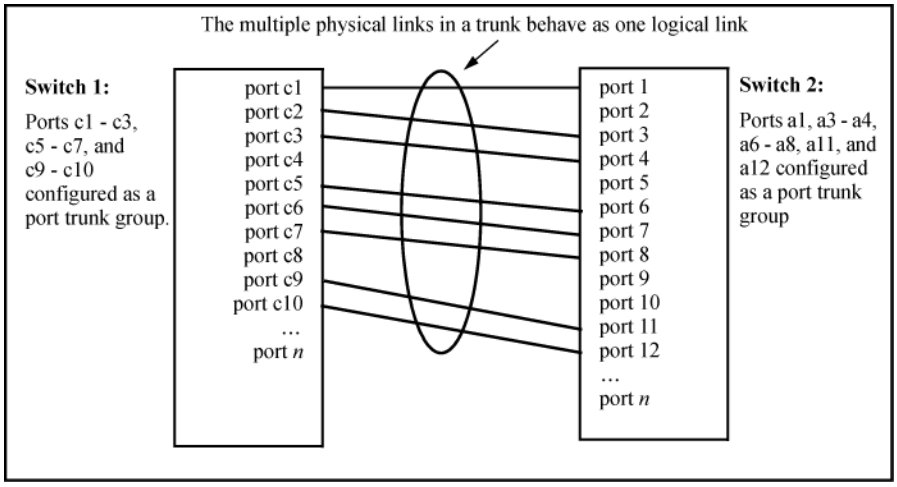
PoE Event Log messages

Please see the *Event Log Message Reference Guide* for information about Event Log messages. To see these manuals, go to http://www.hpe.com/networking. Auto search the model number for your switch, for example, **Switch 2920**. Then select the device from the list and click on **Product manuals**. Click on the “User guide” link under **Manuals**.

Overview of port trunking

Port trunking allows you to assign up to eight physical links to one logical link (trunk) that functions as a single, higher-speed link providing dramatically increased bandwidth. This capability applies to connections between backbone devices as well as to connections in other network areas where traffic bottlenecks exist. A **trunk group** is a set of up to eight ports configured as members of the same port trunk. The ports in a trunk group do not have to be consecutive. For example:

Figure 9 *Conceptual example of port trunking*



Port connections and configuration

All port trunk links must be point-to-point connections between a switch and another switch, router, server, or workstation configured for port trunking. No intervening, non-trunking devices are allowed. It is important to note that ports on both ends of a port trunk group must have the same mode (speed and duplex) and flow control settings.

Link connections

The switch does not support port trunking through an intermediate, non-trunking device such as a hub, or using more than onemedia type in a port trunk group. Similarly, for proper trunk operation, all links in the same trunk group must have the samespeed, duplex, and flow control.

Port security restriction

Port security does not operate on a trunk group. If you configure port security on one or more ports that are later added to a trunk group, the switch resets the port security parameters for those ports to the factory-default configuration.

CAUTION

To avoid broadcast storms or loops in your network while configuring a trunk, first disable or disconnect all ports you want to add to or remove from the trunk. After you finish configuring the trunk, enable or re-connect the ports.

Port trunk features and operation

The switches covered in this guide offer these options for port trunking:

- LACP: IEEE 802.3ad–Trunk group operation using LACP on page 120
- Trunk: Non-Protocol–Trunk group operation using the trunk option on page 125

Up to 60 trunk groups are supported on the switches. The actual maximum depends on the number of ports available on the switch and the number of links in each trunk. (Using the link aggregation control protocol–LACP–option, you can include standby trunked ports in addition to the maximum of eight actively trunking ports.) The trunks do not have to be the same size; For example, 100 two-port trunks and 11 eight-port trunks are supported.

NOTE

LACP requires full-duplex (FDx) links of the same media type (10/100Base-T, 100FX, and so on) and the same speed, and enforces speed and duplex conformance across a trunk group. For most installations, Hewlett Packard Enterprise Switch recommends that you leave the port Mode settings at `Auto` (the default). LACP also operates with `Auto-10`, `Auto-100`, and `Auto-1000 (if negotiation selects FDx)`, and `10FDx`, `100FDx`, and `1000FDx` settings. (The 10-gigabit ports available for some switch models allow only the `Auto` setting.)

Fault tolerance

If a link in a port trunk fails, the switch redistributes traffic originally destined for that link to the remaining links in the trunk. The trunk remains operable as long as there is at least one link in operation. If a link is restored, that link is automatically included in the traffic distribution again. The LACP option also offers a standby link capability, which enables you to keep links in reserve for service if one or more of the original active links fails. (See Trunk group operation using LACP on page 120.)

Trunk configuration methods

Dynamic LACP trunk

The switch automatically negotiates trunked links between LACP-configured ports on separate devices, and offers one dynamic trunk option: LACP. To configure the switch to initiate a dynamic LACP trunk with another device, use the `interface` command in the CLI to set the default LACP option to `active` on the ports you want to use for the trunk. For example, the following command sets ports C1 to C4 to `LACP active`:

```
switch(config) int c1-c4 lacp active
```

The preceding example works if the ports are not already operating in a trunk. To change the LACP option on ports already operating as a trunk, you must first remove them from the trunk. For example, if ports C1 to C4 are LACP-active and operating in a trunk with another device, you would do the following to change them to LACP-passive:

```
switch(config)# no int c1-c4 lacp
```

Removes the ports from the trunk.

```
switch(config)# int c1-c4 lacp passive
```

Configures LACP passive.

Using keys to control dynamic LACP trunk configuration

The `lacp key` option provides the ability to control dynamic trunk configuration. Ports with the same key will be aggregated as a single trunk.

There are two types of keys associated with each port, the Admin key and the Operational key. The Operational key is the key currently in use. The Admin key is used internally to modify the value of the Operational key. The Admin and Operational key are usually the same, but using static LACP can alter the Operational key during runtime, in which case the keys would differ.

The `lacp key` command configures both the Admin and Operational keys when using dynamic LACP trunks. It only configures the Admin key if the trunk is a static LACP trunk. It is executed in the interface context.

Syntax

`no lacp [active | passive | key <0-65535>]`

Sets the LACP key. During dynamic link aggregation using LACP, ports with the same key are aggregated as a single trunk.

Enabling LACP and configuring an LACP key

```
switch(config)# int A2-A3 lacp active
switch(config)# int A2-A3 lacp key 500

switch(config)# show lacp

                           LACP
       LACP    Trunk   Port            LACP    Admin  Oper
  Port Enabled Group   Status  Partner Status  Key    Key
  ---- ------- ------- ------- ------- ------- ------ ------
  A2   Active  A2      Down    No      Success 500    500
  A3   Active  A3      Down    No      Success 500    500
```

An interface configured with a different LACP key

```
switch(config)# int A5 lacp active
switch(config)# int A5 lacp key 250

switch# show lacp
                           LACP
       LACP    Trunk   Port            LACP    Admin  Oper
  Port Enabled Group   Status  Partner Status  Key    Key
  ---- ------- ------- ------- ------- ------- ------ ------
  A1   Active  Dyn1    Up      Yes     Success 100    100
  A2   Active  Dyn1    Up      Yes     Success 100    100
  A3   Active  Dyn1    Up      Yes     Success 100    100
  A4   Active  Dyn1    Up      Yes     Success 100    100
  A5   Active  A5      Up      No      Success 250    250
```

Static trunk

The switch uses the links you configure with the Port/Trunk Settings screen in the menu interface or the `trunk` command in the CLI to create a static port trunk. The switch offers two types of static trunks: LACP and Trunk.

Table 10: *Trunk types used in static and dynamic trunk groups*

Trunking method	LACP	Trunk
Dynamic	Yes	No
Static	Yes	No

The following table describes the trunking options for LACP and Trunk protocols.

Table 11: *Trunk configuration protocols*

Protocol	Trunking Options
LACP (802.3ad)	Provides dynamic and static LACP trunking options. ■ **Dynamic LACP** – Use the switch-negotiated dynamic LACP trunk when: • The port on the other end of the trunk link is configured for Active or Passive LACP. • You want fault-tolerance for high-availability applications. If you use an eightlink trunk, you can also configure one or more additional links to operate as standby links that will activate only if another active link goes down. ■ **Static LACP** – Use the manually configured static LACP trunk when: • The port on the other end of the trunk link is configured for a static LACP trunk. • You want to configure non-default spanning tree or IGMP parameters on an LACP trunk group. • You want an LACP trunk group to operate in a VLAN other than the default VLAN and GVRP is disabled. See VLANs and dynamic LACP on page 123. • You want to use a monitor port on the switch to monitor an LACP trunk. For more information, see Trunk group operation using LACP on page 120.
Trunk (non-protocol)	Provides manually configured, static-only trunking to: ■ Most Switches and routing switches are not running the 802.3ad LACP protocol. ■ Windows NT and HPE-UX workstations and servers Use the Trunk option when: ■ The device to which you want to create a trunk link is using a non-802.3ad trunking protocol. ■ You are unsure which type of trunk to use, or the device to which you want to create a trunk link is using an unknown trunking protocol. ■ You want to use a monitor port on the switch to monitor traffic on a trunk. See Trunk group operation using the trunk option on page 125.

Table 12: *General operating rules for port trunks*

Protocol	Trunking Options
Media:	For proper trunk operation, all ports on both ends of a trunk group must have the same media type and mode (speed and duplex). (For the switches, it is recommended to leave the port mode setting at `Auto` or, in networks using Cat 3 cabling, `Auto-10`.)
Port Configuration:	The default port configuration is Auto, which enables a port to sense

Protocol	Trunking Options
	speed and negotiate duplex with an auto-enabled port on another device. It is recommended that you use the Auto setting for all ports you plan to use for trunking. Otherwise, you must manually ensure that the mode setting for each port in a trunk is compatible with the other ports in the trunk. See:Recommended port mode setting for LACP on page 112 example. All of the following operate on a per-port basis, regardless of trunk membership: ■ Enable/Disable ■ Flow control (Flow Ctrl) LACP is a full-duplex protocol. See Trunk group operation using LACP on page 120.
Trunk configuration:	All ports in the same trunk group must be the same trunk type (LACP or trunk). All LACP ports in the same trunk group must be either all static LACP or all dynamic LACP. A trunk appears as a single port labeled `Dyn1` (for an LACP dynamic trunk) or `Trk1` (for a static trunk of type LACP, Trunk) on various menu and CLI screens. For a listing of which screens show which trunk types, see How the switch lists trunk data on page 125. For spanning-tree or VLAN operation, configuration for all ports in a trunk is done at the trunk level. (You cannot separately configure individual ports within a trunk for spanning-tree or VLAN operation.)
Traffic distribution:	All of the switch trunk protocols use the SA/DA (source address/ destination address) method of distributing traffic across the trunked links. See Outbound traffic distribution across trunked links on page 126.
Spanning Tree:	802.1D (STP) and 802.1w (RSTP) Spanning Tree operate as a global setting on the switch (with one instance of Spanning Tree per switch). 802.1s (MSTP) Spanning Tree operates on a per-instance basis (with multiple instances allowed per switch). For each Spanning Tree instance, you can adjust Spanning Tree parameters on a per-port basis. A static trunk of any type appears in the Spanning Tree configuration display, and you can configure Spanning Tree parameters for a static trunk in the same way that you would configure Spanning Tree parameters on a non-trunked port. (Note that the switch lists the trunk by name–such as Trk1–and does not list the individual ports in the trunk.) For example, if ports C1 and C2 are configured as a static trunk named Trk1, they are listed in the Spanning Tree display as Trk1 and do not appear as individual ports in the Spanning Tree displays. See A port trunk in a Spanning Tree listing on page 112. When Spanning Tree forwards on a trunk, all ports in the trunk will be forwarding. Conversely, when Spanning Tree blocks a trunk, all ports in the trunk are blocked. A dynamic LACP trunk operates only with the default Spanning Tree settings. Also, this type of trunk appears in the CLI `show spanning-tree` display, but not in the Spanning Tree Operation display of the Menu interface. If you remove a port from a static trunk, the port retains the same Spanning Tree settings that were configured for the trunk. In the below Example:, ports C1 and C2 are members of TRK1 and do not appear as individual ports in the port configuration part of the listing. See: A port trunk in a Spanning Tree listing on page 112 example.
IP multicast protocol (IGMP):	A static trunk of any type appears in the IGMP configuration display, and you can configure IGMP for a static trunk in the same way that you would configure IGMP on a non-trunked port. (Note that the switch lists the trunk by name–such as Trk1–and does not list the individual ports in the trunk.) Also, creating a new trunk automatically places the trunk in IGMP Auto status if IGMP is enabled for the default VLAN.A dynamic LACP trunk operates only with the default IGMP settings and does not appear in the IGMP configuration display or `show ip igmp` listing.
VLANs:	Creating a new trunk automatically places the trunk in the DEFAULT_VLAN, regardless of whether the ports in the trunk were in another VLAN. Similarly, removing a port from a trunk group automatically places the port in the default VLAN. You can configure a static trunk in the same way that you configure a port for membership in any VLAN. For a dynamic LACP trunk to operate in a VLAN other than the default VLAN (DEFAULT_ VLAN), GVRP must be enabled. See Trunk group operation using LACP on page 120.

Protocol	Trunking Options
Port security:	Trunk groups (and their individual ports) cannot be configured for port security, and the switch excludes trunked ports from the `show port-security` listing. If you configure non-default port security settings for a port, then subsequently try to place the port in a trunk, you see the following message and the command is not executed: < `port-list`> Command cannot operate over a logical port.
Monitor port:	A trunk cannot be a monitor port. A monitor port can monitor a static trunk but cannot monitor a dynamic LACP trunk.

Recommended port mode setting for LACP

```
switch(config)# show interfaces config

 Port Settings

 Port   Type       | Enabled Mode          Flow Ctrl MDI
 -----  ---------- + ------- ------------  --------- ----
 1      10/100TX   | Yes     Auto          Enable    Auto
 2      10/100TX   | Yes     Auto          Enable    MDI
```

A port trunk in a Spanning Tree listing

```
 Port  Type      Cost Priority State      | Designated Bridge
 ----- --------- ---- -------- ---------  + ----- -----
 c3    100/1000T 5    12B      Forwarding |  0020c1-b27ac0
 c4    100/1000T 5    12B      Forwarding |  0060b0-889e00
 c5    100/1000T 5    12B      Disabled   |
 c6    100/1000T 5    12B      Disabled   |
 TRk1            1    64       Forwarding |  0001e7-a0ec00
```

Viewing and configuring port trunk groups (CLI)

You can list the trunk type and group for all ports on the switch or for selected ports. You can also list LACP-only status information for LACP-configured ports.

Viewing static trunk type and group for all ports or for selected ports

Syntax

`show trunks [< port-list >]`

Omitting the <*port-list*> parameter results in a static trunk data listing for all LAN ports in the switch.

Example

In a switch where ports A4 and A5 belong to Trunk 1 and ports A7 and A8 belong to Trunk 2, you have the options shown in Listing specific ports belonging to static trunks on page 112 and A show trunk listing without specifying ports on page 113 for displaying port data for ports belonging to static trunks.

Using a port list specifies, for switch ports in a static trunk group, only the ports you want to view. In this case, the command specifies ports A5 through A7. However, because port A6 is not in a static trunk group, it does not appear in the resulting listing:

Listing specific ports belonging to static trunks

```
switch# show trunks e 5-7

 Load Balancing

  Port | Name                      Type      | Group Type
  ---- + ------------------------ --------- + ----- -----
  5    | Print-Server-Trunk       10/100TX  | Trk1  Trunk
  7    |                          10/100TX  | Trk2  Trunk
```

The `show trunks <port-list>` command in the above example includes a port list, and thus shows trunk group information only for specific ports that have membership in a static trunk. In A show trunk listing without specifying ports on page 113, the command does not include a port list, so the switch lists all ports having static trunk membership.

A show trunk listing without specifying ports

```
switch# show trunks

 Load Balancing

 Port | Name                      Type      | Group Type
 ---- + ------------------------ --------- + ----- -----
 4    | Print-Server-Trunk       10/100TX  | Trk1  Trunk
 5    | Print-Server-Trunk       10/100TX  | Trk1  Trunk
 7    |                          10/100TX  | Trk2  Trunk
 8    |                          10/100TX  | Trk2  Trunk
```

Viewing static LACP and dynamic LACP trunk data

Syntax

`show lacp`

Lists data for only the LACP-configured ports.

Example

Ports A1 and A2 have been previously configured for a static LACP trunk. (For more on the `Active` parameter, see Table 14: LACP port status data.)

A show LACP listing

```
switch# show lacp

                          LACP
       LACP     Trunk    Port              LACP     Admin  Oper
Port   Enabled  Group    Status   Partner  Status   Key    Key
----   -------  -------  -------  -------  -------  ------ ------
A1     Active   Trk1     Up       Yes      Success  0      250
A2     Active   Trk1     Up       Yes      Success  0      250
A3     Active   A3       Down     No       Success  0      300
A4     Passive  A4       Down     No       Success  0      0
A5     Passive  A5       Down     No       Success  0      0
A6     Passive  A6       Down     No       Success  0      0
```

For a description of each of the above-listed data types, see table Table 14: LACP port status data.

Dynamic LACP Standby Links

Dynamic LACP trunking enables you to configure standby links for a trunk by including more than eight ports in a dynamic LACP trunk configuration. When eight ports (trunk links) are up, the remaining link(s) will be held in

standby status. If a trunked link that is “Up” fails, it will be replaced by a standby link, which maintains your intended bandwidth for the trunk. (Refer to also the “Standby” entry under “Port Status” in "Table 4-5. LACP Port Status Data".) In the next Example:, ports A1 through A9 have been configured for the same LACP trunk. Notice that one of the links shows Standby status, while the remaining eight links are “Up”.

A Dynamic LACP trunk with one standby link

```
switch# show lacp
                                LACP
       LACP      Trunk    Port                LACP    Admin    Oper
Port   Enabled   Group    Status   Partner    Status   Key      Key
----   -------   -----    ------   -------    ------   ----    -----
A1     Active     Dyn1     Up        Yes      Success   100      100
A2     Active     Dyn1     Up        Yes      Success   100      100
A3     Active     Dyn1     Up        Yes      Success   100      100
A4     Active     Dyn1     Up        Yes      Success   100      100
A5     Active     Dyn1     Up        Yes      Success   100      100
A6     Active     Dyn1     Up        Yes      Success   100      100
A7     Active     Dyn1     Up        Yes      Success   100      100
A8     Active     Dyn1     Up        Yes      Success   100      100
A9     Active     Dyn1    Standby    Yes      Success   100      100
```

Configuring a static trunk or static LACP trunk group

NOTE

Configure port trunking **before** you connect the trunked links between switches. Otherwise, a broadcast storm could occur. (If you need to connect the ports before configuring them for trunking, you can temporarily disable the ports until the trunk is configured. See "Enabling or Disabling Ports and Configuring Port Mode".)

The Port trunk features and operation on page 108 describes the maximum number of trunk groups you can configure on the switch. An individual trunk can have up to eight links, with additional standby links if you’re using LACP. You can configure trunk group types as follows:

Trunk Type	Trunk Group Membership	
	Trk**X** (Static)	Dyn**X** (Dynamic)
LACP	Yes	Yes
Trunk	Yes	No

The following examples show how to create different types of trunk groups.

Syntax

`trunk < port-list > < trk1 ... trk60 > {<trunk | lacp>}`

Configures the specified static trunk type.

Example

This example uses ports C4 to C6 to create a non-protocol static trunk group with the group name `Trk2`.

```
switch(config)# trunk c4-c6 trk2 trunk
```

Removing ports from a static trunk group

CAUTION

Removing a port from a trunk can create a loop and cause a broadcast storm. When you remove a port from a trunk where spanning tree is not in use, The switch recommends that you first disable the port or disconnect the link on that port.

Syntax

`no trunk <port-list>`

Removes the specified ports from an existing trunk group.

Example

To remove ports C4 and C5 from an existing trunk group:

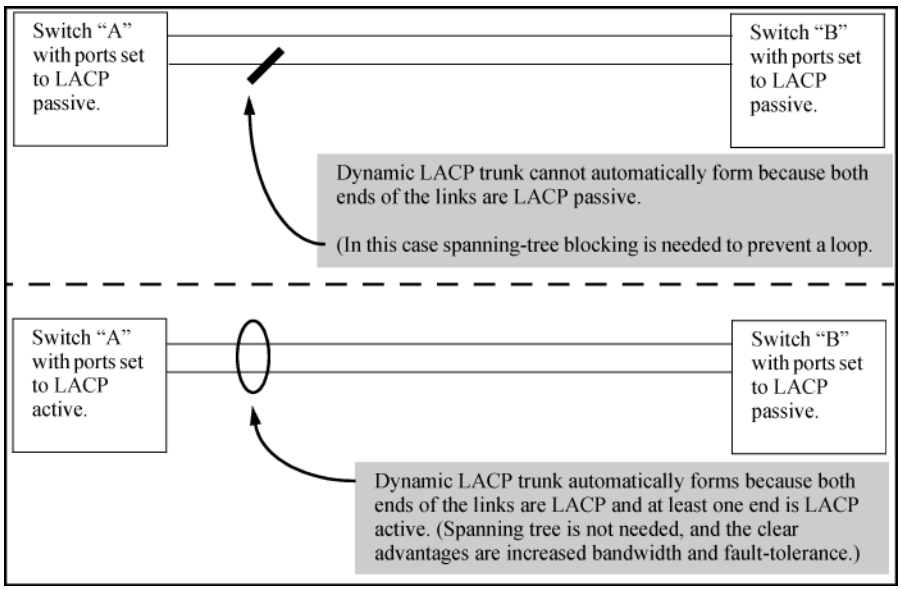
```
switch(config)# no trunk c4-c5
```

Enabling a dynamic LACP trunk group

In the default port configuration, all ports on the switch are set to disabled. To enable the switch to automatically form a trunk group that is dynamic on both ends of the link, the ports on one end of a set of links must be LACP Active. The ports on the other end can be either LACP Activeor LACP Passive. The `active` command enables the switch to automatically establish a (dynamic) LACP trunk group when the device on the other end of the link is configured for LACP Passive.

Example

Figure 10 *Criteria for automatically forming a dynamic LACP trunk*



Syntax

`interface <port-list> lacp active`

Configures `<port-list>` as LACP active. If the ports at the other end of the links on `<port-list>` are configured as LACP passive, this command enables a dynamic LACP trunk group on `<port-list>`.

Example

This example uses ports C4 and C5 to enable a dynamic LACP trunk group.

```
switch(config)# interface c4-c5 lacp active
```

Removing ports from a dynamic LACP trunk group

To remove a port from dynamic LACP trunk operation, you must turn off LACP on the port. (On a port in an operating, dynamic LACP trunk, you cannot change between LACP `Active` and LACP `passive` without first removing LACP operation from the port.)

Unless spanning tree is running on your network, removing a port from a trunk can result in a loop. To help prevent a broadcast storm when you remove a port from a trunk where spanning tree is not in use, Hewlett Packard Enterprise recommends that you first disable the port or disconnect the link on that port.

Syntax

`no interface <port-list> lacp`

Removes `<port-list>` from any dynamic LACP trunk and returns the ports in `<port-list>` to passive LACP.

Example

Port C6 belongs to an operating, dynamic LACP trunk. To remove port C6 from the dynamic trunk and return it to passive LACP, do the following:

```
switch(config)# no interface c6 lacp
switch(config)# interface c6 lacp passive
```

In the above example, if the port on the other end of the link is configured for active LACP or static LACP, the trunked link will be re-established almost immediately.

Specifying Minimum Active Links for LACP

Link Aggregation Control Protocol (LACP) allows the operator to configure a minimum number of active member links in a trunk group to remain operational. When the number of active member links in the trunk is less than the configured threshold value, the LACP trunk will be shut down. An additional option is provided to configure an `enable-timer`, on expiry of which the LACP trunk brought down by the `min-active-links` functionality, will be re-enabled. Once the trunk member ports are re-enabled, the validation for the active links against the configured threshold is performed after a minute and the trunk state will be decided accordingly. The trunk will be up and the traffic will be forwarded though the LACP trunk during this period.

- If the minimum active links are configured without `enable-timer` configuration, the LACP trunk disabled by the feature will remain down until the operator explicitly disables and re-enables the port or triggers a port up indication by any alternative means.
- If the number of active links in a LACP trunk is less than the threshold value, the trunk will not be functional and traffic will not pass through the respective trunk.
- If the number of active links in the trunk drops below the threshold, the entire trunk will be brought down and complete traffic flowing through the same will be dropped. Hence, this configuration must be used carefully in a topology where there is a redundant traffic path.
- It is recommended to configure the `min-active-links` on one side of the trunk.

lacp min-active-links

Syntax

```
lacp min-active-links <value>
no lacp min-active-links <value>
```

Description

Configures the minimum threshold value for the active member links in a LACP trunk group.

The `no` form of this command deletes the configured threshold and sets the threshold value to default.

Command context

```
interface
```

Example

```
eth-Trk
```

Parameters

value

Sets the threshold value for LACP trunk. The value is an integer that ranges from zero to eight which represents the number of minimum active links. The default value is zero which disables the minimum active links.

Example

```
switch(eth-Trk11)# lacp
enable-timer          Configure the time in seconds to wait before re-enabling
                      the trunk disabled by LACP feature for minimum active links.
key                   Set the LACP key.
mad-passthrough       Enable or disable MAD passthrough on the LACP trunks.
min-active-links      Configure the threshold for the minimum number of active
                      member links in a LACP trunk group, for it to be operational.
active                Enable active LACP.
passive               Enable passive LACP.
static                Set the mode of a static LACP port to active or passive.
switch(eth-Trk11)# lacp min-active-links
<0-8>                 Enter a number.
switch(eth-Trk11)# lacp min-active-links 5WARNING: This configuration can result in
disabling the trunk, if the
```

```
number of active links in the trunk drops below the configured threshold.
Continue (y/n)? y
```

lacp enable-timer

Syntax

```
lacp enable-timer <value>
no lacp enable-timer <value>
```

Description

Configures the timer on expiry of which the member links disabled by LACP `min-active-links` functionality, will be re-enabled.

The `no` form of this command deletes the configured time and sets the time to default.

Command context

```
interface
```

Example

```
eth-Trk
```

Parameters

value

Sets the time duration to wait before enabling the disabled trunk. The time duration ranges from 0 to 604800 seconds. The default value is zero which disables the timer.

Example

```
switch(eth-Trk11)# lacp
enable-timer          Configure the time in seconds to wait before re-enabling
                      the trunk disabled by LACP feature for minimum active links.
key                   Set the LACP key.
mad-passthrough       Enable or disable MAD passthrough on the LACP trunks.
min-active-links      Configure the threshold for the minimum number of active
                      member links in a LACP trunk group, for it to be operational.
active                Enable active LACP.
passive               Enable passive LACP.
static                Set the mode of a static LACP port to active or passive.
switch(eth-Trk11)# lacp enable-timer
<0-604800>            Enter a number.
switch(eth-Trk11)# lacp enable-timer 120
```

show lacp min-active-links

Syntax

```
show lacp min-active-links
```

Description

Shows the LACP minimum active links information for each trunk group.

Example

```
switch# show lacp min-active-links
```

```
Trunk   Minimum active  Enable-Time
Group   Links           (seconds)
------- --------------- ------------
Trk1    0               0
Trk3    0               0
Trk9    2               120
Trk17   6               356
```

show running-configuration

```
switch(config)# show running-config

Running configuration:

; JL356A Configuration Editor; Created on release #YC.16.0x.0000x
; Ver #14:27.44.38.04.99.03.b3.b8.ef.74.61.fc.68.f3.8c.fc.e3.ff.37.2f:33

hostname "switch"
module 1 type jl356a
mirror-port 25
trunk 12,24 trk9 lacp
trunk 17-23 trk17 lacp
ip default-gateway 40.1.1.4
interface 1
   disable
   exit
interface 26
   monitor
   exit
interface Trk9
   lacp min-active-links 2
   lacp enable-timer 120
   exit
interface Trk17
   lacp min-active-links 6
   lacp enable-timer 356
   exit
```

Limitations

- Dynamic LACP, static trunks, and distributed trunks will not support this feature.
- The command is not available for REST/next Gen UI.
- If the LACP trunk is down due to lack of active links with the timer enabled, a dynamic update to the `enable-timer` by configuration will not take effect immediately as the current timer runs with the previously configured value.
- When the LACP trunk is blocked by `min-active-links` and the `enable-timer` is running, the member links will be prevented from becoming operational even if there is an external intervention caused by configuration or topology changes.
- If the `enable-timer` is not configured, the operator must restore the member links of the LACP trunk which are blocked by the minimum active links.
- If there is a flap in any member links, the LACP trunk disabled by `min-active-links` may end up flapping when `enable-timer` is not configured.

- The `min-active-links` feature is not supported on the previous releases (that is prior to 16.08 version). On downgrading the switch to the previous version, the configuration will be removed without any warning.

Viewing existing port trunk groups (WebAgent)

While the WebAgent does not enable you to configure a port trunk group, it does provide a view of an existing trunk group.

To view any port trunk groups:

1. In the navigation pane, click **Interface**.
2. Click **Port Info/Config**. The trunk information for the port displays in the **Port Properties** box.

Trunk group operation using LACP

The switch can automatically configure a dynamic LACP trunk group, or you can manually configure a static LACP trunk group.

LACP requires full-duplex (FDx) links of the same media type (10/100Base-T, 100FX, and so on) and the same speed and enforces speed and duplex conformance across a trunk group. For most installations, it is recommended that you leave the port mode settings at `Auto` (the default). LACP also operates with `Auto-10`, `Auto-100`, and `Auto-1000` (if negotiation selects FDx), and `10FDx`, `100FDx`, and `1000FDx` settings.

LACP trunk status commands include:

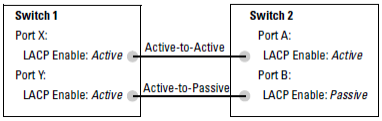
Trunk display method	Static LACP trunk	Dynamic LACP trunk
CLI `show lacp` command	Included in listing.	Included in listing.
CLI `show trunk` command	Included in listing.	Not included.

Thus, to display a listing of dynamic LACP trunk ports, you must use the `show lacp` command.

In most cases, trunks configured for LACP on the switches operate as described in the following table.

Table 13: *LACP trunk types*

LACP port trunk configuration	Operation
Dynamic LACP	This option automatically establishes an 802.3ad-compliant trunk group, with **LACP** for the port Type parameter and **DynX** for the port Group name, where **X** is an automatically assigned value from 1 to 60, depending on how many dynamic and static trunks are currently on the switch. (The switch allows a maximum of 60 trunk groups in any combination of static and dynamic trunks.) Dynamic LACP trunks operate only in the default VLAN (unless GVRP is enabled and `Forbid` is used to prevent the trunked ports from joining the default VLAN). Thus, if an LACP dynamic port forms using ports that are not in the default VLAN, the trunk automatically moves to the default VLAN unless GVRP operation is configured to prevent this from occurring. In some cases, this can create a traffic loop in your network. For more information on this topic, see VLANs and dynamic LACP on page 123.

LACP port trunk configuration	Operation
	Under the following conditions, the switch automatically establishes a dynamic LACP port trunk group and assigns a port Group name: ■ The ports on both ends of each link have compatible mode settings (speed and duplex). ■ The port on one end of each link must be configured for LACP Active and the port on the other end of the same link must be configured for either LACP Passive or LACP Active. For example:  Either of the above link configurations allows a dynamic LACP trunk link. **Backup Links:** A maximum of eight operating links are allowed in the trunk, but, with dynamic LACP, you can configure one or more additional (backup) links that the switch automatically activates if a primary link fails. To configure a link as a standby for an existing eight-port dynamic LACP trunk, ensure that the ports in the standby link are configured as either active-to-active or active-to-passive between switches. **Displaying dynamic LACP trunk data:** To list the configuration and status for a dynamic LACP trunk, use the CLI `show lacp` command. The dynamic trunk is automatically created by the switch and is not listed in the static trunk listings available in the menu interface or in the CLI `show trunk` listing.
Static LACP	Provides a manually configured, static LACP trunk to accommodate these conditions: ■ The port on the other end of the trunk link is configured for a static LACP trunk. ■ You want to configure non-default Spanning Tree or IGMP parameters on an LACP trunk group. ■ You want an LACP trunk group to operate in a VLAN other than the default VLAN and GVRP is disabled. See VLANs and dynamic LACP on page 123 ■ You want to use a monitor port on the switch to monitor an LACP trunk. The trunk operates if the trunk group on the opposite device is running one of the following trunking protocols: ■ Active LACP ■ Passive LACP ■ Trunk This option uses **LACP** for the port Type parameter and **TrkX** for the port Group parameter, where **X** is an automatically assigned value in a range corresponding to the maximum number of trunks the switch allows. See Port trunk features and operation on page 108 for the maximum number of trunk groups allowed on the switches. **Displaying static LACP trunk data :** To list the configuration and status for a static LACP trunk, use the CLI `show lacp` command. To list a static LACP trunk with its assigned ports, use the CLI `show trunk` command or display the menu interface Port/Trunk Settings screen. Static LACP does not allow standby ports.

Default port operation

In the default configuration, LACP is disabled for all ports. If LACP is not configured as Active on at least one end of a link, the port does not try to detect a trunk configuration and operates as a standard, untrunked port. The following table lists the elements of per-port LACP operation. To display this data for a switch, execute the following command in the CLI:

```
switch# show lacp
```

Table 14: *LACP port status data*

Status name	Meaning
Port Number	Shows the physical port number for each port configured for LACP operation (C1, C2, C3 ...). Unlisted port numbers indicate that the missing ports that are assigned to a static trunk group are not configured for any trunking.
LACP Enabled	**Active:** The port automatically sends LACP protocol packets. **Passive:** The port does not automatically send LACP protocol packets and responds only if it receives LACP protocol packets from the opposite device.A link having either two active LACP ports or one active port and one passive port can perform dynamic LACP trunking. A link having two passive LACP ports does not perform LACP trunking because both ports are waiting for an LACP protocol packet from the opposite device. In the default switch configuration, LACP is disabled for all ports.
Trunk Group	**TrkX:** This port has been manually configured into a static LACP trunk. **Trunk group same as port number:** The port is configured for LACP, but is not a member of a port trunk.
Port Status	**Up:** The port has an active LACP link and is not blocked or in standby mode. **Down:** The port is enabled, but an LACP link is not established. This can indicate, For example, a port that is not connected to the network or a speed mismatch between a pair of linked ports. **Disabled:** The port cannot carry traffic. **Blocked:** LACP, Spanning Tree has blocked the port. (The port is not in LACP standby mode.) This may be caused by a (brief) trunk negotiation or a configuration error, such as differing port speeds on the same link or trying to connect the switch to more trunks than it can support. (See Table 11: Trunk configuration protocols.) Some older devices are limited to four ports in a trunk. When eight LACP-enabled ports are connected to one of these older devices, four ports connect, but the other four ports are blocked. **Standby:** The port is configured for dynamic LACP trunking to another device, but the maximum number of ports for the dynamic trunk to that device has already been reached on either the switch or the other device. This port will remain in reserve, or "standby" unless LACP detects that another, active link in the trunk has become disabled, blocked, or down. In this case, LACP automatically assigns a standby port, if available, to replace the failed port.
LACP Partner	**Yes:** LACP is enabled on both ends of the link. **No:** LACP is enabled on the switch, but either LACP is not enabled or the link has not been detected on the opposite device.
LACP Status	**Success:** LACP is enabled on the port, detects and synchronizes with a device on the other end of the link, and can move traffic across the link. **Failure:** LACP is enabled on a port and detects a device on the other end of the link, but is not able to synchronize with this device, and therefore is not able to send LACP packets across the link. This can be caused, For example, by an intervening device on the link (such as a hub), a bad hardware connection, or if the LACP operation on the opposite device does not comply with the IEEE 802.3ad standard.

LACP notes and restrictions

802.1X (Port-based access control) configured on a port

To maintain security, LACP is not allowed on ports configured for 802.1X authenticator operation. If you configure port security on a port on which LACP (active or passive) is configured, the switch removes the LACP configuration, displays a notice that LACP is disabled on the port, and enables 802.1X on that port.

```
switch(config)# aaa port-access authenticator b1
LACP has been disabled on 802.1x port(s).
switch(config)#
```

The switch does not allow you to configure LACP on a port on which port access (802.1X) is enabled. For example:

```
switch(config)# int b1 lacp passive
Error configuring port < port-number > : LACP and 802.1x cannot
be run together.
switch(config)#
```

To restore LACP to the port, you must first remove the 802.1X configuration of the port and then re-enable LACP active or passive on the port.

Port security configured on a port

To maintain security, LACP is not allowed on ports configured for port security. If you configure port security on a port on which LACP (active or passive) is configured, the switch removes the LACP configuration, displays a notice that LACP is disabled on the port, and enables port security on that port. For example:

```
switch(config)# port-security a17 learn-mode static address-
limit 2 LACP has been disabled on secured port(s).
switch(config)#
```

The switch does not allow you to configure LACP on a port on which port security is enabled. For example:

```
switch(config)# int a17 lacp passive
Error configuring port A17: LACP and port security cannot be
run together.
switch(config)#
```

To restore LACP to the port, you must remove port security and re-enable LACP active or passive.

Changing trunking methods

To convert a trunk from static to dynamic, you must first eliminate the static trunk.

Static LACP trunks

When a port is configured for LACP (active or passive), but does not belong to an existing trunk group, you can add that port to a static trunk. Doing so disables dynamic LACP on that port, which means you must manually configure both ends of the trunk.

Dynamic LACP trunks

You can configure a port for LACP-active or LACP-passive, but on a dynamic LACP trunk you cannot configure the other options that you can on static trunks. If you want to manually configure a trunk, use the `trunk` command.

VLANs and dynamic LACP

A dynamic LACP trunk operates only in the default VLAN (unless you have enabled GVRP on the switch and use `Forbid` to prevent the ports from joining the default VLAN).

If you want to use LACP for a trunk on a non-default VLAN and GVRP is disabled, configure the trunk as a static trunk.

Blocked ports with older devices

Some older devices are limited to four ports in a trunk. When eight LACP-enabled ports are connected to one of these older devices, four ports connect, but the other four ports are blocked. The LACP status of the blocked

ports is shown as "Failure."

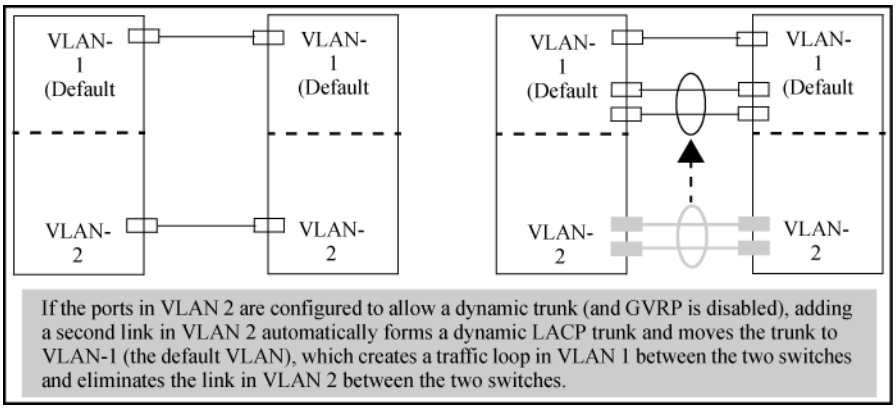
If one of the other ports becomes disabled, a blocked port replaces it (Port Status becomes "Up"). When the other port becomes active again, the replacement port goes back to blocked (Port Status is "Blocked"). It can take a few seconds for the switch to discover the current status of the ports.

Blocked ports with LACP

```
switch(eth-B1-B8)# show lacp

                          LACP

  PORT    LACP      TRUNK    PORT      LACP      LACP
  NUMB    ENABLED   GROUP    STATUS    PARTNER   STATUS
  ----    -------   ------   ------    -------   ------
  B1      Active    Dyn1     Up        Yes       Success
  B2      Active    Dyn1     Up        Yes       Success
  B3      Active    Dyn1     Up        Yes       Success
  B4      Active    Dyn1     Up        Yes       Success
  B5      Active    Dyn1     Blocked   Yes       Failure
  B6      Active    Dyn1     Blocked   Yes       Failure
  B7      Active    B7       Down      No        Success
  B8      Active    B8       Down      No        Success
```

If there are ports that you do not want on the default VLAN, ensure that they cannot become dynamic LACP trunk members. Otherwise a traffic loop can unexpectedly occur. For example:

Figure 11 *A dynamic LACP trunk forming in a VLAN can cause a traffic loop*



Easy control methods include either disabling LACP on the selected ports or configuring them to operate in static LACP trunks.

Spanning Tree and IGMP

If Spanning Tree, IGMP, or both are enabled in the switch, a dynamic LACP trunk operates only with the default settings for these features and does not appear in the port listings for these features.

Half-duplex, different port speeds, or both not allowed in LACP trunks

Theports on both sides of an LACP trunk must be configured for the same speed and for full-duplex (FDx). The 802.3ad LACP standard specifies a full-duplex (FDx) requirement for LACP trunking. (10-gigabit ports operate only at FDx.)

A port configured as LACP passive and not assigned to a port trunk can be configured to half-duplex (HDx). However, in any of the following cases, a port cannot be reconfigured to an HDx setting:

- If the port is a 10-gigabit port.
- If a port is set to LACP Active, you cannot configure it to HDx.
- If a port is already a member of a static or dynamic LACP trunk, you cannot configure it to HDx.
- If a port is already set to HDx, the switch does not allow you to configure it for a static or dynamic LACP trunk.

Dynamic/static LACP interoperation

A port configured for dynamic LACP can properly interoperate with a port configured for static (TrkX) LACP, but any ports configured as standby LACP links are ignored.

Trunk group operation using the trunk option

This method creates a trunk group that operates independently of specific trunking protocols and does not use a protocol exchange with the device on the other end of the trunk. With this choice, the switch simply uses the SA/DA method of distributing outbound traffic across the trunked ports without regard for how that traffic is handled by the device at the other end of the trunked links. Similarly, the switch handles incoming traffic from the trunked links as if it were from a trunked source.

When a trunk group is configured with the `trunk` option, the switch automatically sets the trunk to a priority of "4" for Spanning Tree operation (even if Spanning Tree is currently disabled). This appears in the running-config file as `spanning-tree Trkn priority 4`. Executing `write memory` after configuring the trunk places the same entry in the startup-config file.

Use the `trunk` option to establish a trunk group between a switch and another device, where the other device's trunking operation fails to operate properly with LACP trunking configured on the switches.

How the switch lists trunk data

Static trunk group

Appears in the menu interface and the output from the CLI `show trunk` and `show interfaces` commands.

Dynamic LACP trunk group

Appears in the output from the CLI `show lacp` command.

Interface option	Dynamic LACP trunk group	Static LACP trunk group	Static non-protocol
CLI `show trunk`	No	Yes	Yes
CLI `show interfaces`	No	Yes	Yes
CLI `show lacp`	Yes	Yes	No
CLI `show spanning-tree`	No	Yes	Yes
CLI `show igmp`	No	Yes	Yes

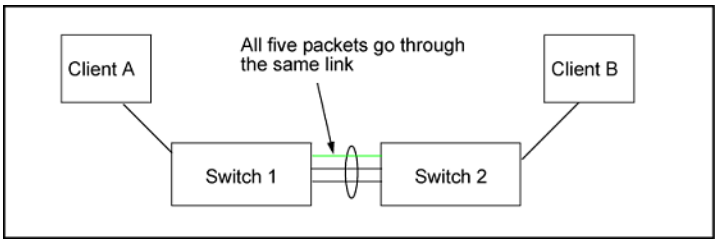
Interface option	Dynamic LACP trunk group	Static LACP trunk group	Static non-protocol
CLI `show config`	No	Yes	Yes

Outbound traffic distribution across trunked links

The two trunk group options (LACP and trunk) use SA/DA pairs for distributing outbound traffic over trunked links. That is, the switch sends traffic from the same source address to the same destination address through the same trunked link, and may also send traffic from the same source address to a different destination address through the same link or a different link, depending on the mapping of path assignments among the links in the trunk. Likewise, the switch distributes traffic for the same destination address but from different source addresses through links depending on the path assignment.

The load-balancing is done on a per-communication basis. Otherwise, traffic is transmitted across the same path as shown in the figure below. That is, if Client A attached to Switch 1 sends five packets of data to Server A attached to Switch 2, the same link is used to send all five packets. The SA/DA address pair for the traffic is the same. The packets are not evenly distributed across any other existing links between the two switches; they all take the same path.

Figure 12 *Example of single path traffic through a trunk*



The actual distribution of the traffic through a trunk depends on a calculation using bits from the SA/DA. When an IP address is available, the calculation includes the last five bits of the IP source address and IP destination address; otherwise, the MAC addresses are used. The result of that process undergoes a mapping that determines which link the traffic goes through. If you have only two ports in a trunk, it is possible that all the traffic will be sent through one port even if the SA/DA pairs are different. The more ports you have in the trunk, the more likely it is that the traffic will be distributed among the links.

When a new port is added to the trunk, the switch begins sending traffic, either new traffic or existing traffic, through the new link. As links are added or deleted, the switch redistributes traffic across the trunk group. For example, in the figure below showing a three-port trunk, traffic could be assigned as shown in the following table.

Figure 13 *Example of port-trunked network*

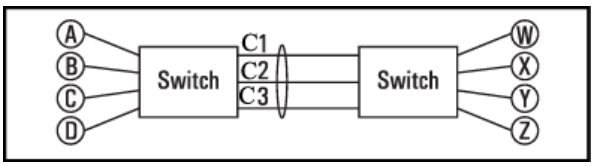


Table 15: *Example of link assignments in a trunk group (SA/DA distribution)*

Source	Destination	Link
Node A	Node W	1
Node B	Node X	2
Node C	Node Y	3
Node D	Node Z	1
Node A	Node Y	2
Node B	Node W	3

Because the amount of traffic coming from or going to various nodes in a network can vary widely, it is possible for one link in a trunk group to be fully utilized while other links in the same trunk have unused bandwidth capacity, even if the assignments were evenly distributed across the links in a trunk.

Trunk load balancing using port layers

Trunk load balancing using port layers allows the use of TCP/UDP source and destination port number for trunk load balancing. This is in addition to the current use of source and destination IP address and MAC addresses. Configuration of Layer 4 load balancing would apply to all trunks on the switch. Only non-fragmented packets will have their TCP/UDP port number used by load balancing. This ensures that all frames associated with a fragmented IP packet are sent through the same trunk on the same physical link.

The priority for using layer packet information when this feature is enabled is as follows:

Procedure

1. L4-based: If the packet protocol is an IP packet, use Layer 4, or Layer 3, or Layer 2 information, whichever is present, in that order.
2. L3-based: If the packet protocol is an IP packet, use Layer 3, or Layer 2 information, whichever is present, in that order.
3. L2-based: If the packet protocol is an IP packet use Layer 2 information.
4. For all options, if the packet is not an IP packet, use Layer 2 information.

Enabling trunk load balancing

Enter the following command to enable load balancing.

Syntax

```
trunk-load-balance L3-based | [L4-based >]
```

This option enables load balancing based on port layer information. The configuration is executed in global configuration context and applies to the entire switch.

Default: L3-based load balancing

L2-based:	Load balance based on Layer 2 information.
L3-based:	Load balance based on Layer 3 information if present, or Layer 2 information.
L4-based:	Load balance on Layer 4 port information if present, or Layer 3 if present, or Layer 2.

Enabling L4-based trunk load balancing

```
switch(config)# trunk-load-balance L4 based
```

Output when L4-based trunk load balancing is enabled

```
Switch(config)# show trunk

Load Balancing Method: L4-based

 Port | Name                           Type      | Group  Type
 ---- + ------------------------------ --------- + ------ -------
 41                                    100/1000T   Trk1   Trunk
 42                                    100/1000T   Trk1   Trunk
```

Note in Running config file when L4-based trunk load balancing is enabled on page 128 that in if L4 trunk load balancing is enabled, a line appears in the running-config file. If it is not enabled, nothing appears as this is the default and the default values are not displayed.

Running config file when L4-based trunk load balancing is enabled

```
switch(config)# show running-config

Running configuration

; J9091A Configuration Editor; Created on release #XX.15.02.0001x

hostname "Switch"
module 1 type J8702A
module 5 type J9051A
module 7 type J8705A
module 10 type J8708A
module 12 type J8702A
trunk-load-balance L4-based
vlan 1
   name "DEFAULT_VLAN"
   untagged A1-A24, G1-G24, J1-J4, L1-L24
   ip address dhcp-bootp
   tagged EUP
   no untagged EDP
   exit
snmp-server community "public" unrestricted
```

Rate-limiting

Rate-limiting is intended for use on edge ports in a network. It is not recommended for use on links to other switches, routers, or servers within a network, or for use in the network core. Doing so can interfere with applications the network requires to function properly.

All traffic rate-limiting

Rate-limiting for all traffic operates on a per-port basis to allow only the specified bandwidth to be used for inbound or outbound traffic. When traffic exceeds the configured limit, it is dropped. This effectively sets a usage level on a given port and is a tool for enforcing maximum service level commitments granted to network users. This feature operates on a per-port level and is not configurable on port trunks. Rate-limiting is designed to be applied at the network edge to limit traffic from non-critical users or to enforce service agreements such as those offered by Internet Service Providers (ISPs) to provide only the bandwidth for which a customer has paid.

Rate-limiting also can be applied by a RADIUS server during an authentication client session. Applying rate-limiting to desirable traffic is **not recommended**. For further details, see "RADIUS Authentication and Accounting" in the *Access Security Guide* for your switch.

The switches also support ICMP rate-limiting to mitigate the effects of certain ICMP-based attacks.

ICMP traffic is necessary for network routing functions. For this reason, blocking all ICMP traffic is not recommended.

Configuring in/out rate-limiting

Syntax

`no int <port-list> rate-limit all <in|out> percent <0-100>|kbps <0-100000000>>`

Configures a traffic rate limit (on non-trunked ports) on the link. The `no` form of the command disables rate-limiting on the specified ports.

The `rate-limit all` command controls the rate of traffic sent or received on a port by setting a limit on the bandwidth available. It includes options for:

- Rate-limiting on inbound or outbound traffic.
- Specifying the traffic rate as either a percentage of bandwidth, or in terms of bits per second.

(Default: Disabled.)

`in` **or** `out`	Specifies a traffic rate limit on inbound traffic passing through that port or on outbound traffic.
`percent` **or** `kbps`	Specifies the rate limit as a percentage of total available bandwidth, or in kilobits per second.

NOTE

The granularity of actual limits may vary across different switch models.

For more details on configuring rate-limiting, see All traffic rate-limiting.

Notes:

- The `rate-limiticmp` command specifies a rate limit on inbound ICMP traffic only (see ICMP rate-limiting).
- Rate-limiting does not apply to trunked ports (including meshed ports).
- Kbps rate-limiting is done in segments of 1% of the lowest corresponding media speed. For example, if the media speed is 1 Kbps, the value would be 1 Mbps. A 1-100 Kbps rate-limit is implemented as a limit of 100 Kbps; a limit of 100-199 Kbps is also implemented as a limit of 100 Kbps, a limit of 200-299 Kbps is implemented as a limit of 200 Kbps, and so on.
- Percentage limits are based on link speed. For example, if a 100 Mbps port negotiates a link at 100 Mbps and the inbound rate-limit is configured at 50%, then the traffic flow through that port is limited to no more than 50 Mbps. Similarly, if the same port negotiates a 10 Mbps link, then it allows no more than 5 Mbps of inbound traffic.Configuring a rate limit of 0 (zero) on a port **blocks all traffic on that port**. However, if this is the desired behavior on the port, Hewlett Packard Enterprise recommends using the `<port-list>` disable command instead of configuring a rate limit of 0.

You can configure a rate limit from either the global configuration level or from the port context level. For example, either of the following commands configures an inbound rate limit of 60% on ports 3 - 5:

```
switch(config)# int 3-5 rate-limit all in percent 60
switch(eth-3-5)# rate-limit all in percent 60
```

Displaying the current rate-limit configuration

The `show rate-limit all` command displays the per-port rate-limit configuration in the running-config file.

Syntax

`show rate-limit all [<port-list>]`

Without **`[port-list]`**, this command lists the rate-limit configuration for all ports on the switch.

With **`[port-list]`**, this command lists the rate-limit configuration for the specified ports. This command operates the same way in any CLI context.

If you want to view the rate-limiting configuration on the first six ports:

Example

Listing the rate-limit configuration on page 130 shows a rate-limiting configuration for the first six ports. In this instance:

- Ports 1-4 are configured with an outbound rate limit of 200 Kbps.
- Port 5 is configured with an inbound rate limit of 20%.
- Port 6 is not configured for rate-limiting.

Listing the rate-limit configuration

```
switch# show rate-limit all 1-6

 All-Traffic Rate Limit Maximum %
```

```
        | Inbound            Radius      | Outbound           Radius
  Port  | Limit     Mode     Override    | Limit     Mode     Override
  ------ + --------- -------- ----------- + --------- -------- --------
  1     | Disabled  Disabled No-override | 200       kbps     No-override
  2     | Disabled  Disabled No-override | 200       kbps     No-override
  3     | Disabled  Disabled No-override | 200       kbps     No-override
  4     | Disabled  Disabled No-override | 200       kbps     No-override
  5     | 20        %        No-override | Disabled  Disabled No-override
  6     | Disabled  Disabled No-override | Disabled  Disabled No-override
```

To view **RADIUS**-assigned rate-limit information, use one of the following command options:

```
show port-access
       web-based clients <port-list> detailed
       mac-based clients <port-list> detailed
       authenticator clients <port-list> detailed
```

For more on **RADIUS**-assigned rate-limits, see title "Configuring RADIUS Server Support for Switch Services" in the latest Management and Configuration Guide for your switch.

The `show running` command displays the currently applied setting for any interfaces in the switch configured for all traffic rate-limiting and ICMP rate limiting.

The `show config` command displays this information for the configuration currently stored in the `startup-config` file. (Note that configuration changes performed with the CLI, but not followed by a `write mem` command, do not appear in the `startup-config` file.)

Rate-limit settings listed in the show config output

```
switch# show config

Startup configuration: 3

; J9727A Configuration Editor; Created on release #WB.15.18.0000x
; Ver #09:14.29.eb.8f.fc.f3.ff.37.2d:ba

hostname "Switch"
module 1 type j9727a
interface 1
   rate-limit all out kbps 200
   exit
interface 2
   rate-limit all out kbps 200
   exit
interface 3
   rate-limit all out kbps 200
   exit
interface 4
   rate-limit all out kbps 200
   exit
interface 5
   rate-limit all in percent 20
   exit
```

Operating notes for rate-limiting

- **Rate-limiting operates on a per-port basis, regardless of traffic priority.** Rate-limiting is available on all types of ports (other than trunked ports) and at all port speeds configurable for these switches.
- **Rate-limiting on a trunk is not allowed for the `all`, `bcast`, `icmp`, and `mcast` traffic types.** Rate-limiting is not supported on ports configured in a trunk group (including mesh ports).Configuring a port for rate-limiting and then adding it to a trunk suspends rate-limiting on the port while it is in the trunk. Attempting to configure rate-limiting on a port that already belongs to a trunk generates the following message:*<port-list>*: `Operation is not allowed for a trunked port.`
- **Rate-limiting and hardware.** The hardware will round the actual Kbps rate down to the nearest multiple of 64 Kbps.
- **Rate-limiting is visible as an outbound forwarding rate.** Because inbound rate-limiting is performed on packets during packet-processing, it is not shown via the inbound drop counters. Instead, this limit is verifiable as the ratio of outbound traffic from an inbound rate-limited port versus the inbound rate. For outbound rate-limiting, the rate is visible as the percentage of available outbound bandwidth (assuming that the amount of requested traffic to be forwarded is larger than the rate-limit).
- **Operation with other features.** Configuring rate-limiting on a port where other features affect port queue behavior (such as flow control) can result in the port not achieving its configured rate-limiting maximum. For example, in a situation where flow control is configured on a rate-limited port, there can be enough "back pressure" to hold high-priority inbound traffic from the upstream device or application to a rate that is lower than the configured rate limit. In this case, the inbound traffic flow does not reach the configured rate and lower priority traffic is not forwarded into the switch fabric from the rate-limited port. (This behavior is termed "head-of-line blocking" and is a well-known problem with flow-control.)In another type of situation, an outbound port can become oversubscribed by traffic received from multiple rate-limited ports. In this case, the actual rate for traffic on the rate-limited ports may be lower than configured because the total traffic load requested to the outbound port exceeds the port's bandwidth, and thus some requested traffic may be held off on inbound.
- **Traffic filters on rate-limited ports.** Configuring a traffic filter on a port does not prevent the switch from including filtered traffic in the bandwidth-use measurement for rate-limiting when it is configured on the same port. For example, ACLs, source-port filters, protocol filters, and multicast filters are all included in bandwidth usage calculations.
- **Monitoring (mirroring) rate-limited interfaces.** If monitoring is configured, packets dropped by rate-limiting on a monitored interface are still forwarded to the designated monitor port. (Monitoring shows what traffic is inbound on an interface, and is not affected by "drop" or "forward" decisions.)
- **Optimum rate-limiting operation.** Optimum rate-limiting occurs with 64-byte packet sizes. Traffic with larger packet sizes can result in performance somewhat below the configured bandwidth. This is to ensure the strictest possible rate-limiting of all sizes of packets.

For the Aruba 2920 switches, use a single PDU when trying to configure through SNMP.

Rate-limiting is applied to the available bandwidth on a port and not to any specific applications running through the port. If the total bandwidth requested by all applications is less than the configured maximum rate, then no rate-limit can be applied. This situation occurs with a number of popular throughput-testing applications, as well as most regular network applications. Consider the following exampl that uses the minimum packet size:

The total available bandwidth on a 100 Mbps port "X" (allowing for Inter-packet Gap–IPG), with no rate-limiting restrictions, is:

```
(((100,000,000 bits) / 8 ) / 84) × 64 = 9,523,809 bytes per second
```

where:

- The divisor (84) includes the 12-byte IPG, 8-byte preamble, and 64-bytes of data required to transfer a 64-byte packet on a 100 Mbps link.
- Calculated "bytes-per-second" includes packet headers and data. This value is the maximum "bytes-per-second" that 100 Mbps can support for minimum-sized packets.

Suppose port "X" is configured with a rate limit of 50% (4,761,904 bytes). If a throughput-testing application is the only application using the port and transmits 1 Mbyte of data through the port, it uses only 10.5% of the port's available bandwidth, and the rate-limit of 50% has no effect. This is because the maximum rate permitted (50%) exceeds the test application's bandwidth usage (126,642-164,062 bytes, depending upon packet size, which is only 1.3% to 1.7% of the available total). Before rate-limiting can occur, the test application's bandwidth usage must exceed 50% of the port's total available bandwidth. That is, to test the rate-limit setting, the following must be true:

```
bandwidth usage (0.50 × 9,523,809)
```

ICMP rate-limiting

In IP networks, ICMP messages are generated in response to either inquiries or requests from routing and diagnostic functions. These messages are directed to the applications originating the inquiries. In unusual situations, if the messages are generated rapidly with the intent of overloading network circuits, they can threaten network availability. This problem is visible in denial-of-service (DoS) attacks or other malicious behaviors where a worm or virus overloads the network with ICMP messages to an extent where no other traffic can get through. (ICMP messages themselves can also be misused as virus carriers). Such malicious misuses of ICMP can include a high number of ping packets that mimic a valid source IP address and an invalid destination IP address (spoofed pings), and a high number of response messages (such as Destination Unreachable error messages) generated by the network.

ICMP rate-limiting provides a method for limiting the amount of bandwidth that may be used for inbound ICMP traffic on a switch port. This feature allows users to restrict ICMP traffic to percentage levels that permit necessary ICMP functions, but throttle additional traffic that may be caused by worms or viruses (reducing their spread and effect). In addition, ICMP rate-limiting preserves inbound port bandwidth for non-ICMP traffic.

CAUTION

ICMP is necessary for routing, diagnostic, and error responses in an IP network. ICMP rate-limiting is primarily used for throttling worm or virus-like behavior and should normally be configured to allow one to five percent of available inbound bandwidth (at 10 Mbps or 100 Mbps speeds) or 100 to 10,000 kbps (1Gbps or 10 Gbps speeds) to be used for ICMP traffic. **This feature should not be used to remove all ICMP traffic from a network.**

NOTE

ICMP rate-limiting does not throttle non-ICMP traffic. In cases where you want to throttle both ICMP traffic and all other inbound traffic on a given interface, you can separately configure both ICMP rate-limiting and all-traffic rate-limiting.

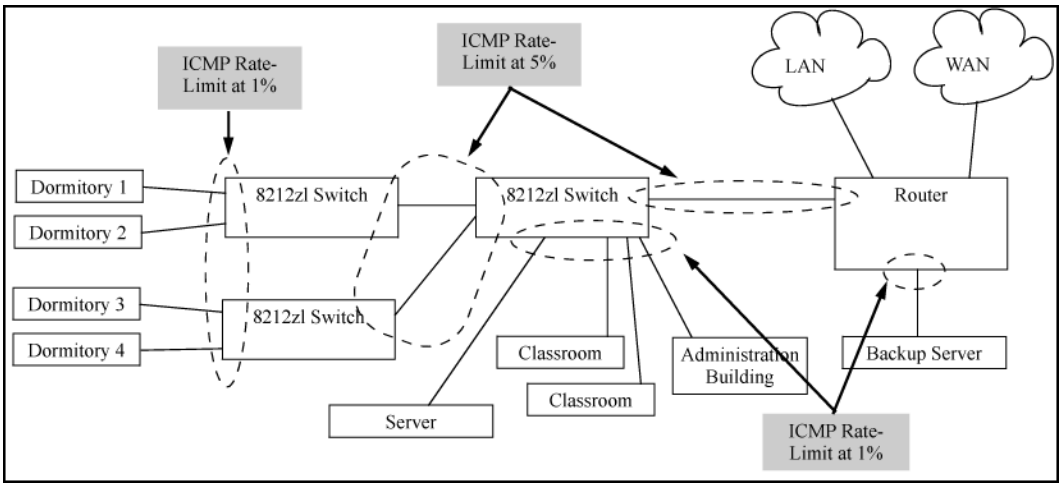
The all-traffic rate-limiting command (`rate-limit all`) and the ICMP rate-limiting command (`rate-limit icmp`) operate differently:

- All-traffic rate-limiting applies to both inbound and outbound traffic and can be specified either in terms of a percentage of total bandwidth or in terms of bits per second;
- ICMP rate-limiting applies only to inbound traffic and can be specified as only a percentage of total bandwidth.

Guidelines for configuring ICMP rate-limiting

Apply ICMP rate-limiting on all connected interfaces on the switch to effectively throttle excessive ICMP messaging from any source. Figure 14: Example of ICMP rate-limiting shows an example of how to configure this for a small to mid-sized campus though similar rate-limit thresholds are applicable to other network environments. On edge interfaces, where ICMP traffic should be minimal, a threshold of 1% of available bandwidth should be sufficient for most applications. On core interfaces, such as switch-to-switch and switch-to-router, a maximum threshold of 5% should be sufficient for normal ICMP traffic. ("Normal" ICMP traffic levels should be the maximums that occur when the network is rebooting.)

Figure 14 *Example of ICMP rate-limiting*



Configuring ICMP rate-limiting

For detailed information about ICMP rate-limiting, see ICMP rate-limiting.

The `rate-limit icmp` command controls inbound usage of a port by setting a limit on the bandwidth available for inbound ICMP traffic.

Syntax

`no int <port-list> rate-limit icmp {< percent < 0-100 > | kbps < 0-10000000 > | [trap-clear>]}`

Configures inbound ICMP traffic rate-limiting. You can configure a rate limit from either the global configuration level (as shown above) or from the interface context level. The `no` form of the command disables ICMP rate-limiting on the specified interfaces.

(Default: Disabled.)

`percent <1-100>`	Values in this range allow ICMP traffic as a percentage of the bandwidth available on the interface.
`kbps <0-10000000>`	Specifies the rate at which to forward traffic in kilobits per second.
`0`	Causes an interface to drop all incoming ICMP traffic and is not recommended. See the ICMP rate-limiting.
`trap-clear`	Clears existing ICMP rate limiting trap condition.

ICMP rate-limiting is not supported on meshed ports. (Rate-limiting can reduce the efficiency of paths through a mesh domain).

Example:

Either of the following commands configures an inbound rate limit of 1% on ports A3 to A5, which are used as network edge ports:

```
switch(config) # int a3-a5 rate-limit icmp 1
switch(eth-A3-A5) # rate-limit icmp 1
```

When using kbps-mode ICMP rate-limiting, the rate-limiting only operates on the IP payload part of the ICMP packet (as required by metering RFC 2698). This means that effective metering is at a rate greater than the configured rate, with the disparity increasing as the packet size decreases (the packet to payload ratio is higher).

Also, in kbps mode, metering accuracy is limited at low values, For example, less than 45 Kbps. This is to allow metering to function well at higher media speeds such as 10 Gbps.

For information on using ICMP rate-limiting and all-traffic rate-limiting on the same interface, see Using both ICMP rate-limiting and all-traffic rate-limiting on the same interface.

Using both ICMP rate-limiting and all-traffic rate-limiting on the same interface

ICMP and all-traffic rate-limiting can be configured on the same interface. All-traffic rate-limiting applies to all inbound or outbound traffic (including ICMP traffic), while ICMP rate-limiting applies only to inbound ICMP traffic.

If the all-traffic load on an interface meets or exceeds the currently configured all-traffic inbound rate-limit while the ICMP traffic rate-limit on the same interface has not been reached, all excess traffic is dropped, including any inbound ICMP traffic above the all-traffic limit (regardless of whether the ICMP rate-limit has been reached).

Example:

Suppose:

- The all-traffic inbound rate-limit on port "X" is configured at 55% of the port's bandwidth.
- The ICMP traffic rate-limit on port "X" is configured at 2% of the port's bandwidth.

If at a given moment:

- Inbound ICMP traffic on port "X" is using 1% of the port's bandwidth, and
- Inbound traffic of all types on port "X" demands 61% of the ports's bandwidth.

All inbound traffic above 55% of the port's bandwidth, including any additional ICMP traffic, is dropped as long as all inbound traffic combined on the port demands 55% or more of the port's bandwidth.

Viewing the current ICMP rate-limit configuration

The `show rate-limit icmp` command displays the per-interface ICMP rate-limit configuration in the running-config file.

Syntax

`show rate-limit icmp [< port-list >]`

Without *[port-list]*, this command lists the ICMP rate-limit configuration for all ports on the switch.

With *[port-list]*, this command lists the rate-limit configuration for the specified interfaces. This command operates the same way in any CLI context.

If you want to view the rate-limiting configuration on ports 1-6:

Listing the rate-limit configuration

```
switch(config)# show rate-limit icmp 1-6

 Inbound ICMP Rate Limit Maximum Percentage

        |          Rate
  Port  | Mode     Limit
  ----- + -------- --------
  1     | Disabled Disabled
  2     | kbps     100
  3     | %        5
  4     | %        1
  5     | %        1
  6     | Disabled Disable
```

The `show running` command displays the currently applied setting for any interfaces in the switch configured for all traffic rate-limiting and ICMP rate-limiting.

The `show config` command displays this information for the configuration currently stored in the `startup-config` file. (Note that configuration changes performed with the CLI, but not followed by a `write mem` command, do not appear in the `startup-config` file.)

Operating notes for ICMP rate-limiting

ICMP rate-limiting operates on an interface (per-port) basis to allow, on average, the highest expected amount of legitimate, inbound ICMP traffic.

- **Interface support:** ICMP rate-limiting is available on all types of ports (other than trunk ports or mesh ports), and at all port speeds configurable for the switch.
- **Rate-limiting is not permitted on mesh ports:** Either type of rate-limiting (all-traffic or ICMP) can reduce the efficiency of paths through a mesh domain.
- **Rate-limiting on a trunk is not allowed for the** `all`, `bcast`, `icmp`, **and** `mcast` **traffic types.** Neither all-traffic nor ICMP rate-limiting are supported on ports configured in a trunk group.
- **ICMP percentage-based rate-limits are calculated as a percentage of the negotiated link speed:** For example, if a 100 Mbps port negotiates a link to another switch at 100 Mbps and is ICMP rate-limit configured at 5%, the inbound ICMP traffic flow through that port is limited to 5 Mbps. Similarly, if the same port negotiates a 10 Mbps link, it allows 0.5 Mbps of inbound traffic. If an interface experiences an inbound flow of ICMP traffic in excess of its configured limit, the switch generates a log message and an SNMP trap (if an SNMP trap receiver is configured).
- **ICMP rate-limiting is port-based:** ICMP rate-limiting reflects the available percentage of an interface's entire inbound bandwidth. The rate of inbound flow for traffic of a given priority and the rate of flow from an ICMP rate-limited interface to a particular queue of an outbound interface are not measures of the actual ICMP rate limit enforced on an interface.
- **Below-maximum rates:** ICMP rate-limiting operates on a per-interface basis, regardless of traffic priority. Configuring ICMP rate-limiting on an interface where other features affect inbound port queue behavior (such as flow control) can result in the interface not achieving its configured ICMP rate-limiting maximum. For example, in some situations with flow control configured on an ICMP rate-limited interface, there can be enough "back pressure" to hold high-priority inbound traffic from the upstream device or application to a rate that does not allow bandwidth for lower-priority ICMP traffic. In this case, the inbound traffic flow may not permit the forwarding of ICMP traffic into the switch fabric from the rate-limited interface. (This behavior is termed "head-of-line blocking" and is a well-known problem with flow-control.) In cases where both types of rate-limiting (`rate-limit all` and `rate-limit icmp`) are configured on the same interface, this situation is more likely to occur.

  In another type of situation, an outbound interface can become oversubscribed by traffic received from multiple ICMP rate-limited interfaces. In this case, the actual rate for traffic on the rate-limited interfaces may be lower than configured because the total traffic load requested to the outbound interface exceeds the interface's bandwidth, and thus some requested traffic may be held off on inbound.
- **Monitoring (mirroring) ICMP rate-limited interfaces:** If monitoring is configured, packets dropped by ICMP rate-limiting on a monitored interface are still forwarded to the designated monitor port. (Monitoring shows what traffic is inbound on an interface, and is not affected by "drop" or "forward" decisions.)
- **Optimum rate-limiting operation:** Optimum rate-limiting occurs with 64-byte packet sizes. Traffic with larger packet sizes can result in performance somewhat below the configured inbound bandwidth. This is to ensure the strictest possible rate-limiting of all sizes of packets.
- **Outbound traffic flow:** Configuring ICMP rate-limiting on an interface does **not** control the rate of outbound traffic flow on the interface.

ICMP rate-limiting trap and Event Log messages

If the switch detects a volume of inbound ICMP traffic on a port that exceeds the ICMP rate-limit configured for that port, it generates one SNMP trap and one informational Event Log message to notify the system operator of the condition. (The trap and Event Log message are sent within two minutes of when the event occurred on the port.) For example:

```
I 06/30/05 11:15:42 RateLim: ICMP traffic exceeded configured limit on port A1
```

These trap and Event Log messages provide an advisory that inbound ICMP traffic on a given interface has exceeded the configured maximum. The additional ICMP traffic is dropped, but the excess condition may indicate an infected host (or other traffic threat or network problem) on that interface. The system operator should investigate the attached devices or network conditions further; the switch does not send more traps or Event Log messages for excess ICMP traffic on the affected port until the system operator resets the port's ICMP trap function.

The switch does not send more traps or Event Log messages for excess ICMP traffic on the affected port until the system operator resets the port's ICMP trap function. The reset can be done through SNMP from a network management station or through the CLI with the `trap-clear` command option.

Syntax

`interface <port-list> rate-limit icmp trap-clear`

On a port configured with ICMP rate-limiting, this command resets the ICMP trap function, which allows the switch to generate a new SNMP trap and an Event Log message if ICMP traffic in excess of the configured limit is detected on the port.

Example

An operator noticing an ICMP rate-limiting trap or Event Log message originating with port 1 on a switch would use the following command to reset the port to send a new message if the condition occurs again:

```
switch(config)# interface 1 rate-limit icmp trap-clear
```

Determining the switch port number used in ICMP port reset commands

To enable excess ICMP traffic notification traps and Event Log messages, use the `setmib` command described on ICMP rate-limiting trap and Event Log messages on page 138. The port number included in the command corresponds to the internal number the switch maintains for the designated port and not the port's external identity.

To match the port's external slot/number to the internal port number, use the `walkmib ifDescr` command, as shown in the following example:

Matching internal port numbers to external port numbers

```
switch# walkmib ifDescr
ifDescr.1 = 1
ifDescr.2 = 2
ifDescr.3 = 3
ifDescr.4 = 4
ifDescr.5 = 5
ifDescr.6 = 6
ifDescr.7 = 7
ifDescr.8 = 8
ifDescr.9 = 9
ifDescr.10 = 10
ifDescr.11 = 11
```

```
ifDescr.12 = 12
ifDescr.13 = 13
ifDescr.14 = 14
ifDescr.15 = 15
ifDescr.16 = 16
ifDescr.17 = 17
ifDescr.18 = 18
ifDescr.19 = 19
ifDescr.20 = 20
ifDescr.21 = 21
ifDescr.22 = 22
ifDescr.23 = 23
ifDescr.24 = 24
ifDescr.210 = Trk1
ifDescr.211 = Trk2
ifDescr.330 = DEFAULT_VLAN
ifDescr.4425 = Switch software loopback interface
ifDescr.4426 = Switch software loopback interface
.
.
.
```

Configuring inbound rate-limiting for broadcast and multicast traffic

You can configure rate-limiting (throttling) of inbound broadcast and multicast traffic on the switch, which helps prevent the switch from being disrupted by traffic storms if they occur on the rate-limited port. The rate-limiting is implemented as a percentage of the total available bandwidth on the port.

The `rate-limit` command can be executed from the global or interface context, for example:

```
switch(config)# interface 3 rate-limit bcast in percent 10
```

or

```
switch(config)# interface 3
switch(eth-3)# rate-limit bcast in percent 10
```

Syntax

`rate-limit {< bcast | mcast >} in percent < 0-100 >`

Parameters

`in percent <0-100>`

Also supports configuring limit in *kbps*

`no rate-limit {<bcast | [mcast >]} in`

Enables rate-limiting and sets limits for the specified inbound broadcast or multicast traffic. Only the amount of traffic specified by the percent is forwarded.

Default: Disabled

If you want to set a limit of 50% on inbound broadcast traffic for port 3, you can first enter interface context for port 3 and then execute the `rate-limit` command, as shown in Inbound broadcast rate-limiting of 50% on port 3 on page 139. Only 50% of the inbound broadcast traffic will be forwarded.

Inbound broadcast rate-limiting of 50% on port 3

```
switch(config)# int 3
switch(eth-3)# rate-limit bcast in percent 50

switch(eth-3)# show rate-limit bcast
```

```
 Broadcast-Traffic Rate Limit Maximum %

  Port   | Inbound Limit Mode      Radius Override
  ------ + ------------- --------- ---------------
  1      | Disabled      Disabled  No-override
  2      | Disabled      Disabled  No-override
  3      | Disabled      %         No-override
  4      | Disabled      Disabled  No-override
  5      | Disabled      Disabled  No-override
```

If you rate-limit multicast traffic on the same port, the multicast limit is also in effect for that port, as shown in Inbound multicast rate-limiting of 20% on port 3 on page 140. Only 20% of the multicast traffic will be forwarded.

Inbound multicast rate-limiting of 20% on port 3

```
switch(eth-3)# rate-limit mcast in percent 20
switch(eth-3)# show rate-limit mcast

 Multicast-Traffic Rate Limit Maximum %

  Port   | Inbound Limit Mode      Radius Override
  ------ + ------------- --------- ---------------
  1      | Disabled      Disabled  No-override
  2      | Disabled      Disabled  No-override
  3      | 20            %         No-override
  4      | Disabled      Disabled  No-override
```

To disable rate-limiting for a port enter the `no` form of the command, as shown in Disabling inbound multicast rate-limiting for port 3 on page 140.

Disabling inbound multicast rate-limiting for port 3

```
switch(eth-3)# no rate-limit mcast in

switch(eth-3)# show rate-limit mcast

 Multicast-Traffic Rate Limit Maximum %

  Port   | Inbound Limit Mode      Radius Override
  ------ + ------------- --------- ---------------
  1      | Disabled      Disabled  No-override
  2      | Disabled      Disabled  No-override
  3      | Disabled      Disabled  No-override
  4      | Disabled      Disabled  No-override
```

Operating Notes

The following information is displayed for each installed transceiver:

- Port number on which transceiver is installed.
- Type of transceiver.
- Product number – Includes revision letter, such as A, B, or C. If no revision letter follows a product number, this means that no revision is available for the transceiver.
- Part number – Allows you to determine the manufacturer for a specified transceiver and revision number.
- For non-Aruba switches installed transceiver, no transceiver type, product number, or part information is displayed. In the Serial Number field, `non-operational` is displayed instead of a serial number.

- The following error messages may be displayed for a non-operational transceiver:
  - `Unsupported Transceiver. (SelfTest Err#060)`
  - `This switch only supports revision B and above transceivers.`
  - `Self test failure.`
  - `Transceiver type not supported in this port.`
  - `Transceiver type not supported in this software version.`
  - `Not an Switch Transceiver.`

Guaranteed minimum bandwidth (GMB)

GMB provides a method for ensuring that each of a given port's outbound traffic priority queues has a specified minimum consideration for sending traffic out on the link to another device. This can prevent a condition where applications generating lower-priority traffic in the network are frequently or continually "starved" by high volumes of higher-priority traffic.

GMB operation

Earlier software releases supported GMB configuration on a per-port basis. Beginning with software release 15.18, the 2920 and 5400R switches also support GMB configuration on static trunks. (GMB configuration is not supported on dynamic LACP or distributed (DT) trunks.

For application to static trunk interfaces (2920 and 5400r only), GMB enforcement is applied individually to each port belonging to the trunk, and not to the trunk as a whole.

For any port, group of ports or, static trunks, you can use the default minimum bandwidth settings for each outbound priority queue or a customized bandwidth profile. It is also possible to disable the feature entirely.

The switch services per-port outbound traffic in a descending order of priority; that is, from the highest priority to the lowest priority. By default, each port (including each port in a static trunk) offers eight prioritized, outbound traffic queues. Tagged VLAN traffic is prioritized according to the 802.1p priority the traffic carries. Untagged VLAN traffic is assigned a priority of **0** (normal).

Table 16: *Per-port outbound priority queues*

802.1p Priority settings in tagged VLAN packets[1]	Outbound priority queue for a given port
1 (low)	1
2 (low)	2
0 (normal)	3
3 (normal)	4
4 (medium)	5
5 (medium)	6

802.1p Priority settings in tagged VLAN packets[1]	Outbound priority queue for a given port
6 (high)	7
7 (high)	8

You can use GMB to reserve a specific percentage of each port's available outbound bandwidth for each of the eight priority queues. This means that regardless of the amount of high-priority outbound traffic on a port (including each port in a static trunk), you can ensure that there will always be bandwidth reserved for lower-priority traffic.

Since the switch services outbound traffic according to priority (highest to lowest), the highest-priority outbound traffic on a given port automatically receives the first priority in servicing. Thus, in most applications, it is necessary only to specify the minimum bandwidth you want to allocate to the lower priority queues. In this case, the high-priority traffic automatically receives all unassigned bandwidth without starving the lower-priority queues.

Conversely, configuring a bandwidth minimum on only the high-priority outbound queue of a port or static trunk (and not providing a bandwidth minimum for the lower-priority queues) is not recommended, because it may "starve" the lower-priority queues.

For a given port, when the demand on one or more outbound queues exceeds the minimum bandwidth configured for those queues, the switch apportions unallocated bandwidth to these queues on a priority basis. As a result, specifying a minimum bandwidth for a high-priority queue but not specifying a minimum for lower-priority queues can starve the lower-priority queues during periods of high demand on the high priority queue. For example, if a port or static trunk configured to allocate a minimum bandwidth of 80% for outbound high-priority traffic experiences a demand above this minimum, this burst starves lower-priority queues that **do not have a minimum configured**. Normally, this will not altogether halt lower priority traffic on the network, but will likely cause delays in the delivery of the lower-priority traffic.

The sum of the GMB settings for all outbound queues on a given port or static trunk cannot exceed 100%.

[1]The switch processes outbound traffic from an untagged port at the "0" (normal) priority level.

Impacts of QoS queue configuration on GMB operation

The section Configuring GMB for outbound traffic on page 143 assumes the ports on the switch offer eight prioritized, outbound traffic queues. This may not always be the case, however, because the switch supports a QoS queue configuration feature that allows you to reduce the number of outbound queues from eight (the default) to four queues, or two.

Changing the number of queues affects the GMB commands (`interface bandwidth-min` and `show bandwidth output`) such that they operate only on the number of queues currently configured. If the queues are reconfigured, the guaranteed minimum bandwidth per queue is automatically re-allocated according to the following percentages:

Table 17: *Default GMB percentage allocations per QoS queue configuration*

802.1p priority	8 queues (default)	4 queues	2 queues
1 (lowest)	2%	10%	90%
2	3%		
0 (normal)	30%	70%	
3	10%		
4	10%	10%	10%
5	10%		
6	15%	10%	
7 (highest)	20%		

For more information on queue configuration and the associated default minimum bandwidth settings, see the "Quality of Service (QoS): managing bandwidth more effectively" in the *Advanced Traffic Management Guide* for your switch.

Configuring GMB for outbound traffic

For any port, group of ports, or static trunk, you can configure either the default minimum bandwidth settings for each outbound priority queue or a customized bandwidth allocation. For most applications, Hewlett Packard Enterprise recommends configuring GMB with the same values on all ports on the switch so that the outbound traffic profile is consistent for all outbound traffic. However, there may be instances where it may be advantageous to configure special profiles on connections to servers or to the network infrastructure (such as links to routers, other switches, or to the network core).

Syntax

`no int <port-list|trk_#> bandwidth-min output`

Configures the default minimum bandwidth allocation for the outbound priority queue for each port or static trunk in the *<port-list|trk_#>*. In the eight-queue configuration, the default values per priority queue are:

- Queue 1 (low priority): 2%
- Queue 2 (low priority): 3%
- Queue 3 (normal priority): 30%
- Queue 4 (normal priority): 10%
- Queue 5 (medium priority): 10%
- Queue 6 (medium priority): 10%
- Queue 7 (high priority): 15%
- Queue 8 (high priority): 20%

The `no` form of the command disables GMB for all ports and trunks in the *<port-list>*. In this state, which is the equivalent of setting all outbound queues on a port or static trunk to **0** (zero), a high level of higher-priority traffic can starve lower-priority queues, which can slow or halt lower-priority traffic in the network.

You can configure bandwidth minimums from either the global configuration level (as shown above) or from the port or static trunk context level. For information on outbound port queues, see Table 16: Per-port outbound priority queues .

Syntax

`no int <<port-list|trk_#>> bandwidth-min output [0-100|strict] [0-100]`

Select a minimum bandwidth.

For ports and trunks in *<port-list|trk_#>*, specifies the minimum outbound bandwidth as a percent of the total bandwidth for each outbound queue. The queues receive service in descending order of priority of each port.

For application to static trunk interfaces (2920 and 5400R only), GMB enforcement is applied individually to each port belonging to the trunk, and not to the trunk as a whole.

You must specify a bandwidth percent value for all except the highest priority queue, which may instead be set to "strict" mode. The sum of the bandwidth percentages below the top queue cannot exceed 100%. (**0** is a value for a queue percentage setting.)

Configuring a total of less than 100% across the eight queues results in unallocated bandwidth that remains harmlessly unused unless a given queue becomes oversubscribed. In this case, the unallocated bandwidth is apportioned to oversubscribed queues in descending order of priority. For example, if you configure a minimum of 10% for queues 1 to 7 and 0% for queue 8, the unallocated bandwidth is available to all eight queues in the following prioritized order:

- Queue 8 (high priority)
- Queue 7 (high priority)
- Queue 6 (medium priority)
- Queue 5 (medium priority)
- Queue 4 (normal priority)
- Queue 3 (normal priority)
- Queue 2 (low priority)
- Queue 1 (low priority)

A setting of **0** (zero percent) on a queue means that no bandwidth minimum is specifically reserved for that queue for each of the ports (including trunked ports) in the *<port-list|trk_#>*.

Also, there is no benefit to setting the high-priority queue (queue 8) to **0** (zero) unless you want the medium queue (queues 5 and 6) to be able to support traffic bursts above its guaranteed minimum.

`[strict]`: Provides the ability to configure the highest priority queue as `strict`. Per-queue values must be specified in priority order, with queue 1 having the lowest priority and queue 8 (or 4, or 2) having the highest priority (the highest queue is determined by how many queues are configured on the switch. Two, four, and eight queues are permitted (see the `qos queue-config` command). The strict queue is provided all the bandwidth it needs. Any remaining bandwidth is shared among the non-strict queues based on need and configured bandwidth profiles (the profiles are applied to the leftover bandwidth in this case). The total sum of percentages for non-strict queues must not exceed 100.

Configuring 0% for a queue can result in that queue being starved if any higher queue becomes over-subscribed and is then given all unused bandwidth.

The switch applies the bandwidth calculation to the link speed the port or trunk is currently using. For example, if a 10/100 Mbs port negotiates to 10 Mbps on the link, it bases its GMB calculations on 10 Mbps, not 100 Mbps.

Use `show bandwidth output <<port-list|trk_#>>` to display the current GMB configuration. (The `show config` and `show running` commands do not include GMB configuration data.)

Example

For example, suppose you want to configure the following outbound minimum bandwidth availability for ports 1 and 2:

Priority of outbound port queue	Minimum bandwidth %	Effect on outbound bandwidth allocation
8	20%	Queue 8 has the first priority use of all outbound bandwidth not specifically allocated to queues 1 to 7. If, For example, bandwidth allocated to queue 5 is not being used and queues 7 and 8 become oversubscribed, queue 8 has first-priority use of the unused bandwidth allocated to queue 5.
7	15%	Queue 7 has a GMB of 15% available for outbound traffic. If queue 7 becomes oversubscribed and queue 8 is not already using all of the unallocated bandwidth, queue 7 can use the unallocated bandwidth. Also, any unused bandwidth allocated to queues 6 to queue 1 is available to queue 7 if queue 8 has not already claimed it.
6	10%	Queue 6 has a GMB of 10% and, if oversubscribed, is subordinate to queues 8 and 7 in priority for any unused outbound bandwidth available on the port.
5	10%	Queue 5 has a GMB of 10% and, if oversubscribed, is subordinate to queues 8, 7, and 6 for any unused outbound bandwidth available on the port.
4	10%	Queue 4 has a GMB of 10% and, if oversubscribed, is subordinate to queues, 8, 7, 6, and 5 for any unused outbound bandwidth available on the port.
3	30%	Queue 3 has a GMB of 30% and, if oversubscribed, is subordinate to queues, 8, 7, 6, 5, and 4 for any unused outbound bandwidth available on the port.
2	3%	Queue 2 has a GMB of 3% and, if oversubscribed, is subordinate to queues, 8, 7, 6, 5, 4, and 3 for any unused outbound bandwidth available on the port.
1	2%	Queue 1 has a GMB of 2% and, if oversubscribed, is subordinate to all the other queues for any unused outbound bandwidth available on the port.

Either of the following commands configures ports 1 through 5 with bandwidth settings:

```
switch(config) # int 1-5 bandwidth-min output 2 3 30 10 10 10 15 strict
Switch(interface 1-5) # bandwidth-min output 2 3 30 10 10 10 15 strict
```

Viewing the current GMB configuration

This command displays the per-port GMB configuration in the `running-config` file.

Syntax

`show bandwidth output <port-list|trk_#>`

Without *<port-list|trk_#>*, this command lists the GMB configuration for all ports and static trunks on the switch.

With *<port-list|trk_#>*, this command lists the GMB configuration for the specified ports and static trunks.

This command operates the same way in any CLI context. If the command lists `Disabled` for a port or trunk, there are no bandwidth minimums configured for any queue on the port or trunk. (See the description of the `no` form of the `bandwidth-min output` command.)

Listing the GMB configuration on page 146 displays the GMB configuration resulting from either of the above commands.

Listing the GMB configuration

```
switch(config)# show bandwidth output 1-5, trk1
 Outbound Guaranteed Minimum Bandwidth %
  Port   Q1  Q2     Q3  Q4     Q5  Q6  Q7  Q8
  ------ --- ------ --- ------ --- --- --- ------
  1      2   3      30  10     10  10  15  strict
  2      2   3      30  10     10  10  15  strict
  3      2   3      30  10     10  10  15  strict
  4      2   3      30  10     10  10  15  strict
  5      2   3      30  10     10  10  15  strict
  Trk1   2   3      30  10     10  10  15  strict
```

GMB operating notes

Impact of QoS queue configuration on GMB commands

Changing the number of queues causes the GMB commands (`interface bandwidth-min` and `show bandwidth output`) to operate only on the number of queues currently configured. In addition, when the `qos queue-config` command is executed, any previously configured `bandwidth-min output` settings are removed from the startup configuration. For the default GMB percentage allocations per number of queues, see Table 17: Default GMB percentage allocations per QoS queue configuration.

Rate-limiting Unknown Unicast Traffic

Unknown unicast traffic consists of unicast packets with unknown destination MAC addresses. The switch floods the unicast packets to all interfaces that are members of the VLAN. An attacker can bring down the network by sending out packets to random destination MAC addresses and hence it is important to rate limit traffic with unknown destination addresses.

You can rate limit the unknown unicast traffic per port level in either percent or kbps mode.

rate-limit unknown-unicast in percent

Syntax

```
interface port-list rate-limit unknown-unicast in percent 0-100
```

Description

Sets a rate limit for unicast flood traffic.

Command context

```
interface
```

Parameters

in

Sets a rate limit for incoming unicast flood traffic.

percent

Specifies the rate limit as a percentage of the total available bandwidth.

kbps

Specifies the rate limit in Kb/s.

Example

```
switch(config)# int 2
switch(eth-2)# rate-limit
all                   Set a rate limit for all traffic.
bcast                 Set a rate limit for broadcast traffic.
icmp                  Set a rate limit for ICMP traffic.
mcast                 Set a rate limit for multicast traffic.
queues                Set a rate limit for each traffic queue.
unknown-unicast       Set a rate limit for unicast flood traffic.
switch(eth-2)# rate-limit unknown-unicast
in                    Set a rate limit for incoming unicast flood traffic.
switch(eth-2)# rate-limit unknown-unicast in
kbps
percent
switch(eth-2)# rate-limit unknown-unicast in percent 10
switch(eth-2)# show rate-limit
 bcast                 Show broadcast traffic rate limits.
 icmp                  Show ICMP traffic rate limits.
 mcast                 Show multicast traffic rate limits.
 queues                Show limits for outgoing queue traffic.
 unknown-unicast       Show unicast flood traffic rate limits.
switch(eth-2)# show rate-limit unknown-unicast
 [ethernet] PORT-LIST  The ports to show information for.

switch(eth-2)# show rate-limit unknown-unicast 2

 Unknown-Unicast Traffic Rate Limit Maximum %

  Port   | Inbound Limit Mode
  ------ + ------------- ---------
  2      | 10             %
```

rate-limit unknown-unicast in kbps

Syntax

```
interface port-list rate-limit unknown-unicast in kbps rate
```

Description

Sets a rate limit for unicast flood traffic.

Command context

`interface`

Parameters

`in`

Sets a rate limit for incoming unicast flood traffic.

`percent`

Specifies the rate limit as a percentage of the total available bandwidth.

`kbps`

Specifies the rate limit in Kb/s.

Example

```
switch(config)# int 1
switch(eth-1)# rate-limit
all                   Set a rate limit for all traffic.
bcast                 Set a rate limit for broadcast traffic.
icmp                  Set a rate limit for ICMP traffic.
mcast                 Set a rate limit for multicast traffic.
queues                Set a rate limit for each traffic queue.
unknown-unicast       Set a rate limit for unicast flood traffic.
switch(eth-1)# rate-limit unknown-unicast
in                    Set a rate limit for incoming unicast flood traffic.
switch(eth-1)# rate-limit unknown-unicast  in
kbps
percent
switch(eth-1)# rate-limit unknown-unicast  in kbps 100
switch(eth-1)# show rate-limit
all                   Show total traffic rate limits.
bcast                 Show broadcast traffic rate limits.
icmp                  Show ICMP traffic rate limits.
mcast                 Show multicast traffic rate limits.
queues                Show limits for outgoing queue traffic.
unknown-unicast       Show unicast flood traffic rate limits.
switch(eth-1)# show rate-limit unknown-unicast

Unknown-Unicast Traffic Rate Limit Maximum %

  Port   | Inbound Limit Mode
  ------ + ------------- ---------
  1      | 100            kbps
  2      | Disabled      Disabled
  3      | Disabled      Disabled
  4      | Disabled      Disabled
  5      | Disabled      Disabled
  6      | Disabled      Disabled
  7      | Disabled      Disabled
  8      | Disabled      Disabled
  9      | Disabled      Disabled
  10     | Disabled      Disabled
  11     | Disabled      Disabled
  12     | Disabled      Disabled
  13     | Disabled      Disabled
  14     | Disabled      Disabled
  15     | Disabled      Disabled
  16     | Disabled      Disabled
```

show rate-limit unknown-unicast

Syntax

`show rate-limit unknown-unicast`

Description

Displays the per port rate limit configuration.

Command context

`interface`

Parameters

`ethernet <port-list>`

To view the rate limit configuration for the specified port.

Example

```
switch(eth-2)# show rate-limit unknown-unicast

 Unknown-Unicast Traffic Rate Limit Maximum %

  Port   | Inbound Limit Mode
  ------ + ------------- ---------
  1      | 10            kbps
  2      | 10            %
  3      | Disabled      Disabled
  4      | Disabled      Disabled
  5      | Disabled      Disabled
  6      | Disabled      Disabled
  7      | Disabled      Disabled
  8      | Disabled      Disabled
  9      | Disabled      Disabled
  10     | Disabled      Disabled
  11     | Disabled      Disabled
  12     | Disabled      Disabled
  13     | Disabled      Disabled
  14     | Disabled      Disabled
  15     | Disabled      Disabled
  16     | Disabled      Disabled
  17     | Disabled      Disabled
  18     | Disabled      Disabled
```

Jumbo frames

The maximum transmission unit(MTU) is the maximum size IP frame the switch can receive for Layer 2 frames inbound on a port. The switch drops any inbound frames larger than the MTU allowed on the port. Ports operating at a minimum of 1 Gbps can accept forward frames of up to 9220 bytes (including four bytes for a VLAN tag) when configured for jumbo traffic. You can enable inbound jumbo frames on a per-VLAN basis. That is, on a VLAN configured for jumbo traffic, all ports belonging to that VLAN and **operating** at a minimum of 1 Gbps allow inbound jumbo frames of up to 9220 bytes.

Operating rules

- **Required port speed**: This feature allows inbound and outbound jumbo frames on ports operating at a minimum of 1 Gbps.
- **GVRP operation**: A VLAN enabled for jumbo traffic cannot be used to create a dynamic VLAN. A port belonging to a statically configured, jumbo-enabled VLAN cannot join a dynamic VLAN.
- **Port adds and moves**: If you add a port to a VLAN that is already configured for jumbo traffic, the switch enables that port to receive jumbo traffic. If you remove a port from a jumbo-enabled VLAN, the switch disables jumbo traffic capability on the port only if the port is not currently a member of another jumbo-enabled VLAN. This same operation applies to port trunks.
- **Jumbo traffic sources**: A port belonging to a jumbo-enabled VLAN can receive inbound jumbo frames through any VLAN to which it belongs, including non-jumbo VLANs. For example, if VLAN 10 (without jumbos enabled) and VLAN 20 (with jumbos enabled) are both configured on a switch, and port 1 belongs to both VLANs, port 1 can receive jumbo traffic from devices on either VLAN. For a method to allow only some ports in a VLAN to receive jumbo traffic, see Configuring a maximum frame size on page 153.

Jumbo traffic-handling

- Configuring a voice VLAN to accept jumbo frames is not recommended. Voice VLAN frames are typically small, and allowing a voice VLAN to accept jumbo frame traffic can degrade the voice transmission performance.
- You can configure the default, primary, and/or (if configured) the management VLAN to accept jumbo frames on all ports belonging to the VLAN.
- When the switch applies the default MTU (1522-bytes including 4 bytes for the VLAN tag) to a VLAN, all ports in the VLAN can receive incoming frames of up to 1522 bytes. When the switch applies the jumbo MTU (9220 bytes including 4 bytes for the VLAN tag) to a VLAN, all ports in that VLAN can receive incoming frames of up to 9220 bytes. A port receiving frames exceeding the applicable MTU drops such frames, causing the switch to generate an Event Log message and increment the "Giant Rx" counter (displayed by `show interfaces <port-list>`).
- The switch allows flow control and jumbo frame capability to co-exist on a port.
- The default MTU is 1522 bytes (including 4 bytes for the VLAN tag). The jumbo MTU is 9220 bytes (including 4 bytes for the VLAN tag).
- When a port is not a member of any jumbo-enabled VLAN, it drops all jumbo traffic. If the port is receiving "excessive"inbound jumbo traffic, the port generates an Event Log message to notify you of this condition. This same condition also increments the switch's "Giant Rx" counter.
- If you do not want all ports in a given VLAN to accept jumbo frames, you can consider creating one or more jumbo VLANs with a membership comprising only the ports you want to receive jumbo traffic. Because a port belonging to one jumbo-enabled VLAN can receive jumbo frames through any VLAN to which it belongs, this method enables you to include both jumbo-enabled and non-jumbo ports within the same VLAN.

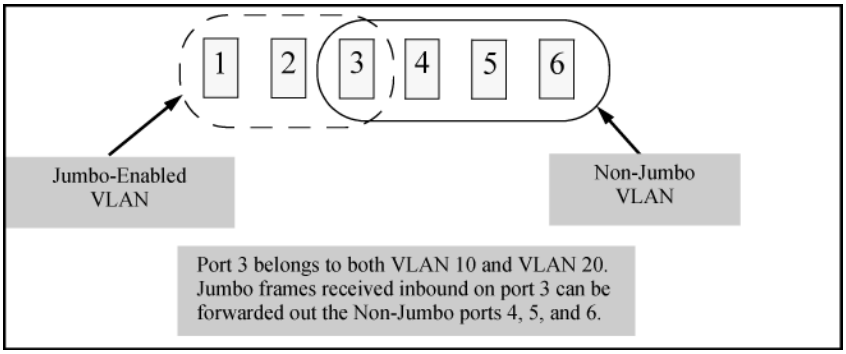
  For example, suppose you want to allow inbound jumbo frames only on ports 6, 7, 12, and 13. However, these ports are spread across VLAN 100 and VLAN 200 and also share these VLANs with other ports you want excluded from jumbo traffic. A solution is to create a third VLAN with the sole purpose of enabling jumbo traffic on the desired ports, while leaving the other ports on the switch disabled for jumbo traffic. That is:

	VLAN 100	VLAN 200	VLAN 300
Ports	6-10	11-15	6, 7, 12, and 13
Jumbo-enabled?	No	No	Yes

If there are security concerns with grouping the ports as shown for VLAN 300, you can either use source-port filtering to block unwanted traffic paths or create separate jumbo VLANs, one for ports 6 and 7, and another for ports 12 and 13.

- **Outbound jumbo traffic.** Any port operating at 1 Gbps or higher can transmit outbound jumbo frames through any VLAN, regardless of the jumbo configuration. The VLAN is not required to be jumbo-enabled, and the port is not required to belong to any other, jumbo-enabled VLANs. This can occur in situations where a non-jumbo VLAN includes some ports that do not belong to another, jumbo-enabled VLAN and some ports that do belong to another, jumbo-enabled VLAN. In this case, ports capable of receiving jumbo frames can forward them to the ports in the VLAN that do not have jumbo capability, as shown in Figure 15: Forwarding jumbo frames through non-jumbo ports.

Figure 15 *Forwarding jumbo frames through non-jumbo ports*



Jumbo frames can also be forwarded out non-jumbo ports when the jumbo frames received inbound on a jumbo-enabled VLAN are routed to another, non-jumbo VLAN for outbound transmission on ports that have no memberships in other, jumbo-capable VLANs. Where either of the above scenarios is a possibility, the downstream device must be configured to accept the jumbo traffic. Otherwise, this traffic will be dropped by the downstream device.

Configuring jumbo frame operation

For detailed information about jumbo frames, see Jumbo frames on page 149.

Overview

1. Determine the VLAN membership of the ports or trunks through which you want the switch to accept inbound jumbo traffic. For operation with GVRP enabled, refer to the GVRP topic under “Operating Rules”, above.
2. Ensure that the ports through which you want the switch to receive jumbo frames are operating at least at gigabit speed. (Check the Mode field in the output for the `show interfaces brief <port-list>` command.)
3. Use the `jumbo` command to enable jumbo frames on one or more VLANs statically configured in the

switch. (All ports belonging to a jumbo-enabled VLAN can receive jumbo frames.

4. Execute `write memory` to save your configuration changes to the `startupconfig` file.

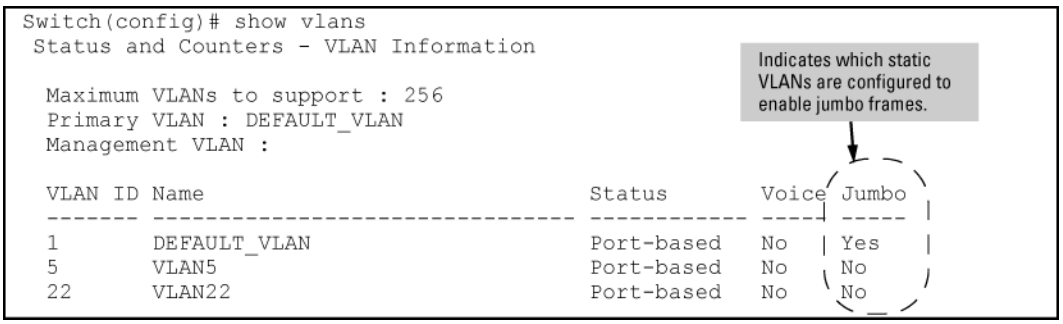
Viewing the current jumbo configuration

Syntax

`show vlans`

Lists the static VLANs configured on the switch and includes a Jumbo column to indicate which VLANs are configured to support inbound jumbo traffic. All ports belonging to a jumbo-enabled VLAN can receive jumbo traffic. (For more information, see Configuring a maximum frame size on page 153.) See Figure 16: Example: listing of static VLANs to show jumbo status per VLAN.

Figure 16 *Example: listing of static VLANs to show jumbo status per VLAN*



Syntax

`show vlans ports <port-list>`

Lists the static VLANs to which the specified ports belong, including the `Jumbo` column to indicate which VLANs are configured to support jumbo traffic.

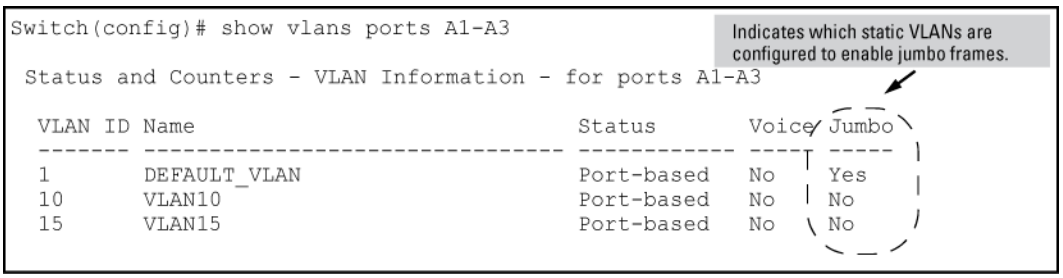
Entering only one port in <*port-list*> results in a list of all VLANs to which that port belongs.

Entering multiple ports in <*port-list*> results in a superset list that includes the VLAN memberships of all ports in the list, even though the individual ports in the list may belong to different subsets of the complete VLAN listing.

Example

If port 1 belongs to VLAN 1, port 2 belongs to VLAN 10, and port 3 belongs to VLAN 15, executing this command with a *port-list* of **1 - 3** results in a listing of all three VLANs, even though none of the ports belong to all three VLANS. (See Figure 17: Example: listing the VLAN memberships for a range of ports.)

Figure 17 *Example: listing the VLAN memberships for a range of ports*

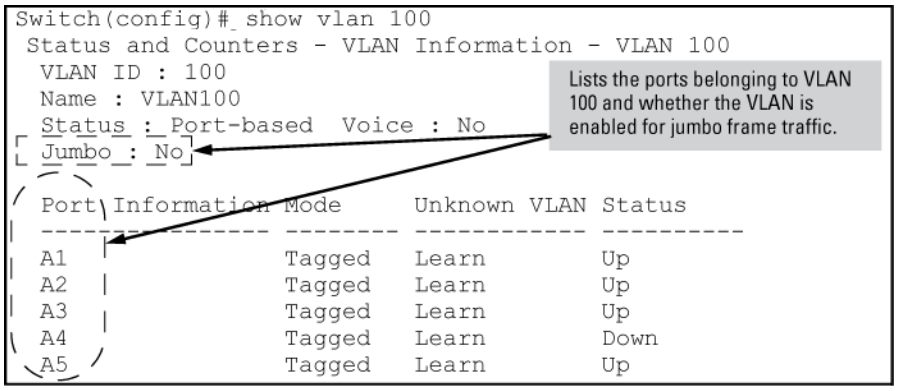


Syntax

`show vlans <vid>`

Shows port membership and jumbo configuration for the specified *vid*. (See Figure 18: Example: listing the port membership and jumbo status for a VLAN.)

Figure 18 *Example: listing the port membership and jumbo status for a VLAN*



Enabling or disabling jumbo traffic on a VLAN

Syntax

`vlan <vid> jumbo`
`no vlan <vid> jumbo`

Configures the specified VLAN to allow jumbo frames on all ports on the switch that belong to that VLAN. If the VLAN is not already configured on the switch, `vlan <vid> jumbo` also creates the VLAN.

A port belonging to one jumbo VLAN can receive jumbo frames through any other VLAN statically configured on the switch, regardless of whether the other VLAN is enabled for jumbo frames.

The `no` form of the command disables inbound jumbo traffic on all ports in the specified VLAN that do not also belong to another VLAN that is enabled for jumbo traffic. In a VLAN context, the command forms are `jumbo` and `no jumbo`.

(Default: Jumbos disabled on the specified VLAN.)

Configuring a maximum frame size

You can globally set a maximum frame size for jumbo frames that will support values from 1518 bytes to 9216 bytes for untagged frames.

Syntax

`jumbo max-frame-size <size>`

Sets the maximum frame size for jumbo frames. The range is from 1518 bytes to 9216 bytes. (Default: 9216 bytes)

The jumbo `max-frame-size` is set on a GLOBAL level.

Default: 9216 bytes

Configuring IP MTU

The following feature is available on the switches covered in this guide. `jumbos` support is required for this feature. On switches that do not support this command, the IP MTU value is derived from the maximum frame size and is not configurable.

You can set the IP MTU globally by entering this command. The value of `max-frame-size` must be greater than or equal to 18 bytes more than the value selected for `ip-mtu`. For example, if `ip-mtu` is set to 8964, the `max-frame-size` is configured as 8982.

Syntax

`jumbo ip-mtu <size>`

Globally sets the IP MTU size. Values range between 1500 and 9198 bytes. This value must be 18 bytes less than the value of `max-frame-size`.

(Default: 9198 bytes)

SNMP implementation

Jumbo maximum frame size

The maximum frame size for jumbos is supported with the following proprietary MIB object:

`hpSwitchMaxFrameSize OBJECT-TYPE`

This is the value of the global `max-frame-size` supported by the switch. The default value is set to 9216 bytes.

Jumbo IP MTU

The IP MTU for jumbos is supported with the following proprietary MIB object:

`hpSwitchIpMTU OBJECT-TYPE`

This is the value of the global jumbos IP MTU (or L3 MTU) supported by the switch. The default value is set to 9198 bytes (a value that is 18 bytes less than the largest possible maximum frame size of 9216 bytes). This object can be used only in switches that support `max-frame-size` and `ip-mtu` configuration.

Displaying the maximum frame size

Use the `show jumbos` command to display the globally configured untagged maximum frame size for the switch, as shown in the following Example:.

```
switch(config)# show jumbos

 Jumbos Global Values

  Configured : MaxFrameSize : 9216   Ip-MTU : 9198
  In Use     : MaxFrameSize : 9216   Ip-MTU : 9198
```

For more information about frame size, see Jumbo frames on page 149.

Operating notes for maximum frame size

- When you set a maximum frame size for jumbo frames, it must be on a global level. You cannot use the `jumbo max-frame-size` command on a per-port or per-VLAN basis.
- The original way to configure jumbo frames remains the same, which is per-VLAN, but you cannot set a maximum frame size per-VLAN.

- Jumbo support must be enabled for a VLAN from the CLI or through SNMP.
- Setting the maximum frame size does not require a reboot.
- When you upgrade to a version of software that supports setting the maximum frame size from a version that did not, the `max-frame-size` value is set automatically to 9216 bytes.
- Configuring a jumbo maximum frame size on a VLAN allows frames up to `max-frame-size` even though other VLANs of which the port is a member are not enabled for jumbo support.

Troubleshooting

A VLAN is configured to allow jumbo frames, but one or more ports drops all inbound jumbo frames

The port may not be operating at a minimum of 1 Gbps on the other switches covered in this guide. Regardless of a port's configuration, if it is actually operating at a speed lower than 1 Gbps for the other switches, it drops inbound jumbo frames. For example, if a port is configured for `Auto` mode (`speed-duplex auto`), but has negotiated a 7 Mbps speed with the device at the other end of the link, the port cannot receive inbound jumbo frames. To determine the actual operating speed of one or more ports, view the `Mode` field in the output for the following command:

`show interfaces brief <port-list>`

A non-jumbo port is generating "Excessive undersize/giant frames" messages in the Event Log

The switches can transmit outbound jumbo traffic on any port, regardless of whether the port belongs to a jumbo VLAN. In this case, another port in the same VLAN on the switch may be jumbo-enabled through membership in a different, jumbo-enabled VLAN, and may be forwarding jumbo frames received on the jumbo VLAN to non-jumbo ports.

Fault Finder

Fault Finder is a feature that helps administrators to debug unusual network activity such as flapping links or transceivers or to troubleshoot issues such as multicast or broadcast storms. Fault Finder helps in preventing network loops and taking care of situations that arise out of defective equipment and malicious attacks.

The following is the list of issues detected by the Fault Finder:

- Excessive CRC/alignment errors (bad cable)
- Excessive flapping of transceivers (bad transceiver)
- Too many undersized/giant packets (bad driver)
- Excessive late collisions (cable too long)
- High collision or drop rate (over bandwidth)
- Excessive broadcast packets (broadcast storm)
- Excessive multicast packets (multicast storm)
- Duplex mismatch (duplex mismatch HDx - reconfigure to Full Duplex)
- Duplex mismatch (duplex mismatch FDx - reconfigure port to Auto)

- Rapid detection of link faults and recoveries (link flap)
- Link loss detection (loss of link)

Fault finder is also known as FFI (find-fix-inform).

Fault Finder thresholds

Switches feature automatic fault detection, which helps protect against network loops and defective equipment. The fault detection sensitivity setting determines the types of alerts reported to the Alert Log based on their level of severity or sensitivity. The sensitivity levels are:

- **High Sensitivity.**

  This policy directs the switch to send all alerts to the Alert Log. This setting is most effective on networks that have none or few problems.

- **Medium Sensitivity.**

  This policy directs the switch to send alerts related to network problems to the Alert Log. If you want to be notified of problems which cause a noticeable slowdown on the network, use this setting.

- **Low Sensitivity.**

  This policy directs the switch to send only the most severe alerts to the Alert Log. This policy is most effective on a network where there are normally a lot of problems and you want to be informed of only the most severe ones

- **Disabled.**

  Disables the Alert Log and transmission of alerts (traps) to the management server (in cases where a network management tool such as ProCurve Manager is in use). Use this option when you don't want to use the Alert Log.

Enabling Fault Finder

Enter this CLI command to enable fault detection:

Syntax

```
no fault-finder [fault][sensitivity <low|medium|high>][action <warn|warn-and-disable>]
```

Enables or disables Fault Finder and sets sensitivity.

When the `warn-and-disable` action option is configured, Fault Finder may also shut down a bad port in addition to sending an alert to the Alert Log.

Default setting: `fault-finder sensitivity medium action warn`

[`fault`]: Supported values are:

- `all`: All fault types
- `bad-driver`: Too many undersized/giant packets
- `bad-transceiver`: Excessive jabbering
- `bad-cable`: Excessive CRC/alignment errors
- `too-long-cable`: Excessive late collisions
- `over-bandwidth`: High collision or drop rate

- `broadcast-storm`: Excessive broadcasts
- `duplex-mismatch-HDx`: Duplex mismatch. Reconfigure to Full Duplex
- `duplex-mismatch-FDx`: Duplex mismatch. Reconfigure port to Auto
- `link-flap`: Rapid detection of link faults and recoveries
- `loss-of-link`: Link loss detected. (Sensitivity not applicable)

Examples

To set Fault Finder with a high sensitivity to issue a warning and then disable a port on which there is a high collision or drop rate, you could configure these options:

```
switch(config)# fault-finder over-bandwidth sensitivity
high action warn-and-disable
```

To set Fault Finder with a medium sensitivity to issue a warning about excessive CRC or alignment errors on a port, you could configure these options:

```
switch(config)# fault-finder bad-cable sensitivity
medium action warn
```

To set Fault Finder with a low sensitivity to issue a warning about rapid detection of link faults, you could configure these options:

```
switch(config)# fault-finder link-flap sensitivity
low action warn
```

To disable Fault Finder, enter this command:

```
switch(config)# no fault-finder all
```

The following table describes the trunking options for LACP and Trunk protocols.

Table 18: *Fault finder sensitivities for supported conditions*

Condition triggering fault finder	Sensitivities			Units (in packets)	Time period	Fault finder reacts:
	High	Medium	Low			
Bad driver – Too many under-sized packets or too many giant packets\	6	21	36	1/10,000 Incoming	20 secs	If (undersized/ total) >= (sensitivity/ 10,000)OrIf (giant/total) >= (sensitivity/ 10,000)

Condition triggering fault finder	Sensitivities			Units (in packets)	Time period	Fault finder reacts:
Bad transceiver – Excessive jabbering - Jabbers: (Jabbers are packets longer than the MTU) - Fragments: (packets shorter than they should be)	65	2110	3614	1/10,000 IncomingOne Fragments	20 secs20 secs	If (jabbers/ total) >= (sensitivity/ 10,000)Or If fragment count in the last 20 seconds >= sensitivity
Bad cable – Excessive CRC/ alignment errors	6	21	36	1/10,000 Incoming	20 secs	If (CRC and alignment errors/ total) >= (sensitivity/ 10,000)
Too Long Cable – Excessive late collisions (a late collision error occurs after the first 512 bit times)	6	21	36	1/10,000 Outgoing	20 secs	If (late collisions/ total) >= (sensitivity/ 10,000)
Over bandwidth - High collision rate - High drop rate	665	21257	36449	1/10,000 OutgoingOne Packet	5 mins5 mins	If (excessive collisions/ total) >= (sensitivity/ 10,000)The count of dropped packets >= sensitivity during the last 5 minutes.
Broadcast storm – Excessive broadcasts	1457	5000	8525	One broadcast Packet	1 sec	If the average per second of broadcast packets in the last 20 seconds >= sensitivity
Muticast storm – Excessive multicasts	1457	5000	8525	One Multicast Packet	1 sec	If the average per second of multicast packets in the last 20 seconds >= sensitivity
Duplex mismatch HDx	6	21	36	1/10,000 Outgoing	20 sec	If (late collisions/ total) >= (sensitivity/ 10,000)
Duplex mismatch FDx	6	21	36	1/10,000 Incoming	20 sec	If (CRC and alignment errors/ total) >= (sensitivity/ 10,000)
Link flap – Excessive transitions between linkup and linkdown states.	4	7	11	One Transitions	10 sec	If the Transition count in the last 10s >= sensitivity.

Example of sensitivity calculation

If a sensitivity is set to High, and a bad cable is causing 15 CRC errors out of a total of 3500 packets transmitted in a 20 second period:

1. CRC errors/total must be >= (sensitivity/10,000) to trigger an alert.
2. CRC errors/total = 15/3500 = .00043
3. Sensitivity/10,000 = 6/10,000 = .0006
4. .00043 is not greater than or equal to .0006, so an alert is not triggered.

Using SNMP tools to manage the switch

SNMP is a management protocol that allows an SNMP client application to retrieve device configuration and status information and to configure the device (**get** and **set**). You can manage the switch via SNMP from a network management station.

To implement SNMP management, the switch must have an IP address configured either manually or dynamically (using DHCP or Bootp). If multiple VLANs are configured, each VLAN interface should have its own IP address. For DHCP use with multiple VLANs, see section "The Primary VLAN" in the "Static Virtual LANs (VLANs)" of the *Advanced traffic management guide* for your switch.

If you use the switch's Authorized IP Managers and Management VLAN features, ensure that the SNMP management station, the choice of switch port used for SNMP access to the switch, or both, are compatible with the access controls enforced by these features. Otherwise, SNMP access to the switch will be blocked.

For more information on Authorized IP Managers, see the *Access Security Guide* for your switch. (The latest version of this guide is available on the Networking website.) For information on the Management VLAN feature, see the section "The Secure Management VLAN" in the "Static Virtual LANs (VLANs)" chapter of the *Advanced Traffic Management Guide* for your switch.

SNMP management features

SNMP management features on the switch include:

- SNMP version 1, version 2c, or version 3 over IP
- Security via configuration of SNMP communities (SNMPv3 communities on page 167)
- Security via authentication and privacy for SNMPv3 access
- Event reporting via SNMP
  - Version 1 traps
  - RMON: groups 1, 2, 3, and 9
- Flow sampling using sFlow
- Standard MIBs, such as the Bridge MIB (RFC 1493), Ethernet MAU MIB (RFC 1515), and others.

The switch SNMP agent also uses certain variables that are included in an proprietary MIB (management information base) file.

1. Type a model number of your switch (For example, 8212) or product number in the **Auto Search** text box.
2. Select an appropriate product from the drop down list.
3. Click the Display selected button.

4. From the options that appear, select Software downloads.
5. MIBs are available with switch software in the Other category.

Click on `software updates`, then `MIBs`.

SNMPv1 and v2c access to the switch

SNMP access requires an IP address and subnet mask configured on the switch. If you are using DHCP/Bootp to configure the switch, ensure that the DHCP/Bootp process provides the IP address.

Once an IP address is configured, the main steps for configuring SNMPv1 and v2c access management features are:

Procedure

1. Configure the appropriate SNMP communities. (See SNMPv3 communities on page 167.)
2. Configure the appropriate trap receivers.

In some networks, authorized IP manager addresses are not used. In this case, all management stations using the correct community name may access the switch with the View and Access levels that have been set for that community. If you want to restrict access to one or more specific nodes, you can use the switch's IP Authorized Manager feature. (See the access security guide for your switch.)

If network management security is a concern, Hewlett Packard Enterprise recommends that you change the write access for the "public" community to "Restricted."

SNMPv3 access to the switch

SNMPv3 access requires an IP address and subnet mask configured on the switch. (See "IP Configuration" on page 8-2.) If you are using DHCP/Bootp to configure the switch, ensure that the DHCP/Bootp process provides the IP address. (See "DHCP/Bootp Operation".)

Once you have configured an IP address, the main steps for configuring SNMPv3 access management features are the following:

Procedure

1. Enable SNMPv3 for operation on the switch (see Enabling SNMPv3 on page 162).
2. Configure the appropriate SNMP users (see SNMPv3 users on page 163).
3. Configure the appropriate SNMP communities (see SNMPv3 communities on page 167).
4. Configure the appropriate trap receivers (see SNMP notifications).

In some networks, authorized IP manager addresses are not used. In this case, all management stations using the correct User and community name may access the switch with the View and Access levels that have been set for that community. If you want to restrict access to one or more specific nodes, you can use the IP Authorized Manager feature for the switch. (See the access security guide for your switch.)

SNMP version 3 (SNMPv3) adds some new commands to the CLI for configuring SNMPv3 functions. To enable SNMMPv3 operation on the switch, use the `snmpv3 enable` command. An initial user entry will be generated with MD5 authentication and DES privacy.

You may (optionally) restrict access to only SNMPv3 agents by using the `snmpv3 only` command. To restrict write-access to only SNMPv3 agents, use the `snmpv3 restricted-access` command.

Restricting access to only version 3 messages will make the community named “public” inaccessible to network management applications (such as autodiscovery, traffic monitoring, SNMP trap generation, and threshold setting) from operating in the switch.

Enabling and disabling switch for access from SNMPv3 agents

This includes the creation of the initial user record.

Syntax

```
no snmpv3 enable
```

Enabling or disabling restrictions to access from only SNMPv3 agents

When enabled, the switch rejects all non-SNMPv3 messages.

Syntax

```
no snmpv3 only
```

Enabling or disabling restrictions from all non-SNMPv3 agents to read-only access

Syntax

```
no snmpv3 restricted-access
```

Viewing the operating status of SNMPv3

Syntax

```
show snmpv3 enable
```

Viewing status of message reception of non-SNMPv3 messages

Syntax

```
show snmpv3 only
```

Viewing status of write messages of non-SNMPv3 messages

Syntax

```
show snmpv3 restricted-access
```

Enabling SNMPv3

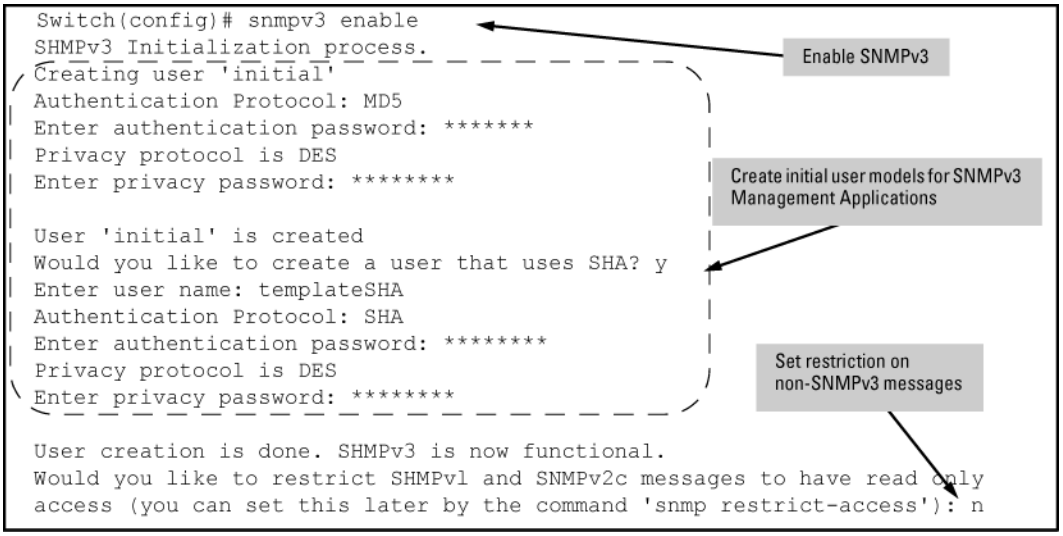
The `snmpv3 enable` command allows the switch to:

- Receive SNMPv3 messages.
- Configure initial users.
- Restrict non-version 3 messages to "read only" (optional).

Restricting access to only version 3 messages makes the community named "public" inaccessible to network management applications (such as autodiscovery, traffic monitoring, SNMP trap generation, and threshold setting) from running on the switch.

Example

Figure 19 *SNMP version 3 enable command*



SNMPv3 users

NOTE

To create new users, most SNMPv3 management software requires an initial user record to clone. The initial user record can be downgraded and provided with fewer features, but not upgraded by adding new features. For this reason, Hewlett Packard Enterprise recommends that when you enable SNMPv3, you also create a second user with SHA authentication and DES privacy.

To use SNMPv3 on the switch, you must configure the users that will be assigned to different groups:

Procedure

1. Configure users in the User Table with the `snmpv3 user` command.

   To view the list of configured users, enter the `show snmpv3 user` command (see Adding users).
2. Assign users to Security Groups based on their security model with the `snmpv3 group` command (see Assigning users to groups (CLI)).

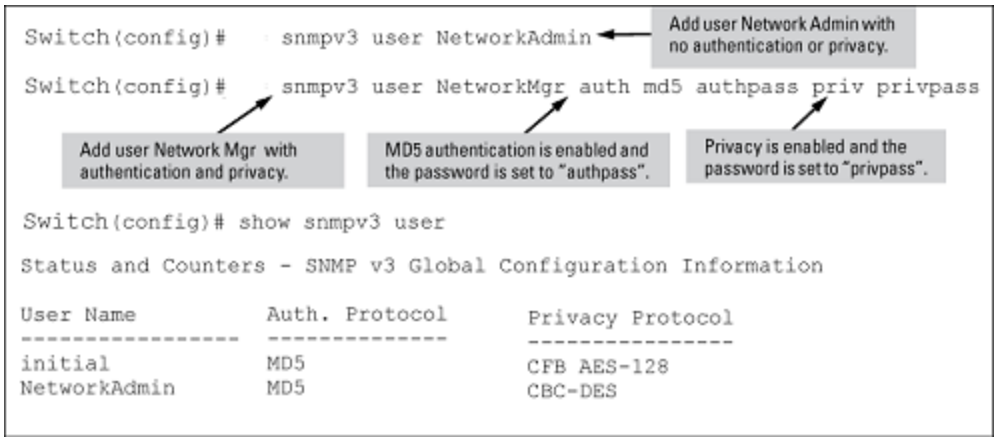
CAUTION

If you add an SNMPv3 user without authentication, privacy, or both, to a group that requires either feature, the user will not be able to access the switch. Ensure that you add a user with the appropriate security level to an existing security group.

Adding users

To configure an SNMPv3 user, you must first add the user name to the list of known users with the `snmpv3 user` command, as shown in the following image.

Figure 20 *Adding SNMPv3 users and displaying SNMPv3 configuration*



SNMPv3 user commands

Syntax

```
no snmpv3 user <USER_NAME> [auth md5|sha] <AUTH_PASS> [priv des|aes] <PRIV_PASS>
no snmpv3 remote-engine-id <engineid> user <username> [auth {md5| sha}
         <authentication password>] [priv {des|aes} <privacy password>]
```

Parameters and options

no

Used to delete a user entry. When you delete a user, only the user name is required.

<AUTH_PASS>

With authorization, you can set either MD5 or SHA authentication. The authentication password *auth_pass* must be 6 to 32 characters and is mandatory when you configure authentication.

priv des|aes

With privacy, the switch supports DES (56-bit), AES (128-bit), and AES-256 (256-bit) encryption. Defaults to DES. AES 128-bit, AES 256-bit, and DES 56-bit encryptions are supported as privacy protocols. Other nonstandard encryption algorithms, such as AES-172 and 3-DES are not supported.

<PRIV_PASS>

The privacy password *priv_pass* must be 6 to 32 characters and is mandatory when you configure privacy.

remote-engine-id <engineid>

Sets the SNMPv3 remote engine ID in colon-separated hexadecimal notation.

Listing Users

To display the management stations configured to access the switch with SNMPv3 and view the authentication and privacy protocols that each station uses, enter the `show snmpv3 user` command.

Syntax

```
show snmpv3 user
```

Displays information about the management stations configured on VLAN 1 to access the switch.

Display of the management stations configured on VLAN 1

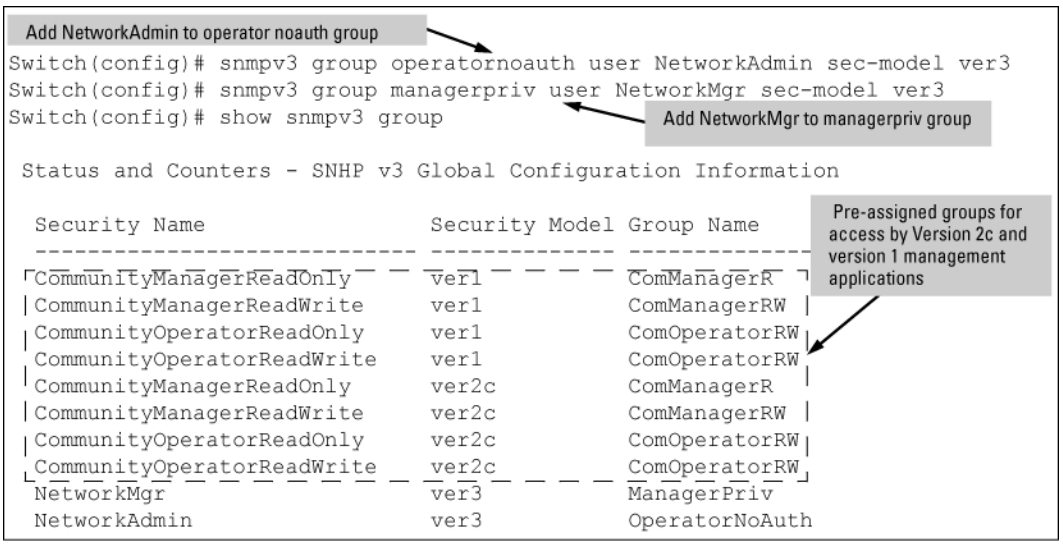
```
switch# configure terminal
switch(config)# vlan 1
```

```
switch(vlan-1)# show snmpv3 user

Status and Counters - SNMPv3 Global Configuration Information

 User Name       Auth. Protocol   Privacy Protocol
 -----------     --------------   -----------------
 initial         MD5              CFB AES-128
 NetworkAdmin    MD5              CBC-DES
```

Assigning users to groups (CLI)

Next you must set the group access level for the user by assigning the user to a group. The access level for the user is done with the `snmpv3 group` command as shown in the following image. For more details on the MIBs access for a given group, see Group access levels on page 165.

Figure 21 *Example: assigning users to groups*



Syntax

`no snmpv3 group`

Assigns or removes a user to a security group for access rights to the switch. To delete an entry, all the following three parameters must be included in the command:

`group <group_name>`	Identifies the group that has the privileges that will be assigned to the user. For more details, see Group access levels on page 165.
`user <user_name>`	Identifies the user to be added to the access group that must match the user name added with the `snmpv3 user` command.
`sec-model {<ver1 | ver2c| ver3`	Defines which security model to use for the added user. An SNMPv3 access group use only the ver3 security model.

Group access levels

The switch supports eight predefined group access levels, shown in the following table. There are four levels for use by version 3 users and four are used for access by version 2c or version 1 management applications.

Table 19: *Predefined group access levels*

Group name	Group access type	Group read view	Group write view
managerpriv	Ver3 Must have Authentication and Privacy	ManagerReadView	ManagerWriteView
managerauth	Ver3 Must have Authentication	ManagerReadView	ManagerWriteView
operatorauth	Ver3 Must have Authentication	OperatorReadView	DiscoveryView
operatornoauth	Ver3 No Authentication	OperatorReadView	DiscoveryView
commanagerrw	Ver2c or Ver1	ManagerReadView	ManagerWriteView
commanagerr	Ver2c or Ver1	ManagerReadView	DiscoveryView
comoperatorrw	Ver2c or Ver1	OperatorReadView	OperatorReadView
comoperatorr	Ver2c or Ver1	OperatorReadView	DiscoveryView

Table 20: *SNMPv3 Params and Group Configs Combinations*

SNMPv3 Params	SNMPv3 group	Snmpv3 user config
noauth (no authentication and no privacy)	operatornoauth	snmpv3 user "user1"
auth (authentication and no privacy)	managerpriv, managerauth,operatorauth, operatornoauth	snmpv3 user "user1" auth md5 "45800d22ccb8b485ab52fe2d8b92ea85"
priv (authentication and privacy)	managerpriv, managerauth,operatorauth, operatornoauth	snmpv3 user "user1" auth md5 "45800d22ccb8b485ab52fe2d8b92ea85" priv des "45800d22ccb8b485ab52fe2d8b92ea85"

Each view allows you to view or modify a different set of MIBs:

- **Manager Read View** – access to all managed objects
- **Manager Write View** – access to all managed objects except the following:
  - vacmContextTable
  - vacmAccessTable
  - vacmViewTreeFamilyTable
- **OperatorReadView** – no access to the following:
  - icfSecurityMIB
  - hpSwitchIpTftpMode
  - vacmContextTable
  - vacmAccessTable

- vacmViewTreeFamilyTable
- usmUserTable
- snmpCommunityTable

- **Discovery View** - Access limited to samplingProbe MIB.

All access groups and views are predefined on the switch. There is no method to modify or add groups or views to those that are predefined on the switch.

SNMPv3 communities

SNMP commuities are supported by the switch to allow management applications that use version 2c or version 1 to access the switch. The communities are mapped to Group Access Levels that are used for version 2c or version 1 support. This mapping happens automatically based on the communities access privileges, but special mappings can be added with the `snmpv3 community` command (see Mapping SNMPv3 communities (CLI) on page 167).

Mapping SNMPv3 communities (CLI)

SNMP commuities are supported by the switch to allow management applications that use version 2c or version 1 to access the switch. For more details, see SNMPv3 communities on page 167.

Syntax

`no snmpv3 community`

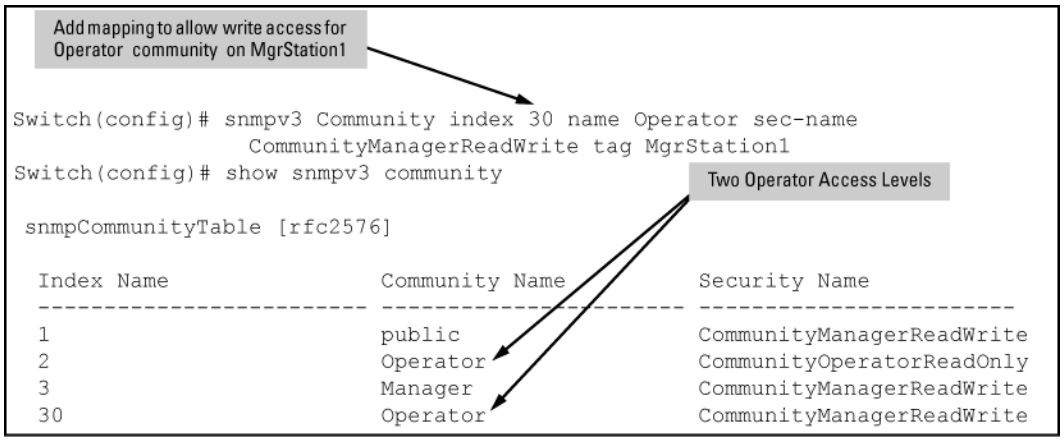
Maps or removes a mapping of a community name to a group access level. To remove a mapping you need to specify only the `index_name` parameter.

`index <index_name>`	An index number or title for the mapping. The values of 1 to 5 are reserved and can not be mapped.
`name <community_name>`	The community name that is being mapped to a group access level.
`sec-name <security_name>`	The group level to which the community is being mapped.
`tag <tag_value>`	This is used to specify which target address may have access by way of this index reference.

Example

The following image shows the assigning an Operator community on MgrStation1 to the *CommunityOperatorReadWrite* group. Any other operator has an access level of *CommunityOperatorReadOnly*.

Figure 22 *Assigning a community to a group access level*



SNMP community features

Use SNMP communities to restrict access to the switch by SNMP management stations by adding, editing, or deleting SNMP communities. You can configure up to five SNMP communities, each with either an operator-level or a manager-level view and either restricted or unrestricted write access.

Using SNMP requires that the switch have an IP address and subnet mask compatible with your network.

Listing community names and values (CLI)

This command lists the data for currently configured SNMP community names (along with trap receivers and the setting for authentication traps–see SNMP notifications).

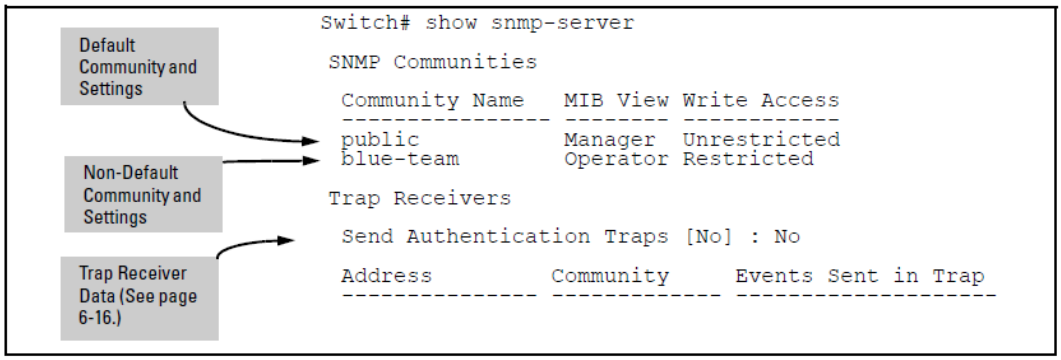
Syntax

`show snmp-server [< community-string >]`

Example

Lists the data for all communities in a switch; that is, both the default "public" community name and another community named "blue-team."

Figure 23 *Example: SNMP community listing with two communities*



To list the data for only one community, such as the "public" community, use the above command with the community name included. For example:

```
switch# show snmp-server public
```

Configuring community names and values (CLI)

The `snmp-server` command enables you to add SNMP communities with either default or specific access attributes, and to delete specific communities.

Syntax

`no snmp-server community <community-name>`

Configures a new community name.

- If you do not also specify `operator` or `manager`, the switch automatically assigns the community to the `operator` MIB view.
- If you do not specify `restricted` or `unrestricted`, the switch automatically assigns the community to `restricted` (read-only) access.

The `no` form uses only the `<community-name>` variable and deletes the named community from the switch.

`[operator | manager]`	Optionally assigns an access level. ■ At the `operator` level, the community can access all MIB objects except the CONFIG MIB. ■ At the `manager` level, the community can access all MIB objects.
`[restricted | unrestricted]`	Optionally assigns MIB access type. ■ Assigning the `restricted` type allows the community to read MIB variables, but not to set them. ■ Assigning the `unrestricted` type allows the community to read and set MIB variables.

Example

To add the following communities:

Community	Access Level	Type of Access
red-team	manager (**Access to all MIB objects**.)	unrestricted (**read/write**)
blue-team	operator (**Access to all MIB objects except the CONFIG MIB**.)	restricted (**read-only**)

```
switch(config)# snmp-server community red-team
   manager unrestricted
switch(config)# snmp-server community blue-team
   operator restricted
```

To eliminate a previously configured community named "gold-team":

```
switch(config) # no snmp-server community gold-team
```

SNMP notifications

The switches:

- Default Traps: A switch automatically sends default traps to trap receivers using the configured community name. You have to configure and supply the community name to use in the trap-receiver config, there is no default. Use the `snmp-server host <IP_ADDRESS> community "<COMMUNITY_NAME>"` command to configure a community name and the `snmp-server host <IP_ADDRESS> community "<COMMUNITY_NAME>" trap-level [all | critical | not-info | debug | none]` command to set the level of traps to send to the community.
- SNMPv2c informs
- SNMP v3 notification process, including traps

This section describes how to configure a switch to send network security and link-change notifications to configured trap receivers.

Supported Notifications

By default, the following notifications are enabled on a switch:

- Manager password changes
- SNMP authentication failure
- Link-change traps: when the link on a port changes from up to down (linkDown) or down to up (linkUp)
- Port-security (web, MAC, or 802.1X) authentication failure
- Invalid password entered in a login attempt through a direct serial, Telnet, or SSH connection
- Inability to establish a connection with the RADIUS or TACACS+ authentication server
- DHCP snooping events
- ARP protection events

General steps for configuring SNMP notifications

Procedure

1. Determine the versions of SNMP notifications that you want to use in your network.

   If you want to use SNMPv1 and SNMPv2c traps, you must also configure a trap receiver. See the following sections and follow the required configuration procedures:

   - SNMPv1 and SNMPv2c Traps on page 171
   - Configuring an SNMP trap receiver (CLI) on page 171
   - Enabling SNMPv2c informs (CLI) on page 174

   If you want to use SNMPv3 notifications (including traps), you must also configure an SNMPv3 management station. Follow the required configuration procedure in Configuring SNMPv3 notifications (CLI) on page 175.
2. To reconfigure any of the SNMP notifications that are enabled by default to be sent to a management station (trap receiver), see Enabling Link-Change Traps (CLI) on page 181.
3. (Optional) See the following sections to configure optional SNMP notification features and verify the current configuration:
   - Configuring the source IP address for SNMP notifications (CLI) on page 181
   - Viewing SNMP notification configuration (CLI) on page 183

SNMPv1 and SNMPv2c Traps

The switches support the following functionality from earlier SNMP versions (SNMPv1 and SNMPv2c):

- **Trap receivers**: A **trap receiver** is a management station to which the switch sends SNMP traps and (optionally) event log messages sent from the switch. From the CLI you can configure up to ten SNMP trap receivers to receive SNMP traps from the switch.
- **Default Traps**: A switch automatically sends default traps to trap receivers using the configured community name. You have to configure and supply the community name to use in the trap-receiver config, there is no default. Use the `snmp-server host <IP_ADDRESS> community "<COMMUNITY_NAME>"` command to configure a community name and the `snmp-server host <IP_ADDRESS> community "<COMMUNITY_NAME>" trap-level[all | critical | not-info | debug | none]` command to set the level of traps to send to the community.
- **Thresholds**: A switch automatically sends all messages created when a system threshold is reached to the network management station that configured the threshold, regardless of the trap receiver configuration.

SNMP trap receivers

Use the `snmp-server host` command to configure a trap receiver that can receive SNMPv1 and SNMPv2c traps, and (optionally) Event Log messages. When you configure a trap receiver, you specify its community membership, management station IP address, and (optionally) the type of Event Log messages to be sent.

If you specify a community name that does not exist–that is, has not yet been configured on the switch–the switch still accepts the trap receiver assignment. However, no traps are sent to that trap receiver until the community to which it belongs has been configured on the switch.

To replace one community name with another for the same IP address, you must first enter the

`no snmp-server host <community-name> {< ipv4-address | ipv6-address >}`

command to delete the unwanted community name. Otherwise, if you add a new community name with an IP address that is already used with a different community name, two valid community name entries are created for the same management station.

If you do not specify the event level (`[none|all|not-info|critical|debug]`), the switch does not send Event Log messages as traps. However, "well-known" traps and threshold traps (if configured) are still sent.

Configuring an SNMP trap receiver (CLI)

Syntax

`snmp-server host {< ipv4-addr | ipv6-addr >} < community name>`

Configures a destination network management station to receive SNMPv1/v2c traps and (optionally) Event Log messages sent as traps from the switch, using the specified community name and destination IPv4 or IPv6 address. You can specify up to ten trap receivers (network management stations). (The default community name is `public`.)

`[{<none | all | not-info | critical | debug>}]`	(Optional) Configures the security level of the Event Log messages you want to send as traps to a trap receiver (see the following table). ■ The type of Event Log message that you specify applies only to Event Log messages, not to threshold traps. ■ For each configured event level, the switch continues to send threshold traps to all network management stations that have the appropriate threshold level configured. ■ If you do not specify an event level, the switch uses the default value (none) and sends no Event Log messages as traps.
`[<inform>]`	(Optional) Configures the switch to send SNMPv2 inform requests when certain events occur. For more information, see Enabling SNMPv2c informs (CLI) on page 174.

Table 21: *Security levels for Event Log messages sent as traps*

Security Level	Action
None (default)	Sends no Event Log messages.
All	Sends all Event Log messages.
Not-Info	Sends all Event Log messages that are not for information only.
Critical	Sends only Event Log messages for critical error conditions.
Debug	Sends only Event Log messages needed to troubleshoot network- and switch-level problems.

Example

To configure a trap receiver in a community named "red-team" with an IP address of 10.28.227.130 to receive only "critical" event log messages, you can enter the following command:

```
switch(config)# snmp-server host 10.28.227.130 red-team critical
```

Overview

You can configure the threshold limit as a percentage for RMON event log memory. Range is between 1 to 100. An RMON log message is generated when the RMON event logging memory reaches the configured threshold percentage. If SNMP traps are enabled, then the same traps are generated for the RMON event.

Use the `rmonlog-set-threshold` command to set the threshold limit for RMON event log memory.

rmonlog-set-threshold

Syntax

```
rmonlog-set-threshold <percentage>
no rmonlog-set-threshold <percentage>
```

Description

Configures the threshold percentage for RMON event logging. The default value is 80.

The `no` form of this command resets RMON event logging threshold to default value.

Command context

```
config
```

Parameters

percentage

Specifies the threshold percentage value between 1 to 100.

Examples

```
switch (config)# rmonlog-set-threshold 45
switch (config)# show running-config

Running configuration:

; JL071A Configuration Editor; Created on release #KB.16.06.0000x
; Ver #13:03.f8.1c.fb.7f.bf.bb.ff.7c.59.fc.7b.ff.ff.fc.ff.ff.3f.ef:05

hostname "switch"
module 1 type jl071x
flexible-module A type JL081A
interface A1
   speed-duplex auto-100
   exit
snmp-server community "public" unrestricted
oobm
   ip address dhcp-bootp
   exit
vlan 1
   name "DEFAULT_VLAN"
   untagged 1-24,A1-A4
   ip address dhcp-bootp
   ipv6 enable
   ipv6 address dhcp full
   exit
rmonlog-set-threshold 45
```

The following event log message is logged when the RMON log memory reaches the threshold value.

```
W 03/25/18 07:44:51 03443 system:The event log buffer is 45% full.
```

SNMP trap when MAC address table changes

An SNMP trap is generated when a laptop/PC is removed from the back of an IP phone and the laptop/PC MAC address ages out of the MAC table for the Aruba 2930 switch.

The mac-notify trap feature globally enables the generation of SNMP trap notifications on MAC address table changes (learns/moves/removes/ages.)

The following command enables trap for aged MAC addresses:

Syntax

```
switch(config)# no mac-notify traps [port-list] aged
```

Example

For port 1 the command is:

Syntax

```
switch(config)# mac-notify traps 1 aged
```

show command

Use the following show command to display the different mac-notify traps configured on an interface:

Syntax

```
Switch # show mac-notify traps
```

Displays the following information:

```
Mac Notify Trap Information
Mac-notify Enabled : No
Mac-move Enabled : No
Trap-interval : 30
Port   MAC Addresses trap learned/removed/aged
------ ---------------------------------------
1       Learned, Removed & Aged
2            Removed & Aged
3            Learned & Aged
4            Learned & Removed
5            Aged
6            Learned
7            Removed
```

Example

For port 1 the command would be as follows

```
Switch # show mac-notify traps 1
```

Displays the following information:

```
1 Aged
```

SNMPv2c informs

On a switch enabled for SNMPv2c, you can use the `snmp-server host inform` command (Enabling SNMPv2c informs (CLI) on page 174) to send inform requests when certain events occur. When an SNMP Manager receives an inform request, it can send an SNMP response back to the sending agent on the switch to let the agent know that the inform request reached its destination.

If the sending agent on the switch does not receive an SNMP response back from the SNMP Manager within the timeout period, the inform request may be resent, based on the retry count value.

When you enable SNMPv2c inform requests to be sent, you must specify the IP address and community name of the management station that will receive the inform notification.

Enabling SNMPv2c informs (CLI)

For information about enabling SNMPv2c informs, see SNMPv2c informs on page 174.

Syntax

`no snmp-server host {< ipv4-addr | ipv6-addr >} <community name> inform [retries < count >] [timeout < interval >]`

Enables (or disables) the `inform` option for SNMPv2c on the switch and allows you to configure options for sending SNMP inform requests.

`retries`	Maximum number of times to resend an `inform` request if no SNMP response is received.(Default: 3)
`timeout`	Number of seconds to wait for an acknowledgement before resending the `inform` request.(Default: 15 seconds)

NOTE

The `retries` and `timeout` values are not used to send trap requests.

To verify the configuration of SNMPv2c informs, enter the `show snmp-server` command, as shown in the following image (note indication of inform **Notify Type** in bold):

Display of SNMPv2c inform configuration

```
switch(config)# show snmp-server

 SNMP Communities

  Community Name   MIB View Write Access
  ---------------- -------- ------------ public          Manager  Unrestricted

 Trap Receivers

  Link-Change Traps Enabled on Ports [All] : All
  ...
  Address               Community       Events Sent Notify Type Retry Timeout
  --------------------- --------------- ----------- ----------- ----- --------
  15.28.333.456         guest           All         inform      3     15

 Excluded MIBs

 Snmp Response Pdu Source-IP Information

  Selection Policy   : Default rfc1517

 Trap Pdu Source-IP Information
  Selection Policy   : Configured IP
  Ip Address        : 10.10.10.10
```

Configuring SNMPv3 notifications (CLI)

The SNMPv3 notification process allows messages that are passed via SNMP between the switch and a network management station to be authenticated and encrypted.

Procedure

1. Enable SNMPv3 operation on the switch by entering the `snmpv3 enable` command.

   When SNMPv3 is enabled, the switch supports:

   - Reception of SNMPv3 notification messages (traps and informs)
   - Configuration of initial users
   - (Optional) Restriction of non-SNMPv3 messages to "read only"

2. Configure SNMPv3 users by entering the `snmpv3 user` command. Each SNMPv3 user configuration is entered in the User Table.
3. Assign SNMPv3 users to security groups according to their level of access privilege by entering the `snmpv3 group` command.
4. Define the name of an SNMPv3 notification configuration by entering the `snmpv3 notify` command.

   #### Syntax

   `no snmpv3 notify <notify_name> tagvalue <tag_name> type {inform|trap}`

Associates the name of an SNMPv3 notification configuration with a tag name used (internally) in SNMPv3 commands. To delete a notification-to-tag mapping, enter `no snmpv3 notify notify_name`.

`notify <notify_name>`	Specifies the name of an SNMPv3 notification configuration.
`tagvalue <tag_name>`	Specifies the name of a tag value used in other SNMPv3 commands, such as `snmpv3 targetaddress params taglist tag_name` in Step 5.
`type`	Specifies the notification type as `inform` or `trap`. By default, the notification type is `trap`.

5. Configure the target address of the SNMPv3 management station to which SNMPv3 informs and traps are sent by entering the `snmpv3 targetaddress` command.

Syntax

`no snmpv3 targetaddress <ASCII-STR> params <ASCII-STR><IP-ADDR> taglist <ASCII-STR>`

Configures the IPv4 or IPv6 address, name, and configuration filename of the SNMPv3 management station to which notification messages are sent.

`params <ASCII-STR>`	Name of the SNMPv3 station's parameters file. The parameters filename configured with `params <ASCII-STR>` must match the `params <ASCII-STR>` value entered with the `snmpv3 params` command in Step 6. The `<IP-ADDR>` sets the IP address of the destination.
`taglist <ASCII-STR> [ASCII-STR] …`	Specifies the SNMPv3 notifications (identified by one or more `ASCII-STR` values) to be sent to the IP address of the SNMPv3 management station. You can enter more than one `ASCII-STR` value. Each `ASCII-STR` value must be already associated with the name of an SNMPv3 notification configuration entered with the `snmpv3 notify` command in Step 4.Use a blank space to separate values. `ASCII-STR` You can enter up to 103 characters in `ASCII-STR` entries following the `taglist` keyword.
`[filter {<none | debug | all | not-info | critical>}]`	(Optional) Configures the type of messages sent to a management station.(Default: none.)
`[udp-port <port >]`	(Optional) Specifies the UDP port to use.(Default: 162.)
`[port-mask <mask >]`	(Optional) Specifies a range of UDP ports. (Default: 0.)

[addr-mask <*mask* >]	(Optional) Specifies a range of IP addresses as destinations for notification messages. (Default: 0.)
[retries <*value* >]	(Optional) Number of times a notification is retransmitted if no response is received. Range: 1-255.(Default: 3.)
[timeout <*value* >]	(Optional) Time (in millisecond increments) allowed to receive a response from the target before notification packets are retransmitted. Range: 0-2147483647.[Default: 1500 (15 seconds).]
[max-msg-size <*size* >]	(Optional) Maximum number of bytes supported in a notification message to the specified target. (Default: 1472)

6. Create a configuration record for the target address with the `snmpv3 params` command.

Syntax

`no snmpv3 params <ASCII-STR> user <user_name> sec-model <security_model>message-processing <security_model> <security_service>`

Applies the configuration parameters and IP address of an SNMPv3 management station (from the `params <ASCII-STR>` value configured with the `snmpv3 targetaddress` command in Step 5) to a specified SNMPv3 user (from the `user <user_name>` value configured with the `snmpv3 user` command in Step 2).

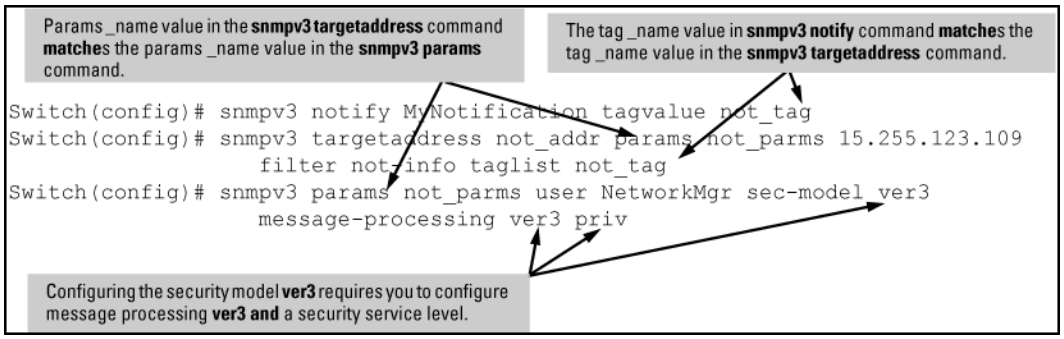
If you enter the `snmpv3 params user` command, you must also configure a security model (`sec_model`) and message processing algorithm (`message-processing`).

{<sec_model [ver1 | ver2c | ver3>]}	Configures the security model used for SNMPv3 notification messages sent to the management station configured with the `snmpv3 targetaddress` command in Step 5. If you configure the security model as `ver3`, you must also configure the message processing value as `ver3`.
{msg-processing {<ver1 | ver2c | ver3>} [noaut | auth | priv]}	Configures the algorithm used to process messages sent to the SNMPv3 target address. If you configure the message processing value as `ver3` and the security model as `ver3`, you must also configure a security services level (`noauth`, `auth`, or `priv`).

Example

An example to how to configure SNMPv3 notification in the following image:

Figure 24 *Example: SNMPv3 notification configuration*



Network security notifications

By default, a switch is enabled to send the SNMP notifications listed in Supported Notifications on page 170 when a network security event (For example, authentication failure) occurs. However, before security notifications can be sent, you must first configure one or more trap receivers or SNMPv3 management stations as described in:

- Configuring an SNMP trap receiver (CLI) on page 171
- Configuring SNMPv3 notifications (CLI) on page 175

You can manage the default configuration of the switch to disable and re-enable notifications to be sent for the following types of security events:

- ARP protection events
- Inability to establish a connection with the RADIUS or TACACS+ authentication server
- DHCP snooping events
- Dynamic IP Lockdown hardware resources consumed
- Link change notification
- Invalid password entered in a login attempt through a direct serial, Telnet, or SSH connection
- Manager password changes
- Port-security (web, MAC, or802.1X) authentication failure
- SNMP authentication failure
- Running configuration changes

Enabling or disabling notification/traps for network security failures and other security events (CLI)

Syntax

```
no snmp-server enable traps [arp-protect | auth-server-fail | dhcp-server | dhcp-snooping
| dhcpv6-snooping | dyn-ip-lockdown | dyn-ipv6-lockdown | event-list | link-change |
login-failure-mgr | mac-count-notify | mac-notify | macsec | nd-snooping | password-
change-mgr | port-security | running-config-change | snmp-authentication | startup-
config-change | vsf ]
```

Enables or disables sending one of the security notification types listed below to configured trap receivers. (Unless otherwise stated, all of the following notifications are enabled in the default configuration.)

The notification sends a trap:

`arp-protect`	Traps for Dynamic ARP Protection.
`auth-server-fail`	Traps reporting authentication server unreachable.
`dhcp-server`	Traps for DHCP-Server.
`dhcp-snooping`	Traps for DHCP-Snooping.
`dhcpv6-snooping`	Set the traps for DHCPv6 snooping.
`dyn-ip-lockdown`	Traps for Dynamic Ip Lockdown.
`dyn-ipv6-lockdown`	Enable traps for Dynamic IPv6 Lockdown.
`event-list`	Enable traps for specified events. Enter the event-list as a range, separated by commas, or both. The event-list should not exceed 100 event IDs. When the event -list is configured, trap will be sent only for the specif ied events. **NOTE:** `setmib` command overrides the configuration of `snmp-server enable traps event-list` command for the specified event ids. If the override operation occurs, then the following RMON message will be logged with respective event id: `setmib command overrides the configuration of "snmp-server enable traps event-list" for event id: %d`
`link-change`	Traps for link-up and link-down.
`login-failure-mgr`	Traps for management interface login failure.
`mac-count-notify`	Traps for MAC addresses learned on the specified ports exceeds the threshold.
`mac-notify`	Traps for (learned/removed) MAC address table changes.
`macsec`	Configure the traps for MACsec notifications.

`nd-snooping`	Set the trap for nd snooping
`password-change-mgr`	Traps for management interface password change.
`port-security`	Traps for port access authentication failure.
`running-config-change`	Traps for running config change.
`snmp-authentication [extended | standard]`	Select RFC-1157 (standard) or ICF-SNMP (extended) traps.
`Startup-config-change`	Traps for changes to the startup configuration.
`vsf`	Enable traps for the VSF functionality.

To determine the specific cause of a security event, check the Event Log in the console interface to see why a trap was sent. For more information, see *Using the Event Log for Troubleshooting Switch Problems*.

Viewing the current configuration for network security notifications (CLI)

Enter the `show snmp-server traps` command, as shown in the following example. Note that command output is a subset of the information displayed with the `show snmp-server` command in Figure 25: Display of SNMP notification configuration .

Display of configured network security notifications

```
switch(config)# show snmp-server traps

 Trap Receivers

  Link-Change Traps Enabled on Ports [All] : A1-A24

  Traps Category                  Current Status
  ------------------------------  -------------------------
  SNMP Authentication           : Extended
  Password change               : Enabled
  Login failures                : Enabled
  Port-Security                 : Enabled
  Authorization Server Contact  : Enabled
  DHCP Snooping                 : Enabled
  Dynamic ARP Protection        : Enabled
```

```
Dynamic IP Lockdown           : Enabled


Address                 Community  Events Sent Notify Type Retry Timeout
----------------------- ---------- ----------- ----------- ----- -------
15.255.5.225            public     All         trap          3   15
2001:0db8:0000:0001
  :0000:0000:0000:0121  user_1     All         trap          3   15

Excluded MIBs
```

Enabling Link-Change Traps (CLI)

By default, a switch is enabled to send a trap when the link state on a port changes from up to down (linkDown) or down to up (linkUp). To reconfigure the switch to send link-change traps to configured trap receivers, enter the `snmp-server enable traps link-change` command.

Syntax

`no snmp-server enable traps link-change <port-list> [all]`

Enables or disables the switch to send a link-change trap to configured trap receivers when the link state on a port goes from up to down or down to up.

Enter `all` to enable or disable link-change traps on all ports on the switch.

Readable interface names in traps

The SNMP trap notification messages for linkup and linkdown events on an interface includes IfDesc and IfAlias var-bind information.

Source IP address for SNMP notifications

The switch uses an interface IP address as the source IP address in IP headers when sending SNMP notifications (traps and informs) or responses to SNMP requests.

For multi-netted interfaces, the source IP address is the IP address of the outbound interface of the SNMP reply, which may differ from the destination IP address in the IP header of the received request. For security reasons, it may be desirable to send an SNMP reply with the IP address of the destination interface (or a specified IP address) on which the corresponding SNMP request was received.

To configure the switch to use the source IP address on which an SNMP request was received in SNMP notification or traps and replies, enter the `snmp-server response-source` and `snmp-server trap-source` commands (For more information, see Configuring the source IP address for SNMP notifications (CLI) on page 181

Configuring the source IP address for SNMP notifications (CLI)

For more information, see Source IP address for SNMP notifications on page 181.

Syntax

`no snmp-server response-source [dst-ip-of-request | [ipv4-addr | ipv6-addr] | loopback <0-7>]`

Specifies the source IP address of the SNMP response PDU. The default SNMP response PDU uses the IP address of the active interface from which the SNMP response was sent as the source IP address.

The `no` form of the command resets the switch to the default behavior (compliant with rfc-1517).

(Default: Interface IP address)

`dst-ip-of-request`	Destination IP address of the SNMP request PDU that is used as the source IP address in an SNMP response PDU.
`[ipv4-addr | ipv6-addr]`	User-defined interface IP address that is used as the source IP address in an SNMP response PDU. Both IPv4 and IPv6 addresses are supported.
`loopback <0-7>`	IP address configured for the specified loopback interface that is used as the source IP address in an SNMP response PDU. If multiple loopback IP addresses are configured, the lowest alphanumeric address is used.

To use the IP address of the destination interface on which an SNMP request was received as the source IP address in the IP header of SNMP traps and replies, enter the following command:

```
switch(config)# snmp-server response-source dst-ip-of-request
```

Syntax

`no snmp-server trap-source [ipv4-addr | loopback <0-7>]`

Specifies the source IP address to be used for a trap PDU. To configure the switch to use a specified source IP address in generated trap PDUs, enter the `snmp-server trap-source` command.

The `no` form of the command resets the switch to the default behavior (compliant with rfc-1517).

(Default: Use the interface IP address in generated trap PDUs)

ipv4-addr	User-defined interface IPv4 address that is used as the source IP address in generated traps. IPv6 addresses are not supported.
`loopback <0-7>`	P address configured for the specified loopback interface that is used as the source IP address in a generated trap PDU. If multiple loopback IP addresses are configured, the lowest alphanumeric address is used.

When you use the `snmp-server response-source` and `snmp-server trap-source` commands, note the following behavior:

- The `snmp-server response-source` and `snmp-server trap-source` commands configure the source IP address for IPv4 interfaces only.
- You must manually configure the `snmp-server response-source` value if you wish to change the default user-defined interface IP address that is used as the source IP address in SNMP traps (RFC 1517).
- The values configured with the `snmp-server response-source` and `snmp-server trap-source` commands are applied globally to all interfaces that are sending SNMP responses or SNMP trap PDUs.
- Only the source IP address field in the IP header of the SNMP response PDU can be changed.
- Only the source IP address field in the IP header and the SNMPv1 Agent Address field of the SNMP trap PDU can be changed.

Verifying the configuration of the interface IP address used as the source IP address in IP headers for SNMP replies and traps sent from the switch (CLI)

Enter the `show snmp-server` command to display the SNMP policy configuration, as shown in the following example.

Display of source IP address configuration

```
switch(config)# show snmp-server

 SNMP Communities

  Community Name   MIB View Write Access
  ---------------- -------- ------------
  public           Manager  Unrestricted

 Trap Receivers
  Link-Change Traps Enabled on Ports [All] : All

  ...

 Excluded MIBs
 Snmp Response Pdu Source-IP Information
  Selection Policy : dstIpOfRequest [1]

 Trap Pdu Source-IP Information
  Selection Policy : Configured IP
```

[1]dstIpOfRequest: The destination IP address of the interface on which an SNMP request is received and used as the source IP address in SNMP replies.

Viewing SNMP notification configuration (CLI)

Syntax

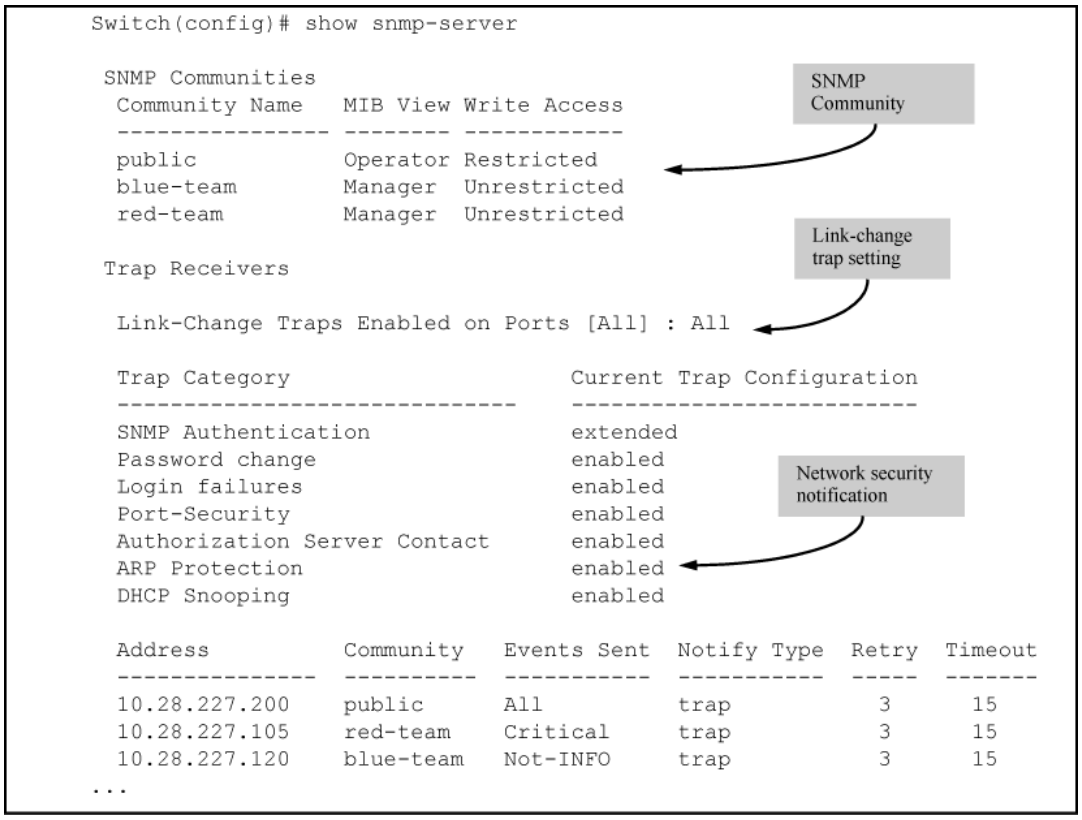
`show snmp-server`

Displays the currently configured notification settings for versions SNMPv1 and SNMPv2c traps, including SNMP communities, trap receivers, link-change traps, and network security notifications.

Example:

In the following Example:, the `show snmp-server` command output shows that the switch has been configured to send SNMP traps and notifications to management stations that belong to the "public," "red-team," and "blue-team" communities.

Figure 25 *Display of SNMP notification configuration*



Hardware events and traps

Current default traps

The default event scenarios for currently generated traps on AOS-S switches are:

- Device cold start notifications
- Device warm start notifications
- Port down notifications
- Port up notifications
- Authentication failure notifications
- Enterprise change notifications
- Intrusion alarm notifications

Event scenario matrix

Different event scenarios for which traps are generated:

Event Id	Severity	Action	Message
68	Info	Slot Insertion	I 06/20/16 09:18:43 00068 chassis: AM1: Slot C Inserted
67	Info	Slot Removal	I 06/20/16 09:18:50 00067 chassis: AM1: Slot C Removed

Event Id	Severity	Action	Message
405	Info	Transceiver Insertion	I 06/20/16 09:18:56 00405 ports: AM1: port A23 xcvr hot-swap insert
406	Info	Transceiver Removal	I 06/20/16 09:19:04 00406 ports: AM1: port A23 xcvr hot-swap remove
552	Warning	Stacking module Insertion	W 04/20/16 09:20:43 00552 chassis: ST1-CMDR: Stacking Module insertion detected: Reboot required
552	Warning	Stacking module Removal	W 06/20/16 09:19:43 00552 chassis: ST1-CMDR: Stacking Module removal detected: Reboot required

Enabling and disabling traps

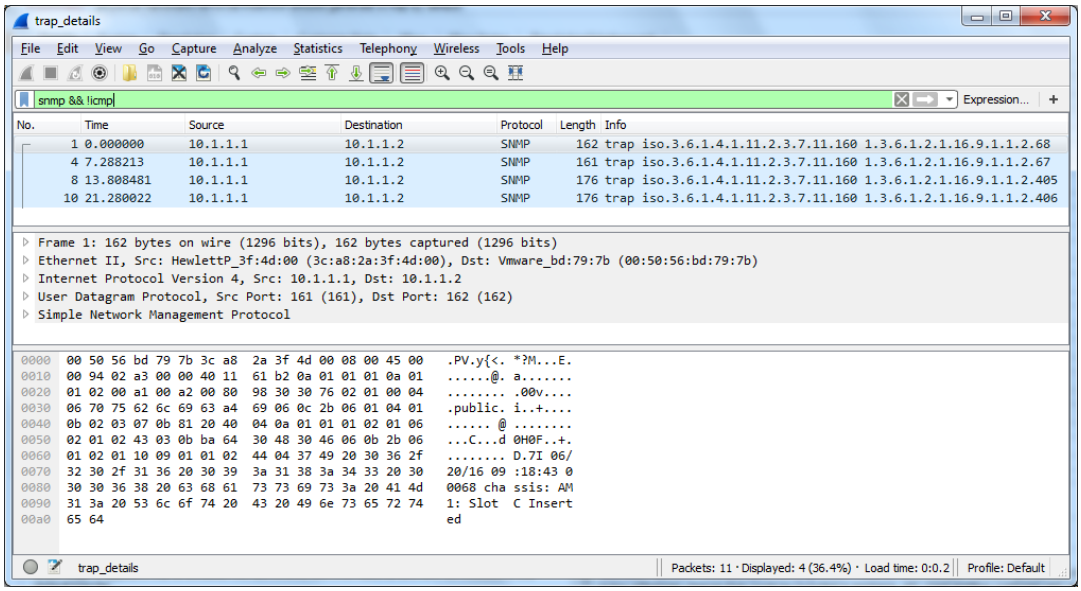
Action	Command
Disable both the log and trap	`setMib eventType.<event_Id> -i 1 - to disable both log & Trap`
Enable log only	`setMib eventType.<event_Id> -i 2 - to allow only log`
Enable both the log and trap (Default)	`setMib eventType.<event_Id> -i 4 - to allow both log & Trap`
Enable trap only	`setMib eventType.<event_Id> -i 3 - to allow only trap`

If the event is configured to disable a trap, then the trap will not be sent for that particular event. In all other scenarios, a trap is generated for the listed events.

SNMP trap captures examples

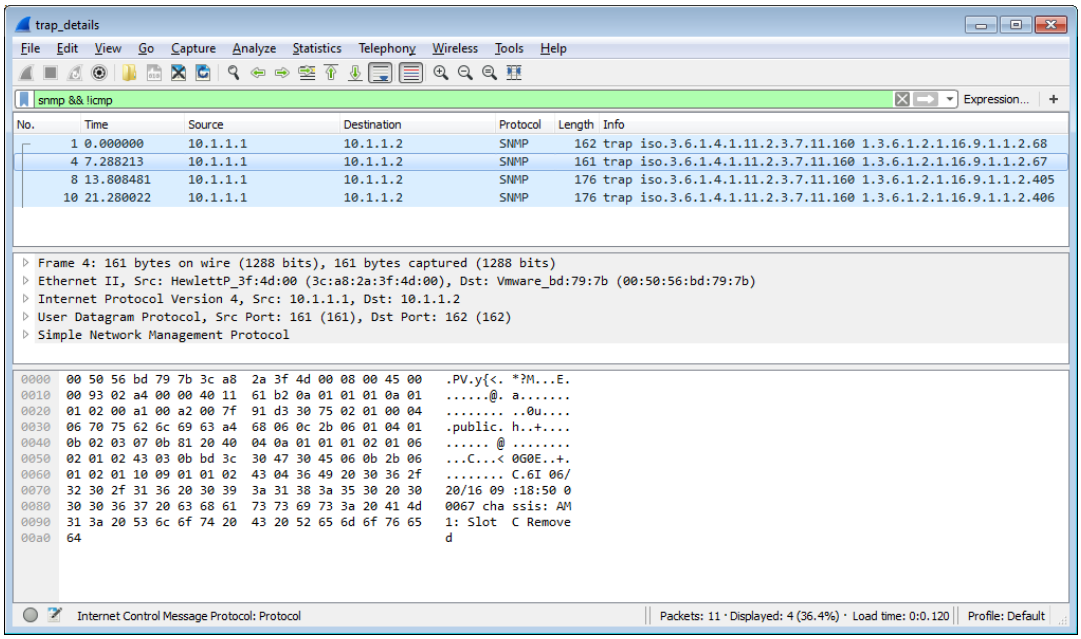
Inserting a slot module

Event Id: 68



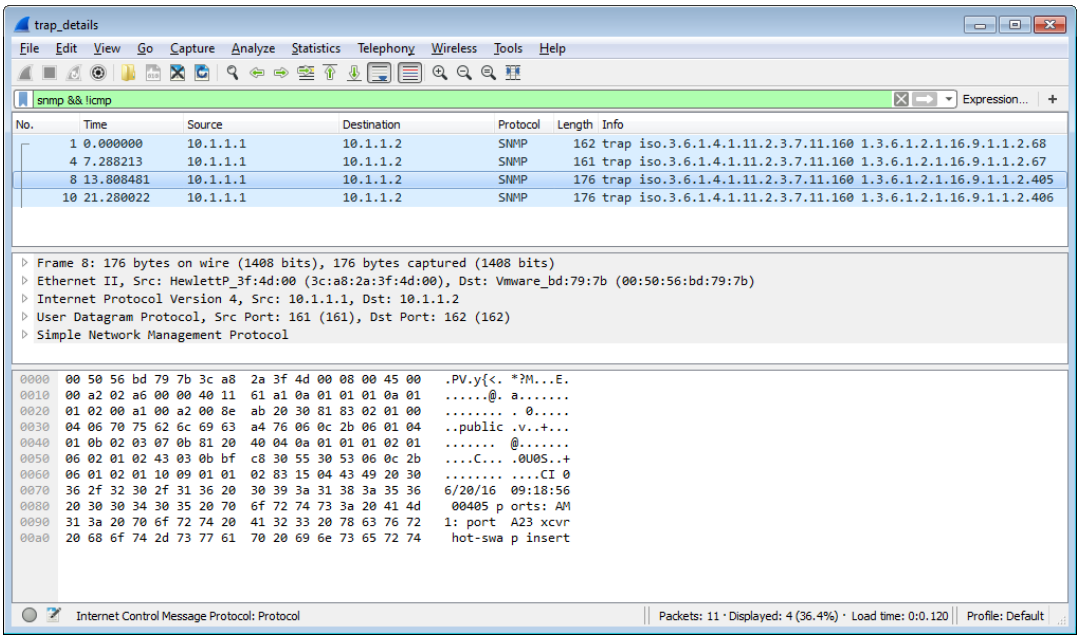
Removing a slot module

Event Id: 67

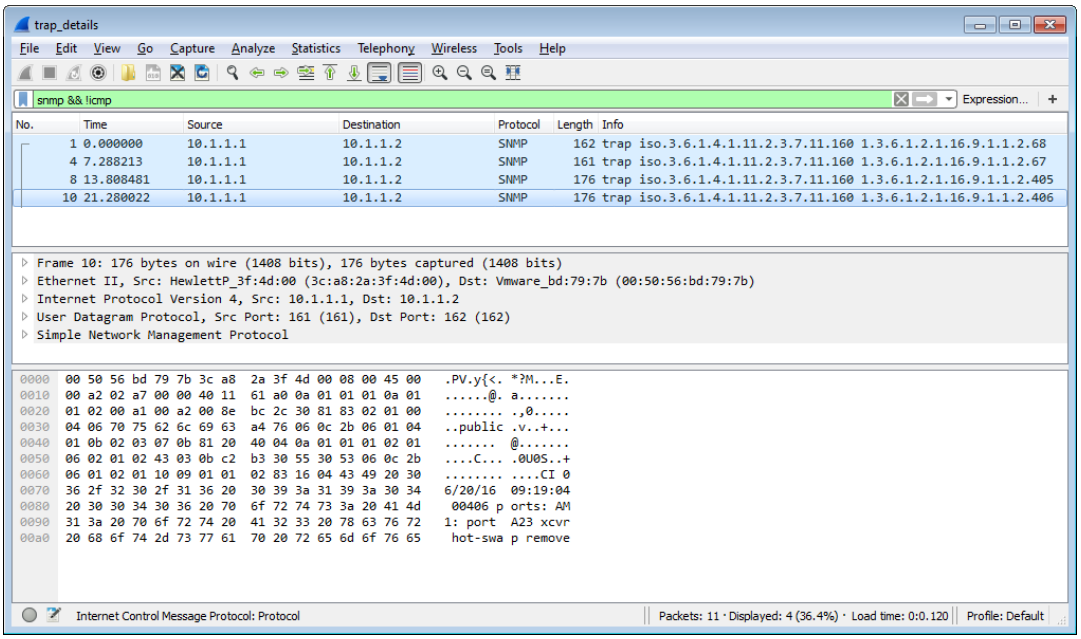


Inserting transceiver

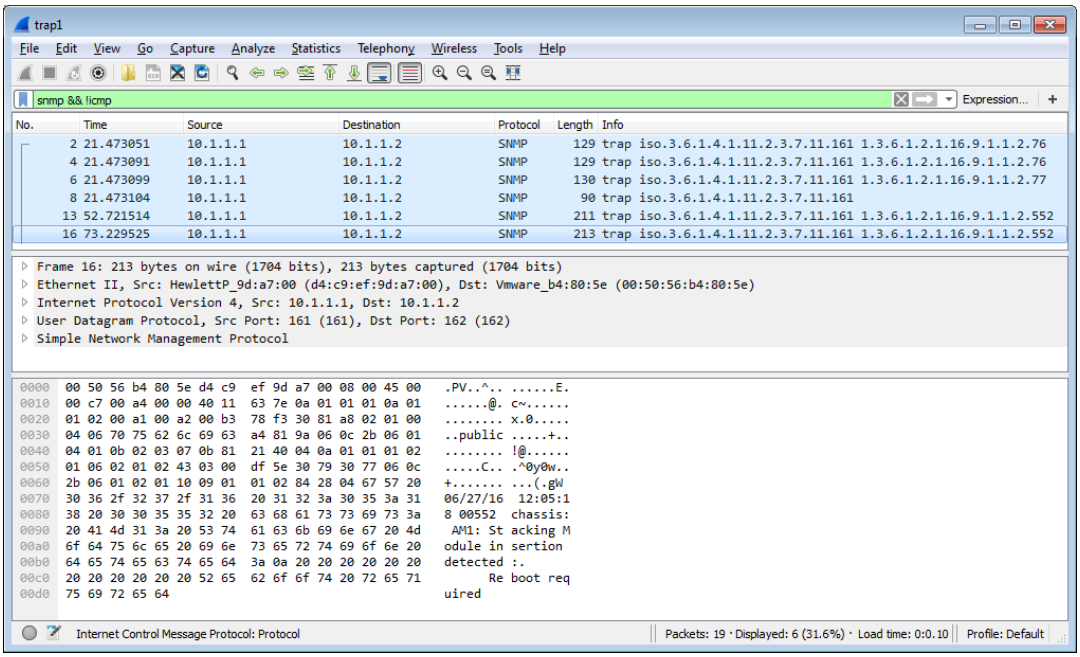
Event Id: 405



Removing a transceiver



Inserting a stack-module



Configuring the MAC address count option

The MAC Address Count feature provides a way to notify the switch management system when the number of MAC addresses learned on a switch port exceeds the permitted configurable number.

To enable the mac-count-notify option, enter this command in global config context.

Syntax

`no snmp-server enable traps mac-count-notify`

Sends a trap when the number of MAC addresses learned on the specified ports exceeds the configured `<learned-count>` value.

To configure the mac-count-notify option on a port or ports, enter this command. When the configured number of MAC addresses is exceeded (the learned-count), a trap is sent.

Syntax

`no mac-count-notify traps <port-list> [<learned-count>]`

Configures `mac-count-notify traps` on the specified ports (or all) for the entire switch.

The `no` form of the command disables `mac-count-notify traps`.

`[<learned-count>]`: The number of MAC addresses learned before sending a trap. Values range between 1-128.

Default: 32

Configuring mac-count notify traps on ports 5-7

```
switch (config)# mac-count-notify traps 5-7 50
```

Displaying information about the mac-count-notify option

Use the show mac-count-notify traps [<port-list>] command to display information about the configured value for sending a trap, the current count, and if a trap has been sent.

Information displayed for the show mac-count-notify traps command

```
switch(config)# show mac-count-notify traps

Mac-count-notify Enabled: Yes

Port    Count for        Count    Trap Sent
        sending Trap
------  ---------------  -------  ------------
1
2
3
4
5          50             0        No
6          50             2        No
7          50             0        No
8
9
...
```

The interface context can be used to configure the value for sending a trap.

Configuring mac-count-notify traps from the interface context

```
switch(config)# interface 5
Switch (eth-5)# mac-count-notify traps 35
```

The `show snmp-server traps` command displays whether the MAC Address Count feature is enabled or disabled.

Information about SNMP traps, including MAC address count being Enabled/Disabled

```
switch(config)# show snmp-server traps

 Trap Receivers

  Link-Change Traps Enabled on Ports [All] : All

  Traps Category                 Current Status
  _____________________________  __________________
  SNMP Authentication           : Extended
  Password change               : Enabled
  Login failures                : Enabled
  Port-Security                 : Enabled
  Authorization Server Contact  : Enabled
  DHCP-Snooping                 : Enabled
  Dynamic ARP Protection        : Enabled
  Dynamic IP Lockdown           : Enabled


  MAC address table changes     : Disabled
  MAC Address Count             : Enabled [1]

  Address          Community   Events  Type   Retry  Timeout
  ---------------- ----------- ------- ------ ------ -------
  15.146.194.77    public      None    trap   3      15
  15.255.134.252   public      None    trap   3      15
  16.181.49.167    public      None    trap   3      15
  16.181.51.14     public      None    trap   3      15

Excluded MIBs
```

[1]The notify option is enabled.

Advanced management: RMON

The switch supports RMON (remote monitoring) on all connected network segments. This allows for troubleshooting and optimizing your network.

The following RMON groups are supported:

- Ethernet Statistics (except the numbers of packets of different frame sizes)
- Alarm
- History (of the supported Ethernet statistics)
- Event

The RMON agent automatically runs in the switch. Use the RMON management station on your network to enable or disable specific RMON traps and events. Note that you can access the Ethernet statistics, Alarm and Event groups from the Switch Manager network management software.

CLI-configured sFlow with multiple instances

sFlow can also be configured via the CLI for up to three distinct sFlow instances: once enabled, an sFlow receiver/destination can be independently configured for full flow-sampling and counter-polling. CLI-configured sFlow instances may be saved to the startup configuration to persist across a switch reboot.

Configuring sFlow (CLI)

The following sFlow commands allow you to configure sFlow instances via the CLI. For more information, see Advanced management: RMON.

Syntax

`no sflow <receiver-instance> destination <ip-address> [< udp-port-num >]`

Enables an sFlow receiver/destination. The receiver-instance number must be a 1, 2, or 3.

By default, the udp destination port number is 6343.

To disable an sFlow receiver/destination, enter `no sflow receiver-instance`.

Syntax

`sflow <receiver-instance> sampling <port-list> <sampling rate>`

Once an sFlow receiver/destination has been enabled, this command enables flow sampling for that instance. The receiver-instance number is 1, 2, or 3, and the sampling rate is the allowable non-zero skipcount for the specified port or ports.

To disable flow-sampling for the specified port-list, repeat the above command with a sampling rate of `0`.

Syntax

`sflow <receiver-instance> polling <port-list> <polling interval>`

Once an sFlow receiver/destination has been enabled, this command enables counter polling for that instance. The receiver-instance number is 1, 2, or 3, and the polling interval may be set to an allowable non-zero value to enable polling on the specified port or ports.

To disable counter-polling for the specified port-list, repeat the above command with a polling interval of `0`.

Under the multiple instance implementation, sFlow can be configured via the CLI or via SNMP. However, CLI-owned sFlow configurations cannot be modified via SNMP, whereas SNMP-owned instances can be disabled via the CLI using the `no sflow <receiver-instance>` command.

Viewing sFlow Configuration and Status (CLI)

The following sFlow commands allow you to display sFlow configuration and status through the CLI Viewing sFlow destination information on page 191 is an example of `sflow agent` information.

Syntax

`show sflow agent`

Displays sFlow agent information. The agent address is normally the IP address of the first VLAN configured.

The `show sflow agent` command displays read-only switch agent information. The version information shows the sFlow version, MIB support, and software versions; the agent address is typically the IP address of the first VLAN configured on the switch.

Viewing sflow agent formation

```
switch# show sflow agent

  Version          1.3;XX.11.40
  Agent Address    10.0.10.228
```

Syntax

`show sflow <receiver instance> destination`

Displays information about the management station to which the sFlow sampling-polling data is sent.

The `show sflow instance destination` command includes information about the management-station's destination address, receiver port, and owner, as shown in the following example.

Viewing sFlow destination information

```
switch# show sflow 2 destination

  Destination Instance        2
  sflow                       Enabled
  Datagrams Sent              221
  Destination Address         10.0.10.41
  Receiver Port               6343
  Owner                       Administrator, CLI-owned, Instance 2
  Timeout (seconds)           99995530
  Max Datagram Size           1400
  Datagram Version Support    5
```

Note the following details:

- **Destination Address** remains blank unless it has been configured.
- **Datagrams Sent** shows the number of datagrams sent by the switch agent to the management station since the switch agent was last enabled.
- **Timeout** displays the number of seconds remaining before the switch agent will automatically disable sFlow (this is set by the management station and decrements with time).

- **Max Datagram Size** shows the currently set value (typically a default value, but this can also be set by the management station).

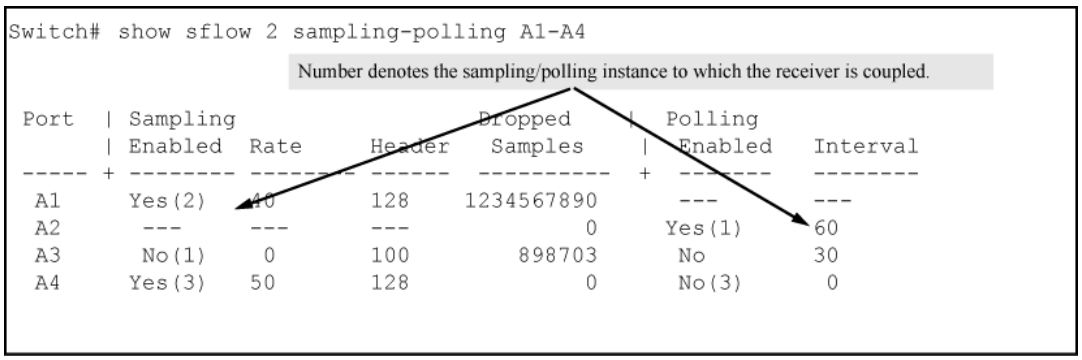
Syntax

`show sflow <receiver instance> sampling-polling <port-list/range>`

Displays status information about sFlow sampling and polling.

The `show sflow instance sampling-polling [port-list]` command displays information about sFlow sampling and polling on the switch, as shown in the following example. You can specify a list or range of ports for which to view sampling information.

Figure 26 *Example: Viewing sFlow sampling and polling information*



NOTE

The sampling and polling instances (noted in parentheses) coupled to a specific receiver instance are assigned dynamically, and so the instance numbers may not always match. The key thing to note is whether sampling or polling is enabled on a port, and the sampling rates or polling intervals for the receiver instance configured on each port.

Configuring UDLD verify before forwarding

When an UDLD enabled port transitions to link-up, the port will begin with a UDLD blocking state. UDLD will probe via protocol packet exchange to determine the bidirectional state of the link. Until UDLD has completed the probe, all data traffic will be blocked. If the link is found to be bidirectional, UDLD will unblock the port for data traffic to pass. Once UDLD unblocks the port, other protocols will see the port as up and data traffic can be safely forwarded.

The default mode of a switch is “forward first then verify”. Enabling UDLD link-up will default to “forward first then verify”. To change the mode to “verify then forward”, you need to configure using the commands found in section 6.72.

NOTE

Link-UP data traffic will resumed after probing the link partner completes. All other protocols running will see the port as down.

UDLD time delay

UDLD protocol informs the link partner simultaneously as it detects a state change from unidirectional to bidirectional traffic. Additional packet exchanges will be carried out by UDLD in addition to the existing UDLD exchanges whenever state changes from unidirectional to bidirectional.

Table 22: *Peer state transition timings*

Interval Time	Interval 1	Interval 1 + delta	Interval 2	Interval 3
	5 sec	5+(<5) sec*	10 sec	15 sec
With triggered updates	State = blockedPeer State = blocked	Inform PeerState = unblockedPeer State = unblocked	Regular UDLD TX	Regular UDLD TX
Without triggered updates	State = blockedPeer State = blocked	State = unblockedPeer State = blocked	Inform PeerState = unblockedPeer State = unblocked	Regular UDLD TX
*delta is the time when the unblock event occurs on local side				

Restrictions

- There is no support available when configuring this mode from the web and menu interface.
- There are no new packet types are introduced with UDLD.
- There are no new UDLD timers being introduced.

UDLD configuration commands

Syntax

```
switch(config)# link-keepalive mode [verify-then-forward | forward-then-verify]
```

This command configures the link-keepalive mode.

Link-keepalive provides two modes of operation; `verify-then-forward` and `forward-then-verify`.

When using the `verify-then-forward` mode, the port is in a blocking state until the link configured for UDLD establishes bidirectional communication. When using the `forward-then-verify` mode, the port forwards the data then verifies the status of the link-in state.

When a unidirectional state is detected, the port is moved to a blocked state.

When a bidirectional state is detected, the data is forwarded without interruption.

Syntax

```
switch(config)# link-keepalive mode verify-then-forward
```

Keeps the port in a logically blocked state until the link configured for UDLD has been successfully established in bi-directional communication.

Syntax

```
switch(config)# link-keepalive mode forward-then-verify
```

Forwards the data then verifies the status of the link. If a unidirectional state is detected, the port is then moved to a blocked state.

Syntax

```
switch(config)# link-keepalive interval <deciseconds>
```

Configure the interval for `link-keepalive`. The `link-keepalive` interval is the time between sending two UDLD packets. The time interval is entered in deciseconds (1/10 sec). The default keepalive interval is 50 deciseconds.

Example

A value of 10 is 1 sec., 11 is 1.1 sec.

Syntax

```
switch(config)# link-keepalive retries <number>
```

Maximum number of sending attempts for UDLD packets before declaring the link as faulty.

Default keepalive attempt is 4.

Show commands

Syntax

```
switch(config)# show link-keepalive
```

Sample output

```
Total link-keepalive enabled ports: 8
Keepalive Retries : 4
Keepalive Interval: 5 sec
Keepalive Mode : verify-then-forward
Physical Keepalive Adjacent UDLD
Port Enabled Status Status Switch VLAN
----- ------- ---------------- --------- ------------- ----------
1 Yes down off-line 000000-000000 untagged
2 Yes down off-line 000000-000000 untagged
3 Yes down off-line 000000-000000 untagged
4 Yes down off-line 000000-000000 untagged
5 Yes down off-line 000000-000000 untagged
6 Yes down off-line 000000-000000 untagged
7 Yes down off-line 000000-000000 untagged
8 Yes down off-line 000000-000000 untagged
```

RMON generated when user changes UDLD mode

RMON events are generated when UDLD is configured. The first time you configure the mode, the UDLD states will be re-initialized. An event log entry is initiated to include the reason for the initial UDLD blocking state during link up.

Example

UDLD mode `[verify-then-forward | forward-then-verify]` is configured

Severity: - Info.

LLDP

To standardize device discovery on all switches, LLDP is implemented while offering limited read-only support for CDP, as documented in this manual. For the latest information on your switch model, consult the Release Notes (available on the HPE Networking website). If LLDP has not yet been implemented (or if you are running an older version of software), consult a previous version of the *Management and Configuration Guide* for device discovery details.

LLDP (Link Layer Discovery Protocol): provides a standards-based method for enabling the switches covered in this guide to advertise themselves to adjacent devices and to learn about adjacent LLDP devices.

LLDP-MED (LLDP Media Endpoint Discovery): Provides an extension to LLDP and is designed to support VoIP deployments.

LLDP-MED is an extension for LLDP, and the switch requires that LLDP be enabled as a prerequisite to LLDP-MED operation.

An SNMP utility can progressively discover LLDP devices in a network by:

Procedure

1. Reading a given device's Neighbors table (in the Management Information Base, or MIB) to learn about other, neighboring LLDP devices.
2. Using the information learned in step 1 to find and read the neighbor devices' Neighbors tables to learn about additional devices, and so on.

Also, by using `show` commands to access the switch's neighbor database for information collected by an individual switch, system administrators can learn about other devices connected to the switch, including device type (capability) and some configuration information. In VoIP deployments using LLDP-MED on the switches, additional support unique to VoIP applications is also available. See LLDP-MED (media-endpoint-discovery) on page 209.

General LLDP operation

An LLDP packet contains data about the transmitting switch and port. The switch advertises itself to adjacent (neighbor) devices by transmitting LLDP data packets out all ports on which outbound LLDP is enabled and by reading LLDP advertisements from neighbor devices on ports that are inbound LLDP-enabled. (LLDP is a one-way protocol and does not include any acknowledgement mechanism.) An LLDP-enabled port receiving LLDP packets inbound from neighbor devices stores the packet data in a Neighbor database (MIB).

LLDP-MED

This capability is an extension to LLDP and is available on the switches. See LLDP-MED (media-endpoint-discovery) on page 209.

Packet boundaries in a network topology

- Where multiple LLDP devices are directly connected, an outbound LLDP packet travels only to the next LLDP device. An LLDP-capable device does not forward LLDP packets to any other devices, regardless of whether they are LLDP-enabled.
- An intervening hub or repeater forwards the LLDP packets it receives in the same manner as any other multicast packets it receives. Thus, two LLDP switches joined by a hub or repeater handle LLDP traffic in the same way that they would if directly connected.
- Any intervening 802.1D device or Layer-3 device that is either LLDP-unaware or has disabled LLDP operation drops the packet.

LLDP operation configuration options

In the default configuration, LLDP is enabled and in both transmit and receive mode on all active ports. The LLDP configuration includes global settings, which apply to all active ports on the switch, and per-port settings, which affect only the operation of the specified ports.

The commands in the LLDP sections affect both LLDP and LLDP-MED operation. For information on operation and configuration unique to LLDP-MED, see LLDP-MED (media-endpoint-discovery) on page 209.

Enable or disable LLDP on the switch

In the default configuration, LLDP is globally enabled on the switch. To prevent transmission or receipt of LLDP traffic, you can disable LLDP operation.

Enable or disable LLDP-MED

In the default configuration for the switches, LLDP-MED is enabled by default. (Requires that LLDP is also enabled.) For more information, see LLDP-MED (media-endpoint-discovery) on page 209.

Change the frequency of LLDP packet transmission to neighbor devices

On a global basis, you can increase or decrease the frequency of outbound LLDP advertisements.

Change the Time-To-Live for LLDP packets sent to neighbors

On a global basis, you can increase or decrease the time that the information in an LLDP packet outbound from the switch will be maintained in a neighbor LLDP device.

Transmit and receive mode

With LLDP enabled, the switch periodically transmits an LLDP advertisement (packet) out each active port enabled for outbound LLDP transmissions and receives LLDP advertisements on each active port enabled to receive LLDP traffic (Configuring per-port transmit and receive modes (CLI) on page 204). Per-port configuration options include four modes:

- Transmit and receive (`tx_rx`): This is the default setting on all ports. It enables a given port to both transmit and receive LLDP packets and to store the data from received (inbound) LLDP packets in the switch's MIB.
- Transmit only (`txonly`): This setting enables a port to transmit LLDP packets that can be read by LLDP neighbors. However, the port drops inbound LLDP packets from LLDP neighbors without reading them. This prevents the switch from learning about LLDP neighbors on that port.
- Receive only (`rxonly`): This setting enables a port to receive and read LLDP packets from LLDP neighbors and to store the packet data in the switch's MIB. However, the port does not transmit outbound LLDP packets. This prevents LLDP neighbors from learning about the switch through that port.
- Disable (`disable`): This setting disables LLDP packet transmissions and reception on a port. In this state, the switch does not use the port for either learning about LLDP neighbors or informing LLDP neighbors of its presence.

SNMP notification

You can enable the switch to send a notification to any configured SNMP trap receiver(s) when the switch detects a remote LLDP data change on an LLDP-enabled port (Configuring SNMP notification support on page 204).

Per-port (outbound) data options

The following table lists the information the switch can include in the per-port, outbound LLDP packets it generates. In the default configuration, all outbound LLDP packets include this information in the TLVs transmitted to neighbor devices. However, you can configure LLDP advertisements on a per-port basis to omit some of this information (Configuring a remote management address for outbound LLDP advertisements (CLI) on page 205).

Table 23: *Data available for basic LLDP advertisements*

Data type	Configuration options	Default	Description
Time-to-Live	1	120 Seconds	The length of time an LLDP neighbor retains the advertised data before discarding it.
Chassis Type[1]	N/A	Always Enabled	Indicates the type of identifier used for Chassis ID.
Chassis ID[2]	N/A	Always Enabled	Uses base MAC address of the switch.
Port Type[3, 3]	N/A	Always Enabled	Uses "Local," meaning assigned locally by LLDP.
Port Id[3]	N/A	Always Enabled	Uses port number of the physical port. This is an internal number reflecting the reserved slot/port position in the chassis. For more information on this numbering scheme, see the appendix "MAC Address Management".
Remote Management Address			
Type[3]	N/A	Always Enabled	Shows the network address type.
Address[4]	Default or Configured	Uses a default address selection method unless an optional address is configured. See Remote management address on page 198.	
System Name[3]	Enable/Disable	Enabled	Uses the switch's assigned name.
System Description[3]	Enable/Disable	Enabled	Includes switch model name and running software version, and ROM version.
Port Description[3]	Enable/Disable	Enabled	Uses the physical port identifier.
System capabilities supported[3]	Enable/Disable	Enabled	Identifies the switch's primary capabilities (bridge, router).
System capabilities enabled[3,5]	Enable/Disable	Enabled	Identifies the primary switch functions that are enabled, such as routing.

[1]The Packet Time-to-Live value is included in LLDP data packets.

[1]Subelement of the Chassis ID TLV.

[2]Populated with data captured internally by the switch. For more on these data types, refer to the IEEE P802.1AB Standard.

[3]Subelement of the Port ID TLV.

[4]Subelement of the Remote-Management-Address TLV.

[5]Subelement of the System Capability TLV.

Remote management address

The switch always includes an IP address in its LLDP advertisements. This can be either an address selected by a default process or an address configured for inclusion in advertisements. See IP address advertisements.

Debug logging

You can enable LLDP debug logging to a configured debug destination (Syslog server, a terminal device, or both) by executing the `debug lldp` command. (For more information on Debug and Syslog, see the "Troubleshooting" appendix in this guide.) Note that the switch's Event Log does not record usual LLDP update messages.

Options for reading LLDP information collected by the switch

You can extract LLDP information from the switch to identify adjacent LLDP devices. Options include:

- Using the switch's `show lldp info` command options to display data collected on adjacent LLDP devices–as well as the local data the switch is transmitting to adjacent LLDP devices (Displaying the global LLDP, port admin, and SNMP notification status (CLI) on page 199).
- Using an SNMP application that is designed to query the Neighbors MIB for LLDP data to use in device discovery and topology mapping.
- Using the `walkmib` command to display a listing of the LLDP MIB objects

LLDP and LLDP-MED standards compatibility

The operation covered by this section is compatible with these standards:

- IEEE P802.1AB
- RFC 2922 (PTOPO, or Physical Topology MIB)
- RFC 2737 (Entity MIB)
- RFC 2863 (Interfaces MIB)
- ANSI/TIA-1057/D6 (LLDP-MED; refer to LLDP-MED (media-endpoint-discovery) on page 209.)

LLDP operating rules

For additional information specific to LLDP-MED operation, see LLDP-MED (media-endpoint-discovery) on page 209.

Port trunking

LLDP manages trunked ports individually. That is, trunked ports are configured individually for LLDP operation, in the same manner as non-trunked ports. Also, LLDP sends separate advertisements on each port in a trunk, and not on a per-trunk basis. Similarly, LLDP data received through trunked ports is stored individually, per-port.

IP address advertisements

In the default operation, if a port belongs to only one static VLAN, the port advertises the lowest-order IP address configured on that VLAN. If a port belongs to multiple VLANs, the port advertises the lowest-order IP address configured on the VLAN with the lowest VID. If the qualifying VLAN does not have an IP address, the port advertises 127.0.0.1 as its IP address. For example, if the port is a member of the default VLAN (VID=1), and there is an IP address configured for the default VLAN, the port advertises this IP address. In the default operation, the IP address that LLDP uses can be an address acquired by DHCP or Bootp.

You can override the default operation by configuring the port to advertise any IP address that is manually configured on the switch, even if the port does not belong to the VLAN configured with the selected IP address (Configuring a remote management address for outbound LLDP advertisements (CLI) on page 205). (Note that LLDP cannot be configured through the CLI to advertise an addresses acquired through DHCP or Bootp. However, as mentioned above, in the default LLDP configuration, if the lowest-order IP address on the VLAN with the lowest VID for a given port is a DHCP or Bootp address, the switch includes this address in its LLDP advertisements unless another address is configured for advertisements on that port.) Also, although LLDP allows configuring multiple remote management addresses on a port, only the lowest-order address configured on the port will be included in outbound advertisements. Attempting to use the CLI to configure LLDP with an IP address that is either not configured on a VLAN or has been acquired by DHCP or Bootp results in the following error message.

```
xxx.xxx.xxx.xxx: This IP address is not configured or is a DHCP address.
```

Spanning-tree blocking

Spanning tree does not prevent LLDP packet transmission or receipt on STP-blocked links.

802.1X blocking

Ports blocked by 802.1X operation do not allow transmission or receipt of LLDP packets.

Configuring LLDP operation

Displaying the global LLDP, port admin, and SNMP notification status (CLI)

In the default configuration, LLDP is enabled and in both transmit and receive mode on all active ports. The LLDP configuration includes global settings that apply to all active ports on the switch, and per-port settings that affect only the operation of the specified ports.

The commands in this section affect both LLDP and LLDP-MED operation. for information on operation and configuration unique to LLDP-MED, refer to “LLDP-MED (Media-Endpoint-Discovery)”.

Syntax

`show lldp config`

Displays the LLDP global configuration, LLDP port status, and SNMP notification status. For information on port admin status, see Configuring per-port transmit and receive modes (CLI) on page 204.

`show lldp config` produces the following display when the switch is in the default LLDP configuration:

Viewing the general LLDP configuration

```
switch(config)# show lldp config

 LLDP Global Configuration

  LLDP Enabled [Yes] : Yes
  LLDP Transmit Interval     [30] : 30
```

```
 LLDP Hold time Multiplier   [4] : 4
 LLDP Delay Interval         [2] : 2
 LLDP Reinit Interval        [2] : 2
 LLDP Notification Interval  [5] : 5
 LLDP Fast Start Count       [5] : 5

LLDP Port Configuration

 Port | AdminStatus NotificationEnabled  Med Topology Trap Enabled
 ---- + ----------- -------------------  -------------------------
 A1   | Tx_Rx       False                False
 A2   | Tx_Rx       False                False
 A3   | Tx_Rx       False                False
 A4   | Tx_Rx       False                False
 A5   | Tx_Rx       False                False
 A6   | Tx_Rx       False                False
 A7   | Tx_Rx       False                False
 A8   | Tx_Rx       False                False
```

The values displayed in the LLDP column correspond to the `lldp refresh-interval` command

Viewing port configuration details (CLI)

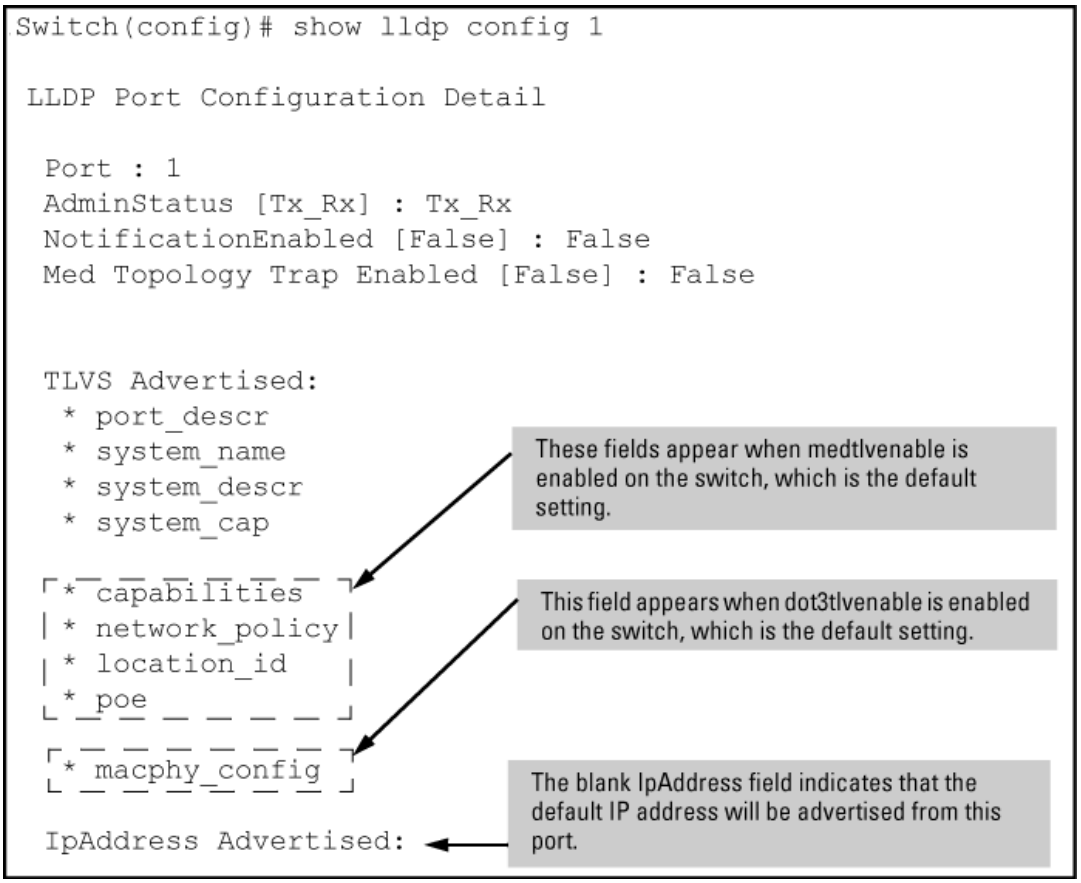
Syntax

`show lldp config <port-list>`

Displays the LLDP port-specific configuration for all ports in <*port-list*>, including which optional TLVs and any non-default IP address that are included in the port's outbound advertisements.

For information on the notification setting, see Configuring SNMP notification support on page 204. For information on the other configurable settings displayed by this command, see Configuring per-port transmit and receive modes (CLI) on page 204.

Figure 27 *Per-port configuration display*



Configuring Global LLDP Packet Controls

The commands in this section configure the aspects of LLDP operation that apply the same to all ports in the switch.

LLDP operation on the switch

Enabling LLDP operation (the default) causes the switch to:

- Use active, LLDP-enabled ports to transmit LLDP packets describing itself to neighbor devices.
- Add entries to its neighbors table based on data read from incoming LLDP advertisements.

Enabling or disabling LLDP operation on the switch (CLI)

For more information, see LLDP operation on the switch on page 201.

Syntax

`no lldp run`

Enables or disables LLDP operation on the switch.

The `no` form of the command, regardless of individual LLDP port configurations, prevents the switch from transmitting outbound LLDP advertisements and causes the switch to drop all LLDP advertisements received from other devices.

The switch preserves the current LLDP configuration when LLDP is disabled. After LLDP is disabled, the information in the LLDP neighbors database remains until it times-out.

(Default: Enabled)

Disabling LLDP

```
switch(config)# no lldp run
```

Changing the packet transmission interval (CLI)

This interval controls how often active ports retransmit advertisements to their neighbors.

Syntax

`lldp refresh-interval <5-32768>`

Changes the interval between consecutive transmissions of LLDP advertisements on any given port.

(Default: 30 seconds)

The `refresh-interval` must be greater than or equal to (4 x `delay-interval`). (The default `delay-interval` is 2). For example, with the default `delay-interval`, the lowest `refresh-interval` you can use is 8 seconds (4 x 2=8). Thus, if you want a `refresh-interval` of 5 seconds, you must first change the delay interval to 1 (that is, 4 x 1 5). If you want to change the `delay-interval`, use the `setmib` command.

Time-to-Live for transmitted advertisements

The Time-to-Live value (in seconds) for all LLDP advertisements transmitted from a switch is controlled by the switch that generates the advertisement and determines how long an LLDP neighbor retains the advertised data before discarding it. The Time-to-Live value is the result of multiplying the `refresh-interval` by the `holdtime-multiplier`.

Changing the time-to-live for transmitted advertisements (CLI)

For more information, see Time-to-Live for transmitted advertisements.

Syntax

`lldp holdtime-multiplier <2-10>`

Changes the multiplier an LLDP switch uses to calculate the Time-to-Live for the LLDP advertisements it generates and transmits to LLDP neighbors. When the Time-to-Live for a given advertisement expires, the advertised data is deleted from the neighbor switch's MIB.

(Default: 4; Range 2-10)

Example

If the refresh-interval on the switch is 15 seconds and the `holdtime-multiplier` is at the default, the Time-to-Live for advertisements transmitted from the switch is 60 seconds (4 x 15).

To reduce the Time-to-Live, you could lower the `holdtime-interval` to 2, which would result in a Time-to-Live of 30 seconds.

```
switch(config)# lldp holdtime-multiplier 2
```

Delay interval between advertisements generated by value or status changes to the LLDP MIB

The switch uses a **delay-interval** setting to delay transmitting successive advertisements resulting from these LLDP MIB changes. If a switch is subject to frequent changes to its LLDP MIB, lengthening this interval can reduce the frequency of successive advertisements. You can change the delay-interval by using either an SNMP network management application or the CLI `setmib` command.

Changing the delay interval between advertisements generated by value or status changes to the LLDP MIB (CLI)

Syntax

```
setmib lldpTxDelay.0 -i <1-8192>
```

Uses `setmib` to change the minimum time (delay-interval) any LLDP port will delay advertising successive LLDP advertisements because of a change in LLDP MIB content.

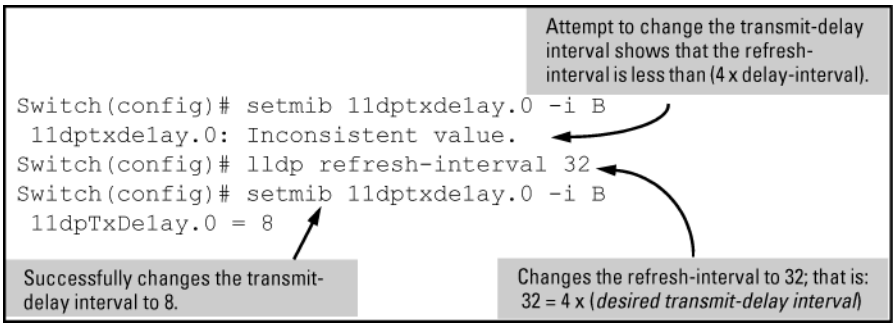
(Default: 2; Range 1-8192)

The LLDP refresh-interval (transmit interval) must be greater than or equal to (4 x delay-interval). The switch does not allow increasing the delay interval to a value that conflicts with this relationship. That is, the switch displays `Inconsistent value` if (4 x delay-interval) exceeds the current transmit interval, and the command fails. Depending on the current refresh-interval setting, it may be necessary to increase the refresh-interval before using this command to increase the delay-interval.

Example

To change the delay-interval from 2 seconds to 8 seconds when the refresh-interval is at the default 30 seconds, you must first set the refresh-interval to a minimum of 32 seconds (32 = 4 x 8) as shown in the following image.

Figure 28 *Changing the transmit-delay interval*



Reinitialization delay interval

In the default configuration, a port receiving a `disable` command followed immediately by a `txonly`, `rxonly`, or `tx_rx` command delays reinitializing for two seconds, during which LLDP operation remains disabled. If an active port is subjected to frequent toggling between the LLDP disabled and enabled states, LLDP advertisements are more frequently transmitted to the neighbor device. Also, the neighbor table in the adjacent device changes more frequently as it deletes, then replaces LLDP data for the affected port which, in turn, generates SNMP traps (if trap receivers and SNMP notification are configured). All of this can unnecessarily increase network traffic. Extending the reinitialization-delay interval delays the ability of the port to reinitialize and generate LLDP traffic following an LLDP disable/enable cycle.

Changing the reinitialization delay interval (CLI)

Syntax

```
setmib lldpReinitDelay.0 -i <1-10>
```

Uses `setmib` to change the minimum time (reinitialization delay interval) an LLDP port will wait before reinitializing after receiving an LLDP disable command followed closely by a txonly or tx_rx command. The delay interval commences with execution of the `lldp admin-status  port-list disable` command.

(Default: 2 seconds; Range 1-10 seconds)

Example

The following command changes the reinitialization delay interval to five seconds:

```
switch(config)# setmib lldpreinitdelay.0 -i 5
```

Configuring SNMP notification support

You can enable SNMP trap notification of LLDP data changes detected on advertisements received from neighbor devices, and control the interval between successive notifications of data changes on the same neighbor.

Enabling LLDP data change notification for SNMP trap receivers (CLI)

Syntax

`no lldp enable-notification <port-list>`

Enables or disables each port in *port-list* for sending notification to configured SNMP trap receivers if an LLDP data change is detected in an advertisement received on the port from an LLDP neighbor.

(Default: Disabled)

For information on configuring trap receivers in the switch, see SNMP notifications.

Example

This command enables SNMP notification on ports 1 - 5:

```
switch(config)# lldp enable-notification 1-5
```

Changing the minimum interval for successive data change notifications for the same neighbor

If LLDP trap notification is enabled on a port, a rapid succession of changes in LLDP information received in advertisements from one or more neighbors can generate a high number of traps. To reduce this effect, you can globally change the interval between successive notifications of neighbor data change.

Syntax

`setmib lldpnotificationinterval.0 -i <1-3600>`

Globally changes the interval between successive traps generated by the switch. If multiple traps are generated in the specified interval, only the first trap is sent. The remaining traps are suppressed. (A network management application can periodically check the switch MIB to detect any missed change notification traps. See IEEE P802.1AB or later for more information.)

(Default: 5 seconds)

Example

The following command limits change notification traps from a particular switch to one per minute.

```
switch(config)# setmib lldpnotificationinterval.0 -i 60 lldpNotificationInterval.0=60
```

Configuring per-port transmit and receive modes (CLI)

Syntax

`lldp admin-status <port-list> {<txonly | rxonly | tx_rx | disable>}`

With LLDP enabled on the switch in the default configuration, each port is configured to transmit and receive LLDP packets. These options enable you to control which ports participate in LLDP traffic and whether the participating ports allow LLDP traffic in only one direction or in both directions.

`txonly`	Configures the specified ports to transmit LLDP packets, but block inbound LLDP packets from neighbor devices.
`rxonly`	Configures the specified ports to receive LLDP packets from neighbors, but block outbound packets to neighbors.
`tx_rx`	Configures the specified ports to both transmit and receive LLDP packets. (This is the default setting.)
`disable`	Disables LLDP packet transmit and receive on the specified ports.

Basic LLDP per-port advertisement content

In the default LLDP configuration, outbound advertisements from each port on the switch include both mandatory and optional data.

Mandatory Data

An active LLDP port on the switch always includes the mandatory data in its outbound advertisements. LLDP collects the mandatory data, and, except for the Remote Management Address, you cannot use LLDP commands to configure the actual data.

- Chassis Type (TLV subelement)
- Chassis ID (TLV)
- Port Type (TLV subelement)
- Port ID (TLV)
- Remote Management Address (TLV; actual IP address is a subelement that can be a default address or a configured address)

Configuring a remote management address for outbound LLDP advertisements (CLI)

This is an optional command you can use to include a specific IP address in the outbound LLDP advertisements for specific ports. For more information, see Basic LLDP per-port advertisement content.

Syntax

`no lldp config <port-list> ipAddrEnable <ip-address>`

Replaces the default IP address for the port with an IP address you specify. This can be any IP address configured in a static VLAN on the switch, even if the port does not belong to the VLAN configured with the selected IP address.

The `no` form of the command deletes the specified IP address.

If there are no IP addresses configured as management addresses, the IP address selection method returns to the default operation.

Default: The port advertises the IP address of the lowest-numbered VLAN (VID) to which it belongs. If there is no IP address configured on the VLANs to which the port belongs, and if the port is not configured to advertise an IP address from any other (static) VLAN on the switch, the port advertises an address of 127.0.0.1.)

This command does not accept either IP addresses acquired through DHCP or Bootp, or IP addresses that are not configured in a static VLAN on the switch.

Example

If port 3 belongs to a subnetted VLAN that includes an IP address of 10.10.10.100 and you want port 3 to use this secondary address in LLDP advertisements, you need to execute the following command:

```
switch(config)# lldp config 3 ipAddrEnable 10.10.10.100
```

Syntax

`no lldp config <port-list> basicTlvEnable <TLV-Type>`

`port_descr`	For outbound LLDP advertisements, this TLV includes an alphanumeric string describing the port. (Default: Enabled)
`system_name`	For outbound LLDP advertisements, this TLV includes an alphanumeric string showing the assigned name of the system.(Default: Enabled)
`system_descr`	For outbound LLDP advertisements, this TLV includes an alphanumeric string describing the full name and version identification for the hardware type, software version, and networking application of the system.(Default: Enabled)
`system_cap`	For outbound advertisements, this TLV includes a bitmask of supported system capabilities (device functions). Also includes information on whether the capabilities are enabled.(Default: Enabled)

Example

If you want to exclude the system name TLV from the outbound LLDP advertisements for all ports on a switch, use this command:

```
switch(config)# no lldp config 1-24 basicTlvEnable system_name
```

If you later decide to reinstate the system name TLV on ports 1-5, use this command:

```
switch(config)# lldp config 1-5 basicTlvEnable system_name
```

Optional Data

You can configure an individual port or group of ports to exclude one or more of the following data types from outbound LLDP advertisements.

- Port description (TLV)
- System name (TLV)
- System description (TLV)
- System capabilities (TLV)
  - System capabilities Supported (TLV subelement)
  - System capabilities Enabled (TLV subelement)
- Port speed and duplex (TLV subelement)

Optional data types, when enabled, are populated with data internal to the switch; that is, you cannot use LLDP commands to configure their actual content.

Support for port speed and duplex advertisements

This feature is optional for LLDP operation, but is **required** for LLDP-MED operation.

Port speed and duplex advertisements are supported on the switches to inform an LLDP endpoint and the switch port of each other's port speed and duplex configuration and capabilities. Configuration mismatches between a switch port and an LLDP endpoint can result in excessive collisions and voice quality degradation. LLDP enables discovery of such mismatches by supporting SNMP access to the switch MIB for comparing the current switch port and endpoint settings. (Changing a current device configuration to eliminate a mismatch requires intervention by the system operator.)

An SNMP network management application can be used to compare the port speed and duplex data configured in the switch and advertised by the LLDP endpoint. You can also use the CLI to display this information. For more information on using the CLI to display port speed and duplex information, see Viewing the current port speed and duplex configuration on a switch port on page 219.

Configuring support for port speed and duplex advertisements (CLI)

For more information, see Support for port speed and duplex advertisements on page 207.

Syntax

```
no lldp config <port-list> dot3TlvEnable macphy_config
```

Parameters

`macphy_config`

MAC Physical Config TLV

`poeplus_config`

Power Via MDI Config TLV

`eee_config`

EEE Config TLV

For outbound advertisements, this TLV includes the (local) switch port's current speed and duplex settings, the range of speed and duplex settings the port supports, and the method required for reconfiguring the speed and duplex settings on the device (autonegotiation during link initialization, or manual configuration).

Using SNMP to compare local and remote information can help in locating configuration mismatches.

(Default: Enabled)

For LLDP operation, this TLV is optional. For LLDP-MED operation, this TLV is mandatory.

Port VLAN ID TLV support on LLDP

The `port-vlan-id` option enables advertisement of the port VLAN ID TLV as part of the regularly advertised TLVs. This allows discovery of a mismatch in the configured native VLAN ID between LLDP peers. The information is visible using `show` commands and is logged to the Syslog server.

Configuring the VLAN ID TLV

This TLV advertisement is enabled by default. To enable or disable the TLV, use this command. For more information, see Port VLAN ID TLV support on LLDP on page 207.

Syntax

```
no lldp config <port-list> dot1TlvEnable port-vlan-id
```

Enables the VLAN ID TLV advertisement.

The `no` form of the command disables the TLV advertisement.

Default: Enabled.

Parameters

`port-vlan-id`

Specifies the 802.1 TLV list to advertise.

`vlan-name`

Specifies that the VLAN name TLV is to be advertised.

Enabling the VLAN ID TLV

```
switch(config)# lldp config a1 dot1TlvEnable port-vlan-id
```

Viewing the TLVs advertised

The show commands display the configuration of the TLVs. The command `show lldp config` lists the TLVs advertised for each port, as shown in the following examples.

Displaying the TLVs for a port

```
switch(config)# show lldp config a1

 LLDP Port Configuration Detail

  Port   : A1
  AdminStatus [Tx_Rx] : Tx_Rx
  NotificationEnabled [False] : False
  Med Topology Trap Enabled [False] : False

  TLVS Advertised:
  * port_descr
  * system_name
  * system_descr
  * system_cap

  * capabilities
  * network_policy
  * location_id
  * poe

  * macphy_config

  * port_vlan_id 1

 IpAddress Advertised:
  :
  :
```

Local device LLDP information

```
switch(config)# show lldp config info local-device a1

 LLDP Port Configuration Information Detail

  Port     : A1
  PortType : local
  PortId   : 1
```

```
  PortDesc : A1

  Port VLAN ID : 1 2
```

Remote device LLDP information

```
switch(config)# show lldp info remote-device a1

LLDP Remote Device Information Detail

  Local Port   : A1
  ChassisType  : mac-address
  ChassisId    : 00 16 35 22 ca 40
  PortType     : local
  PortID       : 1
  SysName      : esp-dback
  System Descr : J8693A Switch, revision XX.13.03, ROM...
  PortDescr    : A1

  System Capabilities Supported : bridge, router
  System Capabilities Enabled   : bridge, router

  Port VLAN ID : 200

  Remote Management Address
     Type    : ipv4
     Address : 192.168.1.1
```

[1]The VLAN ID TLV is being advertised.

[2]The information that LLDP used in its advertisement.

SNMP support

The LLDP-EXT-DOT1-MIB has the corresponding MIB variables for the Port VLAN ID TLV. The TLV advertisement can be enabled or disabled using the MIB object `lldpXdot1ConfigPortVlanTxEnable` in the `lldpXdot1ConfigPortVlanTable`.

The port VLAN ID TLV local information can be obtained from the MIB object `lldpXdot1LocPortVlanId` in the local information table `lldpXdot1LocTable`.

The port VLAN ID TLV information about all the connected peer devices can be obtained from the MIB object `lldpXdot1RemPortVlanId` in the remote information table `lldpXdot1RemTable`.

LLDP-MED (media-endpoint-discovery)

LLDP-MED (ANSI/TIA-1057/D6) extends the LLDP (IEEE 802.1AB) industry standard to support advanced features on the network edge for Voice Over IP (VoIP) endpoint devices with specialized capabilities and LLDP-MED standards-based functionality. LLDP-MED in the switches uses the standard LLDP commands described earlier in this section, with some extensions, and also introduces new commands unique to LLDP-MED operation. The `show` commands described elsewhere in this section are applicable to both LLDP and LLDP-MED operation. LLDP-MED benefits include:

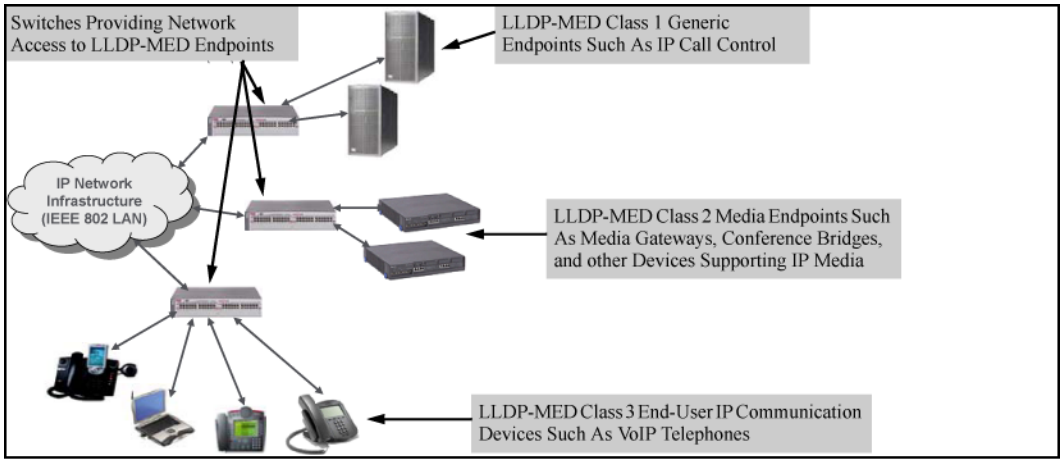
- Plug-and-play provisioning for MED-capable, VoIP endpoint devices
- Simplified, vendor-independent management enabling different IP telephony systems to interoperate on one network
- Automatic deployment of convergence network policies (voice VLANs, Layer 2/CoS priority, and Layer 3/QoS priority)

- Configurable endpoint location data to support the Emergency Call Service (ECS) (such as Enhanced 911 service, 999, 112)
- Detailed VoIP endpoint data inventory readable via SNMP from the switch
- Power over Ethernet (PoE) status and troubleshooting support via SNMP
- support for IP telephony network troubleshooting of call quality issues via SNMP

This section describes how to configure and use LLDP-MED features in the switches to support VoIP network edge devices (media endpoint devices) such as:

- IP phones
- Voice/media gateways
- Media servers
- IP communications controllers
- Other VoIP devices or servers

Figure 29 *Example of LLDP-MED network elements*



LLDP-MED endpoint support

LLDP-MED interoperates with directly connected IP telephony (endpoint) clients having these features and services:

- Autonegotiate speed and duplex configuration with the switch
- Use the following network policy elements configured on the client port
  - Voice VLAN ID
  - 802.1p (Layer 2) QoS
  - Diffserv codepoint (DSCP) (Layer 3) QoS
- Discover and advertise device location data learned from the switch
- Support ECS (such as E911, 999, and 112)
- Advertise device information for the device data inventory collected by the switch, including:

■ Hardware revision ■ Firmware revision	■ Software revision ■ Serial number	■ Manufacturer name ■ Model name	■ Asset ID

- Provide information on network connectivity capabilities (For example, a multi-port VoIP phone with Layer 2 switch capability)
- Support the fast-start capability

LLDP-MED is intended for use with VoIP endpoints and is not designed to support links between network infrastructure devices, such as switch-to-switch or switch-to-router links.

LLDP-MED endpoint device classes

LLDP-MED endpoint devices are, by definition, located at the network edge and communicate using the LLDP-MED framework. Any LLDP-MED endpoint device belongs to one of the following three classes:

- Class 1 (generic endpoint devices): These devices offer the basic LLDP discovery services, network policy advertisement (VLAN ID, Layer 2/802.1p priority, and Layer 3/DSCP priority), and PoE management. This class includes such devices as IP call controllers and communication-related servers.
- Class 2 (media endpoint devices): These devices offer all Class 1 features plus media-streaming capability, and include such devices as voice/media gateways, conference bridges, and media servers.
- Class 3 (communication devices): These devices are typically IP phones or end-user devices that otherwise support IP media and offer all Class 1 and Class 2 features, plus location identification and emergency 911 capability, Layer 2 switch support, and device information management.

LLDP-MED operational support

The switches offer two configurable TLVs supporting MED-specific capabilities:

- medTlvEnable (for per-port enabling or disabling of LLDP-MED operation)
- medPortLocation (for configuring per-port location or emergency call data)

LLDP-MED operation also requires the port speed and duplex TLV (dot3TlvEnable), which is enabled in the default configuration.

Topology change notifications provide one method for monitoring system activity. However, because SNMP normally employs UDP, which does not guarantee datagram delivery, topology change notification should not be relied upon as the sole method for monitoring critical endpoint device connectivity.

LLDP-MED fast start control

Syntax

```
lldp fast-start-count <1-10>
```

An LLDP-MED device connecting to a switch port may use the data contained in the MED TLVs from the switch to configure itself. However, the `lldp refresh-interval` setting (default: 30 seconds) for transmitting advertisements can cause an unacceptable delay in MED device configuration.

To support rapid LLDP-MED device configuration, the `lldp fast-start-count` command temporarily overrides the `refresh-interval` setting for the `fast-start-count` advertisement interval. This results in the port initially advertising LLDP-MED at a faster rate for a limited time. Thus, when the switch detects a new LLDP-MED device on a port, it transmits one LLDP-MED advertisement per second out the port for the duration of the `fast-start-count` interval. In most cases, the default setting should provide an adequate `fast-start-count` interval.

(Default: 5 seconds)

This global command applies only to ports on which a new LLDP-MED device is detected. It does not override the `refresh-interval` setting on ports where non-MED devices are detected.

Advertising device capability, network policy, PoE status and location data

The medTlvEnable option on the switch is enabled in the default configuration and supports the following LLDP-MED TLVs:

- LLDP-MED capabilities: This TLV enables the switch to determine:
  - Whether a connected endpoint device supports LLDP-MED
  - Which specific LLDP-MED TLVs the endpoint supports
  - The device class (1, 2, or 3) for the connected endpoint

  This TLV also enables an LLDP-MED endpoint to discover what LLDP-MED TLVs the switch port currently supports.
- Network policy operating on the port to which the endpoint is connected (VLAN, Layer 2 QoS, Layer 3 QoS)
- PoE (MED Power-over-Ethernet)
- Physical location data (see Configuring location data for LLDP-MED devices on page 215)

LLDP-MED operation requires the macphy_config TLV subelement (enabled by default) that is optional for IEEE 802.1AB LLDP operation. For more information, see the `dot3TlvEnablemacphy_config` command (Configuring support for port speed and duplex advertisements (CLI) on page 207).

Network policy advertisements

Network policy advertisements are intended for real-time voice and video applications, and include these TLV subelements:

- Layer 2 (802.1p) QoS
- Layer 3 DSCP (diffserv code point) QoS
- Voice VLAN ID (VID)

VLAN operating rules

These rules affect advertisements of VLANs in network policy TLVs:

- The VLAN ID TLV subelement applies only to a VLAN configured for voice operation (`vlan <vid> voice`).
- If there are multiple voice VLANs configured on a port, LLDP-MED advertises the voice VLAN having the lowest VID.

- The voice VLAN port membership configured on the switch can be tagged or untagged. However, if the LLDP-MED endpoint expects a tagged membership when the switch port is configured for untagged, or the reverse, a configuration mismatch results. (Typically, the endpoint expects the switch port to have a tagged voice VLAN membership.)
- If a given port does not belong to a voice VLAN, the switch does not advertise the VLAN ID TLV through this port.

Policy elements

These policy elements may be statically configured on the switch or dynamically imposed during an authenticated session on the switch using a RADIUS server and 802.1X or MAC authentication. (Web authentication does not apply to VoIP telephones and other telecommunications devices that are not capable of accessing the switch through a Web browser.) The QoS and voice VLAN policy elements can be statically configured with the following CLI commands:

```
vlan <vid> voice

vlan <vid> {<tagged | untagged> <port-list>}

int <port-list> qos priority <0-7>

vlan <vid> qos dscp <codepoint>
```

A codepoint must have an 802.1p priority before you can configure it for use in prioritizing packets by VLAN-ID. If a codepoint you want to use shows `No Override` in the `Priority` column of the DSCP policy table (display with `show qos-dscp map`, then use `qos-dscp map <codepoint> priority <0-7>` to configure a priority before proceeding. For more information on this topic, see the "Quality of Service (QoS): Managing Bandwidth More Effectively" in the advanced traffic management guide for your switch.

Enabling or Disabling medTlvEnable

In the default LLDP-MED configuration, the TLVs controlled by medTlvEnable are enabled. For more information, see Advertising device capability, network policy, PoE status and location data.

Syntax

```
no lldp config <port-list> medTlvEnable <medTlv>
```

Enables or disables advertisement of the following TLVs on the specified ports:

- Device capability TLV
- Configured network policy TLV
- Configured location data TLV (see Configuring location data for LLDP-MED devices.)
- Current PoE status TLV

(Default: All of the above TLVs are enabled.)

Helps to locate configuration mismatches by allowing use of an SNMP application to compare the LLDP-MED configuration on a port with the LLDP-MED TLVs advertised by a neighbor connected to that port.

`capabilities`	This TLV enables the switch to determine: ■ Which LLDP-MED TLVs a connected endpoint can discover ■ The device class (1, 2, or 3) for the connected endpoint This TLV also enables an LLDP-MED endpoint to discover what LLDP-MED TLVs the switch port currently supports.(Default: enabled)

	This TLV cannot be disabled unless the `network_policy`, `poe`, and `location_id` TLVs are already disabled.
`network_policy`	This TLV enables the switch port to advertise its configured network policies (voice VLAN, Layer 2 QoS, Layer 3 QoS), and allows LLDP-MED endpoint devices to autoconfigure the voice network policy advertised by the switch. This also enables the use of SNMP applications to troubleshoot statically configured endpoint network policy mismatches.(Default: Enabled) Network policy is advertised only for ports that are configured as members of the voice VLAN. If the port belongs to more than one voice VLAN, the voice VLAN with the lowest-numbered VID is selected as the VLAN for voice traffic. Also, this TLV cannot be enabled unless the `capability` TLV is already enabled. For more information, see Network policy advertisements.
`location_id`	This TLV enables the switch port to advertise its configured location data (if any). For more information on configuring location data, see Configuring location data for LLDP-MED devices.(Default: Enabled) When disabled, this TLV cannot be enabled unless the capability TLV is already enabled.
`poe`	This TLV enables the switch port to advertise its current PoE state and to read the PoE requirements advertised by the LLDP-MED endpoint device connected to the port. (Default: Enabled) When disabled, this TLV cannot be enabled unless the `capability` TLV is already enabled. For more on this topic, see PoE advertisements.

PoE advertisements

These advertisements inform an LLDP-MED endpoint of the power (PoE) configuration on switch ports. Similar advertisements from an LLDP-MED endpoint inform the switch of the endpoint's power needs and provide information that can be used to identify power priority mismatches.

PoE TLVs include the following power data:

- **Power type**: indicates whether the device is a power-sourcing entity (PSE) or a PD. Ports on the J8702A PoE zl module are PSE devices. A MED-capable VoIP telephone is a PD.
- **Power source**: indicates the source of power in use by the device. Power sources for PDs include PSE, local (internal), and PSE/local. The switches advertise Unknown.
- **Power priority**: indicates the power priority configured on the switch (PSE) port or the power priority configured on the MED-capable endpoint.
- **Power value**: indicates the total power in watts that a switch port (PSE) can deliver at a particular time, or the total power in watts that the MED endpoint (PD) requires to operate.

Viewing PoE advertisements

To display the current power data for an LLDP-MED device connected to a port, use the following command:

```
show lldp info remote-device <port-list>
```

For more information on this command, see page A-60.

To display the current PoE configuration on the switch, use the following commands:

```
show power brief <port-list>
show power <port-list>
```

Location data for LLDP-MED devices

You can configure a switch port to advertise location data for the switch itself, the physical wall-jack location of the endpoint (recommended), or the location of a DHCP server supporting the switch, endpoint, or both. You also have the option of configuring these different address types:

- **Civic address**: physical address data such as city, street number, and building information
- **ELIN (Emergency Location Identification Number)**: an emergency number typically assigned to MLTS (Multiline Telephone System) Operators in North America
- **Coordinate-based location**: attitude, longitude, and altitude information (Requires configuration via an SNMP application.)

Configuring location data for LLDP-MED devices

Syntax

`no lldp config <port-list> medPortLocation <Address-Type>`

Configures location of emergency call data the switch advertises per port in the `location_id` TLV. This TLV is for use by LLDP-MED endpoints employing location-based applications.

The switch allows one medPortLocation entry per port (without regard to type). Configuring a new medPortLocation entry of any type on a port replaces any previously configured entry on that port.

`civic-addr <COUNTRY-STR> <WHAT> <CA-TYPE> <CA-VALUE> … [< CA-TYPE > < CA-VALUE >] … [< CA-TYPE > < CA-VALUE >]`

Enables configuration of a physical address on a switch port and allows up to 75 characters of address information.

`COUNTRY-STR`	A two-character country code, as defined by ISO 3166. Some examples include `FR` (France), `DE` (Germany), and `IN` (India). This field is required in a `civic-addr` command. (For a complete list of country codes, visit http://www.iso.org.)
`WHAT`	A single-digit number specifying the type of device to which the location data applies: **0**: Location of DHCP server **1**: Location of switch **2**: Location of LLDP-MED endpoint (recommended application) This field is required in a `civic-addr` command.
`Type/Value Pairs (CA-TYPE and CA-VALUE)`	A series of data pairs, each composed of a location data "type" specifier and the corresponding location data for that type. That is, the first value in a pair is expected to be the civic address "type" number (`CA-TYPE`), and the second value in a pair is expected to be the corresponding civic address data (`CA-VALUE`). For example, if the `CA-TYPE` for "city name" is "3," the type/value pair to define the city of Paris is "3 Paris." Multiple type/value pairs can be entered in any order, although Hewlett Packard Enterprise recommends that multiple pairs be entered in ascending order of the `CA-TYPE`. When an emergency call is placed from a properly configured class 3 endpoint device to an appropriate PSAP, the country code, device type, and type/value pairs configured on the switch port are included in the transmission. The "type" specifiers are used by the PSAP to identify and organize the location data components in an understandable format for response personnel to interpret.

	A `civic-addr` command requires a minimum of one type/value pair, but typically includes multiple type/value pairs as needed to configure a complete set of data describing a given location. `CA-TYPE`: This is the first entry in a type/value pair and is a number defining the type of data contained in the second entry in the type/value pair (`CA-VALUE`). Some examples of `CA-TYPE` specifiers include: ■ 3=city ■ 6=street (name) ■ 25=building name (Range: 0 - 255) For a sample listing of `CA-TYPE` specifiers, see Table 24: Some location codes used in CA-TYPE fields. `CA-VALUE`: This is the second entry in a type/value pair and is an alphanumeric string containing the location information corresponding to the immediately preceding `CA-TYPE` entry. Strings are delimited by either blank spaces, single quotes (' ... '), or double quotes ("... "). Each string should represent a specific data type in a set of unique type/value pairs comprising the description of a location, and each string must be preceded by a `CA-TYPE` number identifying the type of data in the string. A switch port allows one instance of any given `CA-TYPE`. For example, if a type/value pair of 6 Atlantic (to specify "Atlantic" as a street name) is configured on port A5 and later another type/value pair of 6 Pacific is configured on the same port, Pacific replaces Atlantic in the civic address location configured for port A5.
`elin-addr <emergency-number>`	This feature is intended for use in ECS applications to support class 3 LLDP-MED VoIP telephones connected to a switch in an MLTS infrastructure. An ELIN is a valid NANP format telephone number assigned to MLTS operators in North America by the appropriate authority. The ELIN is used to route emergency (E911) calls to a PSAP. (Range: 1-15 numeric characters)

Configuring coordinate-based locations

Latitude, longitude, and altitude data can be configured per switch port using an SNMP management application. For more information, see the documentation provided with the application. A further source of information on this topic is RFC 3825-Dynamic host configuration protocol option for coordinate-based location configuration information.

Endpoint use of data from a medPortLocation TLV sent by the switch is device-dependent. See the documentation provided with the endpoint device.

Table 24: *Some location codes used in CA-TYPE fields*

Location element	Code[1]	Location element	Code
national subdivision	1	street number	19
regional subdivision	2	additional location data	22
city or township	3	unit or apartment	26
city subdivision	4	floor	27

Location element	Code[1]	Location element	Code
street	6	room number	28
street suffix	18		

Example

Suppose a system operator wants to configure the following information as the civic address for a telephone connected to her company's network through port A2 of a switch at the following location:

CA-type	CA-type	CA-VALUE
national subdivision	1	CA
city	3	Widgitville
street	6	Main
street number	19	1433
unit	26	Suite 4-N
floor	27	4
room number	28	N4-3

The following example shows the commands for configuring and displaying the above data.

A civic address configuration

```
switch(config)# lldp config 2 medportlocation civic-addr US 2 1 CA 3
Widgitville 6 Main 19 1433 26 Suite_4—N 27 4 28 N4—3

switch(config)# show lldp config 2
 LLDP Port Configuration Detail
  Port : A2
  AdminStatus [Tx_Rx] : Tx_Rx
  NotificationEnabled [False] : False
  Med Topology Trap Enabled [False] : False
  Country Name          : US
  What                  : 2
  Ca-Type               : 1
  Ca-Length             : 2
  Ca-Value              : CA
  Ca-Type               : 3
  Ca-Length             : 11
  Ca-Value              : Widgitville
  Ca-Type               : 6
  Ca-Length             : 4
  Ca-Value              : Main
  Ca-Type               : 19
  Ca-Length             : 4
  Ca-Value              : 1433
  Ca-Type               : 26
  Ca-Length             : 9
  Ca-Value              : Suite_4-N
  Ca-Type               : 27
  Ca-Length             : 1
```

```
  Ca-Value              : 4
  Ca-Type               : 28
  Ca-Length             : 4
  Ca-Value              : N4-3
```

[1]The code assignments in this table are examples from a work-in-progress (the internet draft titled "Dynamic Host Configuration Protocol (DHCPv4 and DHCPv6) Option for Civic Addresses Configuration Information draft-ietf-geoprivdhcp- civil-06" dated May 30, 2005.) For the actual codes to use, contact the PSAP or other authority responsible for specifying the civic addressing data standard for your network.

Viewing switch information available for outbound advertisements

Syntax

`show lldp info local-device [port-list]`

Without the `[port-list]` option, displays the global switch information and the per-port information currently available for populating outbound LLDP advertisements.

With the `[port-list]` option, displays only the following port-specific information that is currently available for outbound LLDP advertisements on the specified ports:

- `PortType`
- `PortId`
- `PortDesc`

This command displays the information available on the switch. Use the `lldp config <port-list>` command to change the selection of information that is included in actual outbound advertisements. In the default LLDP configuration, all information displayed by this command is transmitted in outbound advertisements.

In the default configuration, the switch information currently available for outbound LLDP advertisements appears similar to the display in the following example.

Displaying the global and per-port information available for outbound advertisements

```
switch(config)# show lldp info local-device

 LLDP Local Device Information

  Chassis Type : mac-address
  Chassis Id : 00 23 47 4b 68 DD
  System Name : Switch1
  System Description : J9091A Switch, revision XX.15.06...
  System Capabilities Supported:bridge
  System Capabilities Enabled:bridge

  Management Address
     Type:ipv4
     Address:

  LLDP Port Information

   Port   | PortType  PortId  PortDesc
   ------ + --------- ------- ---------
   1      | local     1       1
   2      | local     2       2
   3      | local     3       3
```

```
   4      | local      4        4
   5      | local      5        5
1
```

The default per-port information content for ports 1 and 2

```
switch(config)# show lldp info local 1-2

  LLDP Local Port Information Detail

   Port     : 1
   PortType : local
   PortId   : 1
   PortDesc : 1

---------------------------------------
   Port     : 2
   PortType : local
   PortId   : 2
   PortDesc : 2
```

[1]The Management Address field displays only the LLDP-configurable IP addresses on the switch. (Only manually-configured IP addresses are LLDP-configurable.) If the switch has only an IP address from a DHCP or Bootp server, then the Management Address field is empty (because there are no LLDP-configurable IP addresses available.

Displaying the current port speed and duplex configuration on a switch port

You can compare port speed and duplex information for a switch port and a connected LLDP-MED endpoint for configuration mismatches by using an SNMP application. You can also use the switch CLI to display this information, if necessary. The `show interfaces brief <port-list>` and `show lldp info remote-device [port-list]` commands provide methods for displaying speed and duplex information for switch ports. For information on displaying the currently configured port speed and duplex on an LLDP-MED endpoint, see Viewing the current port speed and duplex configuration on a switch port on page 219.

Viewing the current port speed and duplex configuration on a switch port

Syntax

`show interfaces brief <port-list>`

Includes port speed and duplex configuration in the `Mode` column of the resulting display.

Viewing advertisements currently in the neighbors MIB

Syntax

`show lldp info remote-device [port-list]`

Without the `[port-list]` option, provides a global list of the individual devices it has detected by reading LLDP advertisements. Discovered devices are listed by the inbound port on which they were discovered.

Multiple devices listed for a single port indicates that such devices are connected to the switch through a hub.

Discovering the same device on multiple ports indicates that the remote device may be connected to the switch in one of the following ways:

- Through different VLANS using separate links. (This applies to switches that use the same MAC address for all configured VLANs.)
- Through different links in the same trunk.

- Through different links using the same VLAN. (In this case, spanning-tree should be invoked to prevent a network topology loop. Note that LLDP packets travel on links that spanning-tree blocks for other traffic types.)

With the `[port-list]` option, provides a listing of the LLDP data that the switch has detected in advertisements received on the specified ports.

For descriptions of the various types of information displayed by these commands, see Table 23: Data available for basic LLDP advertisements.

A global listing of discovered devices

```
switch(config)# show lldp info remote

 LLDP Remote Devices Information

  LocalPort | ChassisId                 PortId PortDescr SysName
  --------- + ------------------------- ------ --------- -------------
  1         | 00 11 85 35 3b 80         6      6         Switch
  2         | 00 11 85 cf 66 60         8      8         Switch
```

An LLLDP-MED listing of an advertisement received from an LLDP-MED (VoIP telephone) source

```
switch(config)# show lldp info remote-device 1

 LLDP Remote Device Information Detail

  Local Port   : A2
  ChassisType  : network-address
  ChassisId    : 0f ff 7a 5c
  PortType     : mac-address
  PortId       : 08 00 0f 14 de f2
  SysName      : Switch
  System Descr : Switch, revision xx.15.06.0000x
  PortDescr    : LAN Port

  System Capabilities Supported : bridge, telephone
  System Capabilities Enabled   : bridge, telephone

  Remote Management Address

  MED Information Detail [1]
    EndpointClass           :Class3
    Media Policy Vlan id    :10
    Media Policy Priority   :7
    Media Policy Dscp       :44
    Media Policy Tagged     :False
    Poe Device Type         :PD
    Power Requested         :47
    Power Source            :Unknown
    Power Priority          :High
```

[1]Indicates the policy configured on the telephone. A configuration mismatch occurs if the supporting port is configured differently.

Displaying LLDP statistics

LLDP statistics are available on both a global and a per-port levels. Rebooting the switch resets the LLDP statistics counters to zero. Disabling the transmit and/or receive capability on a port "freezes" the related port counters at their current values.

For more information, see Displaying LLDP statistics on page 220.

Syntax

`show lldp stats [port-list]`

The **global LLDP** statistics command displays an overview of neighbor detection activity on the switch, plus data on the number of frames sent, received, and discarded per-port.

The **per-port LLDP** statistics command enhances the list of per-port statistics provided by the global statistics command with some additional per-port LLDP statistics.

Global LLDP Counters

`Neighbor Entries List Last Updated`	The elapsed time since a neighbor was last added or deleted.
`New Neighbor Entries Count`	The total of new LLDP neighbors detected since the last switch reboot. Disconnecting, and then reconnecting a neighbor increments this counter.
`Neighbor Entries Deleted Count`	The number of neighbor deletions from the MIB for AgeOut Count and forced drops for all ports.For example, if the admin status for port on a neighbor device changes from `tx_rx` or `txonly` to `disabled` or `rxonly`, the neighbor device sends a "shutdown" packet out the port and ceases transmitting LLDP frames out that port.The device receiving the shutdown packet deletes all information about the neighbor received on the applicable inbound port and increments the counter.
`Neighbor Entries Dropped Count`	The number of valid LLDP neighbors the switch detected, but could not add.This can occur, For example, when a new neighbor is detected when the switch is already supporting the maximum number of neighbors. See Neighbor maximum on page 222.
`Neighbor Entries AgeOut Count`	The number of LLDP neighbors dropped on all ports because of Time-to-Live expiring.

Per-Port LLDP Counters

`NumFramesRecvd`	The total number of valid, inbound LLDP advertisements received from any neighbors on *`port-list`* .Where multiple neighbors are connected to a port through a hub, this value is the total number of LLDP advertisements received from all sources.
`NumFramesSent`	The total number of LLDP advertisements sent from *`port-list`*.
`NumFramesDiscarded`	The total number of inbound LLDP advertisements discarded by *`port-list`*.This can occur, For example, when a new neighbor is detected on the port, but the switch is already supporting the maximum number of neighbors. See Neighbor maximum on page 222. This can also be an indication of advertisement formatting problems in the neighbor device.
`Frames Invalid`	The total number of invalid LLDP advertisements received on the port.An invalid advertisement can be caused by header formatting problems in the neighbor device.

TLVs Unrecognized	The total number of LLDP TLVs received on a port with a type value in the reserved range.This can be caused by a basic management TLV from a later LLDP version than the one currently running on the switch.
TLVs Discarded	The total number of LLDP TLVs discarded for any reason. In this case, the advertisement carrying the TLV may be accepted, but the individual TLV is not usable.
Neighbor Ageouts	The number of LLDP neighbors dropped on the port because of Time-to-Live expiring.

Examples

A global LLDP statistics display

```
switch(config)# show lldp stats

 LLDP Device Statistics

  Neighbor Entries List Last Updated : 2 hours
  New Neighbor Entries Count : 20
  Neighbor Entries Deleted Count : 20
  Neighbor Entries Dropped Count : 0
  Neighbor Entries AgeOut Count : 20

 LLDP Port Statistics

  Port   | NumFramesRecvd NumFramesSent NumFramesDiscarded
  ------ + -------------- ------------- ------------------
  A1     | 97317          97843         0
  A2     | 21             12            0
  A3     | 0              0             0
  A4     | 446            252           0
  A5     | 0              0             0
  A6     | 0              0             0
  A7     | 0              0             0
  A8     | 0              0             0
```

A per-port LLDP statistics display

```
switch(config)# show lldp stats 1

 LLDP Port Statistics Detail

  PortName : 1
  Frames Discarded  : 0
  Frames Invalid    : 0
  Frames Received   : 7309
  Frames Sent       : 7231
  TLVs Unrecognized : 0
  TLVs Discarded    : 0
  Neighbor Ageouts  : 0
```

LLDP Operating Notes

Neighbor maximum

The neighbors table in the switch supports as many neighbors as there are ports on the switch. The switch can support multiple neighbors connected through a hub on a given port, but if the switch neighbor maximum is

reached, advertisements from additional neighbors on the same or other ports will not be stored in the neighbors table unless some existing neighbors time-out or are removed.

LLDP packet forwarding

An 802.1D-compliant switch does not forward LLDP packets, regardless of whether LLDP is globally enabled or disabled on the switch.

One IP address advertisement per port

LLDP advertises only one IP address per port, even if multiple IP addresses are configured by `lldp config port-list ipAddrEnable` on a given port.

802.1Q VLAN Information

LLDP packets do not include 802.1Q header information and are always handled as untagged packets.

Effect of 802.1X Operation

If 802.1X port security is enabled on a port, and a connected device is not authorized, LLDP packets are not transmitted or received on that port. Any neighbor data stored in the neighbor MIB for that port prior to the unauthorized device connection remains in the MIB until it ages out. If an unauthorized device later becomes authorized, LLDP transmit and receive operation resumes.

Neighbor data can remain in the neighbor database after the neighbor is disconnected

After disconnecting a neighbor LLDP device from the switch, the neighbor can continue to appear in the switch's neighbor database for an extended period if the neighbor's `holdtime-multiplier` is high; especially if the `refresh-interval` is large. See Changing the time-to-live for transmitted advertisements (CLI) on page 202.

Mandatory TLVs

All mandatory TLVs required for LLDP operation are also mandatory for LLDP-MED operation.

LLDP and CDP data management

This section describes points to note regarding LLDP and CDP (Cisco Discovery Protocol) data received by the switch from other devices. LLDP operation includes both transmitting LLDP packets to neighbor devices and reading LLDP packets received from neighbor devices. CDP operation is limited to reading incoming CDP packets from neighbor devices. (switches do not generate CDP packets.)

Incoming CDP and LLDP packets tagged for VLAN 1 are processed even if VLAN 1 does not contain any ports. VLAN 1 must be present, but it is typically present as the default VLAN for the switch.

The switch may pick up CDP and LLDP multicast packets from VLAN 1 even when CDP- and /or LLDP-enabled ports are not members of VLAN 1.

LLDP and CDP neighbor data

With both LLDP and (read-only) CDP enabled on a switch port, the port can read both LLDP and CDP advertisements, and stores the data from both types of advertisements in its neighbor database. (The switch **stores** only CDP data that has a corresponding field in the LLDP neighbor database.) The neighbor database itself can be read by either LLDP or CDP methods or by using the `show lldp` commands. Take note of the following rules and conditions:

- If the switch receives both LLDP and CDP advertisements on the same port from the same neighbor, the switch stores this information as two separate entries if the advertisements have different chassis ID and port ID information.
- If the chassis and port ID information are the same, the switch stores this information as a single entry. That is, LLDP data overwrites the corresponding CDP data in the neighbor database if the chassis and port ID information in the LLDP and CDP advertisements received from the same device is the same.
- Data read from a CDP packet does not support some LLDP fields, such as "System Descr," "SystemCapSupported," and "ChassisType." For such fields, LLDP assigns relevant default values. Also:
  - The LLDP "System Descr" field maps to CDP's "Version" and "Platform" fields.
  - The switch assigns "ChassisType" and "PortType" fields as "local" for both the LLDP and the CDP advertisements it receives.
  - Both LLDP and CDP support the "System Capability" TLV. However, LLDP differentiates between what a device is capable of supporting and what it is actually supporting, and separates the two types of information into subelements of the System Capability TLV. CDP has only a single field for this data. Thus, when CDP System Capability data is mapped to LLDP, the same value appears in both LLDP System Capability fields.
  - System Name and Port Descr are not communicated by CDP, and thus are not included in the switch's Neighbors database.

Because switches do not generate CDP packets, they are not represented in the CDP data collected by any neighbor devices running CDP.

A switch with CDP disabled forwards the CDP packets it receives from other devices, but does not store the CDP information from these packets in its own MIB.

LLDP data transmission/collection and CDP data collection are both enabled in the switch's default configuration. In this state, an SNMP network management application designed to discover devices running either CDP or LLDP can retrieve neighbor information from the switch regardless of whether LLDP or CDP is used to collect the device-specific information.

Protocol state	Packet generation	Inbound data management	Inbound packet forwarding
CDP Enabled	N/A	Store inbound CDP data.	No forwarding of inbound CDP packets.
CDP Disabled	N/A	No storage of CDP data from neighbor devices.	Floods inbound CDP packets from connected devices to outbound ports.
LLDP Enabled	Generates and transmits LLDP packets out all ports on the switch.	Store inbound LLDP data.	No forwarding of inbound LLDP packets.
LLDP Disabled	No packet generation.	No storage of LLDP data from neighbor devices.	No forwarding of inbound LLDP packets.

CDP operation and commands

By default the switches have CDP enabled on each port. This is a read-only capability, meaning that the switch can receive and store information about adjacent CDP devices but does not generate CDP packets.

When a CDP-enabled switch receives a CDP packet from another CDP device, it enters that device's data in the CDP Neighbors table, along with the port number where the data was received–and does not forward the packet. The switch also periodically purges the table of any entries that have expired. (The hold time for any data entry in the switch's CDP Neighbors table is configured in the device transmitting the CDP packet and cannot be controlled in the switch receiving the packet.) A switch reviews the list of CDP neighbor entries every three seconds and purges any expired entries.

For details on how to use an SNMP utility to retrieve information from the switch's CDP Neighbors table maintained in the switch's MIB, see the documentation provided with the particular SNMP utility.

Viewing the current CDP configuration of the switch

CDP is shown as enabled/disabled both globally on the switch and on a per-port basis.

Syntax

`show cdp`

Lists the global and per-port CDP configuration of the switch.

The following example shows the default CDP configuration.

Default CDP configuration

```
switch(config)# show cdp

 Global CDP information

  Enable CDP [Yes] : Yes (Receive Only)


  Port CDP
  ---- --------
  1    enabled
  2    enabled
  3    enabled
  .      .
  .      .
  .      .
```

Viewing the current CDP neighbors table of the switch

Devices are listed by the port on which they were detected.

Syntax

`show cdp neighbors`

Lists the neighboring CDP devices the switch detects, with a subset of the information collected from the device's CDP packet.

`[[e] port-numb [detail]]`	Lists the CDP device connected to the specified port. (Allows only one port at a time.)Using `detail` provides a longer list of details on the CDP device the switch detects on the specified port.
`[detail [[e] port-numb]]`	Provides a list of the details for all of the CDP devices the switch detects.Using `port-num` produces a list of details for the selected port.

The following example displays the CDP devices that the switch has detected by receiving their CDP packets.

CDP neighbors table listing

```
switch(config)# show cdp neighbors

 CDP neighbors information

  Port Device ID                    | Platform                    Capability
  ---- ---------------------------- + --------------------------- ----------
  1    Accounting (0030c1-7fcc40)   | J4812A Switch. . .          S
  2    Resear¢1-1 (0060b0-889e43)   | J4121A Switch. . .          S
  4    Support (0060b0_761a45)      | J4121A Switch. . .          S
  7    Marketing (0030c5_33dc59)    | J4313A Switch. . .          S
  12   Mgmt NIC(099a05-09df9b       | NIC Model X666              H
  12   Mgmt NIC(099a05-09df11       | NIC Model X666              H
```

Enabling and Disabling CDP Operation

Enabling CDP operation (the default) on the switch causes the switch to add entries to its CDP Neighbors table for any CDP packets it receives from other neighboring CDP devices.

Disabling CDP operation clears the switch's CDP Neighbors table and causes the switch to drop inbound CDP packets from other devices without entering the data in the CDP Neighbors table.

Syntax

`no cdp run`

Enables or disables CDP read-only operation on the switch.

(Default: Enabled)

Example

To disable CDP read-only on the switch:

```
switch(config)# no cdp run
```

When CDP is disabled:

- `show cdp neighbors`

  displays an empty CDP Neighbors table

- `show cdp`

  displaysGlobal CDP informationEnable CDP [Yes]: No

Enabling or disabling CDP operation on individual ports

In the factory-default configuration, the switch has all ports enabled to receive CDP packets. Disabling CDP on a port causes it to drop inbound CDP packets without recording their data in the CDP Neighbors table.

Syntax

`no cdp enable {< [e] port-list >}`

Example

To disable CDP on port A1:

```
switch(config)# no cdp enable a1
```

Configuring CDPv2 for voice transmission

Legacy Cisco VOIP phones only support manual configuration or using CDPv2 for voice VLAN auto-configuration. LLDP-MED is not supported. CDPv2 exchanges information such as software version, device capabilities, and voice VLAN information between directly connected devices such as a VOIP phone and a switch.

When the Cisco VOIP phone boots up (or sometimes periodically), it queries the switch and advertises information about itself using CDPv2. The switch receives the VOIP VLAN Query TLV (type 0x0f) from the phone and then immediately sends the voice VLAN ID in a reply packet to the phone using the VLAN Reply TLV (type 0x0e). The phone then begins tagging all packets with the advertised voice VLAN ID.

A voice VLAN must be configured before the voice VLAN can be advertised. For example, to configure VLAN 10 as a voice VLAN tagged for ports 1 through 10, enter these commands:

```
switch(config)# vlan 10
switch(vlan-10)# tagged 1-10
switch(vlan-10)# voice
switch(vlan-10)# exit
```

The switch CDP packet includes these TLVs:

- CDP Version: 2
- CDP TTL: 180 seconds
- Checksum
- Capabilities (type 0x04): 0x0008 (is a switch)
- Native VLAN: The PVID of the port
- VOIP VLAN Reply (type 0xe): voice VLAN ID (same as advertised by LLDPMED)
- Trust Bitmap (type 0x12): 0x00
- Untrusted port COS (type 0x13): 0x00

CDP should be enabled and running on the interfaces to which the phones are connected. Use the `cdp enable` and `cdp run` commands.

The `pre-standard-voice` option for the `cdp mode` command allows the configuration of CDP mode so that it responds to received CDP queries from a VoIP phone.

Syntax

`no cdp mode pre-standard-voice [admin-status < port-list > [tx_rx | rxonly]]`

Enable CDP-compatible voice VLAN discovery with pre-standard VoIP phones. In this mode, when a CDP VoIP VLAN query is received on a port from pre-standard phones, the switch replies back with a CDP packet that contains the VID of the voice VLAN associated with that port.

Not recommended for phones that support LLDP-MED.

pre-standard-voice	Enables CDP-compatible voice VLAN discovery with pre-standard VoIP phones.
admin-status	Sets the port in either transmit and receive mode, or receive mode only.Default: tx-rx.

	<port-list> Sets this port in transmit and receive mode, or receive mode only. **rxonly** Enable receive-only mode of CDP processing. **tx_rx** Enable transmit and receive mode.

```
switch(config)# cdp mode pre-standard-voice admin-status A5 rxonly
```

The show cdp output when CDP Run is disabled

```
switch(config)# show cdp
Global CDP information
Enable CDP [yes] : no
```

The show cdp output when cdp run and sdp mode are enabled

```
switch(config)# show cdp

 Global CDP Information

  Enable CDP [Yes]  : Yes
  CDP mode [rxonly] : pre-standard-voice
  CDP Hold Time [180] : 180
  CDP Transmit Interval [60] : 60

  Port CDP       admin-status
  ---- --------- ------------
  A1   enabled   rxonly
  A2   enabled   tx_rx
  A3   enabled   tx_rx
```

When CDP mode is not `pre-standard voice`, the admin-status column is note displayed.

The show cdp output when cdp run and cdp mode rxonly are enabled

```
switch(config)# show cdp

 Global CDP Information

  Enable CDP [Yes} : Yes
  CDP mode [rxonly] : rxonly

  Port CDP
  ---- --------
  A1   enabled
  A2   enabled
  A3   enabled
```

The show running-config when admin-status is configured

```
switch(config)# show running-config

Running configuration:

; J9477A Configuration Editor; Created on release #XX.16.09.0000x
; Ver #03:01:1f:ef:f2
hostname "Switch"
```

```
module 1 type J9307A
cdp mode pre-standard-voice admin-status A5 RxOnly
```

Filtering CDP information

In some environments it is desirable to be able to configure a switch to handle CDP packets by filtering out the MAC address learns from untagged VLAN traffic from IP phones. This means that normal protocol processing occurs for the packets, but the addresses associated with these packets is not learned or reported by the software address management components. This enhancement also filters out the MAC address learns from LLDP and 802.1x EAPOL packets on untagged VLANs.

The feature is configured per-port.

Configuring the switch to filter untagged traffic

Enter this command to configure the switch not to learn CDP, LLDP, or EAPOL traffic for a set of interfaces.

Syntax

`no ignore-untagged-mac <port-list>`

Prevents MAC addresses from being learned on the specified ports when the VLAN is untagged and the destination MAC address is one of the following:

- 01000C-CCCCCC (CDP)
- 0180c2- 00000e (LLDP)
- 0180c2-000003 (EAPOL)

Configuring the switch to ignore packet MAC address learns for an untagged VLAN

```
switch(config) ignore-untagged-mac 1-2
```

Displaying the configuration

Enter the `show running-config` command to display information about the configuration.

Configuration showing interfaces to ignore packet MAC address learns

```
switch(config) show running-config

Running configuration:

; J9627 Configuration Editor; Created on release XX.15.XX
; Ver #03:03.1f.ef:f0

hostname "Switch"
interface 1
   ignore-untagged-mac
   exit
interface 2
   ignore-untagged-mac
   exit
.
.
.
vlan 1
   name "DEFAULT_VLAN"
   untagged 1-24
   ip address dhcp-bootp
   exit
```

```
.
.
.
```

Filtering PVID mismatch log messages

This enhancement filters out PVID mismatch log messages on a per-port basis. PVID mismatches are logged when there is a difference in the PVID advertised by a neighboring switch and the PVID of the switch port which receives the LLDP advertisement. Logging is an LLDP feature that allows detection of possible vlan leakage between adjacent switches. However, if these events are logged too frequently, they can overwhelm the log buffer and push relevant logging data out of log memory, making it difficult to troubleshoot another issue.

Logging is disabled and enabled with the support of CLI commands.

This enhancement also includes displaying the Mac-Address in the PVID mismatch log message when the port ID is Mac-Address instead of displaying garbage characters in the peer device port ID field.

Use the following command to disable the logging of the PVID mismatch log messages:

Syntax

`logging filter [filter-name][sub filter id] <regularexpression> deny`

Regular-expression

The regular expression should match the message which is to be filtered.

Syntax

`logging filter [filter-name] enable`

Overview

A command has been written to suppress the IPv4 / IPv6 management address transmission in outgoing LLDP packets.

A local LAN device transmits organization-specific information in the form of type, length, and value (TLV). The organization-associated values are stored in the LLDP organizationally defined local device LLDP MIB extensions. Management address TLV in IPv4 and IPv6 environments is optional from the TLV basic management set.

TLV basic management set

- Port description TLV — Describes the port in an alpha-numeric format. The value equals the ifDescr object, if the LAN device supports RFC 2863.
- System name TLV — Assigns the system name in an alpha-numeric format. The value equals the sysName object, if the LAN device supports RFC 3418.
- System description TLV — Describes the network entity in an alpha-numeric format. The system description TLV includes the system name, versions of hardware, operating system, and networking software supported in the device. The value equals the sysDescr object, if the LAN device supports RFC 3418.
- System capabilities TLV — Indicates primary functions of the device and if they are enabled in the device.
- Management address TLV — Indicates the addresses of the local LLDP agent. Other remote managers can use this address to obtain information related to the local device.

The command `lldp config <all> ipAddrEnable <IP_ADDR>` is used to advertise specific IP address through the port.

The command `no lldp config <PORT NO> basicTlvEnable management_addr` suppresses the IP address to be advertised.

Command

The following commands allow the user to configure NTP or show NTP configuration.

no lldp config basicTlvEnable management_addr

In the configure context:

Syntax

`no lldp config <PORT_NUM> basicTlvEnable management_addr`

Description

The feature suppresses the IPv4 or IPv6 address as well as suppresses the MAC address if the `no ip address` is configured. By default this management address TLV is enabled in switch. No other TLV (except management address TLV) suppression will occur when this command is used.

Parameter

Management_addr

Management TLV

Example

```
no lldp config all basicTlvEnable management_addr
```

lldp config

Syntax

`lldp config <port-number>`

Description

Configure the lldp for the desired port by number.

Parameters

`basicTlvEnable`

Enables the basic advertised TLV for each port by number.

`<management_addr>`

Use the option `<management_addr>` to specify specific devices to enable TLV advertisement.

Usage

`lldp config <port_num> basicTlvEnable <management_addr>`

Show commands

Use the command `show running-config` to view the lldp configuration.

Example

```
switch# show running-config
Running Configuration
...
no lldp config 1 basicTlvEnable management_addr
```

Example

```
switch# show lldp config 1

LLDP Port Configuration Detail
Port : 1
AdminStatus [Tx_Rx] : Tx_Rx
NotificationEnabled [False] : False
Med Topology Trap Enabled [False] : False
TLVS Advertised:

* management_addr

  IpAddress Advertised:
```

Overview

The Dynamic Host Configuration Protocol (DHCP) is a network protocol that enables a server to automate assignment of IP addresses to hosts. A DHCP server can be configured to provide other network information like IP addresses of TFTP servers, DNS server, boot file name and vendor specific options. Commonly there are two types of address assignments, dynamic and manual. The lease of dynamic addresses is renewed periodically; manual leases are permanently assigned to hosts. With this feature, you can configure multiple pools of IP addresses for IP address assignment and tracking.

IP pools

A DHCP server is configured with IP pools. The server is then instructed to use IP addresses falling into the specified range of IP while offering leases. Multiple IP pools are configured to not have duplicate or overlapping IP subnets. You can also configure a DHCP server with multiple IP ranges within an IP subnet; this confines the allocatable IP addresses within the configured IP pool.

An IP pool will be claimed valid only if it is either:

- Dynamic pool – Has a network address, subnet mask and IP range(s)
- Static pool – Should have a static IP-to-MAC binding.

The DHCP server will discard the invalid and incomplete pools and will only operate on the valid IP pools. The DHCP server will require at least one valid pool to start.

DHCP options

On a DHCP server, an IP pool is configured with various options. These options signify additional information about the network. Options are supported with explicit commands such as `boot-file`. Option codes that correspond to explicit commands can not be configured with a generic option command; the generic option command requires an option code and TLV.

RFC 2132 defines various network information that a client may request when trying to get the lease.

BootP support

The DHCP server also functions as BootP server. A manual binding configured in a static IP Pool may either service a BootP client request or a DHCP client request.

Authoritative server and support for DHCP inform packets

The server message `DHCPinform` may be received when the server is already configured for static IPv4 addresses so that the server can to get configuration parameters dynamically.

RFC 2131 states that if a client has obtained a network address through some other means (e.g., manual configuration), it may use a `DHCPinform` request message to obtain other local configuration parameters. Servers receiving a `DHCPinform` message construct a `DHCPACK` message with any local configuration parameters appropriate for the client without: allocating a new address, checking for an existing binding, filling in `yiaddr` or including lease time parameters.

Authoritative pools

To process the `DHCPINFORM` packets received from a client within the given IP pool, a DHCP server has to be configured as `authoritative` for that IP pool. The server is the sole authority for this IP pool so when a client requests an IP address lease where the server is authoritative, and the server has no record of that IP address, the server will respond with `DHCPNAK` message which indicates that the client should no longer use that IP address. Any `DHCPINFORM` packet received for a non-authoritative pool will be ignored by the DHCP server.

The `authoritative` command has no effect when configured on a static pool or an incomplete pool without a network statement. In such cases, the server intentionally not send an error message.

A CLI toggle is provided under the **pool** context that will allow the `authoritative` configuration.

The `authoritative` command requires a network statement to be configured on a pool.

Authoritative dummy pools

A dummy pool, without the range statement, can be configured and made authoritative. A dummy pool allows static-bind entries which do not have matching dynamic pools with network statements to be configured. By creating a dummy pool on a DHCP server, the support for `DHCPinform` packets will not be actively serving the client on this pool. No active leases or resource consumption will be sent to the DHCP server when this option is used.

Dummy pools help the DHCP server learn the network topology.

Example

```
dhcp-server pool dummy192
network 192.168.10.0 255.255.255.255
option 1…
option 2…
:
option n…
authoritative
exit
```

Change in server behavior

Making the server authoritative for an IP pool changes how the server processes `DHCP REQUEST` packets.

The following table exhibits the behavior on the receiving `DHCP REQUEST` and `DHCP inform` packets from DHCP clients residing on either authoritative and non-authoritative pools.

Table 25: *Authoritative and non-authoritative pools*

	Authoritative Pool			Non-authoritative pool		
When a DHCP client sending..	For Own IP	For IP belonging to different client	Unknown IP falling outside the range	For Own IP	For IP belonging to different client	Unknown IP falling outside the range
DHCP INFORM	send ACK	send ACK	send ACK	DROP	DROP	DROP
DHCP REQUEST	send ACK	send NACK	send NACK	send ACK	DROP	DROP

DHCPv4 configuration commands

DHCPv4 server

dhcp-server

Syntax

```
no dhcp-server [enable | disable]
```

Description

Use this command to nable/disable the DHCPv4 server in a switch. Defaults to disabled.

Parameters and options

no

Removes all DHCPv4 server configurations.

enable

Enables the DHCPv4 server on the device. The `no` form of this command.

disable

Disables the DHCPv4 server on the device.

DHCP address pool name

dhcp-server pool

Syntax

```
no dhcp-server pool <POOL-NAME>
```

Description

Configure the DHCPv4 server IP address pool with either a static IP or a network IP range.

Parameters

pool

DHCPv4 server IP address pool.

ASCII-STR

Enter an ASCII string.

authoritative

Configure the DHCP server authoritative for a pool.

bootfile-name

Specify the boot file name which is used as a boot image.

default-router

List of IP addresses of the default routers.

dns-server

List of IP addresses of the DNS servers.

domain-name

Configure the DNS (Domain Name System) domain name for translation of hostnames to IP addresses.

lease

Lease period of an IP address.

netbios-name-server

List of IP addresses of the NetBIOS (WINS) name servers.

netbios-node-type

NetBIOS node type for a Microsoft DHCPv4 client.

network

Subnet IP and mask of the DHCPv4 server address pool.

option

Raw DHCPv4 server options.

range

Range of IP addresses for the DHCPv4 server address pool.

static-bind

Static binding information for the DHCPv4 server address pool.

tftp-server

Configure a TFTP server for the DHCPv4 server address pool.

Authentication

Switch memory allows up to ten public keys. This means the authentication and encryption keys you use for your third-party client SCP/SFTP software can differ from the keys you use for the SSH session, even though both SCP and SFTP use a secure SSH tunnel.

SSH authentication is mutually exclusive with RADIUS servers.

Some clients, such as PSCP (PuTTY SCP), automatically compare switch host keys for you. Other clients require you to manually copy and paste keys to the `$HOME/.ssh/known_hosts` file. Whatever SCP/SFTP software tool you use, after installing the client software you must verify that the switch host keys are available to the client.

Because the third-party software utilities you may use for SCP/SFTP vary, you should refer to the documentation provided with the utility you select before performing this process.

DHCP client boot file

bootfile-name

Syntax

```
no bootfile-name <FILENAME>
```

Description

Specify the boot file name to be used as the boot image.

DHCP client default router

default-router

Syntax

```
no default-router <IP-ADDR-STR> [IP-ADDR2   IP-ADDR8]
```

Description

Configure the DHCP pool context to the default router for a DHCP client. List all of the IP addresses of the default routers.

Two IP addresses must be separated by a comma.

Maximum of eight default routers can be configured.

DNS IP servers

dns-server

Syntax

```
no dns-server <IP-ADDR> [IP-ADDR2  IP-ADDR8]
```

Description

Configure the DHCP pool context to the DNS IP servers that are available to a DHCP client. List of IP addresses of the DNS servers.

Two IP addresses must be separated by comma.

Maximum of eight DNS servers can be configured.

Configure a domain name

domain-name

Syntax

```
no domain-name <NAME>
```

Description

Configure the DNS domain name for translation of hostnames to IP addresses.

Configure lease time

lease

Syntax

```
no lease [DD:HH:MM| infinite]
```

Description

Configure the lease time for an IP address in the DHCP pool. Lease time is infinite for static pools.

The default lease period is one day.

Parameters and options

DD:HH:MM

Enter lease period.

Lease

Lease period of an IP address.

NetBIOS WINS servers

Syntax

```
no netbios-name-server <IP-ADDR-STR> [IP-ADDR2  IP-ADDR8]
```

Description

Configure the DHCP pool for the NetBIOS WINS servers that are available to a Microsoft DHCP client. List all IP addresses of the NetBIOS(WINS) name servers. The Windows Internet Naming Service (WINS) is a name resolution service that Microsoft DHCP clients use to correlate host names to IP addresses within a general grouping of networks.

Two IP addresses must be separated by a comma.

Maximum of 8 NetBIOS (WINS) name servers can be configured.

NetBIOS node type

net bios-ode-type

Syntax

```
no netbios-node-type [ broadcast | hybrid | mixed | peer-to-peer ]
```

Description

Configure the DHCP pool mode to the NetBIOS node type for a Microsoft DHCP. The NetBIOS node type for Microsoft DHCP clients can be one of four settings: broadcast, peer-to-peer, mixed, or hybrid.

Parameters and options

broadcast

Broadcast node.

hybrid

Hybrid node.

mixed

Mixed node.

peer-to-peer

Peer to peer node.

Subnet and mask

network

Syntax

```
no network <ip-addr/mask-lenght>
```

Description

Configure the DHCPv4 server pool subnet and mask for the DHCP server address pool.

Range is configured to enable pool.

Parameters and options

ip-addr/mask-lenght

Interface IP address/mask.

DHCP server options

Configure DHCP server options

Syntax

```
no option <CODE> {ascii <ascii-string>|hex <hex-string>|ip <IP-ADDR-STR>[IP-ADDR2 … IP-ADDR8]}
```

ascii

Specify ASCII string as option code value.

hex

Specify hexadecimal string as option code value.

ip

Specify one or more IP addresses as option code value.

ip-addr-str

Specify IP address.

ascii-str

Enter an ASCII string.

hex-str

Specify Hexadecimal string.

Configure the raw DHCP server options.

Following DHCP options are not supported:

1,3,6,12,15,44,46,50,52,54,55,57,58,59,61,66,67,82.

You can use the following available CLIs for respective DHCP option codes:

DHCP Option code	CLI Syntax
1	`no network <ip-addr/mask-lenght>`
3	`no default-router <IP-ADDR-STR> [IP-ADDR2 ... IP-ADDR8]`
6	`no dns-server <IP-ADDR> [IP-ADDR2 ... IP-ADDR8]`
15	`no domain-name <name>`
44	`no netbios-name-server <IP-ADDR-STR> [IP-ADDR2 ... IP-ADDR8]`
43	`no option 43 {ascii <ascii-string>|hex <hex-string>|ip <IP-ADDR-STR>[IP-ADDR2 … IP-ADDR8]}`
46	`no netbios-node-type <broadcast | hybrid | mixed | peer-to-peer>`
60	`no option 60 {ascii <ascii-string>|hex <hex-string>|ip <IP-ADDR-STR>[IP-ADDR2 … IP-ADDR8]}`
66	`no tftp-server server-name < ASCII-STR>`
67	`no bootfile-name<filename>`
138	`no option 138 {ascii <ascii-string>|hex <hex-string>|ip <IP-ADDR-STR>[IP-ADDR2 … IP-ADDR8]}`
150	`no tftp-server server-ip <ip-address>` or `no option 150 <IP-ADDR -STR> [IP-ADDR2 ... IP-ADDR8]`

DHCP server raw Option 43 is supported and it is used for AirWave ZTP.

DHCP server raw Option 60 is supported from 16.06.

DHCP server raw Option 138 is supported and it is used for IPsec tunnel configuration in DHCP client.

IP address range

range

Syntax

```
no range <IP-ADDR>[<IP-ADDR>]
```

Description

Configure the DHCP pool to the range of IP address for the DHCP address pool.

Parameters and options

range

Range of IP addresses for the DHCPv4 server address pool.

ip-addr

Low IP address.

High IP address.

Static bindings

static-bind

Syntax

```
static-bind ip <IP-ADDR/MASK-LENGTH> mac <MAC-ADDR>
```

Description

Configure static binding information for the DHCPv4 server address pool. Manual bindings are IP addresses that have been manually mapped to the MAC addresses of hosts that are found in the DHCP database. Manual bindings are just special address pools. There is no limit on the number of manual bindings but you can only configure one manual binding per host pool.

Parameters and options

ip

Specify client IP address.

static-bind

Static binding information for the DHCPv4 server address pool.

ip-addr / mask-length

Interface IP address or mask.

mac

Specify client MAC address.

mac-addr

Enter a MAC address.

TFTP server domain name

tftp-server

Syntax

```
no tftp-server [server-name <server-name> | server-ip < ip-address >]
```

Description

Configure the TFTP server domain name for the DHCP address pool.

Parameters and options

tftp-server

Configure a TFTP server for the DHCPv4 server address pool.

server-name

TFTP server name for the DHCPv4 server address pool.

Configure the TFTP server address

tftp-server

Syntax

```
no tftp-server [server-name <server-name> | server-ip < ip-address >]
```

Description

Configure the TFTP server domain name for the DHCP address pool.

Parameters and options

tftp-server

Configure a TFTP server for the DHCPv4 server address pool.

server-name

TFTP server name for the DHCPv4 server address pool.

Number of ping packets

dhcp-server ping

Syntax

```
no dhcp-server ping [packets <0-10>|timeout <0-10>]
```

Description

Specify, in the global configuration context, the number of ping packets the DHCP server will send to the pool address before assigning the address. The default is two packets.

Parameters and options

ping

Specify DHCPv4 ping parameters.

packets <0-10>

Specify number of ping packets in the range of 0 to 10. 0 disables ping.

timeout <1-10

Ping timeout in the range of 1-10 seconds. Indicates the amount of time the DHCPv4 server must wait before timing out a ping packet. Defaults to one second.

Save DHCP server automatic bindings

dhcp-server database

Syntax

```
no dhcp-server database [file ASCII-STR] [delay<15-86400>][timeout <0-86400>]
```

Description

Specifies DHCPv4 database agent and the interval between database updates and database transfers.

Parameters and options

delay

Seconds to delay writing to the lease database file.

file

URL Format: "tftp://<ip-address>/<filename>".

database

Specifies DHCPv4 database agent and the interval between database updates and database transfers.

timeout

Seconds to wait for the transfer before failing.

ascii-str

Database URL.

<15-86400>

Delay in seconds.

<0-86400>

Timeout in seconds.

DHCP server and SNMP notifications

snmp-server enable traps

Syntax

```
no snmp-server enable traps dhcp-server
```

Description

Configure a DHCP server to send SNMP notifications to the SNMP entity. This command enables or disables event traps sent by the switch.

Parameters and options

dhcp-server

Traps for DHCP-Server.

Conflict logging on a DHCP server

dhcp-server conflict-logging

Syntax

```
no dhcp-server conflict-logging
```

Description

Enable conflict logging on a DHCP server. Default is disabled.

Parameters and options

conflict-logging

Enable DHCPv4 server address conflict logging.

Enable the DHCP server on a VLAN

dhcp-server

Syntax

```
dhcp-server
```

Description

Enable DHCPv4 server on a VLAN. DHCPv4 client or DHCPv4 relay cannot co-exist with DHCPv4 server on a VLAN.

Parameters and options

dhcp-server

Enable DHCPv4 server on a VLAN.

Clear commands

clear dhcp-server conflicts

Syntax

```
clear dhcp-server conflicts <IP-ADDR>
```

Description

Reset DHCPv4 server conflicts database. If IP address is specified, reset only that conflict.

Parameters

dhcp-server

Clears theDHCPv4 server information.

ip-addr

Specify the IP address whose conflict is to be cleared.

Reset all DHCP server and BOOTP counters

clear dhcp-server statistics

Syntax

```
clear dhcp-server statistics
```

Description

Reset all DHCP server and BOOTP counters

Parameters

statistics

Reset DHCPv4 server and BOOTP counters.

Delete an automatic address binding

clear dhcp-server statistics

Syntax

```
clear dhcp-server statistics
```

Description

Delete an automatic address binding from the DHCP server database.

Parameters

binding

Reset DHCPv4 server automatic address bindings.

ip-addr

Specify IP address of the binding is to be cleared.

Show commands

show dhcp-server

Syntax

```
show dhcp-server [binding|conflicts|database|statistics|pool <POOL-NAME>]
```

Description

Show DHCPv4 server global configuration information for the device.

Parameters and options

binding

Display the DHCPv4 server address bindings on the device.

conflicts

Display address conflicts found by a DHCPv4 server when addresses are offered by a client.

database

Display DHCPv4 server database agent information.

statistics

Display DHCPv4 server statistics.

pool <POOL-NAME>

Display the DHCPv4 server IP pool information.

Configuring DHCPv6 snooping and DIPLDv6 through SNMP

DHCPv6 snooping and Dynamic IPv6 Lockdown (DIPLDv6) are currently configurable through SNMP using MIBs. For more information, see the *MIB and Trap Matrix*.

dhcpv6-snooping

Syntax

`no dhcpv6-snooping [vlan <VLAN-ID-RANGE>]`

Description

Enable or disable the global administrative status of DHCPv6 snooping. You must enable DHCP snooping globally (`dhcpv6-snooping`) to enable snooping on any VLAN.

Parameters and options

no

Disabling global administrative status (`no dhcpvt-snooping`) disables snooping on all VLANs.

vlan <VLAN-ID-RANGE>

Disables snooping on a VLAN or a range of VLANs. Requires enabling DHCP global snooping (`dhcpv6-snooping`)

dhcpv6 snooping trust

Syntax

`no dhcpv6-snooping trust ethernet<PORT-LIST>`

Description

Configure trusted interfaces. The system forwards server packets received on trusted interfaces only.

Parameters and options

no

Marks the specified interfaces as untrusted. Port state defaults to untrusted.

dhcpv6-snooping authorized-server

Syntax

`no dhcpv6-snooping authorized-server <IPV6-ADDRESS>`

Description

Configure authorized DHCP servers. For DHCPv6 snooping to allow a server to client packet to be forwarded, it must be received on a trusted port from an authorized server. If no authorized servers are configured, all server addresses are valid.

ddhcpv6-snooping database file

Syntax

```
no dhcpv6-snooping database file [ASCII-STR|delay <15-86400>| timeout<0-86400>]
```

Description

Configure a lease entry file and its options for storing DHCPv6 snooping binding database.

Parameters and options

ASCII-STR

Copies the DHCPv6 snooping lease file to a TFTP server. The parameter ASCII-STR is a URL and is in the format `tftp://<IP-ADDR>/<FILENAME>`. The TFTP address can be up to 255 characters. IP-ADDR can be an IPv4 address or an IPv6 address. The IPv6 address must be enclosed in square brackets [].

timeout *seconds*

Configures the number of seconds to wait for the DSNOOPv6 lease file transfer to complete. An error message is displayed if the file transfer is not completed within the timeout value. A value of zero indicates that the attempt to transfer the DHCPv6 lease file retries indefinitely. The default timeout value is 300 seconds.

database

Configure the parameters to copy the DHCPv6 Snooping lease file to a TFTP server.

delay

Configure the number of seconds to wait before copying the DSNOOPv6 lease file to a TFTP server.

file

Copy the DHCPv6 Snooping lease file to a TFTP server.

timeout

Configure the number of seconds to wait for the DSNOOPv6 lease file transfer to complete.

dhcpv6-snooping max-bindings

Syntax

```
no dhcpv6-snooping max-bindings <PORT-LIST1-8192>
```

Description

Configure the maximum number of binding addresses allowed per binding anchor. A binding anchor is a unique attribute that can be associated with a client address.

Parameters and options

max-bindings

Configuring maximum number of binding addresses allowed per port.

- If the max-bindings value is configured **before** enabling `dhcpv6-snooping` the limit is immediately applied and the bindings are not allowed to exceed the max-bindings value.
- The max-bindings value is **setafter** enabling `dhcpv6-snooping`.
- The current bindings are greater than the max-binding value, the configuration will be applied as and when clients release their IPv6 addresses.
- Current bindings are lesser than that of the value entered, the configuration will be immediately applied.

<PORT-LIST 1-8192>

Specify the ports on which max-bindings need to be applied in the range of 1-8192.

DT trunks can use jumbo VLAN as usual, but user needs to ensure that jumbo is configured on both the DT pairs, otherwise packet drops/fragmentations can be seen.

dhcpv6-relay option 79

Syntax

```
no dhcpv6-relay option 79
```

Description

Enabling option 79 will force the DHCPv6 Relay agent to forward the client Link-layer address. Defaults to disabled.

snmp-server enable traps dhcpv6-snooping

Syntax

```
no snmp-server enable traps dhcpv6-snooping [out-of-resources|errant-reply]
```

Description

Configure the traps for DHCPv6 snooping.

Parameters and options

out-of-resources

This trap is sent when the number of bindings exceed the maximum limit of 8192 bindings.

errant-reply

This trap is sent when a DHCPv6 reply packet is received on an untrusted port or from an un-authorized server.

clear dhcpv6-snooping stats

Syntax

```
clear dhcpv6-snooping stats
```

Description

Clears dhcpv6 snooping statistics.

debug security dhcpv6-snooping

Syntax

```
debug security dhcpv6-snooping [config|event|packet]
```

Description

Enable debug for DHCPv6 snooping.

Parameters and options

config

Debug DHCPv6 snooping configuration.

event

Debug a DHCPv6 snooping event.

packet

Debug DHCPv6 snooping by packet.

ipv6 source-lockdown ethernet

Syntax

```
no ipv6 source-lockdown ethernet <PORT-LIST>
```

Description

Used to configure DIPv6LD lockdown globally and on specific ports which can be configured on per-port basis using the PORT-LIST option.

Parameters and options

[ethernet] PORT-LIST

Specify the ports being configured for Ipv6 source-lockdown.

source-lockdown

Enable IPv6 source lockdown for a specific port.

ipv6 source-binding

Syntax

```
no ipv6 source-binding VLAN-IDIPV6-ADDRMAC-ADDRPORT-NUMIPV6-ADDR
```

Description

Add a DHCPv6 static binding entry into the binding table. Static binding entries will have infinite lifetime.

Parameters and options

VLAN-ID

The VLAN ID of the static binding entry.

Ipv6-ADDRESS

The Ipv6 address of the static binding entry.

MAC-ADDRESS

The MAC address of the static binding entry.

[ethernet] PORT-NUM

Port number of the static binding entry.

IPV6-ADDR

The Ipv6 link-local address of the static binding entry.

snmp-server enable traps dyn-ipv6-lockdown

Syntax

```
no snmp-server enable traps dyn-ipv6-lockdown [out-of-resources | violations]
```

Description

The Dynamic IPv6 Lockdown trap is sent when resources are unavailable for configuring. This trap is sent when a source lockdown violation takes place.

Parameters and options

out-of-resources

Dynamic IPv6 Lockdown out of resources.

violations

Dynamic IPv6 lockdown violations.

debug security dynamic-ipv6-lockdown

Syntax

```
debug security dynamic-ipv6-lockdown
```

Description

Enable debug for DIPLDv6.

Show commands for DHCPv6-snooping

show dhcpv6-snooping

Syntax

```
show dhcpv6-snooping
```

Description

Show dhcpv6 snooping configuration.

show dhcpv6 snooping bindings

Syntax

```
show dhcpv6-snooping bindings
```

Description

Show dhcpv6 snooping binding entries. This would show both dynamic and static binding entries.

show dhcpv6 snooping statistics

Syntax

```
show dhcpv6-snooping stats
```

Description

Show dhcpv6-snooping statistics.

show ipv6 source-lockdown

Syntax

```
show ipv6 source-lockdown [bindings | status]
```

Description

Shows IPv6 source bindings that are configured using the command `IPv6 source-bindings`.

Parameters and options

bindings

Show source bindings for Dynamic IPv6 Lockdown ports.

status

Show source bindings for Dynamic IPv6 Lockdown status.

Show source bindings Dynamic IPv6 Lockdown status

```
Dynamic IPv6 Lockdown Bindings

Port    IPv6 Address                              Vlan   MAC          Not
Address                                                               in HW
---- ---------------------------------------- ----- -------------- -------
A1   3000:abbb:1234:3456:1234: 1234:1234:1234  1     123456-789101  Yes
F23  300:ab::2                                 4092  abcdef-123455  No
```

show ipv6 source-lockdown status

Syntax

```
show ipv6 source-lockdown status
```

Description

Used to show IPV6 source-lockdown status per port.

Parameters and options

source-lockdown

Show dynamic IPv6 Lockdown.

Show dynamic IPv6 Lockdown configuration

```
Dynamic IPv6 Lockdown information
Global State: Enabled
Port   Operational State
------ --------------------------
1    Active
2    Active
IPv6 Source Lockdown is disabled on Ports 3-24.
```

show snmp-server traps

Syntax

show snmp-server traps *<COMMUNITY-STR>*

Description

Shows traps controlled. Shows all information on SNMP communities, trap receivers and SNMP response or trap source-ip policy configured on the switch.

Parameters

traps

Show all configured traps.

<COMMUNITY-STR>

Displays information for the specified community only.

Show snmp-server traps

```
switch(config)# sh snmp-server traps

Trap Receivers
Link-Change Traps Enabled on Ports [All] : All

Traps Category                                          Current Status
_____________________________       ___________________
SNMP Authentication                                   : Extended
Password change                                          : Enabled
Login failures                                            : Enabled
Port-Security                                              : Enabled
Authorization Server Contact                 : Enabled
DHCP-Snooping                                              : Enabled
DHCPv6-Snooping Out of Resource            : Enabled
DHCPv6-Snooping Errant Replies              : Enabled
Dynamic ARP Protection                              : Enabled
Dynamic IP Lockdown                                   : Enabled
Dynamic IPv6 Lockdown Out of Resource : Enabled
Dynamic IPv6 Lockdown Violations           : Enabled
Startup Config change                               : Disabled
Running Config Change                               : Disabled
MAC address table changes                        : Disabled
MAC Address Count                                       : Disabled

Address              Community             Events  Type  Retry  Timeout

Excluded MIBs
switch(config)#
Alignment change - right shifted
```

show distributed-trunking consistency-parameters

Syntax

show distributed-trunking consistency-parameters global <PIM-SM>

Description

Display global peer consistency details. If the platforms do not match an error message similar to inconsistant criteria is returned.

Parameters and options

global

Display global peer consistency details.

<PIM-SM>

Display PIM-SM peer consistency details.

Show distributed-trunking consistency-parameters global

```
switch# show distributed-trunking consistency-parameters global

Local Peer
----- ----
Peer config unavailable.
Image Version KB.15.18.0000x
IP Routing Disabled Disabled
Peer-keepalive interval 1000 0
PIM-DM Support Disabled Disabled
PIM-SM Support Disabled Disabled
IGMP enabled VLANs on Local :
IGMP enabled VLANs on Peer :
PIM-DM Enabled VLANs on Local :  <List of Vlans>
PIM-DM Enabled VLANs on Peer :   <List of Vlans>
PIM-SM Enabled VLANs on Local :  <List of Vlans>
PIM-SM Enabled VLANs on Peer :  <List of Vlans>
DHCP-snooping Enabled on Local :
DHCP-Snooping Enabled on Peer:                 :Yes
DHCP-Snooping Enabled VLANs on Local           :1
DHCP-Snooping Enabled VLANs on Peer            :1
DHCP-Snooping Max-Binding Configured on Local  :Yes
Ports Max-Bindings
------- ------------
TrK2   6
DHCP-Snooping Max-Binding Configured on Peer:   No
```

Feature pim-sm

```
show distributed-trunking consistency-parameters global feature pim-sm

PIM-SM Enabled VLANs on Local  :  20,30
PIM-SM Enabled VLANs on Peer   :  20,30
```

show dhcpv6 relay

Syntax

```
show dhcpv6-relay
```

Description

Displays the DHCPv6 relay configuration. Cannot be configured from the WebUI or Menu.

Sample output

```
show dhcpv6-relay

DHCPV6 Relay Agent : Enabled
Option 79 : Disabled
```

Chapter 10
Zero Touch Provisioning with AirWave and Central

Aruba offers on-premise and cloud-based management solutions for switches, access points, and controllers.

AirWave is an award-winning on-premise Network Management Solution (NMS) that manages both Aruba and third-party network devices. AirWave is ideal for Campus networks and for organizations which prefer to have complete control over the hardware and software and have their NMS within premises (for example: either in the head office or data center or one of the large campuses).

Aruba Central is a popular cloud-based management solution for Branch and Distributed Enterprises which prefer simplicity, programmability, and integration with third-party cloud-based solutions for automation. Central offers cloud portal subscriptions through which one can manage the entire network of Aruba devices, without having to set up, upgrade, scale, or manage an NMS.

In this chapter, the focus is primarily on the Zero Touch Provisioning (ZTP) and connection to either AirWave or Central using ZTP for check-in, configuration download, and management.

What is ZTP?

ZTP enables the auto-configuration of factory-default switches without requiring any manual setup process. It helps the administrators to deploy their fleet of switches at multiple branches without requiring a technical expert onsite. It is of use for distributed enterprises (for example: hotels, hospitals, retail stores, educational institutions, and other enterprises) where an administrator is not available at every site.

Aruba offers ZTP solution which reduces the overall cost of ownership. Aruba ships infrastructure devices such as switches, access points, and controllers directly to the site of usage. With ZTP, even a nontechnical user (for example: store manager in a retail chain or a class teacher in a school) can deploy devices at site. When the devices are connected to AirWave or Central, ZTP automatically sets up the required firmware and configurations, and services without the need for technical expertise on site.

ZTP with AirWave

Aruba supports ZTP using:

- DHCP servers for on-premise management (see DHCP server configuration for DHCP based ZTP).
- Activate for cloud-based management. Activate is a cloud-based inventory management and provisioning service (see Activate based ZTP with AirWave).

You can choose any of the ZTP methods based on your requirement. For example: If all the campuses and branches which an Enterprise manages are reachable within a private network, it is recommended to use DHCP based ZTP. If an Enterprise network spans multiple campuses and branches using WAN to communicate, use Activate based ZTP.

DHCP-based ZTP with AirWave

IPv6 based ZTP is supported from 16.06 switch version. Switches can be connected to AirWave through IPv4 or IPv6 addresses. To enable IPv6 ZTP provisioning, the `ipv6 enable` and `ipv6 address dhcp full` will be enabled by default from 16.06 switch version. These commands also get enabled when the switch upgrades from any older images to 16.06 with factory default configuration. From 16.06 release, the switch can act as DHCP server for IPv4 ZTP. The switch supports DHCP option 60 and 43 which is required for ZTP. AirWave

8.2.6.1 supports IPv6 ZTP over data port and AirWave 8.2.8 will support both IPv4 and IPv6 ZTP over OOBM port.

Configuring DHCP-based ZTP with AirWave

ZTP auto-configures your switches as follows:

Procedure

1. The switch boots up with the factory default configuration.
2. The switch sends out a DHCP discovery from data port/OOBM.

   IPv4:

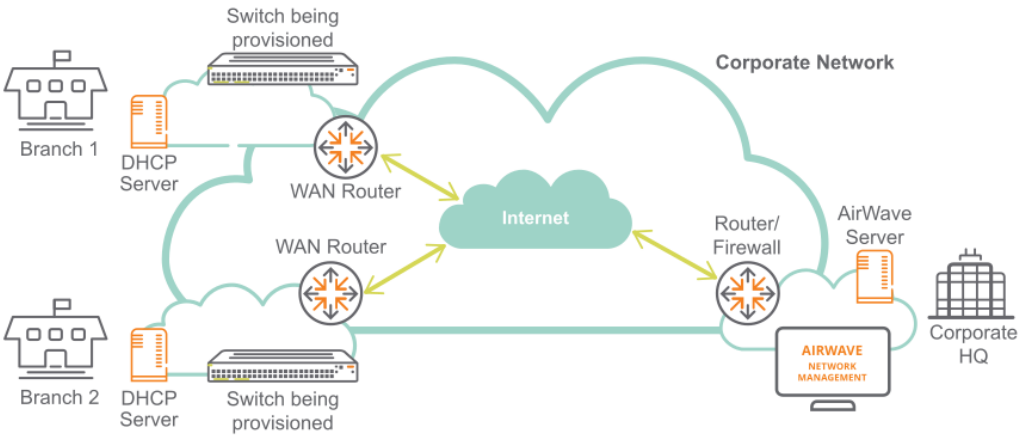
   - The preferred configuration method uses DHCP option 43 value as a string to parse AirWave configuration. Switch expects a DHCP option 60 with value `ArubaInstantAP` along with DHCP option 43 to parse AirWave details.
   - The alternative configuration method supports both encapsulated values from option 43 and direct value from option 43. Encapsulated vendor-specific sub options, with suboption code 146 is for AirWave details.

   IPv4 DHCP sub option 146 is not supported to configure AMP information through OOBM.

   IPv6:

   - IPv6 uses DHCP option 17 with sub option 100 and vendor class Enterprise ID as 47196.
   - DHCPv6 based ZTP on OOBM interface, `ipv6 enable` and `ipv6 address dhcp full` commands are enabled by default on OOBM interface.
3. After the AirWave details are verified and configured, the switch initiates the check-in into the AirWave server using the HTTPS communication. The AirWave configuration must be in the following format:

   ```
   <Group>:<Topfolder>:<folder1>,<AMP IP >,<shared secret>
   ```
4. From 16.08, if AirWave is reachable through both OOBM and Data VLAN, switch tries to register only with AirWave using OOBM.
5. After a successful registration, AirWave can monitor, configure, and troubleshoot the switches. Refer to *Aruba Networks and AirWave Switch Configuration Guide*.
6. Check-in failure retry is done every 60 seconds for 10 retries.
7. If DHCP does not provide AirWave details, the switch connects to Activate (Activate ZTP starts) for AirWave or Aruba Central details. If the DHCP options are not configured for AirWave, the switch is left in its default state for manual configuration.



In the preceding illustration, the workflow is as follows:

1. The switches being provisioned in the branches are booted obtaining the IP address from the DHCP server.
2. The DHCP servers provide information about the AirWave server in the Corporate Head Quarters.
3. The switches connect to the AirWave server through the Corporate Network (MPLS VPN or equivalent).
4. The AirWave server pushes the configuration to the switches based on the AirWave folder, switch model, and branch location.
5. An optional IPsec tunnel can be established between the branches and the Corporate HQ to secure the management traffic. For more information, refer Activate based ZTP with AirWave.

NOTE

If IPsec tunnel is required for AirWave, the switch requires Aruba Mobility Controller IP address, which is provided through ZTP with DHCP Option 138 (CAPWAP).

DHCP server configuration for DHCP based ZTP

You can configure the DHCP server for AirWave using Windows DHCP server, Linux DHCP server, and ArubaOS DHCP server.

Preferred Methods

The following methods are preferred to configure DHCP server for AirWave:

Configure AirWave details in Windows DHCP server for IPv4

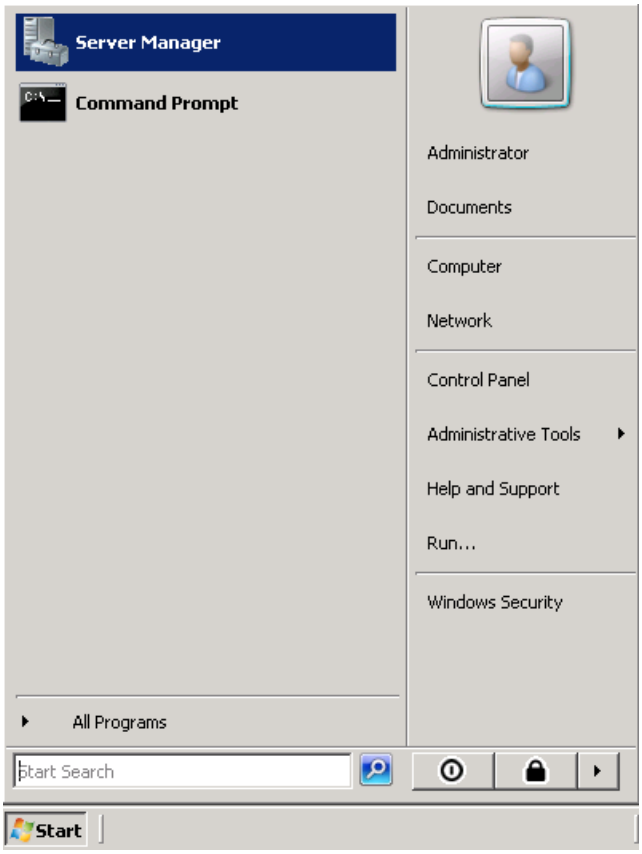
NOTE

AirWave provisioning using IPv6 on Windows based DHCP server is not supported.

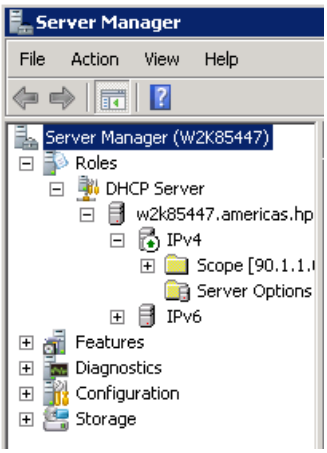
To configure the AirWave details in Windows DHCP server for IPv4, do the following steps:

Procedure:

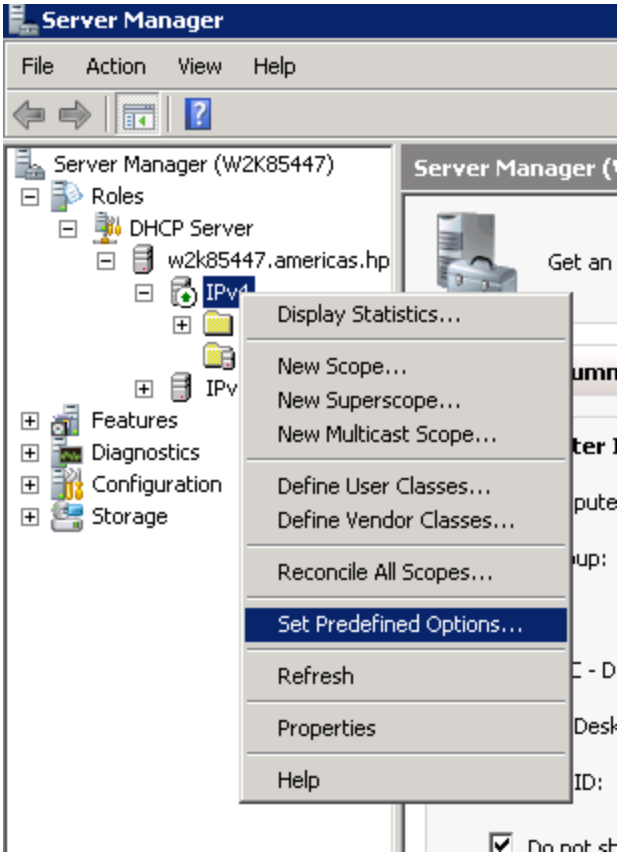
1. From the **Start** menu, select **Server Manager**.



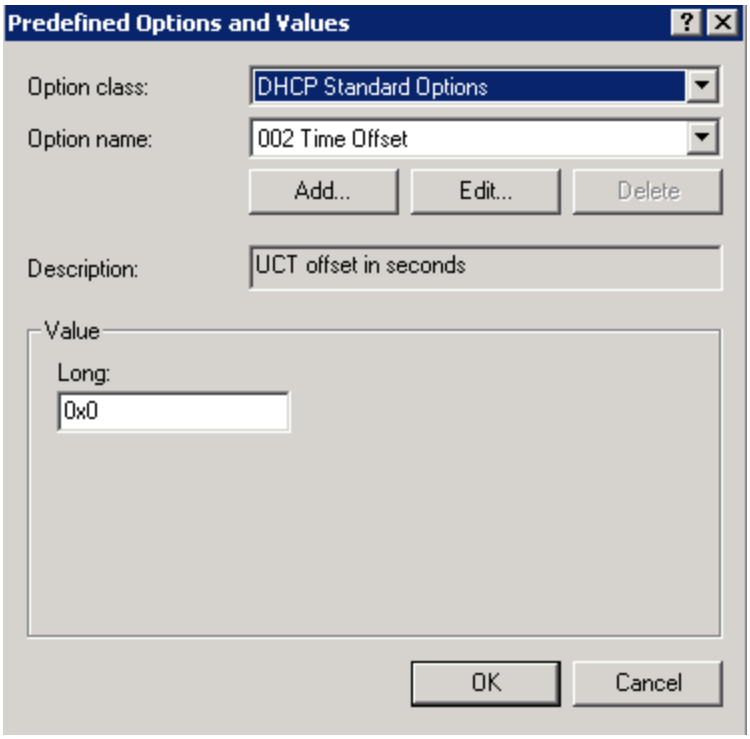
2. Select **Roles -> DHCP -> Server -> w2k8 -> IPv4**.



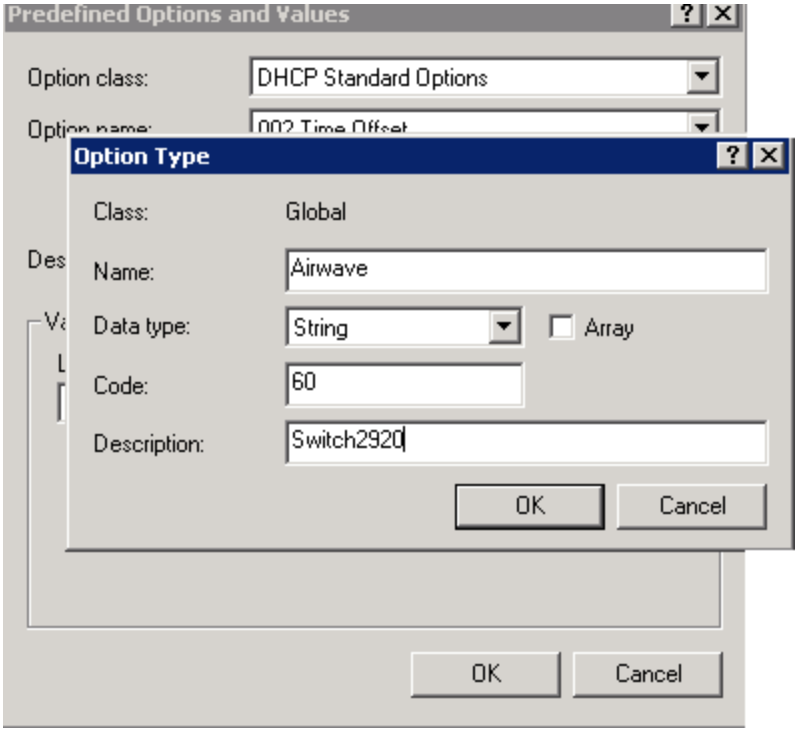
3. Right-click **IPv4** and select **Set Predefined Options...**



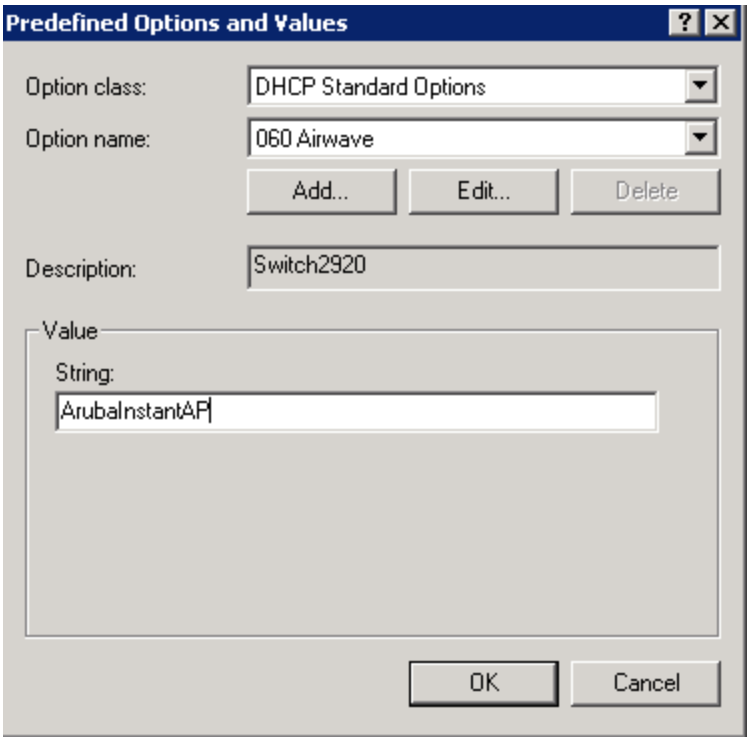
4. The **Predefined Options and Values** screen is displayed. Click **Add...**.



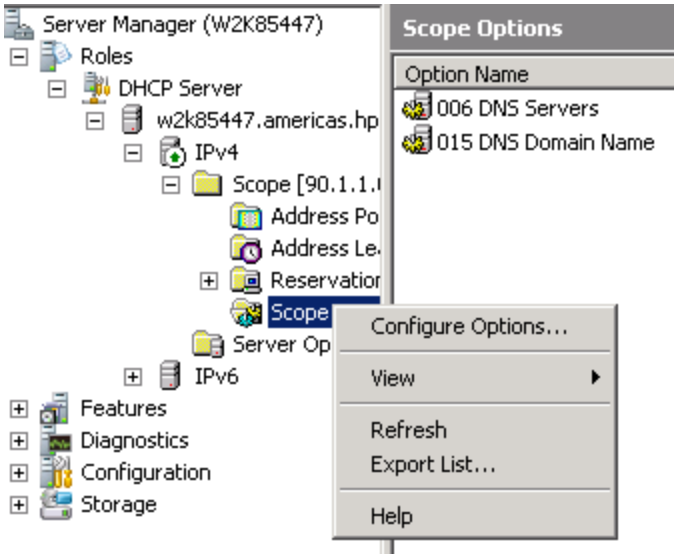
5. Enter the **Name** (any), **Data type** (select **String**), **Code** (enter **60**), and **Description** (any).



6. Click **OK**.
7. From the **Predefined Options and Values** screen, under **Value**, enter the String **ArubaInstantAP**. The string is case-sensitive and must be **ArubaInstantAP**.



8. Click **OK**.
9. Under IPv4, expand **Scope**. Right-click **Scope Options** and select **Configure Options...**

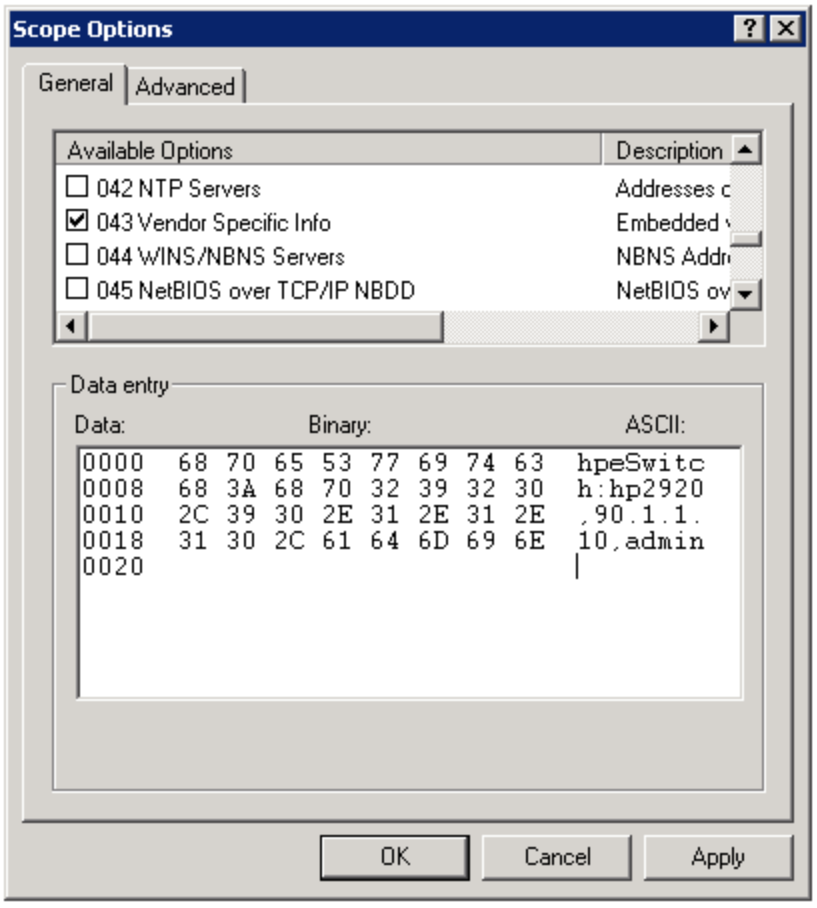


10. Under the General tab, select **043 Vendor Specific Info**. The Data entry data appears. Under ASCII, enter **hpeSwitch:hp2920,90.1.1.10, admin**. The ASCII value has the following format:

```
<Group>:<Topfolder>,<AMP IP>,<shared secret>
```

11. To add subdirectories, use the following format:

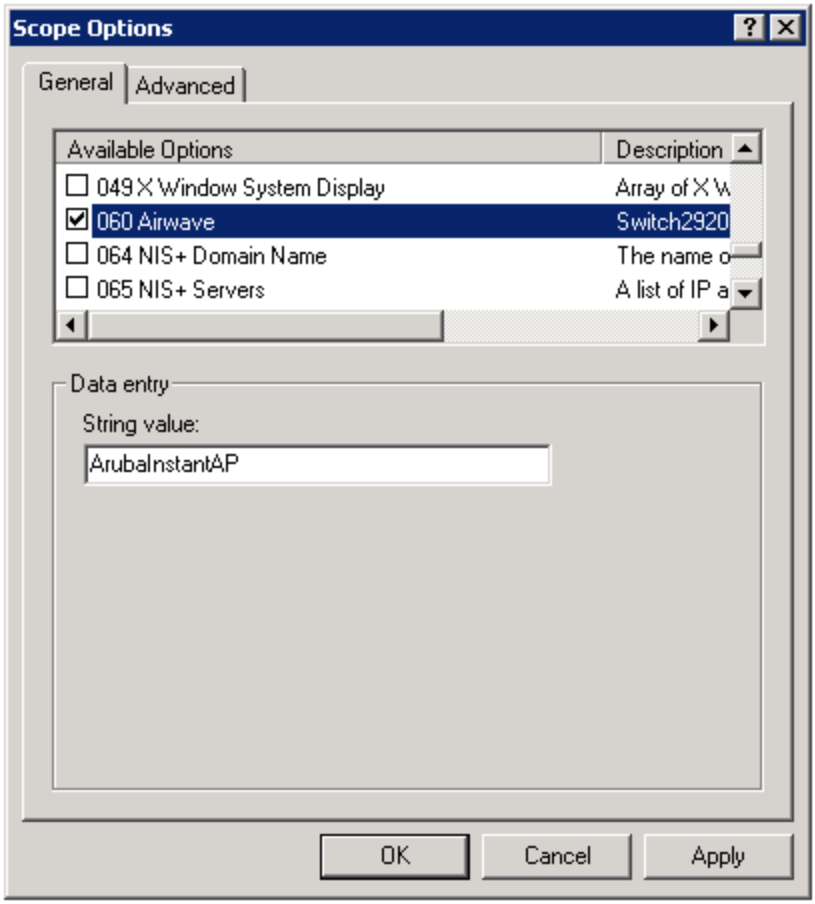
```
<Group>:<Topfolder>:<folder1>,<AMP IP>,<shared secret>
```



12. Under the General tab, select **060 AirWave**. Click **OK**.

NOTE

No changes are required to the 060 option.



13. You can verify the AirWave details as follows:

```
switch# show amp-server
switch# show run
```

Configure AirWave details in Linux DHCP server for IPv4

To configure the AirWave details in Linux DHCP server for IPv4, enter the following information:

```
option CAPWAP code 138 = array of ip-address;
ddns-update-style ad-hoc;
subnet 192.168.20.0 netmask 255.255.255.0 {
   option tftp-server-name "192.168.20.5";
   option routers 192.168.20.31;
   option ntp-servers 192.168.20.5;
   option domain-name "Airport";
   option domain-name-servers 192.168.20.5;
   option CAPWAP 171.0.0.3;

   #option 43 "171.0.0.100";
   range 192.168.20.10 192.168.20.30;
}
```

Configure AirWave details in Linux DHCP server for IPv6

To configure the AirWave details in Linux DHCP server for IPv6, enter the following information:

```
default-lease-time 900;
preferred-lifetime 600;
option dhcp-renewal-time 300;
option dhcp-rebinding-time 600;
allow leasequery;
option dhcp6.info-refresh-time 800;
dhcpv6-lease-file-name "/root/dhcpd6.leases";
host myclient {
        # The entry is looked up by this
        host-identifier option
                dhcp6.client-id 00:01:00:01:00:04:93:e0:00:00:00:00:a2:a2;

        # A fixed address
        fixed-address6 2001::1234;

        # A fixed prefix
        fixed-prefix6 2001::/64;

        # For debug (to see when the entry statements are executed)
        #  (log sol when a matching Solicitation is received)
        ##if packet(0,1) = 1 { log(debug,sol); }
}

# The subnet where the server is attached
subnet6 2001::/64 {
        range6 2001::5000 2001::5090;

        # Some /64 prefixes available for Prefix Delegation (RFC 3633)
#3ffe:501:ffff:100:: 3ffe:501:ffff:111:: /64;
        prefix6 2001::  2001:3:: /64;

        option dhcp6.name-servers 2001::6001,2001::6002;

        option dhcp6.vendor-opts
        00:00:B8:5C:    # HPE enterprise-number
        00:64:00:35:    # suboption (100) + length of AW string


#below hex values are for this ascii string : group:folder,2001::212,secret

67:72:6f:75:70:3a:66:6f:6c:64:65:72:2c:32:30:30:31:3a:3a:32:34:32:2c:73:65:63:72:65:7
4;
}
```

Configure AirWave details in AOS-S Switch DHCP server for IPv4

AirWave provisioning using IPv6 on AOS-S switch based DHCP server is not supported.

To configure the AirWave details in AOS-S switch DHCP server for IPv4, enter the following information:

```
option 43 ascii "group:folder,192.168.240.242,secret1"
option 60 ascii "ArubaInstantAP"
```

Alternate Methods

The following are the alternate methods to configure DHCP server for AirWave:

Configure AirWave details in Windows DHCP server for IPv4

NOTE

AirWave provisioning using IPv6 on Windows based DHCP server is not supported.

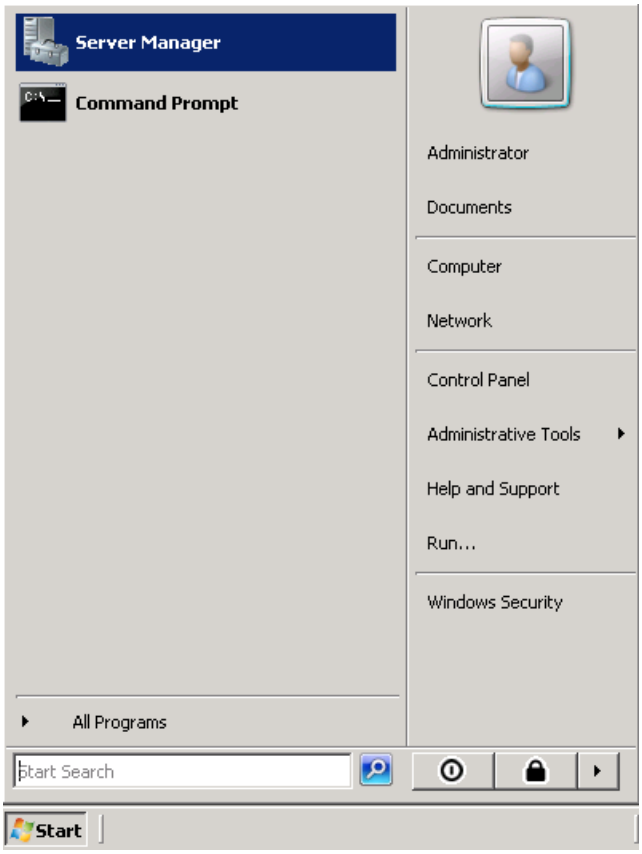
To configure the AirWave details in Windows DHCP server for IPv4, do the following steps:

NOTE

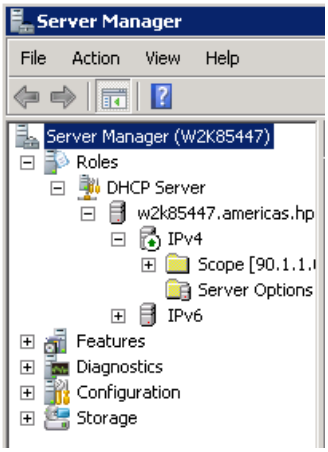
- Use these steps to configure ZTP for every switch by selecting a different Vendor Class for each type of switch.
- This method is not applicable for ZTP through OOBM.

Procedure:

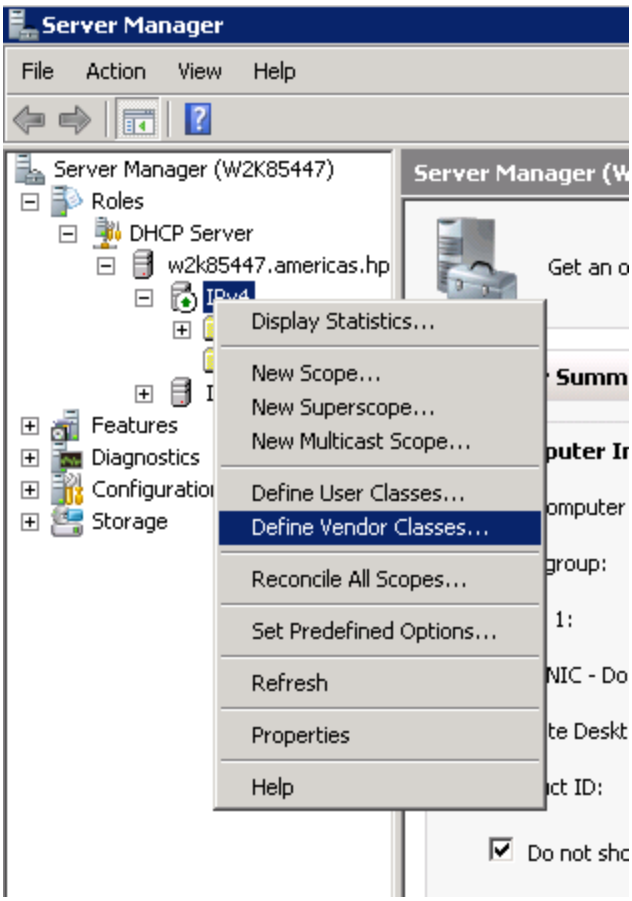
1. From the **Start** menu, select **Server Manager**.



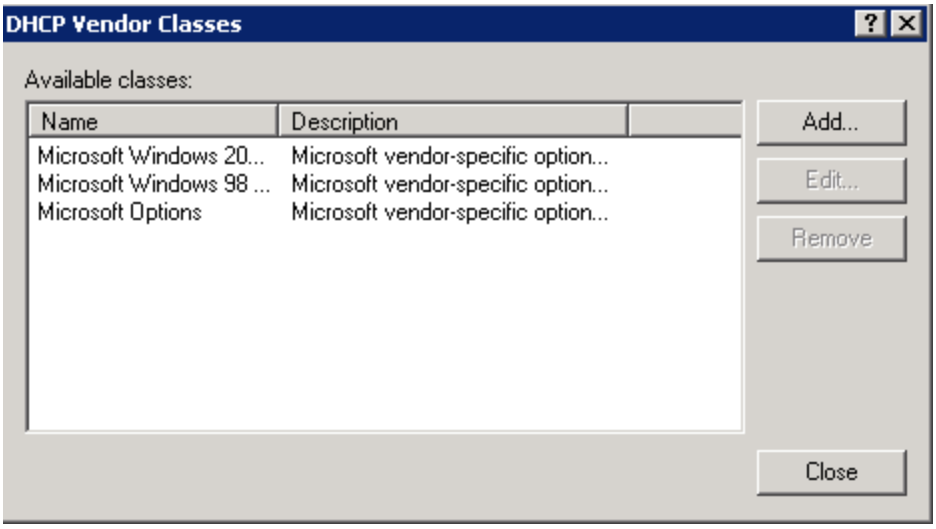
2. Select **Roles -> DHCP -> Server -> w2k8 -> IPv4**.



3. Right-click **IPv4** and select **Define Vendor Classes...**.



4. The DHCP Vendor Classes window is displayed. Click **Add...**.



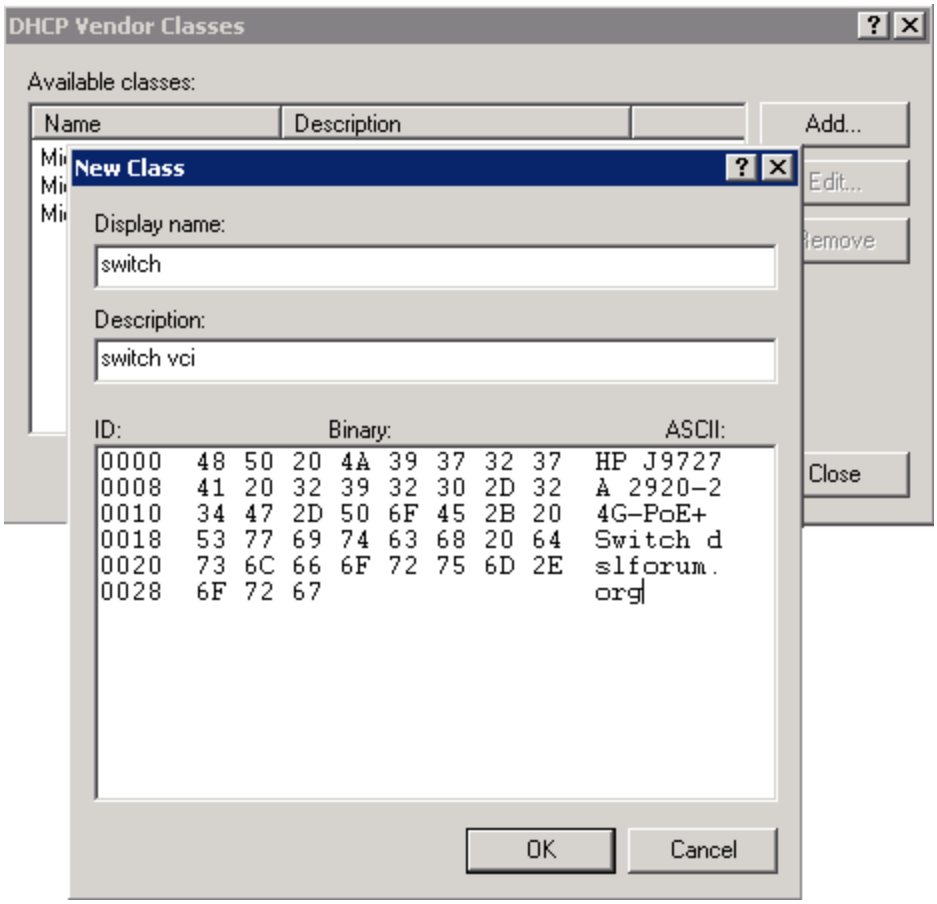
5. To get the vendor-specific value of a switch, go to the switch console and enter:

```
switch# show dhcp client vendor-specific
```

6. The following is the sample command output: Processing of Vendor Specific Configuration is enabled.

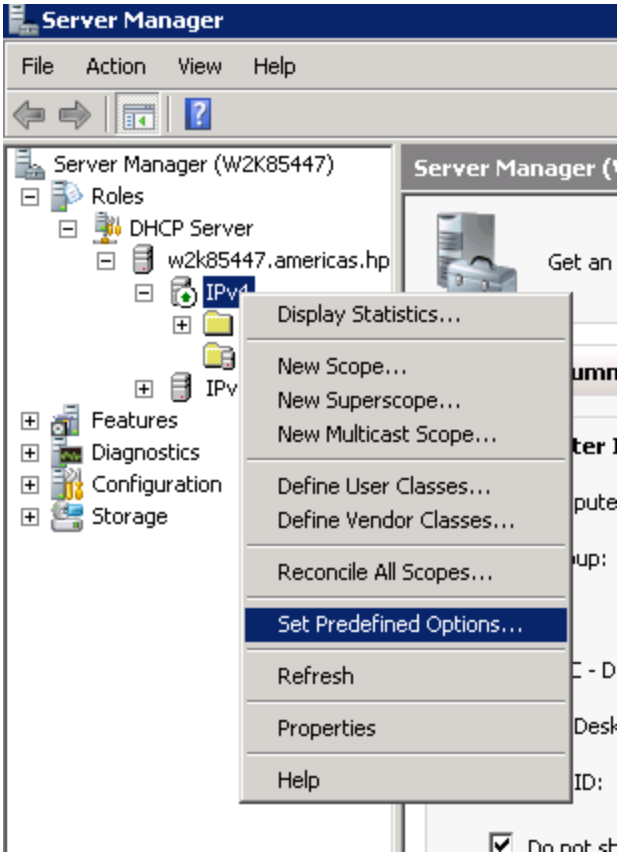
```
    Vendor Class Id = J9729A 2920-24G-PoE+ Switch dslforum.org
```

7. From the New Class window, enter the desired **Display name** (any) and the **Description** (any). For the **ASCII** field, enter the exact value that you got by executing the `show` command performed in the previous step. In this example, **Hewlett Packard Enterprise J9729A 2920-24G-PoE+ Switch dslforum.org**.

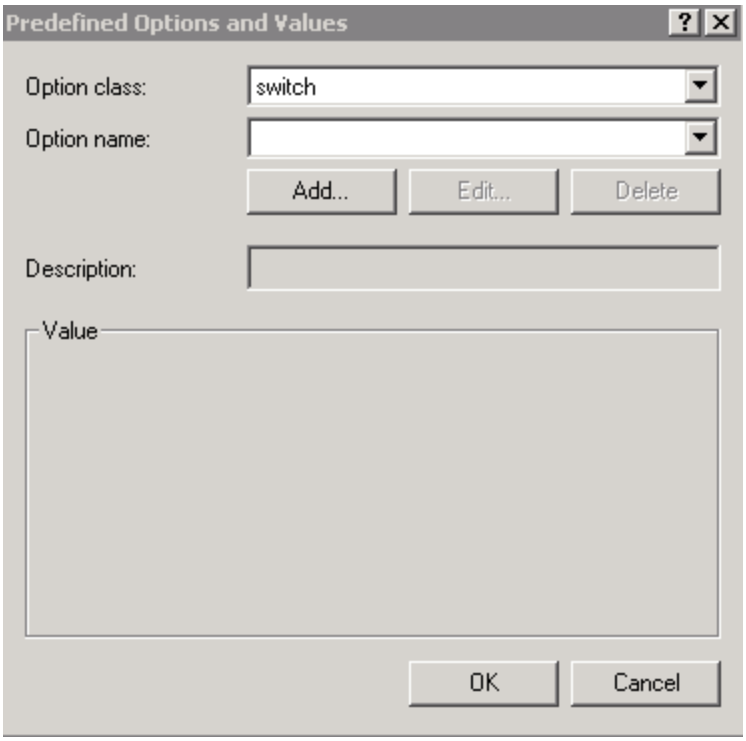

DHCP Vendor Classes
Available classes:
Name
Description
Add...
Edit...
Remove
Close
New Class
Display name:
switch
Description:
switch vci
ID:
Binary:
ASCII:
0000 48 50 20 4A 39 37 32 37 HP J9727
0008 41 20 32 39 32 30 2D 32 A 2920-2
0010 34 47 2D 50 6F 45 2B 20 4G-PoE+
0018 53 77 69 74 63 68 20 64 Switch d
0020 73 6C 66 6F 72 75 6D 2E slforum.
0028 6F 72 67 org
OK
Cancel

8. Click **OK**.

9. Right-click **IPv4** and select **Set Predefined Options...**.

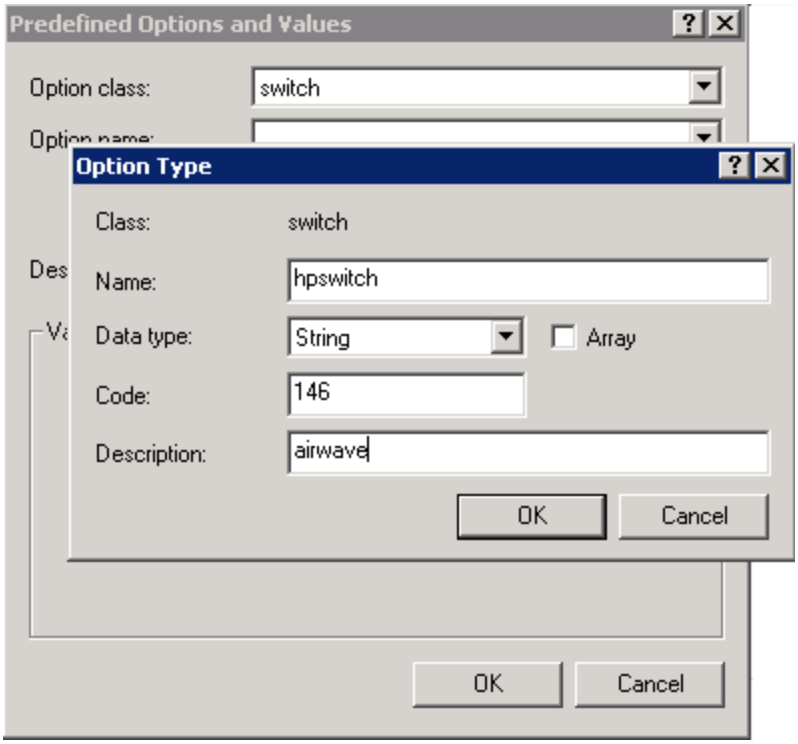


10. From the Predefined Options and Values window, select **Option class**. The Option Class displayed is the one that you configured under **DHCP Vendor Class**. In this example, the Option class is **switch**.



11. Click **Add...**.

12. From the Option Type window, enter the desired **Class** (any), the **Data type** (select **string**), the **Code** (enter **146**), and the **Description** (any).

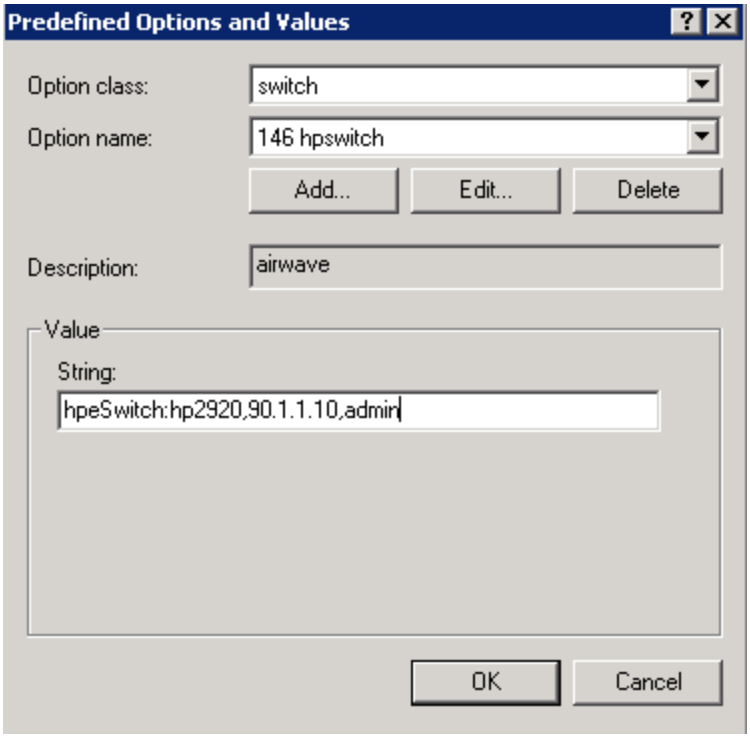


13. Click **OK**.
14. Under the Predefined **Options and Values** window, enter the **Value String**. In this example, enter **hpeSwitch:hp2920,90.1.1.10, admin**. The String has the following format:

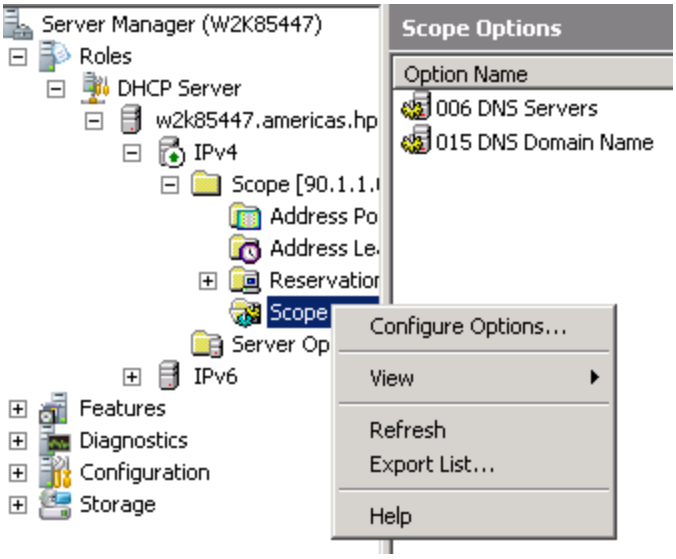
```
<Group>:<Topfolder>,<AMP IP>,<shared secret>
```

15. To add sub-folders, use the following format:

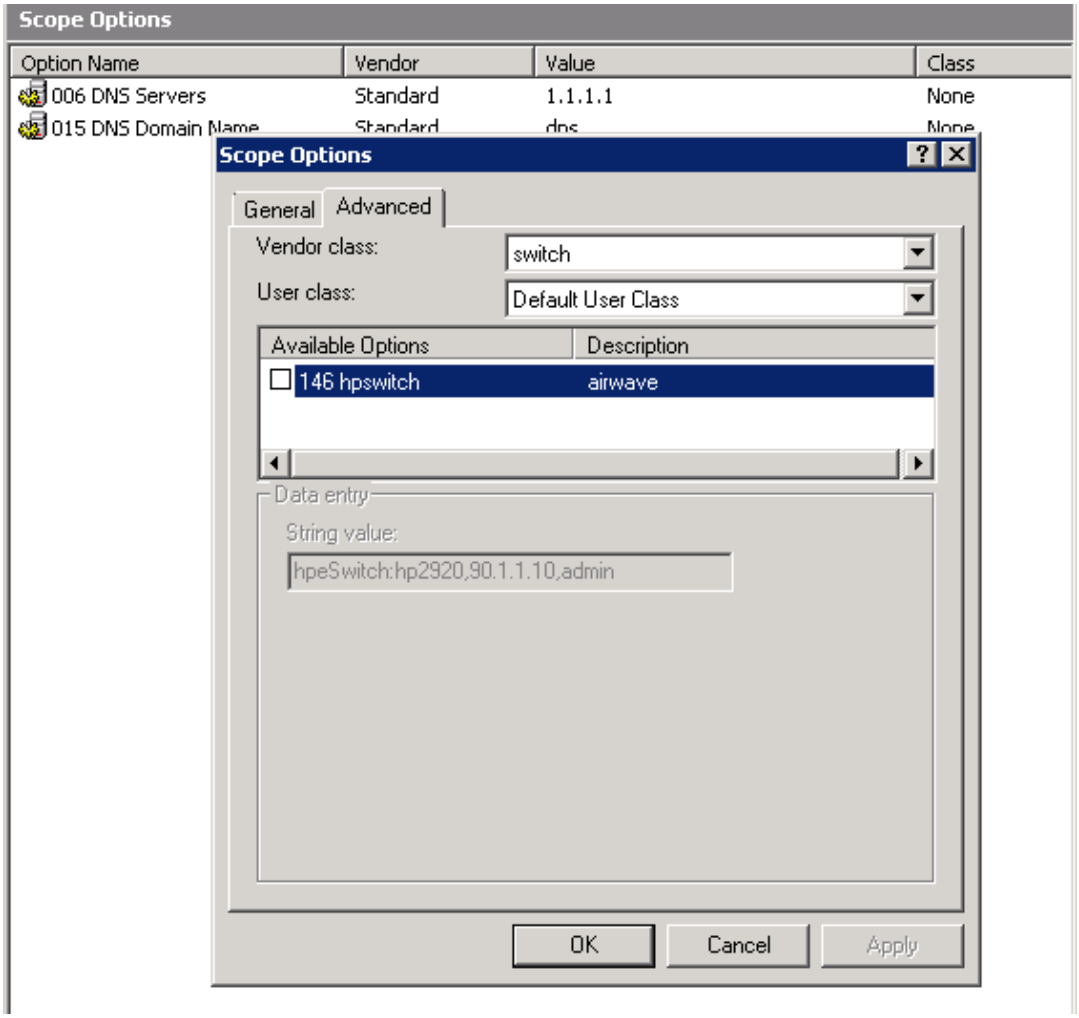
```
<Group>:<Topfolder>:<folder1>,<AMP IP>,<shared secret>
```



16. Click **OK**.
17. Under **IPv4**, expand **Scope**. Right-click **Scope Options** and select **Configure Options...**



18. From the **Scope Options** window:
    a. Select the **Advanced** tab.
    b. Under Vendor class, select the desired switch. In this example, **switch**.
    c. Select the **146 switch** option.
    d. Click **OK**.



19. You can verify the AirWave details as follows:

```
switch# show amp-server
switch# show run
```

Configure AirWave details in Linux DHCP server for IPv4

To configure the AirWave details in Linux DHCP server for IPv4, enter the following information:

```
option space ArubaInstantAP;
option ArubaInstantAP.cfg code 144 = text;
option ArubaInstantAP.img code 145 = text;
option ArubaInstantAP.org code 146 = text;
option CAPWAP code 138 = array of ip-address;

ddns-update-style ad-hoc;

subnet 192.168.20.0 netmask 255.255.255.0 {
   option tftp-server-name "192.168.20.5";
   option routers 192.168.20.31;
   option ntp-servers 192.168.20.5;
   option domain-name "Airport";
   option domain-name-servers 192.168.20.5;
   option CAPWAP 171.0.0.3, 192.168.20.31;

   class "vendor-class" {
        match substring (option vendor-class-identifier,0,2);
```

```
        #match option vendor-class-identifier;
   }
   subclass "vendor-class" "HP" {
      vendor-option-space ArubaInstantAP;
      #option ArubaInstantAP.cfg "runningConfig_5400R.txt";
      #option ArubaInstantAP.img "KB_16_01_0004.swi";
      option ArubaInstantAP.org "aw_group:fold,171.0.0.100,secret1234";
   }
    subclass "vendor-class" "Ar" {
      vendor-option-space ArubaInstantAP;
      #option ArubaInstantAP.cfg "runningConfig_5400R.txt";
      #option ArubaInstantAP.img "KB_16_01_0004.swi";
      option ArubaInstantAP.org "aw_group:fold,171.0.0.100,secret1234";
   }
   range 192.168.20.10 192.168.20.30;
}
```

Limitations

- The HTTPS check-in to AirWave does not support HTTPS proxy.
- For non-ZTP cases, the AirWave check-in starts by validating the following condition:

  Primary or Management VLAN must be configured with the IP address and one of the interfaces must be `UP`. By default, `VLAN 1` is the primary VLAN.
- OOBM redirection is not supported by VSF.

Best Practices

- Implement ZTP in a secure and private environment. Any public access may compromise the security of the switch, as follows:
  - Since ZTP is enabled only on the factory default configuration of the switch, DHCP snooping is not enabled. The Rogue DHCP server must be manually managed.
  - The DHCP offer is in plain data without encryption. Therefore, the offer can be listened by any device on the network and they can in turn obtain the AirWave information.
  - The TLS certificate of the server is not validated by the switch during the HTTPs check-in to AirWave. The AirWave server must be hosted in a private and secure environment of the switch.

Configure AirWave details manually

This section focuses on configuring the switch manually to reach out to AirWave. Manual configuration may be required, if ZTP is disabled due to the following scenarios or if AirWave credentials are not provided during the DHCP offer:

- Switch with configuration that explicitly disables ZTP
- Switch with nondefault configuration
- Switches that have upgraded from older images to 16.xx

In any of the above scenarios, you need to manually configure to reach the AirWave server using the `amp-server` command. This command helps you configure the AirWave IP address, group, folder, and shared secret. You must have the `manager` role to execute this command.

For example:

```
switch(config)# amp-server ip 192.168.1.1 group "group" folder "folder" secret
"branch1024"
```

The `show amp-server` command shows the configuration details:

```
AirWave Configuration details
AMP Server IP : 192.168.1.1
AMP Server Group : GROUP
AMP Server Folder : folder
AMP Server Secret : branch1024
AMP Server Config Status: Configured
```

amp-server

Syntax

`amp-server ip <IP-ADDR | IPv6-ADDR> group <GROUP> folder <FOLDER> secret <SECRET>`
`no amp-server`

Description

The `amp-server` command configures AirWave Management Platform (AMP) IP address, group, folder, and shared secret for triggering the device registration with AMP. The `amp-server` command supports both the IPv4 and IPv6 addresses. Switch cannot be provisioned simultaneously with IPv4 and IPv6 AirWave addresses.

The `amp-server` with IPv6 address is supported from 16.06 switch version.

The `no` form of this command removes the configuration for the AMP server.

Command context

`config`

Parameters

IP-ADDR

AMP server IPv4 address.

IPv6-ADDR

AMP server IPv6 address.

GROUP

AMP server group name.

FOLDER

AMP server folder name.

SECRET

AMP server shared secret string.

Example

```
switch(config)# amp-server
 ip                    Configure AMP server IP address.
switch(config)# amp-server ip
 IP-ADDR               Enter an IP address.
 IPV6-ADDR             Enter an IPv6 address.
```

```
switch(config)# amp-server ip 192.168.1.1
 group                 AMP server group name.
switch(config)# amp-server ip 192.168.1.1 group
 GROUPNAME-STR         AMP server group name.
switch(config)# amp-server ip 192.168.1.1 group grp11
 folder                AMP server folder name.
switch(config)# amp-server ip 192.168.1.1 group grp11 folder
 FOLDERNAME-STR        AMP server folder name.
switch(config)# amp-server ip 192.168.1.1 group grp11 folder fld11
 secret                AMP server shared secret string.
switch(config)# amp-server ip 192.168.1.1 group grp11 folder fld11 secret
 SECRET-STR            AMP server shared secret string.
switch(config)# amp-server ip 192.168.1.1 group grp11 folder fld11 secret scrt11

switch(config)# amp-server ip
 IP-ADDR               Enter an IP address.
 IPV6-ADDR             Enter an IPv6 address.
switch(config)# amp-server ip 2001:1db8:3cd4:1115:1111:2222:1a2f:1a2b
 group                 AMP server group name.
switch(config)# amp-server ip 2001:1db8:3cd4:1115:1111:2222:1a2f:1a2b
group
 GROUPNAME-STR         AMP server group name.
switch(config)# amp-server ip 2001:1db8:3cd4:1115:1111:2222:1a2f:1a2b
group grp21
 folder                AMP server folder name.
switch(config)# amp-server ip 2001:1db8:3cd4:1115:1111:2222:1a2f:1a2b
group grp21 folder
 FOLDERNAME-STR        AMP server folder name.
switch(config)# amp-server ip 2001:1db8:3cd4:1115:1111:2222:1a2f:1a2b
group grp21 folder fld21
 secret                AMP server shared secret string.
switch(config)# amp-server ip 2001:1db8:3cd4:1115:1111:2222:1a2f:1a2b
group grp21 folder fld21 secret
 SECRET-STR            AMP server shared secret string.
switch(config)# amp-server ip 2001:1db8:3cd4:1115:1111:2222:1a2f:1a2b
group grp21 folder fld21 secret scrt21
```

To view the AirWave configuration details, use the `show amp-server` command.

show amp-server

```
AMP Server Configuration details

  AMP Server IP            : 2001:1db8:3cd4:1115:1111:2222:1a2f:1a2b
  AMP Server Group         : grp21
  AMP Server Folder        : fld21
  AMP Server Secret        : scrt21
  AMP Server Config Status : Configured
```

show running-configuration

```
switch# show running-config

; JL071A Configuration Editor; Created on release #KB.16.06.0000x
; Ver #13:03.f8.1c.fb.7f.bf.bb.ff.7c.59.fc.7b.ff.ff.fc.ff.ff.3f.ef:05

hostname "Switch"
module 1 type jl071x
flexible-module A type JL081A
snmp-server community "public" unrestricted
oobm
   ip address dhcp-bootp
   exit
```

```
vlan 1
   name "DEFAULT_VLAN"
   untagged 1-24,A1-A4
   ip address dhcp-bootp
   ipv6 enable
   ipv6 address dhcp full
   exit
amp-server ip 2001:1db8:3cd4:1115:1111:2222:1a2f:1a2b group "grp21" folder "fld21"
   secret "scrt21"
```

`ipv6 enable` and `ipv6 address dhcp full` are enabled by default on VLAN 1 from 16.06 switch version.

debug ztp

Syntax

```
debug ztp
no debug ztp
```

Description

Enables or disables ZTP debug logging.

Parameters and options

`ztp`

Zero Touch Provisioning.

`no`

The `no debug ztp` command disables ZTP debug logging.

Stacking support

The ZTP process for stacked switches with AirWave is similar to the one for the standalone switch, with the exception that only the commander in the stack checks in with AirWave.

Disabling ZTP

ZTP is disabled if you make any of the following changes to the switch configuration:

- Enter the switch configuration mode using the `configure terminal` command.
- Enter into Menu and exit without doing any configuration
- Use CLI, SNMP, REST APIs, menu interface, or the web GUI to configure any settings. The change is shown in the running-configuration of the switch.
- When device is upgraded from any 15.xx version to 16.01, see Image Upgrade.
- Once DHCP server or Activate offers Airwave/Central details, ZTP is disabled. If the details are offered again, it is ignored.

Image Upgrade

If you upgrade from any 15.xx version to version 16.xx, the following minimal set of configuration is validated to enable or disable the ZTP process:

- If the switch has any other VLAN apart from the default VLAN, ZTP gets disabled.
- In default VLAN, if the IPv4 address is not set as DHCP (default option is DHCP), ZTP gets disabled.
- In default VLAN, if IPv6 is enabled or configured, ZTP gets disabled.

If you have any other configuration during the upgrade, ZTP will continue to be in the enabled state.

Using SNMPv3 in AirWave Template

- The SNMPv3 `engine-id` in the AirWave template must be a variable whose value is retrieved from the target switch at runtime. The same `engine-id` variable must be configured as a local `engine-id` in the template. The local `engine-id` makes a target switch to have constant `engine-id` always. The template must not have hardcoded `engine-id`. The SNMPv3 `engine-id` must be unique for each device in the network managed by AirWave.

```
snmp-server engine-id local "%snmpv3_engineid%"
snmpv3 engine-id "%snmpv3_engineid%"
```

- There must be at least one SNMPv3 user configuration in the template. The user configuration must have plaintext key values for auth and priv. The plaintext keys will be encrypted when template is pushed to switch. Each SNMPv3 user should be assigned to a suitable SNMPv3 group with security model as version 3 in the template.

```
snmpv3 enable
snmpv3 group managerauth user "snmpv3user" sec-model ver3
snmpv3 user "snmpv3user" auth md5 "snmpv3user" priv des "snmpv3user"
```

- The following is the sample template:

```
%template_header%
hostname "%hostname%"
%module_command%
include-credentials
snmp-server community "public" unrestricted
snmp-server engine-id local "%snmpv3_engineid%"
snmpv3 engineid "%snmpv3_engineid%"
snmpv3 enable
snmpv3 group managerauth user "snmpv3user" sec-model ver3
snmpv3 user "snmpv3user" auth md5 "snmpv3user" priv des "snmpv3user"
vlan 1
   name "DEFAULT_VLAN"
   untagged %vlan_1_untag_command%
%if use_dhcp=1%
   ip address dhcp-bootp
%endif%
%if use_dhcp=0%
   ip address %ip_address% %netmask%
%endif%
   ipv6 enable
%if use_ipv6_dhcp=1%
   ipv6 address dhcp full
%endif%
%if use_ipv6_dhcp=0%
   ipv6 address %ipv6_address%/%ipv6_prefix_length%
%endif%
   exit
amp-server ip 192.168.240.242 group "group" folder "folder" secret "secret"
```

Troubleshooting

You can troubleshoot switches by using the SSH connection and the device logs available in AirWave. For a list of all RMON message, refer to *Aruba Event Log Message Reference Guide for AOS-S switch 16.10*. You can enable the debug logging with the `debug ztp` command, see debug ztp on page 302.

AMP server messages

To display the AMP server debug messages, enter:

```
switch# debug ztp
```

To print the debug messages to the terminal, enter:

```
switch# debug destination session
```

Activate based ZTP with AirWave

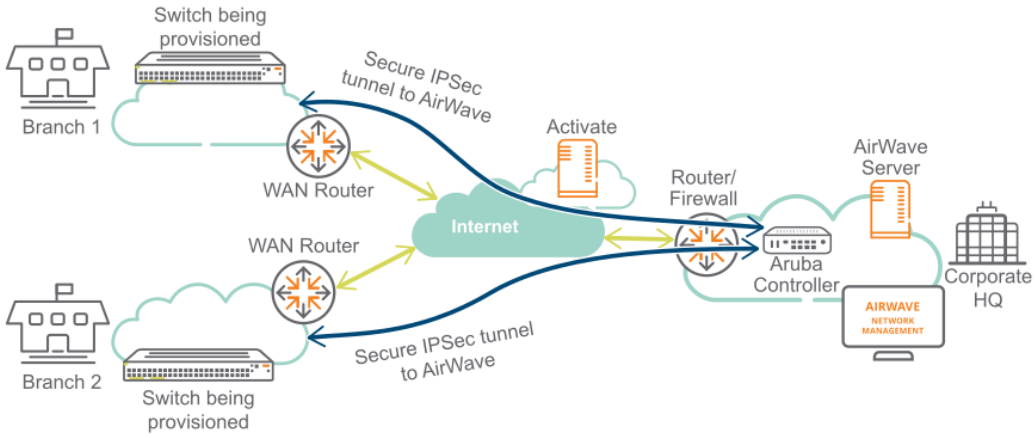
ZTP with Activate is used in the following scenarios to help switches check in through the Internet with public facing instances of Airwave:

- Deployments where administrators do not have a DHCP server to configure Airwave options
- Absence of corporate network reaching every branch

- Activate based ZTP is not supported for IPv6.
- Activate based ZTP is not supported for both IPv4 and IPv6 through OOBM.

Configuring Activate-based ZTP with AirWave

For Activate-based ZTP, the switch connects to Aruba Activate service through the Internet and autoconfiguration takes place based on the settings provided in Activate. For more information on how to set up an Activate account, folder and their rules, refer to the *Aruba Activate User Guide*.



In the preceding illustration, the workflow is as follows:

1. The switches being provisioned in the branches are booted and connect to the Activate on the cloud.
2. Based on the administrator's provisioning (folder, rule), the device is placed in the appropriate folder before getting redirected to the AirWave server in the Corporate HQ.
3. The switches connect to the AirWave server, and the server pushes the configuration to the switches based on the AirWave folder, switch model, and branch location.
4. Optionally, an IPsec tunnel to the Controller in the HQ can be constructed to secure the management traffic to AirWave. This configuration can be set as part of the initial configuration push from Activate.

IPsec for AirWave Connectivity

Overview

This feature supports secure communication between the switch and Aruba mobility controller (VPN concentrator) for AirWave traffic. The switch also provides the necessary support for ZTP by establishing a secure tunnel between the switch and AirWave, which are provided by a DHCP server or Activate.

IPsec ensures that communication between the switch and AirWave server (management traffic) is protected by establishing a secure channel between the switches and the Aruba VPN Controller (connected to AirWave server).

IPsec for Management Traffic

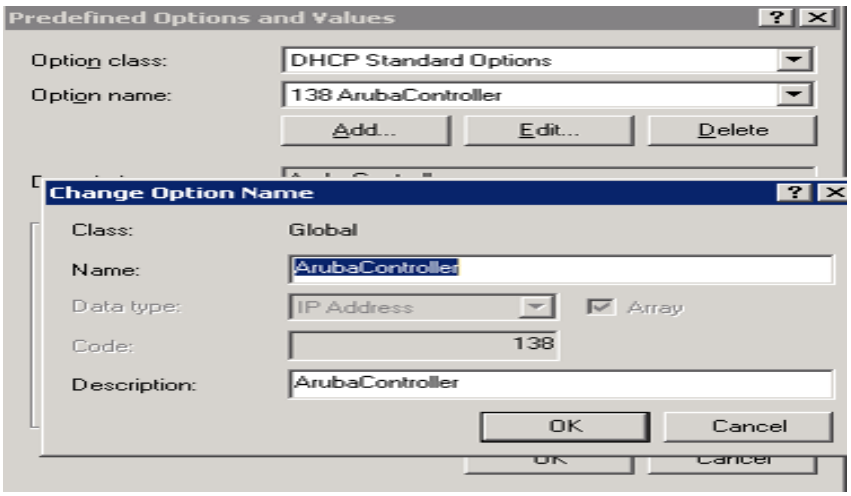
IPsec supports ZTP in deployment scenarios less restrictive than private LANs. ZTP enables switches to be configured and managed automatically without administrator intervention. In a deployment scenario where a switch and AirWave are located in different branches connected through an untrusted public network (the Internet), the communication between the switch and AirWave server can be protected.

- IPsec tunnel is not supported with IPv6.
- IPsec tunnel is not supported through OOBM.

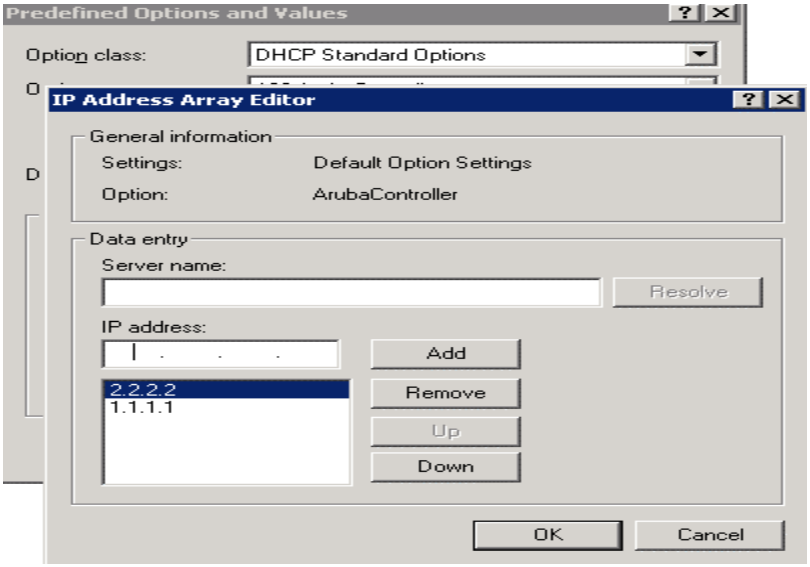
You can configure IPsec tunnel using any of the following methods:

- Activate ZTP
- DHCP ZTP with option 138

1. To assign controller IP addresses, select DHCP option 138.



2. Define the controller IP addresses for both the primary and secondary controllers.



- Manual configuration

IPsec Tunnel Establishment

- IPsec tunnel for AirWave is auto-configured. The switch decides to create IPsec tunnel only when an Aruba controller IP is present in the device before establishing the connection to AirWave.
- If the controller IP is not provided, the switch will try to establish a direct connection to AirWave.
- If the controller IP is present, the switch auto configures and initiates an IPsec tunnel interface. Once the tunnel is established, the Aruba controller provides an inner IP which the switch will then use as source IP to send any AirWave bound traffic. The switch then creates a static route to AirWave with the IPsec tunnel interface as the gateway.

IPsec Tunnel Failures

The following behaviors can cause an IPsec tunnel creation failure:

- Time

  The time in the switch has to be valid and correct. Ensure that NTP configuration is set up on switch and on the controller where the tunnel is terminating.

- Authentication

  The switch MAC addresses for both members must be added to the Aruba controller whitelist.

- Controller IP

  The controller IP must be reachable from the switch.

- Inner IP pool

  Ensure the inner IP pool is configured on the controller. Tunnel establishment is not successful, if the pool is full.

- Static Route

  There must not be any conflicting static route in the system for the AirWave IP configured.

- License

  The controller must have sufficient license to support IPsec tunnels.

IPsec tunnel to secondary controller

AOS-S switch assists support for IPsec tunnel between switch and the Aruba Controller (VPN concentrator) to carry the switch generated traffic to multiple services behind the Aruba Controller. The services include AirWave management station, ClearPass, DNS, Syslog, and so on.

IPsec tunnel needs a backup support for IPsec session failure. If the existing IPsec session is lost, the switch is able to establish a new IPsec tunnel session with a backup controller (secondary controller).

Backup controller support for IPsec tunnel

The switch supports two controllers with all the services such as ClearPass, Syslog, DNS, and AirWave. In such scenarios, a controller functions as a backup controller.

1. `aruba-vpn` is modified to support backup controller IP.

   ```
   aruba-vpn type amp peer-ip <IP_addr> backup-peer-ip <IP_addr>
   no aruba-vpn type amp peer-ip <IP_addr> backup-peer-ip <IP_addr>
   ```

   ```
   switch(config)# aruba-vpn type amp peer-ip 171.0.0.1
   backup-peer-ip Configure the Aruba VPN backup IP address.
   tos Configure the Aruba VPN tos value.
   ttl Configure the Aruba VPN ttl value.
   switch(config)# aruba-vpn type amp peer-ip 171.0.0.1 backup-peer-ip 171.0.0.3
   ```

2. When the switch is configured with both the primary and backup controllers, the switch will establish IPsec tunnel connection with primary controller
3. Switch initiates a new IPsec session with either primary or backup controller once "Dead Peer Detection" event is triggered for existing IPsec session.
4. Switch retries establishing IPsec session with both primary and backup controllers alternatively until a successful IPsec handshake.
5. Switch tries to establish the IPsec tunnel with the same controller when the following events occur:
   - Switch IP change
   - Vlan ID change

- Redundancy switch over

6. If `aruba-vpn type` is *amp*, after five consecutive AirWave check-in failures, the existing tunnel is destroyed and an IPsec tunnel is established with the other controller.

NOTE

ZTP continues to support existing DHCP options for AirWave or Controller IP discovery. You can configure both the primary and backup controllers IP in DHCP.

Switch reachability to the controllers

Figure 30 *Controllers through same VLAN*

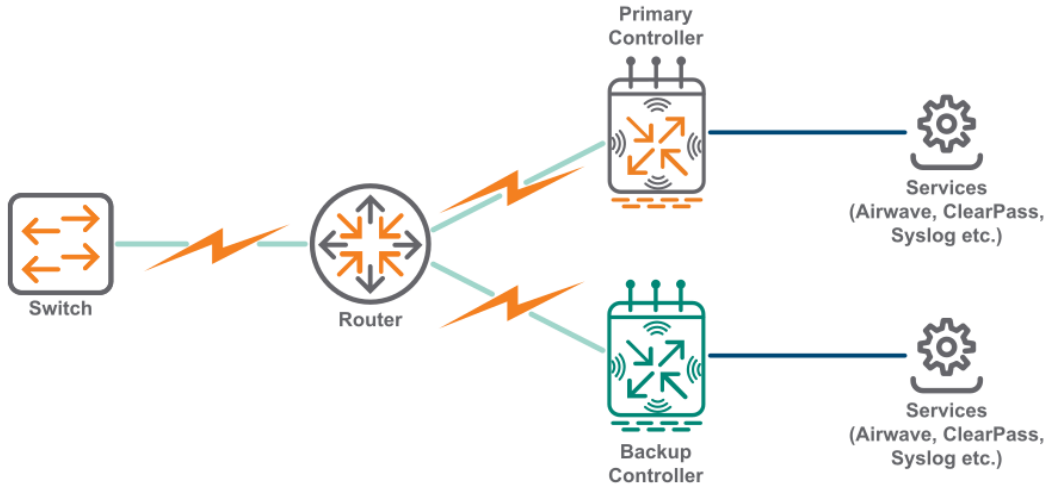
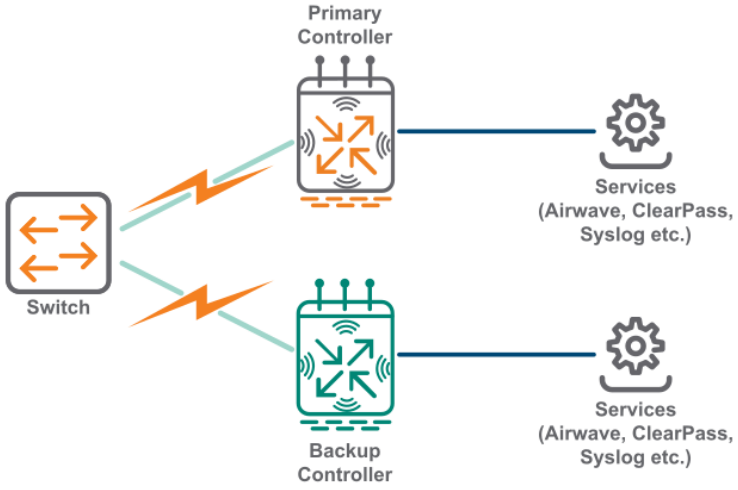


Figure 31 *Controllers through different VLANs*



Restrictions

1. Priority based failover is not supported.
2. When there is a failover to backup controller, the primary controller will not try to re-establish the IPsec session when it becomes active.

3. Failover to the other (either primary or secondary) controller results in data loss. All the existing application sessions in the switch will be terminated.

The failover will take up to three minutes.

4. The events such as time change and port flap, breaks the existing IPsec session and triggers a failover. The new IPsec session is established with a backup controller. In such scenario, switch does not perform any reachability test before selecting a controller to retry.

AirWave IP after discovery

AirWave IP and Aruba Controller IP (either from the Activate Server or from a DHCP server) are established and auto configured in an IPsec-IPv4 Tunnel. Once received, the IPsec tunnel is auto configured and established to send AirWave traffic securely. The Aruba Controller provides an inner-ip to the switch which then can communicate with AirWave.

Configuring the Aruba controller

On the Aruba Controller, configure through CLI:

Procedure

1. Add the switch MAC address to whitelist for authentication. For more information, refer http://www.arubanetworks.com/techdocs/ArubaOS_63_Web_Help/Content/ArubaFrameStyles/Control_Plane/Whitelists_on_Campus_and_Remote_APs.htm
2. Add an IP address pool that can be assigned to switch after tunnel creation. The IP range must not overlap with the interfaces IP on the controller.
   ```
   ip local pool "ipsec" 2.0.0.100 2.0.0.255
   ```
3. Create access lists that permit AirWave traffic and assign them to ap-roles. It is required only if the controller version is less than 6.5.2.0 or 8.1.0.0. If required, you can add specific acls such as `sys switch-role`.
   ```
   ip access-list session acl
   any any tcp 22 permit
   any any tcp 443 permit
   user-role sys-switch role
   access-list session acl
   ```
4. View the whitelist.

AirWave Controller IP configuration commands

aruba-vpn type

Syntax

```
aruba-vpn type amp peer-ip <IP_addr> backup-peer-ip <IP_addr>

no aruba-vpn type amp peer-ip <IP_addr> backup-peer-ip <IP_addr>

aruba-vpn type any peer-ip <IP_addr> backup-peer-ip <IP_addr>

no aruba-vpn type any peer-ip <IP_addr> backup-peer-ip <IP_addr>
```

Description

Configure the Aruba VPN type, peer IP address. When Aruba VPN type is `any`, the tunnel is established independent of Airwave configuration.

The no form of the command removes the `aruba-vpn type` statement from the configuration.

Parameters

`type`

Configure the controller IP.

`amp`

Configure Remote Access VPN session to protect specific switch generated traffic. It also supports secure ZTP of Airwave Management Platform (AMP) server.

`any`

Configure Remote Access VPN session to protect specific switch generated traffic. Secure ZTP is not supported.

`<IP_addr>`

IP address of the VPN.

Usage

```
switch(config)# aruba-vpn type

switch(config)# aruba-vpn type amp

switch(config)# aruba-vpn type amp peer-ip

switch(config)# aruba-vpn type any
```

- When you configure `aruba-vpn type` as `any`, the switch creates a tunnel and updates the `inner-ip`.
- You can create routes using the `ip route` command for next hop as `aruba-vpn` sends management traffic over the tunnel. For example: `ip route 2.0.0.0 255.255.255.0 tunnel aruba-vpn`

Show commands

show aruba-vpn

Syntax

`show aruba-vpn type <VPN-TYPE>`

Description

Show Aruba-VPN configuration information.

show aruba-vpn

```
show aruba-vpn

 Aruba VPN details

  Aruba VPN Type           : amp
  Aruba VPN Peer IP        : 171.0.0.1
  Aruba VPN Backup Peer IP : 171.0.0.3
```

```
  Aruba VPN Config Status  : Configured
  Aruba VPN tos            : Value from IPv4 header
  Aruba VPN ttl            : 64
```

show aruba-vpn type amp

```
show aruba-vpn type amp

 Aruba VPN details

  Aruba VPN Type           : amp
  Aruba VPN Peer IP        : 171.0.0.1
  Aruba VPN Backup Peer IP : 171.0.0.3
  Aruba VPN Config Status  : Configured
  Aruba VPN tos            : Value from IPv4 header
  Aruba VPN ttl            : 64
```

show ip route

Syntax

```
show ip route
```

Description

Show the IP route.

show ip route

```
show ip route

                              IP Route Entries

  Destination        Gateway         VLAN Type      Sub-Type   Metric     Dist.
  ------------------ --------------- ---- --------- ---------- ---------- -----
  0.0.0.0/0          192.168.20.31   1    static               250        1
**2.0.0.9/32         aruba-vpn            static               1          1
 *2.0.0.108/32       aruba-vpn            connected            1          0
  127.0.0.0/8        reject               static               0          0
  127.0.0.1/32       lo0                  connected            1          0
  192.168.20.0/24    DEFAULT_VLAN    1    connected            1          0
```

*The inner IP received from the Aruba Controller.

**Static Route for AirWave IP. Added automatically by the switch after tunnel establishment.

show interfaces tunnel aruba-vpn

Syntax

```
show interfaces tunnel aruba-vpn
```

Description

Auto-configured tunnel interface before creating IPsec. The tunnel ID is auto generated and to avoid conflict with user generated tunnel interface, the tunnel id is always the max tunnel supported by the switch + 1.

aruba-vpn

Display the configuration and status details of aruba-vpn tunnel.

brief

Display brief configuration and status for all tunnels.

Usage

```
show interfaces tunnel aruba-vpn
show interfaces tunnel brief
show interfaces [tunnel] [<TUNNEL-LIST> | <TUNNEL-NAME> | brief | type]
```

```
switch(config)# show interfaces tunnel aruba-vpn


 Tunnel Configuration :

  Tunnel               : tunnel-129
  Tunnel Name          : aruba-vpn-tunnel
  Tunnel Status        : Enabled
  Source Address       : 192.168.20.10
  Destination Address  : 171.0.0.3
  Mode                 : IPsec IPv4
  TOS                  : Value from IPv4 header
  TTL                  : 64
  IPv6                 : Disabled
  MTU                  : 1280


 Current Tunnel Status :

  Tunnel State               : Up
  Destination Address Route  : 0.0.0.0/0
  Next Hop IP                : 192.168.20.31
  Next Hop Interface         : vlan-1
  Next Hop IP Link Status    : Up
  Source Address             : Configured on vlan-1
  IP Datagrams Received      : 11
  IP Datagrams Transmitted   : 36
```

```
switch(config)#  show interfaces tunnel brief
 Status - Tunnel Information Brief
  Tunnel                   : tunnel-129
  Mode                     : IPsec IPv4
  Source Address           : 192.168.20.10
  Destination Address      : 171.0.0.3
  Configured Tunnel Status : Enabled
  Current Tunnel State     : Up
```

show crypto-ipsec sa

Syntax

```
show crypto ipsec sa
```

Description

Show crypto-IPsec statistics.

```
switch# show crypto ipsec sa

  Crypto IPSec Status
  Interface              : 1
  Source Address         : 192.168.20.10
  Destination Address    : 171.0.0.3
  Source Port            : 0              Destination Port    : 0
```

```
SPI                     : 3767553536
Encapsulation Protocol  : ESP
Encryption              : AES             Hash                : SHA1
PFS                     : 0               PFS Group           :
Mode                    : tunnel
Key Life                : 3600            Remaining key Life  : 3303
Key Size                : 0               Remaining key Size  : 0
Interface               : 2
Source Address          : 171.0.0.3
Destination Address     : 192.168.20.10
Source Port             : 0               Destination Port    : 0
SPI                     : 4173307552
Encapsulation Protocol  : ESP
Encryption              : AES             Hash                : SHA1
PFS                     : 0               PFS Group           :
Mode                    : tunnel
Key Life                : 3600            Remaining key Life  : 3301
Key Size                : 0               Remaining key Size  : 0
```

Usage

```
show crypto ipsec statistics
```

show running-configuration

Syntax

```
show running-configuration
```

IP route or tunnel interface will not be displayed in show run as they are auto created.

Description

Displays information about the current configuration.

Parameters

status

Shows whether the running configuration differs from the startup configuration.

structured

Shows the running configuration in a grouped format.

oobm

Shows the running configuration for Out-of-band management (OOBM) used for remote management switch.

change-history [<NUMBER> | detail]

Shows the change-history logs of the running configuration.

Interface [<PORT-LIST> | loopback | tunnel]

Shows the running configuration for interfaces.

router [bgp | ospf | ospf3 | pim | rip | vrrp]

Shows the running configuration for layer 3 routing protocols.

Vlan [<VLAN-LIST>]

Shows the running configuration for VLANs.

hash [recalculate]

Shows the hash calculated for the running configuration.

concise

Shows the running configuration in a concise format. The configurations displayed are for a range of ports.

Examples

show running-configuration

```
#show running-config

Running configuration:

; JL071A Configuration Editor; Created on release #KB.16.10.0011H
; Ver #14:6f.6f.f8.1d.fb.7f.bf.bb.ff.7c.59.fc.7b.ff.ff.fc.ff.ff.3f.ef:00

hostname "Aruba-3810M-24G-1-slot"
module 1 type jl071x
include-credentials
password manager user-name "manager" sha1
 "694ebcc5ea2e27ec8f045553853e06247626b787"
snmp-server community "public" unrestricted
snmpv3 engineid "00:00:00:0b:00:00:70:10:6f:84:0c:80"
aaa port-access mac-based 2 addr-limit 20
aaa port-access mac-based 3 addr-limit 20
aaa port-access mac-based 3 addr-moves
aaa port-access mac-based 4 addr-limit 20
aaa port-access mac-based 4 addr-moves
aaa port-access mac-based 5 addr-moves
aaa port-access mac-based 6 addr-moves
aaa port-access mac-based 8 addr-limit 30
aaa port-access mac-based 9 addr-limit 30
aaa port-access mac-based 10 addr-limit 30
aaa port-access mac-based 13 addr-moves
aaa port-access mac-based 14 addr-moves
aaa port-access mac-based 15 addr-moves
aaa port-access web-based 10 client-limit 20
aaa port-access web-based 11 client-limit 20
aaa port-access web-based 11 client-moves
aaa port-access web-based 12 client-limit 20
aaa port-access web-based 12 client-moves
aaa port-access web-based 13 client-moves
aaa port-access web-based 14 client-limit 30
aaa port-access web-based 14 client-moves
aaa port-access web-based 15 client-limit 30
aaa port-access web-based 15 client-moves
aaa port-access web-based 16 client-limit 30
aaa port-access web-based 20 client-moves
aaa port-access web-based 21 client-moves
aaa port-access web-based 22 client-moves
oobm
   ip address dhcp-bootp
   ipv6 enable
   ipv6 address dhcp full
   exit
vlan 1
```

```
   name "DEFAULT_VLAN"
   untagged 1-24
   ip address dhcp-bootp
   ipv6 enable
   ipv6 address dhcp full
   exit
spanning-tree
spanning-tree 1 point-to-point-mac false root-guard loop-guard tcn-guard bpdu-filter
spanning-tree 2 point-to-point-mac false root-guard loop-guard tcn-guard bpdu-filter
spanning-tree 3 point-to-point-mac false loop-guard tcn-guard bpdu-filter
spanning-tree 4 point-to-point-mac false loop-guard tcn-guard bpdu-filter
spanning-tree 5 point-to-point-mac false loop-guard tcn-guard
spanning-tree 6 point-to-point-mac false loop-guard tcn-guard
spanning-tree mode rapid-pvst

#
```

show running config concise

```
# show running-config concise

Running configuration:

; JL071A Configuration Editor; Created on release #KB.16.10.0011H
; Ver #14:6f.6f.f8.1d.fb.7f.bf.bb.ff.7c.59.fc.7b.ff.ff.fc.ff.ff.3f.ef:00

hostname "Aruba-3810M-24G-1-slot"
module 1 type jl071x
include-credentials
password manager user-name "manager" sha1
 "694ebcc5ea2e27ec8f045553853e06247626b787"
snmp-server community "public" unrestricted
snmpv3 engineid "00:00:00:0b:00:00:70:10:6f:84:0c:80"
aaa port-access mac-based 2-4 addr-limit 20
aaa port-access mac-based 8-10 addr-limit 30
aaa port-access mac-based 3-6,13-15 addr-moves
aaa port-access web-based 10-12 client-limit 20
aaa port-access web-based 14-16 client-limit 30
aaa port-access web-based 11-15,20-22 client-moves
oobm
   ip address dhcp-bootp
   ipv6 enable
   ipv6 address dhcp full
   exit
vlan 1
   name "DEFAULT_VLAN"
   untagged 1-24
   ip address dhcp-bootp
   ipv6 enable
   ipv6 address dhcp full
   exit
spanning-tree
spanning-tree 1-4 bpdu-filter
spanning-tree 1-2 root-guard
spanning-tree 1-6 tcn-guard
spanning-tree 1-6 loop-guard
spanning-tree 1-6 point-to-point-mac false
spanning-tree mode rapid-pvst

#
```

ZTP with Aruba Central

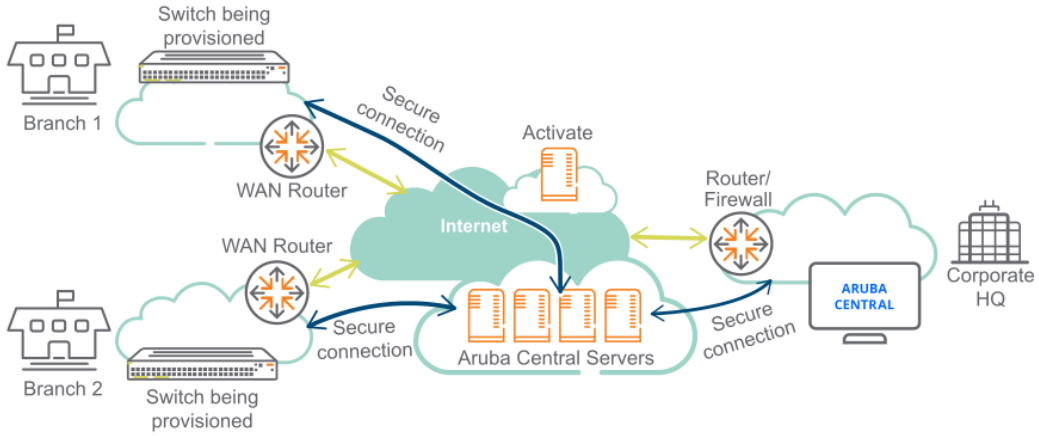
Aruba Central does not require any configuration of local DHCP server or other network components but requires a switch with Internet access.

Users with access to Aruba Central cloud portal must provision their switches and assign licenses accordingly. Once complete, Aruba Central will automatically program the Activate portal with the required switch details and the group to which the switch must check in.

NOTE

- Aruba Central does not support IPv6 connectivity.
- Aruba Central is not applicable for connection through OOBM interface.

The following diagram illustrates the working of Aruba Central ZTP:



Prerequisites for Activate and Aruba Central connections:

- To allow devices to communicate over a network firewall, ensure that the domain names and ports as mentioned in Table 26: Domain Names for Device Communication with Aruba Activate - Table 29: Other Domain Names are allowlisted.
- The connection to Activate or Aruba Central must be through an HTTP or HTTPS proxy.
  - For connection via HTTP proxy, refer to the configuration steps in HTTP Proxy support with ZTP overview on page 304.
  - For connection via HTTPS proxy, the domain names given in Table 26: Domain Names for Device Communication with Aruba Activate, Table 27: Domain Names for Device Communication with Aruba Central, and Table 29: Other Domain Names must be allowlisted so that the TLS connection is not intercepted and modified by the proxy.
- For an exhaustive list of all the URLs, see Opening Firewall Ports for Device Communication.

The workflow is as follows:

1. The switches being provisioned in branches boot and connect to the Activate on the cloud.
2. To establish a TLS connection with Activate, the switches send the Activate server domain name (`devices-v2.arubanetworks.com`) in the `server_name` SNI extension field of the Client Hello message

to Activate. In order to successfully connect to Activate, the following domains must be allowlisted.

Table 26: *Domain Names for Device*

Communication with Aruba Activate

Domain Name	Protocol
device.arubanetworks.com	HTTPS TCP port 443
devices-v2.arubanetworks.com	
est.arubanetworks.com *	
pool.ntp.org	UDP port 123

* Required for Aruba 2530 switches to provision certificate using the EST server in activate.

3. Switch obtains the URL of Aruba Central from Activate and establishes a TLS connection with Aruba Central. While establishing the TLS connection, it sends the server name of Aruba Central in the SNI extension field of the Client Hello message to Aruba Central. To successfully connect to Aruba Central, the following domains must be allowlisted.

Table 27: *Domain Names for Device Communication with Aruba Central*

Region	URL for Device Connectivity	Protocol
US-1	app1.central.arubanetworks.com	HTTPS TCP port 443
US-2	device-prod2.central.arubanetworks.com	HTTPS TCP port 443
US-WEST-4	device-uswest4.central.arubanetworks.com	HTTPS TCP port 443
EU-1	device-eu.central.arubanetworks.com	HTTPS TCP port 443
EU-3	device-eucentral3.central.arubanetworks.com	HTTPS TCP port 443
Canada-1	device-ca.central.arubanetworks.com	HTTPS TCP port 443
China-1	device.central.arubanetworks.com.cn	HTTPS TCP port 443
APAC-1	app1-ap.central.arubanetworks.com	HTTPS TCP port 443
APAC-EAST1	device-apaceast.central.arubanetworks.com	HTTPS TCP port 443

Region	URL for Device Connectivity	Protocol
APAC-SOUTH1	device-apacsouth.central.arubanetworks.com	HTTPS TCP port 443

You must add the URL used to access Aruba Central based on your region.

4. Based on administrator's provisioning (such as folder, rule), the device is placed in the appropriate folder before being redirected to the Aruba Central.
5. The switches check-in with Aruba Central and the server pushes the configuration to the switches based on the group, switch model, and branch location.
6. Software update can be done via Activate and Aruba Central. In order to update the software successfully, the following domain(s) must be allowlisted.

Table 28: *Other Domain Names*

Domain Name	Protocol
http://h30326.www3.hpe.com	TCP port 80

To view the URL for software updates, use the `show activate software-update` command.

7. To access the device console through SSH from Aruba Central, the following domain(s) must be allowlisted.

Table 29: *Other Domain Names*

Domain Name	Protocol
central-eu-rcs.central.arubanetworks.com (for Europe region)	TCP port 443
rcs-m.central.arubanetworks.com (for all other regions)	TCP port 443

For more information on Aruba Central configuration, refer to the *Aruba Central Configuration Guide*.

After the switch successfully checks-in with Aruba Central, the management interfaces on the switch are read-only or disabled.

The following management interfaces on the switch are read-only:

- Web UI
- SNMP
- REST

These interfaces are opened for READ operation after the switch is connected to Aruba Central. For the 2920 switches, only SNMP is read-only, REST and Web UI are disabled.

The following management interfaces on the switch are disabled:

- TR-69
- Menu

There is a restriction on executing the following commands over CLI:

- boot
- recopy
- erase
- reload
- startup-default
- upgrade-software
- setup
- delete
- reboot
- restore
- menu
- write memory
- amp-server

LED Blink feature

Central connectivity loss is indicated by LEDs. If connectivity is broken and Aruba-Central is enabled, the USR/FDX and Locator LEDs will blink. The LEDs will stop blinking once the switch is connected back to Central.

Aruba Central Configuration manually

In factory default switches, ZTP with Central is turned ON. ZTP can be disabled in the following scenarios:

- Switches with edited configuration
- Switches where the administrator has explicitly turned off ZTP with Central

In any of the mentioned scenarios, an administrator can manually configure Aruba Central using the `aruba-central` command.

aruba-central

Syntax

```
aruba-central {enable | disable | support-mode {enable | disable}}
```

Description

Configure Aruba Central server support. When enabled, and when a server web address has been obtained using Aruba Activate, the system will connect to an Aruba Central server. The system will obtain configuration updates and most local configuration commands will be disabled. This mode is enabled by default.

Enter support mode to enable all configuration commands. Normally, when the system is connected to an Aruba Central server, the configuration is updated from that server and most local configuration commands are disabled. Support mode enables those commands for use in troubleshooting problems. Support mode is disabled by default. When the system is not connected to Aruba Central server, the full command set is enabled for local configuration.

Restrictions

- Switch communication to Aruba Central is not supported via OOBM.
- Aruba-central is not supported in FIPS switches and it will be disabled by default.
- Aruba-central is not supported in Stack switches and it will be disabled by default.

To avoid broadcast storm or loops in your network while configuring ZTP, do not have redundant links after you complete ZTP and Airwave registration. Authorize the new switch and then push the Golden Configuration template from Airwave.

Example

Enable Aruba Central server support

```
switch(config)# aruba-central enable
```

Disable Aruba Central server support

```
switch(config)# aruba-central disable
```

Enter support mode to enable all CLI configuration commands

```
switch(config)# aruba-central support-mode enable

This mode will enable all CLI configuration commands, including those normally
reserved bythe Aruba Central service.
Use of this mode may invalidate the configuration provisioned through Aruba Central
server.
Continue (y/n)?
```

Starting with 16.09 release when switches are on-boarding to Central, SNMP access isread-only, and SNMP traps are supported.

Activating AOS-S Switch Firmware Integration

CLIs are available for Activate firmware updates which enables, update, checks and shows firmware upgrades.

Operating Notes

- Switch will periodically check with Activate every seven days for the latest image version.
- Download the image from the URL provided by Activate and upgrade the switch with the new image.

Restrictions

- When a switch is managed by either AirWave or Aruba Central, the automatic firmware check is disabled.
- Activate upgrade from the non-supported build is disabled upon upgrading to version 16.03.

- Upon upgrade from version 16.02 to version 16.03 with activate provision enabled, activate software update will be enabled.

activate software-update enable

Syntax

```
activate software-update [enable | disable]
```

Description

Enables or disables the Activate software update.

Activate software-update is enabled by default.

Parameters

`disable`

Disables the Activate software update.

`enable`

Enables the Activate software update.

Example

Switch will check with activate for every seven days for latest image available and RMON logs will be generated:

```
I 10/25/16 14:04:27 05219 activate:
A system software update is available to version WB.16.02.0012.
```

activate software-update check

Syntax

```
activate software-update check
```

Description

Check the Activate software update manually.

Example

```
switch(config)$# activate software-update check

 Configuration and Status - Activate Software Update

  Activate Server Address      : devices-v2.arubanetworks.com
  Activate Server Polling      : Enabled
  Installed Software Version   : WC.xx.xx
  Server Software Version      : Not available - server communication error.
  Server Software Image URL    : Not available - server communication error.
switch(config)$
```

This switch is not connected to Activate, hence communication error is shown in Server Software Version and Server Software Image URL field.

activate software-update update

Syntax

```
switch#(config) activate software-update update
```

Description

Updates the software for Activate.

Parameters

primary

Update primary software image using the Aruba Activate server.

secondary

Update secondary software image using the Aruba Activate server.

Example

```
switch# activate software-update update

This command will save the current configuration,
update the selected software image, and reboot the
system to the selected partition.

Continue (y/n)? y

000M
```

activate provision

Syntax

```
activate provision {enable | disable | force | override-def-cfg-check} help
```

Description

This command is used to enable, disable, or force system provisioning using Aruba Activate. This command also overrides the current configuration checks for switches which are not in factory default configuration, and initiates system provisioning using Aruba Activate.

Parameters

`enable`

Enables system provisioning using Aruba Activate.

`disable`

Disables system provisioning using Aruba Activate.

`force`

Immediately forces to provision the system using Aruba Activate.

`override-def-cfg-check`

Overrides current configuration check and initiates provisioning using Aruba Activate. This option is used when a switch is not in factory default configuration. This takes effect during the next reboot.

Example

```
switch(config)# activate provision force
switch(config)#
```

```
0008:04:35:03.63 ZTP mactivateCtrl:Hostname resolved with IP: 104.36.249.201:443
0008:04:35:03.78 ZTP mactivateCtrl:Proxy IP is not Configured
0008:04:35:03.86 ZTP mactivateCtrl:EndPoint Url :
   https://devices-v2.arubanetworks.com:443/hpe-provision
0008:04:35:03.98 ZTP mactivateCtrl:SOCKET IS OPEN!!!
0008:04:35:07.64 ZTP mactivateCtrl:Second POST msg is sent to Activate.
0008:04:35:09.15 ZTP mactivateCtrl:activate connection established
0008:04:35:09.23 ZTP mactivateCtrl:Custom CA  CUSTOM_CA installed

0008:04:35:09.30 ZTP mactivateCtrl:Central URL is
   https://internal.central.arubanetworks.com/ws

0008:04:35:09.41 ZTP mactivateCtrl:ZTP is disabled
```

show activate software-update

Syntax

```
show activate software-update
```

Description

Show the configuration and status of the Activate software update.

Example output

```
switch(config)$ show activate software-update

Configuration and Status - Activate Software Update

  Activate Server Address      : devices-v2.arubanetworks.com
  Activate Server Polling      : Enabled
  Installed Software Version   : WC.xx.xx
  Server Software Version      : Not available - server communication error.
  Server Software Image URL    : Not available - server communication error.
switch(config)$
```

Show activate provision

Syntax

```
show activate provision
```

Description

Show the configuration and status of the Activate Provision services.

Examples

```
switch(config)#show activate provision

 Configuration and Status - Activate Provision service
  Activate server address    : devices-v2.arubanetworks.com
  Activate server polling    : Enabled
  Activation key             : ABC-XYZ-123
```

Default status when Activate server polling is not started

```
switch(config)#show activate provision

 Configuration and Status - Activate Provision Service
```

```
  Activate Provision Service   : Enabled
  Activate Server Address      : devices-v2.arubanetworks.com
  Activation Key               : Not Available
  NTP/HTP Time Sync Status     : Not Updated
  Activate DNS Lookup          : NA
  Proxy Server DNS Lookup      : NA
  Activate Connection Status   : NA
  Error Reason                 : NA
  Override Default Config Check: Enabled
```

Connected to Activate (post DNS resolution) and got Central URL

```
switch(config)#show activate provision
Configuration and Status - Activate Provision Service

  Activate Provision Service   : Enabled
  Activate Server Address      : devices-v2.arubanetworks.com
  Activation Key               : ZAELQSRB
  NTP/HTP Time Sync Status     : Time sync from NTP
  Activate DNS Lookup          : Success
  Proxy Server DNS Lookup      : NA
  Activate Connection Status   : Success
  Error Reason                 : NA
  Override Default Config Check: Enabled
```

Disable the Activate polling, after getting the Central URL

```
switch(config)#show activate provision

 Configuration and Status - Activate Provision Service

  Activate Provision Service   : Disabled
  Activate Server Address      : devices-v2.arubanetworks.com
  Activation Key               : ZAELQSRB
  NTP/HTP Time Sync Status     : Time sync from NTP
  Activate DNS Lookup          : Success
  Proxy Server DNS Lookup      : NA
  Activate Connection Status   : Success
  Error Reason                 : NA
  Override Default Config Check: Enabled
```

Unsuccessful Activate connection when device entry not present in Activate

```
switch(config)# show activate provision

 Configuration and Status - Activate Provision Service

  Activate Provision Service   : Enabled
  Activate Server Address      : devices-v2.arubanetworks.com
  Activation Key               : Not Available
  NTP/HTP Time Sync Status     : Time sync from NTP
  Activate DNS Resolution      : Success
  Proxy Server DNS Lookup      : NA
  Activate Connection Lookup   : Failure
  Error Reason                 : Failed response received.
  Status code                  : not-authenticated
  Override Default Config Check: Enabled
```

Activate pushing AirWave parameters to switch

```
switch(config)#show activate provision

 Configuration and Status - Activate Provision Service

  Activate Provision Service   : Enabled
  Activate Server Address      : devices-v2.arubanetworks.com
  Activation Key               : ZAELQSRB
  NTP/HTP Time Sync Status     : Time sync from NTP
  Activate DNS Lookup          : Success
  Proxy Server DNS Lookup      : NA
  Activate Connection Status   : Success
  Error Reason                 : NA
  Override Default Config Check: Enabled
```

Unsuccessful Activate connection due to unresolved Activate server address

```
switch(config)#show activate provision

 Configuration and Status - Activate Provision Service

  Activate Provision Service   : Enabled
  Activate Server Address      : devices-v2.arubanetworks.com
  Activation Key               : Not Available
  Time Sync Status             : Time sync from NTP pool
  Activate DNS Lookup          : Failure
  Proxy Server DNS Lookup      : NA
  Activate Connection Status   : NA
  Error Reason                 : NA
  Override Default Config Check: Enabled
```

DNS resolution is a field in the WebUI (under **Dependencies** section), it will show DNS resolution as *failure* .

Fields added in 16.07.	Status	Validation
Time sync status	▪ Time sync from NTP ▪ Time sync from HTTP ▪ Time sync from other source ▪ Not updated ▪ NA	▪ Default - Not updated, time is not updated from NTP and HTTP. ▪ NA - In this case switch get the time through SNTP/ CLI/time server configuration before NTP/HTTP.
Activate DNS Lookup.	▪ Success ▪ Failure ▪ NA	▪ Default - NA ▪ Other outputs are based on **devices-v2.arubanetworks.com** DNS lookup.
Proxy Server DNS Lookup	▪ Success ▪ Failure ▪ NA	▪ NA - If proxy is not configured. ▪ Other outputs are based on proxy lookup.
Activate Connection Status.	▪ Success ▪ Failure ▪ NA	Default - NA
Error Reason		Default - NA

Troubleshooting

You can troubleshoot switches by using the SSH connection and the device logs available in AirWave. For a list of all RMON message, refer to *Aruba Event Log Message Reference Guide for AOS-S switch 16.10*. You can enable the debug logging with the `debug ztp` command, see debug ztp on page 302.

Show aruba-central

Syntax

`show aruba-central`

Description

Shows Aruba Central server information.

Example

```
switch#show aruba-central
Configuration and Status - Aruba Central

 Server URL              : https://internal.central.arubanetworks.com/ws
 Connected               : Yes
 Mode                    : Managed
 Last Disconnect Time    : NA
 Server DNS Lookup       : Success
 Proxy Server DNS Lookup : NA
 Error Reason            : NA
```

Fields added in 16.07.	Status	Validation
Server DNS Lookup	▪ Success ▪ Failure ▪ NA	By default status is NA. Other status is based on DNS resolution.
Proxy Server DNS Lookup	▪ Success ▪ Failure ▪ NA	If proxy is not configured, status will be NA. Otherwise Status will be set based on proxy server DNS lookup.
Error Reason		Default-NA

Error reason for Aruba Central

Error Reason field is added in the switch firmware as part of Aruba Central Onboarding Feature from 16.07. Error reason log helps in debugging switch firmware for central connectivity failure.

S.No	Preprocessor Directive	Mocana Error Enum	Error Reason
1	`CLOUD_TCP_ERR`	`ERR_TCP`	TCP error. Check the server reachability.
2	`CLOUD_TCP_READ_ERR`	`ERR_TCP_READ_ERROR`	TCP read error. Malformed packet received or the SSL socket is closed.

S.No	Preprocessor Directive	Mocana Error Enum	Error Reason
3	CLOUD_TCP_READ_TIMEOUT_ERR	ERR_TCP_READ_TIMEOUT	TCP timeout. Server is taking longer time to respond. Check the server reachability.
4	CLOUD_TLS_ERR	ERR_SSL	TLS error. Verify if the device or system certificate is valid.
5	CLOUD_TLS_CERT_VAL_ERR	ERR_SSL_CERT_VALIDATION_ FAILED	Certificate validation failed. Verify if it is correctly installed, valid, and trusted.
6	CLOUD_TLS_MUTUAL_AUTH_FAIL_ ERR	ERR_SSL_MUTUAL_ AUTHENTICATION_FAILED	TLS mutual authentication has failed.
7	CLOUD_TLS_MUTUAL_AUTH_NOT_ REQ_ERR	ERR_SSL_MUTUAL_ AUTHENTICATION_NOT_REQUESTED	Client authentication is not requested by server.
8	CLOUD_TLS_MUTUAL_AUTH_REQ_ IGNORE_ERR	ERR_SSL_MUTUAL_ AUTHENTICATION_REQUEST_ IGNORED	TLS mutual authentication request is ignored.
9	CLOUD_TLS_INVALID_SIG_ERR	ERR_SSL_INVALID_SIGNATURE	Unable to verify the signature on a certificate.
10	CLOUD_TLS_NO_DATA_RECV_ERR	ERR_SSL_NO_DATA_TO_RECEIVE	No data received from server. Check the server reachability.
11	CLOUD_CERT_ERR	ERR_CERT	System certificate is invalid.
12	CLOUD_CERT_EXPIRE_ERR	ERR_CERT_EXPIRED	System certificate expired. Contact Aruba support.
13	CLOUD_INVALID_TIME_ERR	ERR_CERT_START_TIME_VALID_ IN_FUTURE	Wrong system time.
14	CLOUD_TLS_MULTIPLE_CONN	ERR_SSL_TOO_MANY_ CONNECTIONS	Too many connections to server. Disconnect the device and connect back.
15	CLOUD_TLS_NO_CIPHER_MATCH	ERR_SSL_NO_CIPHER_MATCH	Cipher suites are not common between device and server.

S.No	Preprocessor Directive	Mocana Error Enum	Error Reason
16	CLOUD_TLS_UNKNOWN_CA	ERR_SSL_UNKNOWN_CERTIFICATE_AUTHORITY	Server certificate is not issued by a trusted CA.
17	CLOUD_TLS_NO_SELF_SIGNET_CERT	ERR_SSL_NO_SELF_SIGNED_CERTIFICATES	Server presented a self-signed certificate. This certificate is not supported for mutual authentication.
18	CLOUD_GENERIC_ERR		TLS generic error (code: -XYZ)
19	CLOUD_HTTP_101_PROT_MISSNG		Internal error: HTTP/1.1 protocol missing. Contact Aruba support.
20	CLOUD_HTTP_UPGRADE_MISSNG_IN_RESP		Internal error: Missing `Upgrade` in HTTP response. Contact Aruba support.
21	CLOUD_HTTP_ACCEPT_KEY_MISSNG_IN_RESP		Internal error: Missing `Sec-WebSocket-Accept` in HTTP response. Contact Aruba support.
22	CLOUD_HTTP_MISMATCH_ACCEPT_KEY		Internal error: Mismatch `Sec-WebSocket-Accept` in HTTP response. Contact Aruba support.
23	CLOUD_URL_NOT_REACHABLE_VIA_PXY		Central server is not reachable through proxy.

debug ztp

Syntax

```
debug ztp
no debug ztp
```

Description

Enables or disables ZTP debug logging.

Parameters and options

ztp

Zero Touch Provisioning.

no

The `no debug ztp` command disables ZTP debug logging.

Error Reason log for Activate Provision

Error Reason field is added in the switch firmware as part of Aruba Central Onboarding Feature from 16.07. Error reason log helps in debugging switch firmware for central connectivity failure.

Following table shows the list of error reasons.

Preprocessor Directive	Error Reason
`ACTIVATE_RESP_FAIL_CODE`	Activate provision fails because of invalid response received from server with status code: `%s`.
`ACTIVATE_CURL_FAIL_CODE`	Device fails to reach Activate server with error: `%s`.
`ACTIVATE_FAIL_PROV_NO_DEVICE_ENTRY`	Device is not registered with Activate server.
`ACTIVATE_NON_TPM_CODE_MISSING`	EST provision with activate server fails because of invalid response received from Activate server.

Stacking support

The ZTP process for stacked switches with Central is similar to the one for a standalone switch, with the exception that only the commander in the stack checks in with Central. For switches supported on Central when stacking is ON, refer to the *Aruba Central Switch Configuration Guide*.

Fault finder switch events

Fault finder switch events supported by Aruba Central
EVENT_FF_BAD_DRIVER_NIC
EVENT_FF_BAD_XCVR_NIC
EVENT_FF_BAD_CABLE
EVENT_FF_CABLE_LEN_HOPS
EVENT_FF_LOOP_OVER_BAND
EVENT_FF_BCAST_STORM
EVENT_PPMGR_DMM_SET_FULL_WARN
EVENT_PPMGR_DMM_SET_AUTO_WARN
EVENT_FF_LINKFLAP

interface device-type network-device

Syntax

```
interface <PORT-LIST> device-type network-device

no interface <PORT-LIST> device-type network-device
```

Configures the type of device and identifies a port connected with a network infrastructure device (such as switch, AP, router). The switch will not report the client entries on the port to Central.

The `no` form of this command removes the configuration of type of the device connected to the ports.

Command context

```
config
```

Parameters

PORT-LIST

Specifies the port number for the device.

Usage

```
no device-type { network-device }
```

Example

```
switch(config)# interface 2
device-type       Configures the type of device being connected to the port.

switch(config)# interface 2 device-type
network-device    Marks a port being connected with a network infra
                  device (switch / AP / router).

switch(config)# interface 2 device-type network-device
```

```
switch(config)# show running config
; JL074A Configuration Editor; Created on release #KB.16.04.0000x
; Ver #10:9b.7f.bf.bb.ff.7c.59.fc.7b.ff.ff.fc.ff.ff.3f.ef:81

hostname "Aruba-3810M-48G-PoEP-1-slot"
module 1 type jl074x
module 2 type jl074y
flexible-module A type JL078A
interface 2
   device-type network-device
   exit
interface 3
   device-type network-device
   exit
```

HTTP Proxy support with ZTP overview

The Aruba switch connects through Public Cloud or infrastructure to access Aruba Activate and Aruba Central. The switch can use a combination of the Public and Private networks to access Aruba AirWave, and Aruba ClearPass. In this case, the switch is visible as an Internet asset that can cause data breaching. Routing connections through the enterprise proxy servers prevents the data breaching.

The AOS-S switch does not set up an HTTP/SSL connection with the public or private server directly. Instead, the switch sets up a TCP connection with the proxy server.

If the public server is available and reachable through the proxy server, then the switch connection to the destination server is successful. After establishing the connection, the proxy server behaves as a Network Address Translation (NAT) device, in which case, the proxy server forwards the received packets to the intended destinations.

Limitations

- HTTPS proxy is not supported.
- Authenticating the HTTP proxy is not supported.
- HTTP proxy support is only for IPv4 endpoints.

Configuring ZTP

When the switch is provisioned for Central or Controller, switch is managed once it is connected to the public network. In case the user wants to reach the public network through the proxy, then the IP address of the proxy server must be present in the switch before initiating the Activate or Central connectivity.

In ZTP mode, the proxy IP address can be received using the DHCP option. The ZTP mode works when the switch is booted with a default configuration. For the switch to connect to public servers through proxy, the proxy IP must be known through DHCP. The switch requests an IP address from the primary VLAN.

The proxy IP address is received through a vendor-specific DHCP option. The switch parses and uses the proxy IP address to connect in ZTP mode. Aruba switches reserve suboption -148 under DHCP vendor-specific option 43 for configuring proxy URL.

After the switch is out of ZTP mode, the proxy IP address if configured through CLI takes precedence. Otherwise, the Aruba OS switch may use the DHCP received proxy IP address for connectivity.

e Proxy Configuration

When configuring the proxy server, the following applications will be taking the proxy route to reach the destination. You can configure the proxy server as indicated in DHCP or `proxy server` command.

- Aruba AirWave
- Aruba Activate
- Firmware download through MNP
- Aruba ClearPass connectivity
- Aruba Central connectivity
- TR69 support

Support for Aruba AirWave

AirWave is used to manage the AOS-S switches and its communication to the switch is over HTTPS. When AirWave is deployed with Aruba controller, an IPsec tunnel is created between the switch and the controller. All the communication between the switch and AirWave occurs through the tunnel. In this case, the proxy is bypassed implicitly.

AirWave establishes ICMP, SNMP, and SSH connections to the switch for switch management. Since AirWave does not have the visibility for the switch IP address, the ICMP, SNMP, and SSH connections will not be initiated to the switch. So reverse NAT functionality must be enabled for ensuring these packets reach the switch. If AirWave must work without proxy, then AirWave IP is bypassed explicitly.

Support for Aruba ClearPass

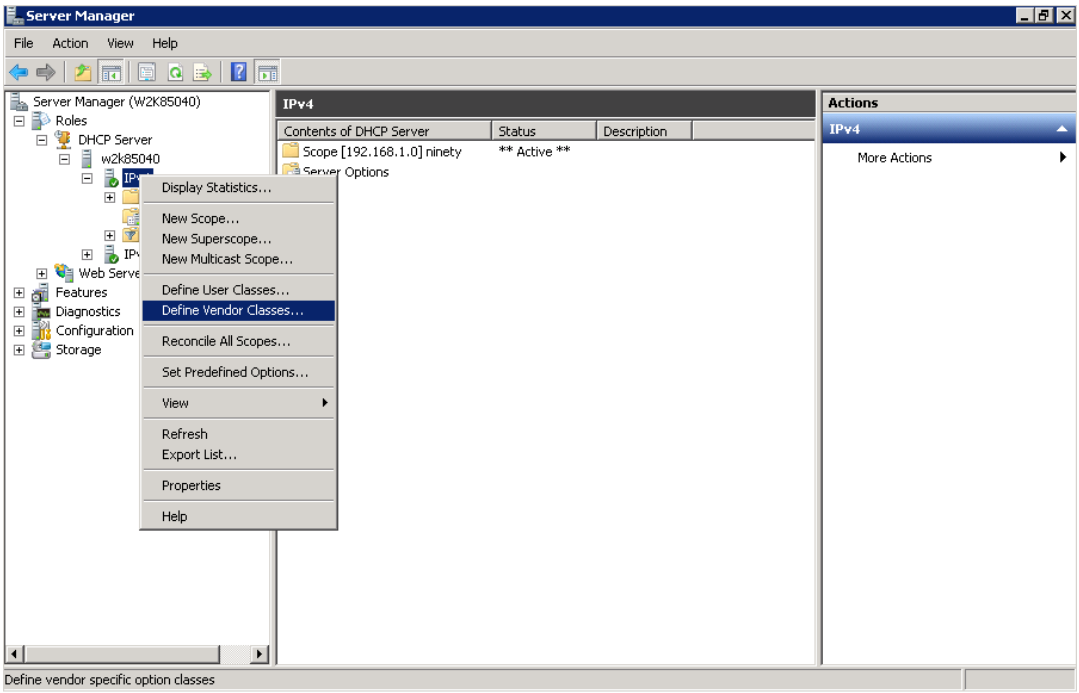
For downloading a user role from ClearPass, switch initiates HTTPS connection with ClearPass. If the proxy is configured, proxy server is used to reach ClearPass. When ClearPass is deployed with Aruba controller, ClearPass must be explicitly exempted from proxy. Add the ClearPass IP address in the exception list of the proxy as the communication happens through the IPsec tunnel or normally.

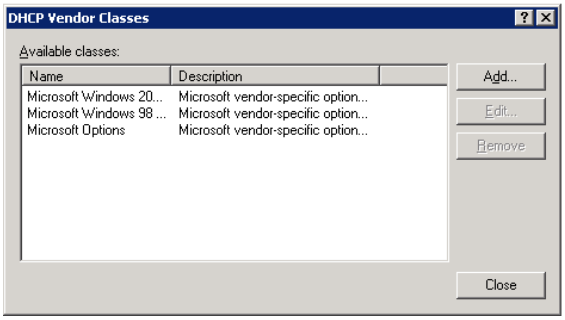
Proxy Configuration using windows DHCP server

In the ZTP provisioning, you can push the Proxy server and exception configurations through a Windows DHCP server using DHCP option 148.

Procedure:

1. Add a new **DHCP Server** role. Navigate to **Server Manager** > **Roles** > **DHCP sever** > **domain DHCP Server** > **IPv4**. In the master pane of the Server Manager window, click **IPv4** and select **Define Vendor classes**.



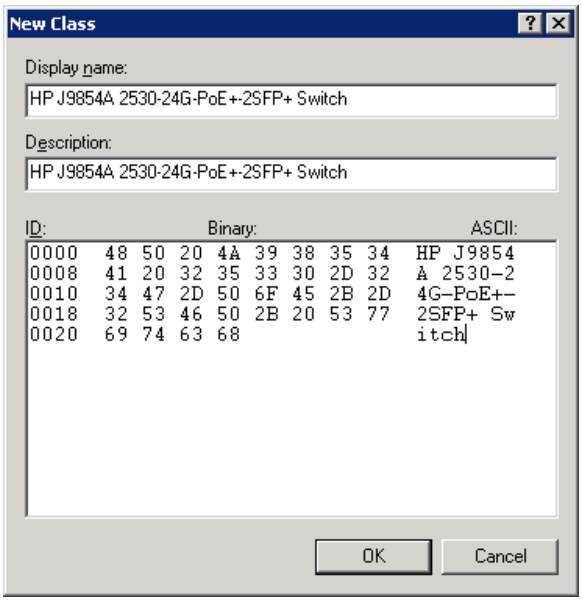


2. To get vendor-specific value of a switch, go to switch command prompt and enter `show dhcp client vendor-specific` command. Vendor class identifier for the switch (VCI) appears as follows:

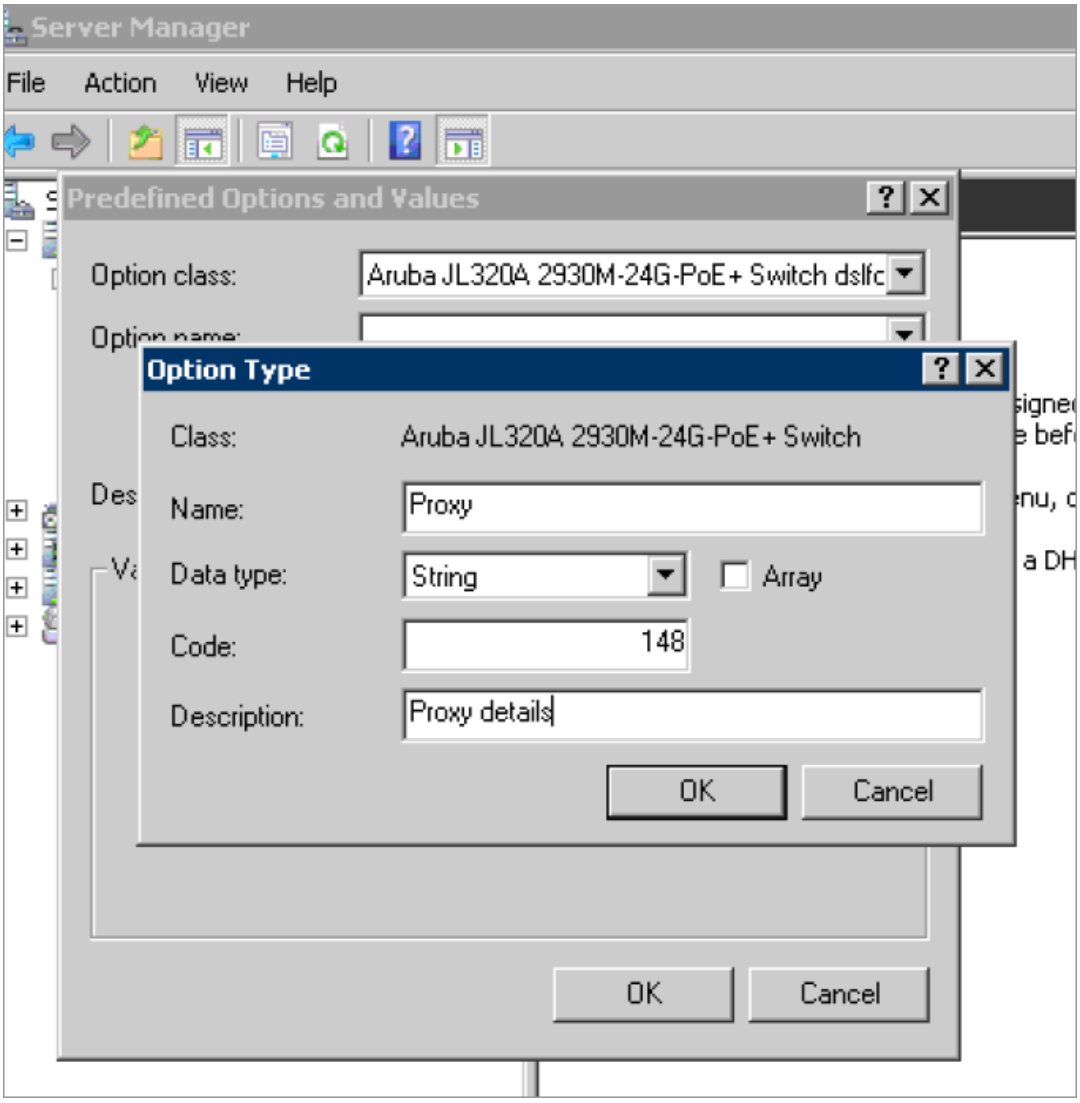
```
Switch#  show dhcp client vendor-specific
Vendor Class Id = J9854A 2530-24G-PoE+-2SFP+ Switch
```

Processing of Vendor Specific Configuration is enabled.

3. Add **Displayed name** and **Description** for the **New Vendor Class** in the ASCII field, add `J9854A 2530-24G-PoE+-2SFP+ Switch` value exactly obtained from the switch, otherwise the option may not work.



4. Right-click **IPv4** and select **Set Predefined Options**. Select option class as the newly defined vendor class, click **ADD** and enter the following information for Proxy details:
   a. Name - Proxy
   b. Data Type - String
   c. Code - 148
   d. Description - Proxy details.



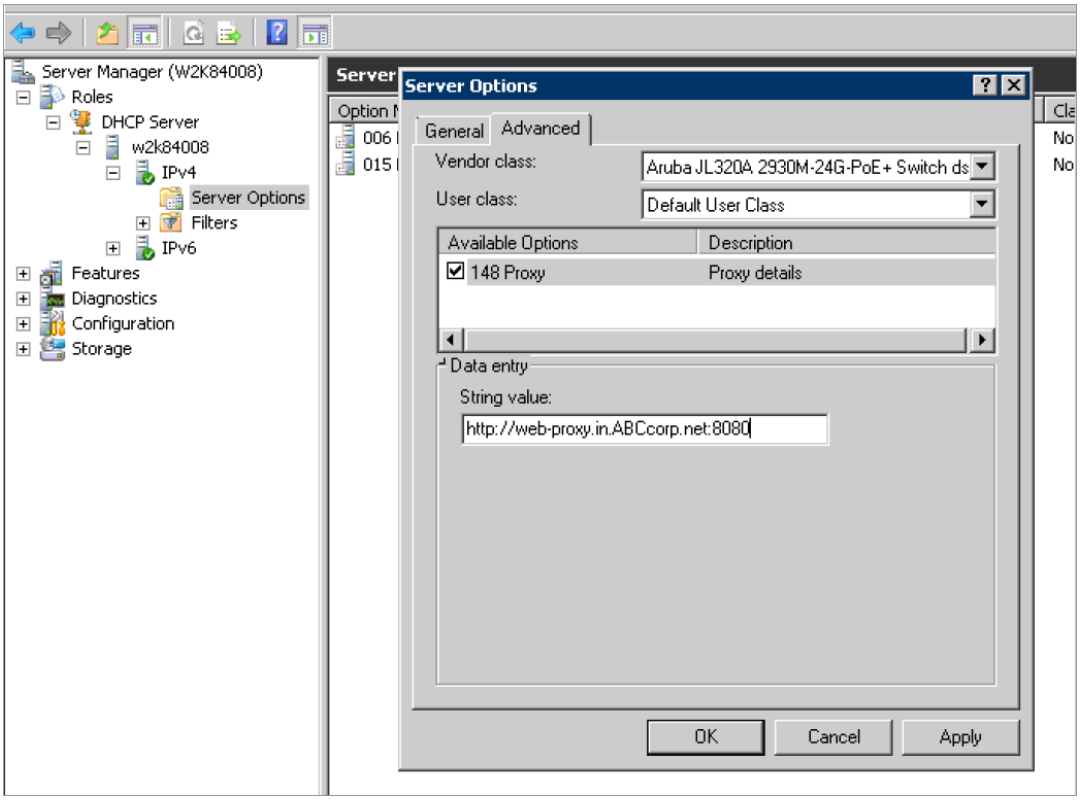
Now the new vendor class will have new suboption with code 148. Next is to add these vendor class and suboptions to the scope. To add proxy server details to scope, navigate to **Server Manager** and select **Server Options** in the **IPv4** window.

5. Right click server options and select **Configure options**. Go to **Advanced** tab, select the vendor class from the menu as the newly defined class. New suboptions that are added appears.

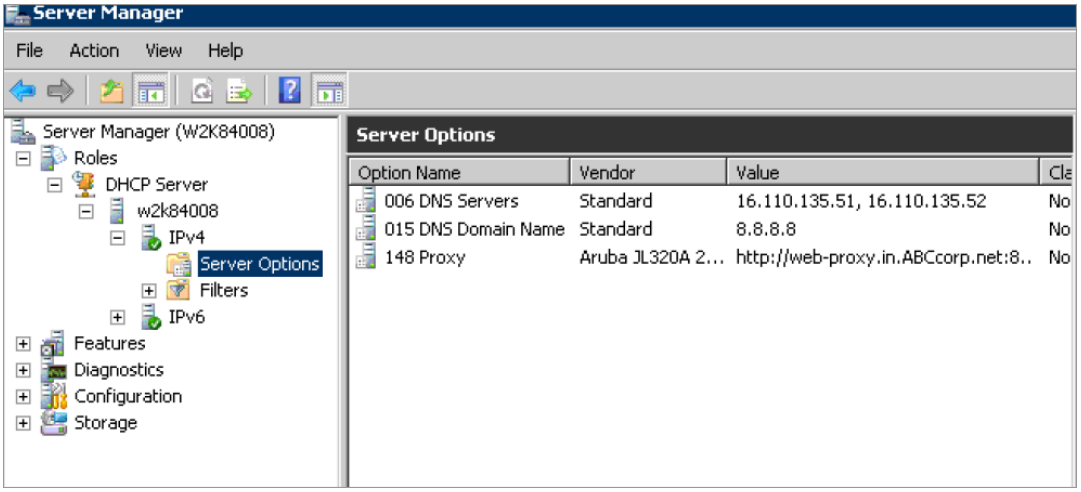
   Check 148 and add Proxy details in string value field, in the format as mentioned:

   `<http://web-proxy.in.ABCcorp.net:8080>` or `<http://192.168.50.18:3128>`

   Check 144 and add configuration filename in string value field (optional).



6. Click **Apply** and **OK** and the proxy option is added in the Server options.



7. Now restart the DHCP service and download new DHCP attributes in the switch, you can check that the proxy details are correctly downloaded in the switch using the `show proxy config` command.

proxy server

Syntax

`proxy server <http://<ip-addr/FQDN>:port number>`

`no proxy server`

Description

Configures the URL/IP address to reach the proxy server. Provide the correct proxy port number along with the URL/IP address. Port number must be in the range of 1024 to 65535. HTTPS proxy server is not supported.

The `no` form of this command removes the proxy server.

Command context

`config`

Parameters

`url:port number`

Specifies the URL address with port number for the proxy server.

`ip-addr:port number`

Specifies the IP address with port number for the proxy server.

Example

```
switch(config)# proxy server "http://web-proxy.au.abccorp.net:3128"
switch(config)# proxy server "http://192.168.0.6:8080"
```

proxy exception ip | host

Syntax

`proxy exception ip | host` *`{ip-addr/mask-length | hostname}`*

`no proxy exception ip | host` *`{ip-addr/mask-length | hostname}`*

Description

Configures an IPv4 address/mask length and URL to the list of IP address and host, which can be reached without the HTTP proxy server.

The `no` form of this command removes the proxy exception for the specified entry (IPv4 address/host name).

Command context

`config`

Parameters

`ip-addr/mask-length | hostname`

Specifies IPv4 address/mask length and host name.

Example

```
switch(config)# proxy exception ip 192.168.0.10/12
switch(config)# proxy exception host "http://web-proxy.au.abdcorp.net:3128"
```

show proxy config

Syntax

`show proxy config`

Description

Shows the proxy configuration.

Command context

```
config
```

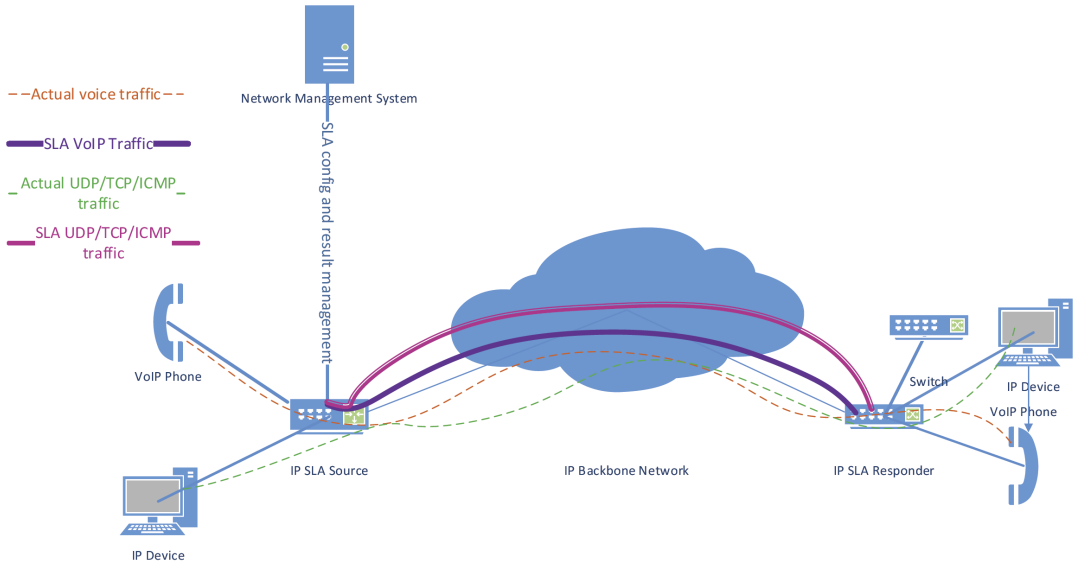
Examples

```
switch(config)# show proxy config

 Http Proxy Configuration details

  Server URL           : http://web-proxy.au.abccorp.net:3128


 Manually configured exceptions

  No      Exception
  ------- ----------------------------------------
  1       192.168.0.10/12
  2       http://web-proxy.au.abdcorp.net:3128



 Automatically added exceptions

  No      Exception
  ------- ----------------------------------------
               1                                                    2.0.0.9
```

On configuring IPsec tunnel, Airwave IP is automatically added as an exception in the switch. The IPsec tunnel is configured directly over the network bypassing the HTTP proxy server.

Overview

IP Service Level Agreement (IP SLA) is a feature that helps administrators collect information about network performance in real time. With increasing pressure on maintaining agreed-upon Service Level Agreements on Enterprises and ISPs alike, IP SLA serves as a useful tool.



Any IP SLA test involves a source node and a destination node. For all discussions in this document, the source is always an AOS-S switch with IP SLA support. As shown in the diagram above, a destination can, in most cases, be any IP-enabled device. For some SLA types that expect a nonstandard response to a test packet, an “SLA responder” must be configured. An “SLA responder” is nothing but an AOS-S switch with IP SLA configurations on it that enable it to respond to the test packet.

The IP SLA feature provides:

- Application-aware monitoring that simulates actual protocol packets.
- Predictable measures that aid in ease of deployment and help with assessment of existing network performance.
- Accurate measures of delay and packet loss for time-sensitive applications.
- End-to-end measurements to represent actual user experience.

We support the following SLA types:

- UDP Echo, including connectivity testing of transport layer (UDP) services, Round-Trip-Time (RTT) measurement, one-way delay, and packet loss details.
- ICMP Echo, including connectivity testing, RTT measurement, and packet loss details.

- TCP Connect, including connectivity testing of transport layer (TCP) services, and handshake time measurement.
- DHCP, which measures the round-trip time taken to discover a DHCP Server and obtain a leased IP address from it.
- DNS, which measures the time taken for a DNS resolution. This measures the difference between the time taken to send a request to the DNS server and the time the IP SLA source receives a reply.
- User Datagram Protocol (UDP) Jitter, which measures RTT, one way jitter and one way delays.
- UDP Jitter for VoIP, which measures RTT, one way jitter, one way delays, ICPIF (Impairment Calculated Planning Impairment Factor) and MOS (Mean Opinion Score).

Limitations for IPSLA support on Aruba switches:

- IP SLA is not enabled for IPv6.
- DHCP SLA supports DHCPv4 only.
- IP SLA tests cannot be initiated over OOBM interfaces.
- History results for the configured IP SLAs will not be available after a switchover or a reboot.
- Maximum number of IP SLAs that can be configured varies based on the type of SLA test.
- When there are multiple IP SLAs configured with destination as hostname, the DNS resolution happens serially. There can be a delay in sending the test probe (which will be sent only after successful DNS resolution).
- For TCP Connect SLA type, the four-tuple (source IP/port, destination IP/port) must be unique.
- System clocks between the source and the responder must be synchronized with NTP if One Way Delay parameters have to be calculated for UDP Echo tests.
- Timeout for probes is 3 seconds for all SLA types and is not configurable.
- Transient spikes in RTT occur during the tests (in the source and the responder) if processor usage is high. Consider average result values over a period of time rather than point-in-time results. This is not applicable for UDP Jitter nor Jitter for VoIP.

Entity	Limit
Maximum number of SLAs enabled.	50
Maximum history bucket size per SLA.[1]	50
Number of responders that can be configured.	10

The following are operational restrictions with respect to IP SLA jitter implementation:

- Feature is supported only on v3-based platforms.
- No history results are stored.
- IPSLA Jitter and Jitter for VoIP initiator and responder is only supported on 5400R with v3 modules (noncompatibility mode), 3810, and 2930F switches.

- The maximum number of Jitter responder sessions (UDP Jitter + Jitter For VoIP) supported is 10. The maximum number of Jitter initiator sessions (UDP Jitter + Jitter For VoIP) supported is 5.
- IMC (Intelligent Management Center) supports below IP SLA:
  - DHCP
- Measurement of RTT and jitter values is in milliseconds.
- IPv6 SLA for UDP jitter and VoIP is not supported.
- UDP jitter and UDP jitter for VoIP tests are not supported over Tunnel, Trunk, and OOBM interfaces.
- UDP jitter and UDP jitter for VoIP results are not carried forward across failover or a device reboot.
- History bucket size cannot be configured for UDP jitter and VoIP tests. Results are aggregated for the last 25 probes.
- System clocks between the source and the responder must be synchronized with NTP if One Way Delay parameters have to be calculated for UDP Jitter & UDP Jitter for VoIP tests.
- The UDP jitter and UDP jitter for VoIP feature on AOS-S switch has the following limited interoperability with Comware 7 SLA v2 version:
  - One Way packet drops (SD packet loss and DS packet loss) on the Comware Jitter initiator is not reported when interoperating with Aruba Jitter Responder.
- IP SLA responder or initiator implementation is not interoperable with Cisco's IP SLA feature.

[1]Not applicable for UDP Jitter and Jitter for VoIP.

Downloading switch software

Switch periodically provides switch software updates through the Switch Networking website. For more information, see the support and warranty booklet shipped with the switch, or visit http://www.hpe.com/networking and click on **software updates**.

This manual uses the terms **switch software** and **software image** to refer to the downloadable software files the switch uses to operate its networking features. Other terms sometimes include **Operating System**, or **OS**.

General software download rules

- Switch software that you download via the menu interface always goes to primary flash.
- After a software download, you must reboot the switch to implement the new software. Until a reboot occurs, the switch continues to run on the software it was using before the download.

Downloading new switch software does not change the current switch configuration. The switch configuration is contained in separate files that can also be transferred. See Transferring switch configurations on page 329.

In most cases, if a power failure or other cause interrupts a flash image download, the switch reboots with the image previously stored in primary flash. In the unlikely event that the primary image is corrupted (which may occur if a download is interrupted by a power failure), the switch goes into boot ROM mode. In this case, use the boot ROM console to download a new image to primary flash.

Using TFTP to download software from a server

This procedure assumes that:

- A software version for the switch has been stored on a TFTP server accessible to the switch. (The software file is typically available from the Switch Networking website at http://www.hpe.com/networking.)
- The switch is properly connected to your network and has already been configured with a compatible IP address and subnet mask.
- The TFTP server is accessible to the switch via IP.

Before you use the procedure, do the following:

- Obtain the IP address of the TFTP server in which the software file has been stored.
- If VLANs are configured on the switch, determine the name of the VLAN in which the TFTP server is operating.
- Determine the name of the software file stored in the TFTP server for the switch (For example, E0820.swi).

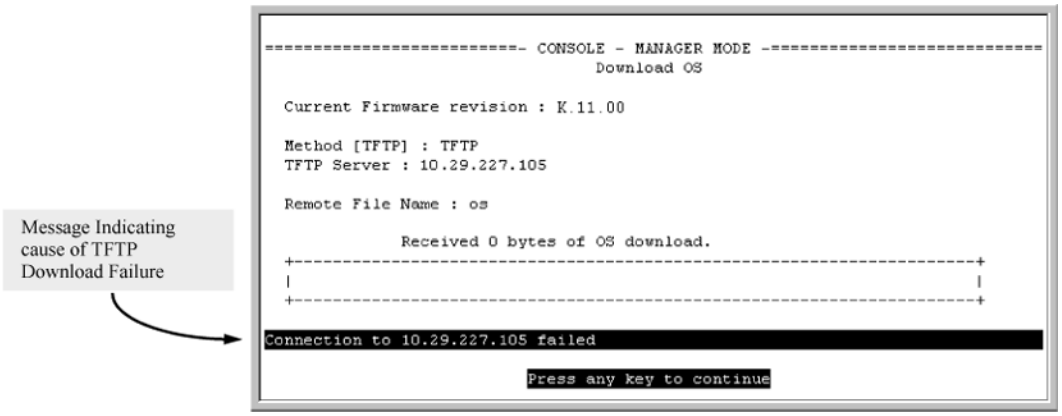
If your TFTP server is a UNIX workstation, ensure that the case (upper or lower) that you specify for the filename is the same case as the characters in the software filenames on the server.

Troubleshooting TFTP download failures

Cause

When using the menu interface, if a TFTP download fails, the Download OS (Operating System, or software) screen indicates the failure as seen in the following figure.

Figure 32 *Example: message for download failure*



Some of the causes of download failures include:

- Incorrect or unreachable address specified for the **TFTP Server** parameter. This may include network problems.
- Incorrect VLAN.
- Incorrect name specified for the **Remote File Name** parameter, or the specified file cannot be found on the TFTP server. This can also occur if the TFTP server is a UNIX machine and the case (upper or lower) for the filename on the server does not match the case for the filename entered for the **Remote File Name** parameter in the **Download OS** (Operating System, or software) screen.
- One or more of the switch's IP configuration parameters are incorrect.
- For a UNIX TFTP server, the file permissions for the software file do not allow the file to be copied.
- Another console session (through either a direct connection to a terminal device or through Telnet) was already running when you started the session in which the download was attempted.

To find more information on the cause of a download failure:

- Examine the messages in the switch's Event Log by executing the `show log tftp` command from the CLI.
- For descriptions of individual Event Log messages, see the latest version of the event log message reference guide for your switch, available on the Switch website. (See "Getting Documentation From the Web".)

If an error occurs in which normal switch operation cannot be restored, the switch automatically reboots itself, and an appropriate message is displayed after the reboot.

Downloading from a server to flash using TFTP (CLI)

Syntax

`copy tftp flash <ip-address> <remote-file> [<primary | secondary>]`

Automatically downloads a switch software file to primary or secondary flash. If you do not specify the flash destination, the TFTP download defaults to primary flash.

Example

To download a switch software file named k0800.swi from a TFTP server with the IP address of 10.28.227.103 to primary flash:

Procedure

1. Execute `copy` as shown below:

   The command to download an OS (switch software)

   ```
   switch# copy tftp flash 10.28.227.103 k0800.swi
   The primary OS Image will be deleted, continue [y/n]? y 1
   01431K 2
   ```

   When the switch finishes downloading the software file from the server, it displays this progress message:

   ```
   Validating and Writing System Software to FLASH ...
   ```

2. When the download finishes, you must reboot the switch to implement the newly downloaded software image. To do so, use one of the following commands:

   ### Syntax

   `boot system flash {<primary | secondary>}`

   Boots from the selected flash.

   ### Syntax

   `reload`

   Boots from the flash image and startup-config file. A switch covered in this guide (with multiple configuration files), also uses the current startup-config file.

   For more information on these commands, see "Rebooting the Switch" in the basic operation guide for your switch.

3. To confirm that the software downloaded correctly, execute `show system` and check the **Firmware revision** line.

   For information on primary and secondary flash memory and the boot commands, see "Using Primary and Secondary Flash Image Options" in the basic operation guide for your switch.

If you use `auto-tftp` to download a new image in a redundant management system, the active management module downloads the new image to both the active and standby modules. Rebooting after the `auto-tftp` process completes reboots the entire system.

[1]This message means that the image you want to upload will replace the image currently in primary flash.

2Dynamic counter continually displays the number of bytes transferred.

Enabling TFTP (CLI)

TFTP is enabled by default on the switch. If TFTP operation has been disabled, you can re-enable it by specifying TFTP client or server functionality with the `tftp [client|server]` command at the global configuration level.

Syntax

`no tftp [client | server]`

Disables/re-enables TFTP for client or server functionality so that the switch can:

- Use TFTP client functionality to access TFTP servers in the network to receive downloaded files.
- Use TFTP server functionality to upload files to other devices on the network.

Usage notes

To disable all TFTP client or server operation on the switch except for the auto-TFTP feature, enter the `no tftp [client|server]` command.

When IP SSH file transfer is used to enable SCP and SFTP functionality on the switch, this disables TFTP client and server functionality. Once ip ssh file transfer is enabled, TFTP and auto-TFTP cannot be re-enabled from the CLI.

When TFTP is disabled, instances of TFTP in the CLI `copy` command and the Menu interface "Download OS" screen become unavailable.

The `no tftp [client|server]` command does not disable auto-TFTP operation. To disable an auto-TFTP command configured on the switch, use the `no auto-tftp` command to remove the command entry from the switch's configuration.

For information on how to configure TFTP file transfers on an IPv6 network, see the "IPv6 Management Features" in the IPv6 configuration guide for your switch.

Configuring the switch to download software automatically from a TFTP server using auto-TFTP (CLI)

The `auto-tftp` command lets you configure the switch to download software automatically from a TFTP server.

At switch startup, the auto-TFTP feature automatically downloads a specified software image to the switch from a specified TFTP server and then reboots the switch. To implement the process, you must first reboot the switch using one of the following methods:

- Enter the `boot system flash primary` command in the CLI.
- With the default flash boot image set to primary flash (the default), enter the `boot` or the `reload` command, or cycle the power to the switch. (To reset the boot image to primary flash, use `boot set-default flash primary`.)

Syntax

`auto-tftp <ip-addr> <filename>`

By default, auto-TFTP is disabled. This command configures the switch to automatically download the specified software file from the TFTP server at the specified IP address. The file is downloaded into primary flash memory at switch startup; the switch then automatically reboots from primary flash.

To enable auto-TFTP to copy a software image to primary flash memory, the version number of the downloaded software file (For example, XX_14_01.swi) must be different from the version number currently in the primary flash image.

The current TFTP client status (enabled or disabled) does not affect auto-TFTP operation. (See Enabling TFTP (CLI) on page 317.)

Completion of the auto-TFTP process may require several minutes while the switch executes the TFTP transfer to primary flash and then reboots again.

The `no` form of the command disables auto-TFTP operation by deleting the `auto-tftp` entry from the startup configuration.

The `no auto-tftp` command does not affect the current TFTP-enabled configuration on the switch. However, entering the `ip ssh filetransfer` command automatically disables both `auto-tftp` and `tftp` operation.

Use USB to transfer files to and from the switch

The switch's USB port (labeled as **Aux Port**) allows the use of a USB flash drive for copying configuration files to and from the switch.

Operating rules and restrictions:

- Unformatted USB flash drives must first be formatted on a PC (Windows FAT format.) For devices with multiple partitions, only the first partition is supported. Devices with secure partitions are not supported.
- If they already exist on the device, subdirectories are supported. When specifying a ***filename*** , you must enter either the individual file name (if at the root) or the full path name (for example, /subdir/filename.)
- To view the contents of a USB flash drive, use the `dir` command. This lists all files and directories at the root. To view the contents of a directory, you must specify the subdirectory name (that is, `dir subdirectory`.)
- The USB port supports a single USB device. USB hubs to add more ports are not supported.

Some USB flash drives may not be supported on your switch. Consult the latest *Release Notes* for information on supported devices.

Using SCP and SFTP

For some situations you may want to use a secure method to issue commands or copy files to the switch. By opening a secure, encrypted SSH session and enabling ip ssh file transfer, you can then use a third-party software application to take advantage of SCP and SFTP. SCP and SFTP provide a secure alternative to TFTP for transferring information that may be sensitive (like switch configuration files) to and from the switch. Essentially, you are creating a secure SSH tunnel as a way to transfer files with SFTP and SCP channels.

Once you have configured your switch to enable secure file transfers with SCP and SFTP, files can be copied to or from the switch in a secure (encrypted) environment and TFTP is no longer necessary.

To use these commands, you must install on the administrator workstation a third-party application software client that supports the SFTP and/or SCP functions. Some examples of software that supports SFTP and SCP are PuTTY, Open SSH, WinSCP, and SSH Secure Shell. Most of these are freeware and may be downloaded without cost or licensing from the internet. There are differences in the way these clients work, so be sure you also download the documentation.

As described earlier in this chapter you can use a TFTP client on the administrator workstation to update software images. This is a plain-text mechanism that connects to a standalone TFTP server or another switch acting as a TFTP server to obtain the software image files. Using SCP and SFTP allows you to maintain your switches with greater security. You can also roll out new software images with automated scripts that make it easier to upgrade multiple switches simultaneously and securely.

SFTP is unrelated to FTP, although there are some functional similarities. Once you set up an SFTP session through an SSH tunnel, some of the commands are the same as FTP commands. Certain commands are not allowed by the SFTP server on the switch, such as those that create files or folders. If you try to issue commands such as `create` or `remove` using SFTP, the switch server returns an error message.

You can use SFTP just as you would TFTP to transfer files to and from the switch, but with SFTP, your file transfers are encrypted and require authentication, so they are more secure than they would be using TFTP. SFTP works only with SSH version 2 (SSH v2).

SFTP over SSH version 1 (SSH v1) is not supported. A request from either the client or the switch (or both) using SSH v1 generates an error message. The actual text of the error message differs, depending on the client software in use. Some examples are:

```
Protocol major versions differ: 2 vs. 1
Connection closed

Protocol major versions differ: 1 vs. 2
Connection closed

Received disconnect from <ip-addr> : /usr/local/libexec/
sftp-server: command not supported
Connection closed
```

SCP is an implementation of the BSD `rcp` (Berkeley UNIX remote copy) command tunneled through an SSH connection.

SCP is used to copy files to and from the switch when security is required. SCP works with both SSH v1 and SSH v2. Be aware that the most third-party software application clients that support SCP use SSHv1.

The general process for using SCP and SFTP involves three steps:

Procedure

1. Open an SSH tunnel between your computer and the switch if you have not already done so.

   (This step assumes that you have already set up SSH on the switch.)
2. Execute `ip ssh filetransfer` to enable secure file transfer.
3. Use a third-party client application for SCP and SFTP commands.

Enabling SCP and SFTP

For more information about secure copy and SFTP, see Using SCP and SFTP on page 319.

Procedure

1. Open an SSH session as you normally would to establish a secure encrypted tunnel between your computer and the switch.

   For more detailed directions on how to open an SSH session, see "Configuring secure shell (SSH)" in the access security guide for your switch. Please note that this is a one-time procedure for new switches or connections. If you have already done it once you should not need to do it a second time.
2. To enable secure file transfer on the switch (once you have an SSH session established between the switch and your computer), open a terminal window and enter the following command:

   ```
   switch(config)# ip ssh filetransfer
   ```

For information on disabling TFTP and auto-TFTP, see Disabling TFTP and auto-TFTP for enhanced security on page 320.

Disabling TFTP and auto-TFTP for enhanced security

Using the `ip ssh filetransfer` command to enable SFTP automatically disables TFTP and auto-TFTP (if either or both are enabled), as shown below.

Switch configuration with SFTP enabled

```
switch(config)# ip ssh filetransfer
Tftp and auto-tftp have been disabled. 1
switch(config)# sho run

Running configuration:

; J9091A Configuration Editor; Created on release #xx.15.xx

hostname "Switch"
module 1 type J8702A
module 2 type J702A
vlan 1
   name "DEFAULT_VLAN"
   untagged A1-A24,B1-B24
   ip address 10.28.234.176 255.255.240.0
   exit
ip ssh filetransfer 2
no tftp-enable
password manager
password operator
```

If you enable SFTP and then later disable it, TFTP and auto-TFTP remain disabled unless they are explicitly re-enabled.

Operating rules are:

- The TFTP feature is enabled by default, and can be enabled or disabled through the CLI or an SNMP application. Auto-TFTP is disabled by default and must be configured through the CLI.
- While SFTP is enabled, TFTP and auto-TFTP cannot be enabled from the CLI. Attempting to enable either non-secure TFTP option while SFTP is enabled produces one of the following messages in the CLI:

  ```
  SFTP must be disabled before enabling tftp.

  SFTP must be disabled before enabling auto-tftp.
  ```

  Similarly, while SFTP is enabled, TFTP cannot be enabled using an SNMP management application. Attempting to do so generates an "inconsistent value" message. (An SNMP management application cannot be used to enable or disable auto-TFTP.)
- To enable SFTP by using an SNMP management application, you must first disable TFTP and, if configured, auto-TFTP on the switch. You can use either an SNMP application or the CLI to disable TFTP, but you must use the CLI to disable auto-TFTP.

[1] Enabling SFTP automatically disables TFTP and auto-tftp and displays this message.

[2]Viewing the configuration shows that SFTP is enabled and TFTP is disabled.

Enabling SSH V2 (required for SFTP)

```
switch(config)# ip ssh version 2
```

As a matter of policy, administrators should **not** enable the SSH V1-only or the SSH V1-or-V2 advertisement modes. SSHv1 is supported on only some legacy switches (such as the Switch Series 2500).

Confirming that SSH is enabled

```
switch(config)# show ip ssh
```

Once you have confirmed that you have enabled an SSH session (with the `show ip ssh` command), enter `ip ssh filetransfer` so that SCP and/or SFTP can run. You can then open your third-party software client application to begin using the SCP or SFTP commands to safely transfer files or issue commands to the switch.

Any attempts to use SCP or SFTP without using `ip ssh filetransfer` cause the SCP or SFTP session to fail. Depending on the client software in use, you will receive an error message on the originating console, for example:

```
IP file transfer not enabled on the switch
```

Disabling secure file transfer

```
switch(config)# no ip ssh filetransfer
```

Authentication

Switch memory allows up to ten public keys. This means the authentication and encryption keys you use for your third-party client SCP/SFTP software can differ from the keys you use for the SSH session, even though both SCP and SFTP use a secure SSH tunnel.

SSH authentication is mutually exclusive with RADIUS servers.

Some clients, such as PSCP (PuTTY SCP), automatically compare switch host keys for you. Other clients require you to manually copy and paste keys to the **`$HOME/.ssh/known_hosts`** file. Whatever SCP/SFTP software tool you use, after installing the client software you must verify that the switch host keys are available to the client.

Because the third-party software utilities you may use for SCP/SFTP vary, you should refer to the documentation provided with the utility you select before performing this process.

SCP/SFTP operating notes

- Any attempts to use SCP or SFTP without using ip ssh filetransfer will cause the SCP or SFTP session to fail. Depending on the client software in use, you will receive an error message on the originating console, for Example:

  ```
  IP file transfer not enabled on the switch
  ```

- There is a delay when SFTP is copying an image onto the switch, and although the command prompt returns in a couple of seconds, the switch may take approximately a minute and half writing the image to flash. You can keep entering the show flash command to see when the copy is complete and the flash is updated. You can also check the log for an entry similar to the following:

  ```
  I 01/09/13 16:17:07 00150 update: Primary Image updated.

  I 01/09/13 16:13:22 00636 ssh: sftp session from 15.22.22.03
  ```

- When an SFTP client connects, the switch provides a file system displaying all of its available files and folders. No file or directory creation is permitted by the user. Files may be only uploaded or downloaded, according to the permissions mask. All of the necessary files the switch needs are already in place on the switch. You do not need to (nor can you) create new files.
- The switch supports one SFTP session or one SCP session at a time.

- All files have read-write permission. Several SFTP commands, such as `create` or `remove`, are not allowed and return an error message. The switch displays the following files:

```
/
+---cfg
|   running-config
|   startup-config
+---log
|   crash-data
|   crash-data-a
|   crash-data-b
|   crash-data-c
|   crash-data-d
|   crash-data-e            "      "
|   crash-data-f ""
|   crash-data-g
|   crash-data-h            "      "
|   crash-data-I ""
|   crash-data-J ""
|   crash-data-K ""
|   crash-data-L "    "
|   crash-log
|   crash-log-a
|   crash-log-b
|   crash-log-c
|   crash-log-d
|   crash-log-e""
|   crash-log-f""
|   crash-log-g
|   crash-log-h" "
|   crash-log-I" "
|   crash-log-J" "
|   crash-log-K" "
|   crash-log-L" "
|   event log
+---os
|   primary
|   secondary
\---ssh
    +---mgr_keys
    |   authorized_keys
    \---oper_keys
    |   authorized_keys
\---core
|   port_1-24.cor    core-dump for ports 1-24 (stackable switches only)
|   port_25-48.cor   core-dump for ports 25-48 (stackable switches only)
```

Once you have configured your switch for secure file transfers with SCP and SFTP, files can be copied to or from the switch in a secure (encrypted) environment and TFTP is no longer necessary.

Troubleshooting SSH, SFTP, and SCP operations

Cause

You can verify secure file transfer operations by checking the switch's event log, or by viewing the error messages sent by the switch that most SCP and SFTP clients print out on their console.

Messages that are sent by the switch to the client depend on the client software in use to display them on the user console.

Broken SSH connection

If an ssh connection is broken at the wrong moment (for instance, the link goes away or spanning tree brings down the link), a fatal exception occurs on the switch. If this happens, the switch gracefully exits the session and produces an Event Log message indicating the cause of failure. The following three examples show the error messages that may appear in the log, depending on the type of session that is running (SSH, SCP, or SFTP):

```
ssh: read error Bad file number, session aborted I 01/01/90
00:06:11 00636 ssh: sftp session from ::ffff:10.0.12.35 W
01/01/90 00:06:26 00641 ssh:

sftp read error Bad file number, session aborted I 01/01/90
00:09:54 00637 ssh: scp session from ::ffff:10.0.12.35 W 01/
01/90

ssh: scp read error Bad file number, session aborted
```

The `Bad file number` is from the system error value and may differ depending on the cause of the failure. In the third Example:, the device file to read was closed as the device read was about to occur.

Attempt to start a session during a flash write

If you attempt to start an SCP (or SFTP) session while a flash write is in progress, the switch does not allow the SCP or SFTP session to start. Depending on the client software in use, the following error message may appear on the client console:

```
Received disconnect from 10.0.12.31: 2: Flash access in
progress

lost connection
```

Failure to exit from a previous session

This next example shows the error message that may appear on the client console if a new SCP (or SFTP) session is started from a client before the previous client session has been closed (the switch requires approximately ten seconds to timeout the previous session):

```
Received disconnect from 10.0.12.31: 2: Wait for previous
session to complete

lost connection
```

Attempt to start a second session

The switch supports only one SFTP session or one SCP session at a time. If a second session is initiated (For example, an SFTP session is running and then an SCP session is attempted), the following error message may appear on the client console:

```
Received disconnect from 10.0.12.31: 2: Other SCP/SFTP
session running

lost connection
```

Using Xmodem to download switch software from a PC or UNIX workstation

This procedure assumes that:

- The switch is connected via the Console RS-232 port to a PC operating as a terminal. (For information on connecting a PC as a terminal and running the switch console interface, see the installation and getting started guide you received with the switch.)
- The switch software is stored on a disk drive in the PC.
- The terminal emulator you are using includes the Xmodem binary transfer feature. (For example, in the HyperTerminal application included with Windows NT, you would use the **Send File** option in the **Transfer** drop-down menu.)

Downloading to primary or secondary flash using Xmodem and a terminal emulator (CLI)

Syntax

```
copy xmodem flash [<primary | secondary>]
```

Downloads a software file to primary or secondary flash. If you do not specify the flash destination, the Xmodem download defaults to primary flash.

Example

To download a switch software file named `E0822.swi` from a PC (running a terminal emulator program such as HyperTerminal) to primary flash:

Procedure

1. Execute the following command in the CLI:

   ```
   switch# copy xmodem flash
   Press 'Enter and start XMODEM on your host...
   ```

2. Execute the terminal emulator commands to begin the Xmodem transfer. For example, using HyperTerminal:
   a. Click on **Transfer**, then **Send File**.
   b. Type the file path and name in the Filename field.
   c. In the Protocol field, select **Xmodem**.
   d. Click on the **[Send]** button.
      The download can take several minutes, depending on the baud rate used in the transfer.
3. When the download finishes, you must reboot the switch to implement the newly downloaded software. To do so, use one of the following commands:

   #### Syntax

   ```
   boot system flash {<primary | secondary>}
   ```

   Reboots from the selected flash

   #### Syntax

   ```
   reload
   ```

   Reboots from the flash image currently in use

   For more information on these commands, see “Rebooting the Switches” in the basic operation guide for your switch.

4. To confirm that the software downloaded correctly:

   ```
   switch# show system
   ```

   Check the **Firmware revision** line. It should show the software version that you downloaded in the preceding steps.

If you need information on primary/secondary flash memory and the boot commands, see "Using Primary and Secondary Flash Image Options" in the basic operation guide for your switch.

Switch-to-switch download

You can use TFTP to transfer a software image between two switches of the same series. The CLI enables all combinations of flash location options.

Downloading the OS from another switch (CLI)

Where two switches in your network belong to the same series, you can download a software image between them by initiating a `copy tftp` command from the destination switch. The options for this CLI feature include:

- Copy from primary flash in the source to either primary or secondary in the destination.
- Copy from either primary or secondary flash in the source to either primary or secondary flash in the destination.

Downloading from primary only (CLI)

Syntax

`copy tftp flash <ip-addr> flash [primary | secondary]`

When executed in the destination switch, downloads the software flash in the source switch's primary flash to either the primary or secondary flash in the destination switch.

If you do not specify either a primary or secondary flash location for the destination, the download automatically goes to primary flash.

To download a software file from primary flash in a switch with an IP address of 10.29.227.103 to the primary flash in the destination switch, you would execute the following command in the destination switch's CLI:

Switch-to-switch, from primary in source to either flash in destination

```
switch# copy tftp flash 10.29.227.13 flash
Device will be rebooted, do you want to continue [y/n]? y
00107K [1]
```

[1]Running Total of Bytes Downloaded

Downloading from either flash in the source switch to either flash in the destination switch (CLI)

Syntax

`copy tftp flash <ip-addr> {</os/primary> | </os/secondary>} [primary | secondary]`

This command (executed in the destination switch) gives you the most options for downloading between switches. If you do not specify either a primary or secondary flash location for the destination, the download automatically goes to primary flash.

To download a software file from secondary flash in a switch with an IP address of 10.28.227.103 to the secondary flash in a destination switch, you would execute the following command in the destination switch's CLI.

Switch-to-switch, from either flash in source to either flash in destination

```
switch# copy tftp flash 10.29.227.13 flash /os/secondary secondary
Device will be rebooted, do you want to continue [y/n]? y
00184K
```

Using AirWave to update switch software

AirWave can be used to update switch products. For further information, refer to the **ZTP with Airwave network Management** chapter in this manual.

Using IMC to update switch software

IMC includes a software update utility for updating on switch products. For further information, refer to the getting started guide and the administrator's guide, provided electronically with the application.

Copying software images

For details on how switch memory operates, including primary and secondary flash, see "Switch Memory and Configuration" in the *Basic Operation Guide* for your switch.

TFTP: Copying a software image to a remote host (CLI)

Syntax

`copy flash tftp <ip-addr> <filename>`

Copies the primary flash image to a TFTP server.

Example

To copy the primary flash to a TFTP server having an IP address of 10.28.227.105:

```
switch# copy flash tftp 10.28.227.105 k0800.swi
```

where `k0800.swi` is the filename given to the flash image being copied.

Xmodem: Copying a software image from the switch to a serially connected PC or UNIX workstation (CLI)

To use this method, the switch must be connected via the serial port to a PC or UNIX workstation.

Syntax

`copy flash xmodem {[<pc] | unix>}`

Uses Xmodem to copy a designated configuration file from the switch to a PC or UNIX workstation.

Example:

To copy the primary flash image to a serially connected PC:

Procedure

1. Execute the following command:

```
switch# copy xmodem flash
Press 'Enter' and start XMODEM on your host...
```

2. After you see the above prompt, press **[Enter]**.
3. Execute the terminal emulator commands to begin the file transfer.

Copying diagnostic data

copy command-log

Syntax

```
copy command-log {sftp | tftp | usb | xmodem}
```

Description

This command copies the Command Log content to a remote host or to a serially-connected PC or UNIX workstation.

- Use the `sftp` option to copy data to an SFTP server.
- Use the `tftp` option to copy data to a TFTP server.
- Use the `usb` option to copy data to a USB flash drive.
- Use the `xmodem` option to copy data to the console using XMODEM.

copy event-log

Syntax

```
copy event-log [tftp <IP-ADDRESS> <FILEPATH_FILENAME> [oobm]] [usb <FILENAME>]
[xmodem <FILENAME>]
```

Description

These commands copy the Event Log content to a remote host, attached USB device, or to a serially connected PC or UNIX workstation.

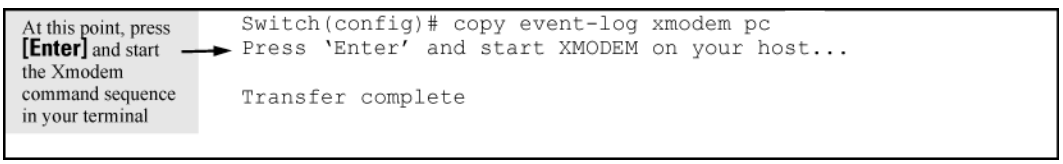
Parameters and options

`oobm`

For switches that have a separate OOBM port, the `oobm` parameter specifies that the transfer is through the OOBM interface. If this parameter is not specified, the transfer is through the data interface. The `oobm` parameter is not available on switches that do not have a separate OOBM port.

Copy the event log to a PC connected to the switch

Sending event log content to a file on an attached PC



Transferring switch configurations

Using the CLI commands described in the section beginning with TFTP: Copying a configuration file to a remote host (CLI), you can copy switch configurations to and from a switch, or copy a software image to configure or replace an ACL in the switch configuration.

For greater security, you can perform all TFTP operations using SFTP, as described in the section Using SCP and SFTP.

You can also use the `include-credentials` command to save passwords, secret keys, and other security credentials in the running config file. For more information, see the section on "Saving Security Credentials in a Config File" in the access security guide for your switch.

TFTP: Copying a configuration file to a remote host (CLI)

Syntax

```
copy {<startup-config | running-config>} tftp < ip-addr > < remote-file > [pc | unix]
copy config <filename> tftp <ip-addr> <remote-file> [pc | unix]
```

This command can copy a designated config file in the switch to a TFTP server. For more information, see "Multiple Configuration Files" in the basic operation guide for your switch.

Example

To upload the current startup configuration to a file named **`sw8200`** in the configs directory on drive **"d"** in a TFTP server having an IP address of 10.28.227.105:

```
switch# copy startup-config tftp 10.28.227.105
   d:\configs\sw8200
```

TFTP: Copying a configuration file from a remote host (CLI)

Syntax

```
copy tftp {<startup-config | running-config> < ip-address > < remote-file >} [pc | unix]
copy tftp config <filename> <ip-address> <remote-file> [pc | unix]
```

This command can copy a configuration from a remote host to a designated config file in the switch. For more information, see "Multiple Configuration Files" in the basic operation guide for your switch.

For more information on flash image use, see "Using Primary and Secondary Flash Image Options" in the basic operation guide for your switch.

Example

To download a configuration file named **sw8200** in the **`configs`** directory on drive **"d"** in a remote host having an IP address of 10.28.227.105:

```
switch# copy tftp startup-config 10.28.227.105
   d:\configs\sw8200
```

TFTP: Copying a customized command file to a switch (CLI)

Using the `copy tftp` command with the `show-tech` option provides the ability to copy a customized command file to the switch. When the `show tech custom` command is executed, the commands in the custom file are executed instead of the hard-coded list of commands. If no custom file is found, the current hard-coded list is executed. This list contains commands to display data, such as the image stamp, running configuration, boot history, port settings, and so on.

Syntax

`copy tftp show-tech <ipv4 or ipv6 address> <filename>`

Copies a customized command file to the switch (see : Using the copy tftp show-tech command to upload a customized command file).

Using the copy tftp show-tech command to upload a customized command file

```
switch(config)# copy tftp show-tech 10.10.10.3 commandfile1
```

Syntax

`show tech custom`

Executes the commands found in a custom file instead of the hard-coded list.

Exit the global config mode (if needed) before executing `show tech` commands.

You can include `show tech` commands in the custom file, with the exception of `show tech custom`. For example, you can include the command `show tech all`.

If no custom file is found, a message displays stating "No SHOW-TECH file found." (No custom file was uploaded with the `copy tftp show-tech` command.)

The show tech custom command

```
switch# show tech custom
No SHOW-TECH file found.
```

USB: Copying a configuration file to a USB device

Syntax

`copy startup-config usb <FILENAME>`

This command can copy a designated config file in the switch to a USB device.

Example:

`MyConfig` is the name given to the configuration file that you copy from the switch to the USB device.

```
switch# copy startup-config usb MyConfig
```

USB: Copying a configuration file from a USB device

Syntax

`copy usb startup-config <FILENAME>`

Description

Copies a configuration file from a USB device to the startup configuration file on the switch. To execute the command, you must know the name of the file to copy.

Example

`MyConfig` is the name given to the configuration file that you copy from the switch to the USB device.

```
switch# copy usb startup-config MyConfig
```

Xmodem: Copying a configuration file to a serially connected PC or UNIX workstation (CLI)

To use this method, the switch must be connected via the serial port to a PC or UNIX workstation. You will need to:

- Determine a filename to use
- Know the directory path you will use to store the configuration file.

Syntax

```
copy {<startup-config | running-config>} xmodem {<pc | unix>}
copy config <filename> xmodem {<pc | unix>}
```

Uses Xmodem to copy a designated configuration file from the switch to a PC or UNIX workstation. For more information, see "Multiple Configuration Files" in the basic operation guide for your switch.

Example

To copy a configuration file to a PC serially connected to the switch:

1. Determine the file name and directory location on the PC.
2. Execute the following command:

   ```
   switch# copy startup-config xmodem pc
   Press 'Enter' and start XMODEM on your host...
   ```

3. After you see the above prompt, press **[Enter]**.
4. Execute the terminal emulator commands to begin the file transfer.

Xmodem: Copying a configuration file from a serially connected PC or UNIX workstation (CLI)

To use this method, the switch must be connected via the serial port to a PC or UNIX workstation on which is stored the configuration file you want to copy. To complete the copying, you need to know the name of the file to copy and the drive and directory location of the file.

Syntax

```
copy xmodem startup-config {<pc | unix>}
copy xmodem config <filename> < {pc | unix>}
```

Copies a configuration file from a serially connected PC or UNIX workstation to a designated configuration file on the switch.

For more information, see "Multiple Configuration Files" in the basic operation guide for your switch.

Example

To copy a configuration file from a PC serially connected to the switch:

Procedure

1. Execute the following command:

```
switch# copy xmodem startup-config pc
Device will be rebooted, do you want to continue [y/n]? y
Press 'Enter' and start XMODEM on your host...
```

2. After you see the above prompt, press **[Enter]**.
3. Execute the terminal emulator commands to begin the file transfer.
4. When the download finishes, you must reboot the switch to implement the newly downloaded software. To do so, use one of the following commands:

Syntax

`boot system flash [primary | secondary]`
`boot system flash [config < filename >]`

Switches boot from the designated configuration file. For more information, see "Multiple Configuration Files" in the basic operation guide for your switch.

Syntax

`reload`

Reboots from the flash image currently in use.

(For more on these commands, see "Rebooting the Switch" in the basic operation guide for your switch.)

Transferring ACL command files

This section describes how to upload and execute a command file to the switch for configuring or replacing an ACL in the switch configuration. Such files should contain only access control entry (ACE) commands. For more on this general topic, including an example of an ACL command file created offline, see the section "Editing ACLs and Creating an ACL Offline" in the "Access Control Lists (ACLs)" of the latest access security guide for your switch.

TFTP: Uploading an ACL command file from a TFTP server (CLI)

Syntax

`copy tftp command-file <ip-addr> <filename.txt> {<unix | pc>}`

Copies and executes the named text file from the specified TFTP server address and executes the ACL commands in the file.

<ip-addr>	The IP address of a TFTP server available to the switch
<filename.txt>	A text file containing ACL commands and stored in the TFTP directory of the server identified by *ip-addr*
{<unix | pc>}	The type of workstation used for serial, Telnet, or SSH access to the switch CLI

Depending on the ACL commands used, this action does one of the following in the `running-config` file:

- Creates a new ACL.
- Replaces an existing ACL. (See "Creating an ACL Offline" in the "Access Control Lists (ACLs)" in the latest access security guide for your switch.)
- Adds to an existing ACL

Example

Suppose you:

- Created an ACL command file named `vlan10_in.txt` to update an existing ACL.
- Copied the file to a TFTP server at 18.38.124.16.

Using a PC workstation, you then execute the following from the CLI to upload the file to the switch and implement the ACL commands it contains:

```
switch(config)# copy tftp command-file 18.38.124.16
vlan10_in.txt pc
```

The switch displays this message:

```
Running configuration may change, do you want to continue
[y/n]?
```

To continue with the upload, press the **[Y]** key. To abort the upload, press the **[N]** key. Note that if the switch detects an illegal (non-ACL) command in the file, it bypasses the illegal command, displays a notice (as shown in : Using the copy command to download and configure an ACL and continues to implement the remaining ACL commands in the file.

Using the copy command to download and configure an ACL

```
switch(config)# copy tftp command-file 10.38.124.18 v1an10_in.txt pc
Running configuration may change, do you want to continue [y/n]? y
  1. ip access-list extended "155"
  2. deny tcp 0.0.0.0 255.255.255.255 10.10.10.2 0.0.0.0 eq 23 log
  3. permit ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
  4. show running
Command files are limited to access-list commands. 1
  5. exit
switch(config)# show running 2
Running configuration:

; J9091A Configuration Editor; Created on release #W.15.05.0000x
; Ver #01:01:00

hostname "Switch"
cdp run
ip default-gateway 10.38.248.1
logging 10.38.227.2
snmp-server community "public" unrestricted
ip access-list extended "155"
deny tcp 0.0.0.0 255.255.255.255 10.10.10.2 0.0.0.0 eq 23 log
permit ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
exit
```

[1]This message indicates that the `show running` command just above it is not an ACL command and will be ignored by the switch.

[2]Manually executing the `show running` from the CLI indicates that the file was implemented, creating ACL 155 in the switch's running configuration.

Xmodem: Uploading an ACL command file from a serially connected PC or UNIX workstation (CLI)

Syntax

```
copy xmodem command-file {<unix | pc>}
```

Uses Xmodem to copy and execute an ACL command from a PC or UNIX workstation. Depending on the ACL commands used, this action does one of the following in the running-config file:

- Creates a new ACL.
- Replaces an existing ACL. (See "Creating an ACL Offline" in the "Access Control Lists (ACLs)" in the latest access security guide for your switch.)
- Adds to an existing ACL.

Single copy command

When a switch crashes, five files relating to the crash; core-dump, crash-data, crash-log, fdr-log, and event-log are created and should be copied for review. All five files (core-dump, crash-data, crash-log, fdr-log, and event-log) should be copied to a destination specified under a directory by file name.

TFTP

A destination directory and files can be created for all crash files (core-dump, crash-data, crash-log, fdr-log, and event-log) on an TFTP server (with write permissions).

SFTP

Files are auto created on the SFTP server as a secured transfer. The destination directories however can be manually created on the server.

Specified directories can be used for the TFTP/SFTP transfers in the `copy` command. If the directory is specified, all files will be copied under one directory, otherwise all files will be copied to the TFTP/SFTP server home directory. It is mandatory to specify the directory name.

Single copy command

Syntax

```
copy sourcedestinationoptions
```

Copy data files to and from the switch.

Source

Specify the source of data using any of the following destinations.

Destination	Operation note
Flash	n/a
SFTP	For transfer of crash-files via SFTP, the destination directory must exist on the SFTP server with write permissions.

Destination	Operation note
	File creation is not mandatory as files are automatically created with the chassis serial number suffix to the filename when using SFTP.
TFTP	For transfer of crash-files via TFTP, the destination directory along with the file names (core-dump, crash-data, crash-log, fdr-log, and event-log) must exist on the TFTP server with write permissions.
Xmodem	n/a

Data Files

Specify the data file to be copied from the source.

Data file	Operation note
`command-output` *`command`*	Specify a command to copy output. When using `command-output`, place the desired CLI command in double-quotes. For example: "show system".
`config` *`file-name`*	Copy named configuration file. The `file-name` option is the source configuration file being copied.
`core-dump`	Copy core-dump file from flash.
`crash-data`	Copy the switch crash-data file.
`crash-log` *`a|b|c|d|e|f|g|h|master`*	Copy the switch crash-log file.
`crash-files`	Copy core-dump, crash-data, crash-log, fdr-log, and event-log files to an SFTP/TFTP server, or xmodem terminal. When using the `crash-files` option, the destination directory alone must be specified as the destination path. Specifying the file names is not mandatory.
`default-config`	Copy custom default-config file.
`event-log`	Copy event-log file.
`fdr-log`	Copy FDR-og file from the switch to an SFTP/TFTP server or xmodem terminal.
`flash`	Copy the switch system image file.
`SFTP server`	Copy data from a SFTP server.
`startup-config`	Copy in-flash configuration file.
`ssh-client-known-hosts`	Copy the known hosts file.

Data file	Operation note
ssh-server-pub-key	Copy the switch's SSH server public key.
running-config	Copy running configuration file.
TFTP	Copy data from a TFTP server.
xmodem	Use xmodem on the terminal as the data source.

Destination

Specify the copy target.

Destination
SFTP
TFTP
USB (available only on the 2930M Switch Series)
xmodem

Destination
SFTP
TFTP
xmodem

Data Files

Specify the data file name at the target.

Data file
command file
config
default-config
flash
pub-key-file
show-tech

Data file
`startup-config`
`ssh-client-key`
`ssh-client-known-hosts`

Parameters

Option	Operation note	Requirement
append	Add the keys for operator access.	n/a
directory	Directory name to upload.	Required for TFTP and SFTP transfers.
filename	File-name to upload/download.	Required for TFTP and SFTP transfers.
hostname	Hostname of the TFTP, SFTP server.	Required for TFTP, SFTP transfers.
IPv4 address	TFTP, SFTP server IPv4 address.	Required for TFTP, SFTP transfers.
IPv6 address	TFTP, SFTP server IPv6 address.	Required for TFTP, SFTP transfers.
manager	Replace the keys for manager access; follow with the `append` option to add the keys.	n/a
operator	Replace the keys for operator access (default); follow with the `append` option to add the keys.	n/a
pc		n/a
unix		n/a

Multiple management switches

Syntax

```
copy crash-files
```

interfaces

Copy interfaces crash files.

management

Copy management crash files.

	Destination		
	SFTP	TFTP	Xmodem
Slot-ID	X	X	X
MM-active	X	X	X
MM-standby	X	X	X

Stacking switches

Syntax

```
copy crash-files
```

member

Copy stack member crash files.

Options for `member`

Option	Destination			
	SFTP	TFTP	USB	xmodem
management	X	X	X	X
interfaces	X	X	X	X

Standalone switches

Syntax

```
copy crash-files
```

Parameters

Option	Destination		
	SFTP	TFTP	xmodem
management	X	X	X
interfaces	X	X	X

Crash file options

Syntax

```
copy crash-files crash-file-options host-name-str | ip-addr | ipv6-addrsftpdirname-str
```

Parameters

host-name-str

Specify hostname of the SFTP server.

ip-addr

Specify SFTP server IPv4 address.

ipv6-addr

Specify SFTP server IPv6 address.

user

Specify the username on the remote system.

username@ip-str

Specify the username along with remote system. Information (hostname, IPv4 or IPv6 address).

dirname-str

Specify the destination directory name.

Destination options

management

Copy management crash files.

Flight Data Recorder (FDR)

The Flight Data Recorder (FDR) log collects information that is "interesting" when the switch is not performing correctly, but has not crashed. Runtime logs are written to FDR memory while the switch is running and crashtime logs are collected and stored in the FDR buffer during a switch crash.

Syntax

```
copy fdr-log [[slot < slot-list >] | [mm-active [[current] | [previous]]] | [mm-standby]
| [all]] tftp [[< hostname] | [ip-addr >]] <filename>
```

Copies `fdr-log` files to a user-specified file.

`all`

Copies all the log files from both management modules and all slots.

`mm-active`

Copies the active management module's log.

`mm-standby`

Copies the standby management module's log.

`slot`

Retrieves the crash log from the module in the identified slots.

USB

The USB port is available only on the 2930M Switch Series.

usb-port

Syntax

```
usb-port

no usb-port
```

Description

Enables the USB port.

The `no` form of the command disables the USB port and any access to the device.

Command context

`Config`

show usb-port

Syntax

```
show usb-port
```

Description

Displays the status of the USB port. It can be enabled, disabled, or not present.

Command context

`operator`

Usage

One of the following messages indicates the presence or absence of a USB device:

- `Not able to sense device in USB port`
- `USB device detected in port`
- `no USB device detected in port`

Example

Display USB port status.

```
switch# show usb-port

  USB port status: enabled
  USB port power status: power on    (USB device detected in port)
```

Downloading switch software using USB

Prerequisites

1. Store a software version for the switch on a USB flash drive. (The latest software file is typically available from the Switch Networking website at http://www.hpe.com/networking/support.)
2. Insert the USB device into the switch's USB port.
3. Determine the name of the software file stored on the USB flash drive (for example, `K.0800.swi`).

4. Decide whether the image will be installed in the primary or secondary flash.

Copying using USB

To copy the primary image to a USB flash drive:

1. Insert a USB device into the switch's USB port.
2. Execute the command: `switch# copy flash usb K.0800.swi primary/secondary` where `K.0800.swi` is the name given to the primary flash image that is copied from the switch to the USB device.

copy flash usb

Syntax

`copy flash usb <FILENAME>`

Description

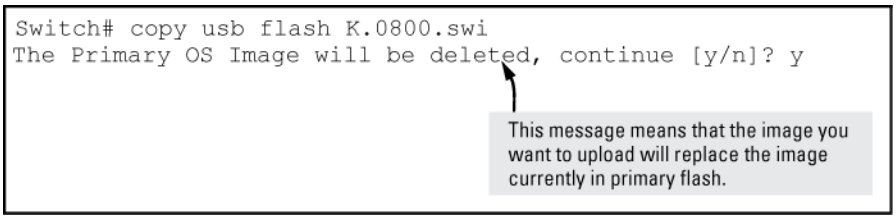
Uses the USB port to copy the specified flash image from the switch to a USB flash memory device. The default setting will use the primary image.

Procedure

Copy a switch software file named `K.0800.swi` from a USB device to primary flash.

1. Issue the `copy usb flash` command as shown below:

   Figure 33 *The command to copy switch software from USB*

2. When the switch finishes copying the software file from the USB device, it displays this progress message: `Validating and Writing System Software to the Filesystem....`
3. When the save finishes, you must reboot the switch to load the newly loaded software.
4. To confirm that the software downloaded correctly, execute `show system` and check the **Software revision** line.

copy usb command-file

Syntax

`copy usb command-file <FILENAME.TXT> [unix|pc]`

Description

Copies and executes the named text file from a USB flash drive and executes the ACL commands in the file. Depending on the ACL commands used, this action does one of the following in the running-config file:

- Creates a new ACL.
- Replaces an existing ACL.
- Adds to an existing ACL.

Parameters

<FILENAME.TXT>

A text file containing ACL commands and stored in the USB flash drive.

unix|pc

The type of workstation used to create the text file.

Upload an ACL command file from USB

Using a PC workstation, execute the following from the CLI to upload the file to the switch and implement the ACL commands it contains:

```
switch(config)# copy usb command-file vlan10_in.txt pc
```

The switch displays this message:

```
Running configuration may change, do you want to continue
[y/n]?
```

If the switch detects an illegal (non-ACL) command in the file, it bypasses the illegal command, displays a notice, and continues to implement the remaining ACL commands in the file.

Overview

The switches have several built-in tools for monitoring, analyzing, and troubleshooting switch and network operation:

- **Status:** Includes options for displaying general switch information, management address data, port status, port and trunk group statistics, MAC addresses detected on each port or VLAN, and STP, IGMP, and VLAN data.
- **Counters:**Display details of traffic volume on individual ports.
- **Event Log:** Lists switch operating events (Using the Event Log for troubleshooting switch problems on page 448).
- **Alert Log:** Lists network occurrences detected by the switch–in the System > Logging screen of the WebAgent.
- **Configurable trap receivers:** Uses SNMP to enable management stations on your network to receive SNMP traps from the switch.
- **Port monitoring (mirroring):** Copy all traffic from the specified ports to a designated monitoring port.
- **Chassis Locator LED:** The blue Locator LED lights up when you enter the `chassislocate` command.

Link test and ping test–analysis tools in troubleshooting situations–are described in Troubleshooting on page 689. See Diagnostic tools on page 479.

Switch and network operations

The switches have several built-in tools for monitoring, analyzing, and troubleshooting switch and network operation:

- Status

  Includes options for displaying general switch information, management address data, port status, port and trunk group statistics, MAC addresses detected on each port or VLAN, and STP, IGMP, and VLAN data.

- Counters

  Display details of traffic volume on individual ports

- Event Log

  Lists switch operating events. See the ProVision switch software troubleshooting guide for troubleshooting information.

- Configurable trap receivers

  Uses SNMP to enable management stations on your network to receive SNMP traps from the switch.

- Port monitoring (mirroring)

  Copy all traffic from the specified ports to a designated monitoring port .

Link test and ping test–analysis tools in troubleshooting situations–are described in the *ProVision Switch Software Troubleshooting Guide*.

Status and counters data

This section describes the status and counters screens available through the switch console interface and/or the WebAgent.

You can access all console screens from the WebAgent via Telnet to the console. Telnet access to the switch is available in the **Device View** window under the **Configuration** tab.

chassislocate

Syntax

Description

Identifies the location of a specific switch by activating the blue locator LED on the front panel of the switch.

```
chassislocate [blink|on|off]
```

Parameters and options

blink <*1-1440*>

Blinks the chassis locate LED for a specified number of minutes (Default: 30 min.)

on <*1-1440*>

Turns the chassis locate LED on for a specified number of minutes (Default: 20 min.)

off

Turns the chassis locate LED off.

Chassislocate at startup

The chassislocate command has an optional parameter that configures it to run in the future instead of immediately.

Syntax

```
chassislocate [on|blink] <MINUTES> at [now|startup]

chassislocate off
```

Parameters

<*MINUTES*>

Specify the number of minutes for the chassis locate LED to remain on or blink.

at

Specify when the command is applied (default immediately.)

now

Turn on the chassis locate LED immediately.

startup

Turn on the chassis locate LED at switch startup.

off

Turn off the chassis locate LED switch

chassislocate at startup

```
chassislocate blink 10 at startup
```

show system chassislocate

Syntax

```
show system chassislocate
```

Description

Displays the current status of the `chassislocate` settings.

Display locator LED status

```
Locator LED Status
          Current    Time
Member    State      Remaining  Configuration
------    -------    ---------  -------------
1         blink      00:27:05   blink 30 at startup
2         on         01:05:27
3         off
```

General system information

Accessing system information (CLI)

Syntax

```
show system [chassislocate | information | fans | power-supply | temperature]
```

Displays global system information and operational parameters for the switch.

`chassislocate`	Shows the chassisLocator LED status. Possible values are On, Off, or Blink.When the status is On or Blink, the number of minutes that the Locator LED will continue to be on or to blink is displayed. (See Accessing system information (CLI) on page 345)
`information`	Shows global system information and operational parameters for the switch. (See Accessing system information (CLI) on page 345.)
`fans`	Shows system fan status. (See Accessing system information (CLI) on page 345.)

Command results for show system chassislocate command

```
switch(config)# show system chassislocate
```

```
Chassis Locator LED: ON 5 minutes 5 seconds

switch(config)# show system chassislocate

Chassis Locator LED: BLINK 10 minutes 6 seconds

switch(config)# show system chassislocate

Chassis Locator LED: OFF
```

System fan status

```
switch(config)# show system fans

Fan Information
   Num | State | Failures
-------+-------------+----------
 Sys-1 | Fan OK | 0

0 / 1 Fans in Failure State
0 / 1 Fans have been in Failure State
```

Switch system information

```
switch(config)# show system

 Status and Counters - General System Information

  System Name         : Switch
  System Contact      :
  System Location     :

  MAC Age Time (sec) : 300

  Time Zone           : 0
  Daylight Time Rule : None

  Software revision  : T.13.XX     Base MAC Addr    : 001635-b57cc0
  ROM Version        : XX.12.12     Serial Number    : LP621KI005

  Up Time            : 51 secs     Memory - Total   : 152,455,616
  CPU Util (%)       : 3                    Free    : 100,527,264

  IP Mgmt - Pkts Rx  :0            Packet - Total   : 6750
            Pkts Tx  :0            Buffers  Free    : 5086
                                            Lowest  : 5086
                                            Missed  : 0
```

Collecting processor data with the task monitor (CLI)

The task monitor feature allows you to enable or disable the collection of processor utilization data. The `task-monitor cpu` command is equivalent to the existing debug mode command `taskusage -d`.

When the `task-monitor` command is enabled, the `show cpu` command summarizes the processor usage by protocol and system functions.

Syntax

`no task-monitor cpu`

Allows the collection of processor utilization data.

Only manager logins can execute this command.

The settings are not persistent, that is, there are no changes to the configuration.

(Default: Disabled)

The task-monitor cpu command and show cpu output

```
switch(config)# task-monitor cpu
switch(config)# show cpu

2 percent busy, from 2865 sec ago
1 sec ave: 9 percent busy
5 sec ave: 9 percent busy
1 min ave: 1 percent busy


 % CPU | Description
-------+-----------------
    99 | Idle
```

task-monitor cpu

Syntax

```
no task-monitor cpu
```

Description

Enables or disables the collection of processor utilization data, and requires a manager log in. Settings are not persistent; there are no changes to the configuration. Defaults to disabled.

task-monitor cpu command

Figure 34 *The task-monitor cpu command and show cpu output*

```
Switch(config)# task-monitor cpu
Switch(config)# show cpu

2 percent busy, from 2865 sec ago
1 sec ave: 9 percent busy
5 sec ave: 9 percent busy
1 min ave: 1 percent busy


 % CPU | Description
-------+--------------------------
    99 | Idle
```

Switch management address information access

show management

Syntax

```
show management
```

Description

Displays switch management address information.

Component information views

The CLI `show modules` command displays additional component information for the following:

- SSM–identification, including serial number
- Mini-GBICS–a list of installed mini-GBICs displaying the type, "J" number, and serial number (when available)

Task usage reporting

The task usage reporting feature provides the ability to collect and display CPU usage data (with a refresh rate of 5 seconds) of running tasks on the switch. It includes the following commands:

- `process-tracking`: This command is used to enable/disable the task-usage collecting capability for a specific module on the switch.
- `show cpu process`: This command is used to display task-usage statistics for a specific module.

Syntax

`no process-tracking [slot[SLOT-LIST] [<time>]] [<time>]`

Enables/disables module process-tracking functionality.

`process-tracking <tab>`

`slot`	Enables/disables process-tracking for a module.
`INTEGER`	Specifies time to track value between 1 second to 30 seconds.
`<cr>`	

`process-tracking slot <tab>`

`SLOT-ID-RANGE`	Enter an alphabetic device slot identifier or slot range.

`process-tracking slot A`

`INTEGER`	Specifies time to track value between 1 second to 30 seconds.
`<cr>`	

`process-tracking slot A 10 <tab>`

`<cr>`	

`process-tracking 10 <tab>`

`<cr>`	

Syntax

```
show cpu [<CHASSIS_MIN_CPU_UTIL_INDEX-CHASSIS_MAX_CPU_UTIL_INDEX>]
[slot <SLOT-LIST>

[<CHASSIS_MIN_CPU_UTIL_INDEX-CHASSIS_MODULE_MAX_CPU_UTIL_INDEX>]]

[process [[slot <SLOT-LIST>] [refresh <iterations>]]
[refresh <iterations>]
```

Shows average CPU utilization over the last 1, 5, and 60 seconds, or the number of seconds specified.

Use the `slot` option to display CPU utilization for the specified modules, rather than the chassis CPU.

Use the `process` option to display module process usages.

Syntax

```
show cpu process [slot [SLOT-LIST][refresh <iterations>]]
[refresh <iterations>]
```

Displays module process usage.

```
show cpu <tab>
```

process	Displays process usage.
slot	Displays module CPU statistics.
<1-300>	Time (in seconds) over which to average CPU utilization.
<cr>	

```
show cpu process <tab>
```

refresh	Number of times to refresh process usage display.
slot	Displays module process usage.
<cr>	

```
show cpu process refresh <tab>
```

INTEGER	Enter an integer number.

```
show cpu process refresh 10 <tab>
```

<cr>	

```
show cpu process slot <tab>
```

SLOT-ID-RANGE	Enter an alphabetic device slot identifier or slot range.

`show cpu process slot A <tab>`

refresh	Number of times to refresh process usage display.
<cr>	

`show cpu process slot A refresh <tab>`

INTEGER	Enter an integer number.

`show cpu process slot A refresh 10 <tab>`

<cr>	

Output for the show cpu process command

```
switch# show cpu process

                              | Recent |  %   | Time Since | Times  | Max
Process Name      | Priority  | Time   | CPU  | Last Ran   | Ran    | Time
----------------- + --------- + ------ + ---- + ---------- + ------ + -------
Idle-1            | 226       | 10 s   | 41   | 57 us      | 380986 | 69 us
Idle-3            | 1         | 5 s    | 20   | 52 us      | 761665 | 55 us
Idle-0            | 226       | 8 s    | 33   | 19 us      | 380867 | 66 us
Sessions & I/O-24 | 171       | 926 ms | 3    | 1 ms       | 150    | 335 ms
```

Output for the show cpu process slot <slot-list> command

```
switch# show cpu process slot A
slot a:

                              | Recent |  %   | Time Since | Times  | Max
Process Name      | Priority  | Time   | CPU  | Last Ran   | Ran    | Time
----------------- + --------- + ------ + ---- + ---------- + ------ + -------
System Services-2 | 156       | 253 ms | 2    | 767 ms     | 12     | 35 ms
Idle-3            | 1         | 3 s    | 28   | 13 ms      | 101309 | 150 us
Hardware Mgmt-2   | 192       | 282 ms | 2    | 303 us     | 44     | 12 ms
Idle-1            | 226       | 6 s    | 55   | 13 ms      | 50793  | 233 us
Idle-0            | 226       | 1 s    | 9    | 14 ms      | 50633  | 106 us
```

Switch management address information

Accessing switch management address information (CLI)

Syntax

`show management`

Determining MAC addresses

Use the CLI to view the switch's port MAC addresses in hexadecimal format.

The switch's base MAC address is used for the default VLAN (VID =1) that is always available on the switch. This is true for dynamic VLANs as well; the base MAC address is the same across all VLANs.

Viewing the MAC addresses of connected devices

Syntax

`show mac-address [port-list | mac-addr | vlan < vid>]`

Lists the MAC addresses of the devices the switch has detected, along with the number of the specific port on which each MAC address was detected.

[*port-list*]	Lists the MAC addresses of the devices the switch has detected, on the specified ports.
[*mac-addr*]	Lists the port on which the switch detects the specified MAC address. Returns the following message if the specified MAC address is not detected on any port in the switch: `MAC address <mac-addr> not found.`
[vlan <*vid*>]	Lists the MAC addresses of the devices the switch has detected on ports belonging to the specified VLAN, along with the number of the specific port on which each MAC address was detected.

Viewing the switch's MAC address assignments for VLANs configured on the switch

The Management Address Information screen lists the MAC addresses for:

- Base switch (default VLAN; VID=1)
- Any additional VLANs configured on the switch.

Also, the Base MAC address appears on a label on the back of the switch.

The Base MAC address is used by the first (default) VLAN in the switch. This is usually the VLAN named "DEFAULT_VLAN" unless the name has been changed (by using the VLAN Names screen). On the switches covered in this guide, the VID (VLAN identification number) for the default VLAN is always "1," **and cannot be changed**.

Viewing the port and VLAN MAC addresses

The MAC address assigned to each switch port is used internally by such features as Flow Control and the spanning-tree protocol. Using the `walkmib` command to determine the MAC address assignments for individual ports can sometimes be useful when diagnosing switch operation.

This procedure displays the MAC addresses for all ports and existing VLANs in the switch, regardless of which VLAN you select.

Procedure

1. If the switch is at the CLI Operator level, use the `enable` command to enter the Manager level of the CLI.
2. Enter the following command to display the MAC address for each port on the switch:

   ```
   switch# walkmib ifPhysAddress
   ```

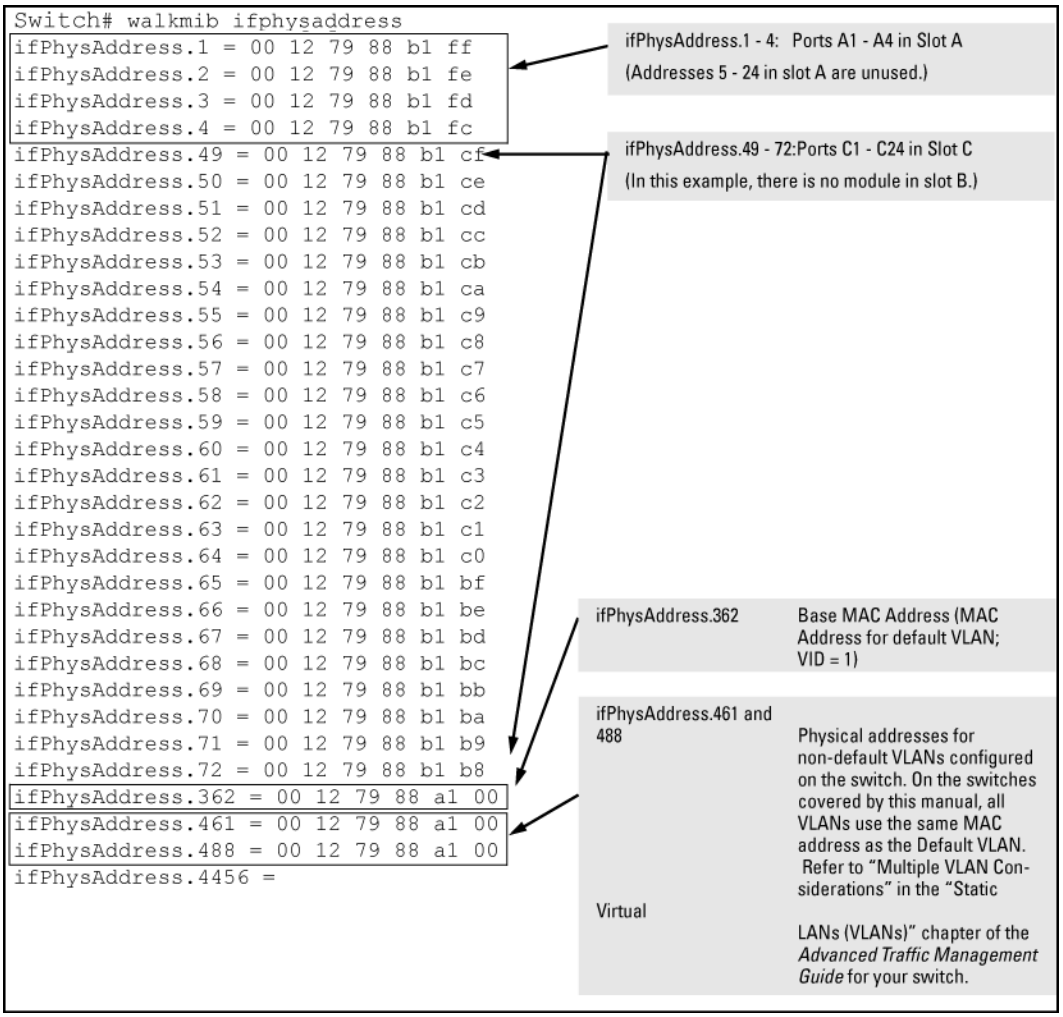
   (The above command is not case-sensitive.)

Example

A switch with the following module configuration shows MAC address assignments similar to those shown in the example below:

- A 4-port module in slot A, a 24-port module in slot C, and no modules in slots B and D
- Two non-default VLANs configured

Figure 35 *Example: Port MAC address assignments on a switch*



Port Status

The WebAgent and the console interface show the same port status data.

Viewing port status (CLI)

Syntax

```
show interfaces brief
```

Viewing port and trunk group statistics (WebAgent)

1. In the navigation pane of the WebAgent, click Interface.
2. Click Port Info/Config.

For information about this screen, click **?** in the upper right corner of the WebAgent screen.

To reset the port counters to zero, you must reboot the switch.

Port and trunk group statistics and flow control status

The features described in this section enable you to determine the traffic patterns for each port since the last reboot or reset of the switch. You can display:

- A general report of traffic on all LAN ports and trunk groups in the switch, along with the per-port flow control status (On or Off).
- A detailed summary of traffic on a selected port or trunk group.

You can also reset the counters for a specific port.

The menu interface provides a dynamic display of counters summarizing the traffic on each port. The CLI lets you see a static "snapshot" of port or trunk group statistics at a particular moment.

As mentioned above, rebooting or resetting the switch resets the counters to zero. You can also reset the counters to zero for the current session. This is useful for troubleshooting. See the Note, below.

The **Reset** action resets the counter display to zero for the current session, but does not affect the cumulative values in the actual hardware counters. (In compliance with the SNMP standard, the values in the hardware counters are not reset to zero unless you reboot the switch.) Exiting from the console session and starting a new session restores the counter displays to the accumulated values in the hardware counters.

Accessing port and trunk group statistics (CLI)

Viewing the port counter summary report

Syntax

```
show interfaces
```

Provides an overview of port activity for all ports on the switch.

Viewing a detailed traffic summary for specific ports

Syntax

```
show interfaces <port-list>
```

Provides traffic details for the ports you specify.

Displaying trunk load balancing statistics

To display trunk counters information since the trunk was formed with the given ports. If ports are added or removed from the trunk-groups, statistical data is reset.

Syntax

```
show trunk-statistics <trunk-group>
```

Displays the trunk counter information since the trunk was formed.

Ouptut for the show trunk-statistics command

```
switch(config)# show trunk-statistics trk1

 Group : Trk1 Ports : 3,4
 Monitoring time : 23 hours 15 minutes

 Totals

  Packets Rx : 3,452,664 Bytes Rx : 14,004,243
  Packets Tx : 2,121,122 Bytes Tx : 2,077,566
  Packets Tx Drop :

  Rates (5 minute weighted average):
   Trunk utilization Rx : 30.2 %
   Trunk utilization Tx : 78.2 %

 Traffic Spread past 5 minutes

  Port | %Tx   | %Rx   | Bytes Rx   | Bytes Tx   | Dropped Frame-Tx
  ---- + ----- + ----- + ---------- + ---------- + ----------------
  3    | 27    | 42    | 1,223,445  | 2,112,122  | 123,122
  4    | 73    | 58    | 356,233    | 993,222    | 0
```

Clearing trunk load balancing statistics

To display trunk counters information since the trunk was formed with the given ports. If ports are added or removed from the trunk-groups, statistical data is reset. The data is for a specific trunk.

Syntax

`clear trunk-statistics <trunk-group>`

Clears statistics for all trunks if no trunks identified.

trunk-group: Clears specific trunk counter information since the trunk was formed.

Resetting the port counters

It is useful to be able to clear all counters and statistics without rebooting the switch when troubleshooting network issues. The `clear statistics global` command clears all counters and statistics for all interfaces except SNMP. You can also clear the counters and statistics for an individual port using the `clear statistics <port-list>` command.

Syntax

`clear statistics {<< port-list > | global>}`

When executed with the *port-list* option, clears the counters and statistics for an individual port.

When executed with the `global` option, clears all counters and statistics for all interfaces except SNMP.

The `show interfaces [<port-list>]` command displays the totals accumulated since the last boot or the last `clear statistics` command was executed. The menu page also displays these totals.

SNMP displays the counter and statistics totals accumulated since the last reboot; it is not affected by the `clear statistics global` command or the `clear statistics <port-list>` command. An SNMP trap is sent whenever the statistics are cleared.

Viewing the switch's MAC address tables

Accessing MAC address views and searches (CLI)

Syntax

```
show mac-address
 [vlan < vlan-id>]
 [<port-list>]
 [< mac-addr >]
```

Listing all learned MAC addresses on the switch, with the port number on which each MAC address was learned

```
Switch# show mac-address
```

Listing all learned MAC addresses on one or more ports, with their corresponding port numbers

For example, to list the learned MAC address on ports A1 through A4 and port A6:

```
Switch# show mac-address a1-a4,a6
```

Listing all learned MAC addresses on a VLAN, with their port numbers

This command lists the MAC addresses associated with the ports for a given VLAN. For example:

```
Switch# show mac-address vlan 100
```

The switches operate with a multiple forwarding database architecture.

Finding the port on which the switch learned a specific MAC address

For example, to find the port on which the switch learns a MAC address of 080009-21ae84:

```
Select VLAN : DEFAULT_VLAN
```

Accessing MSTP Data (CLI)

Syntax

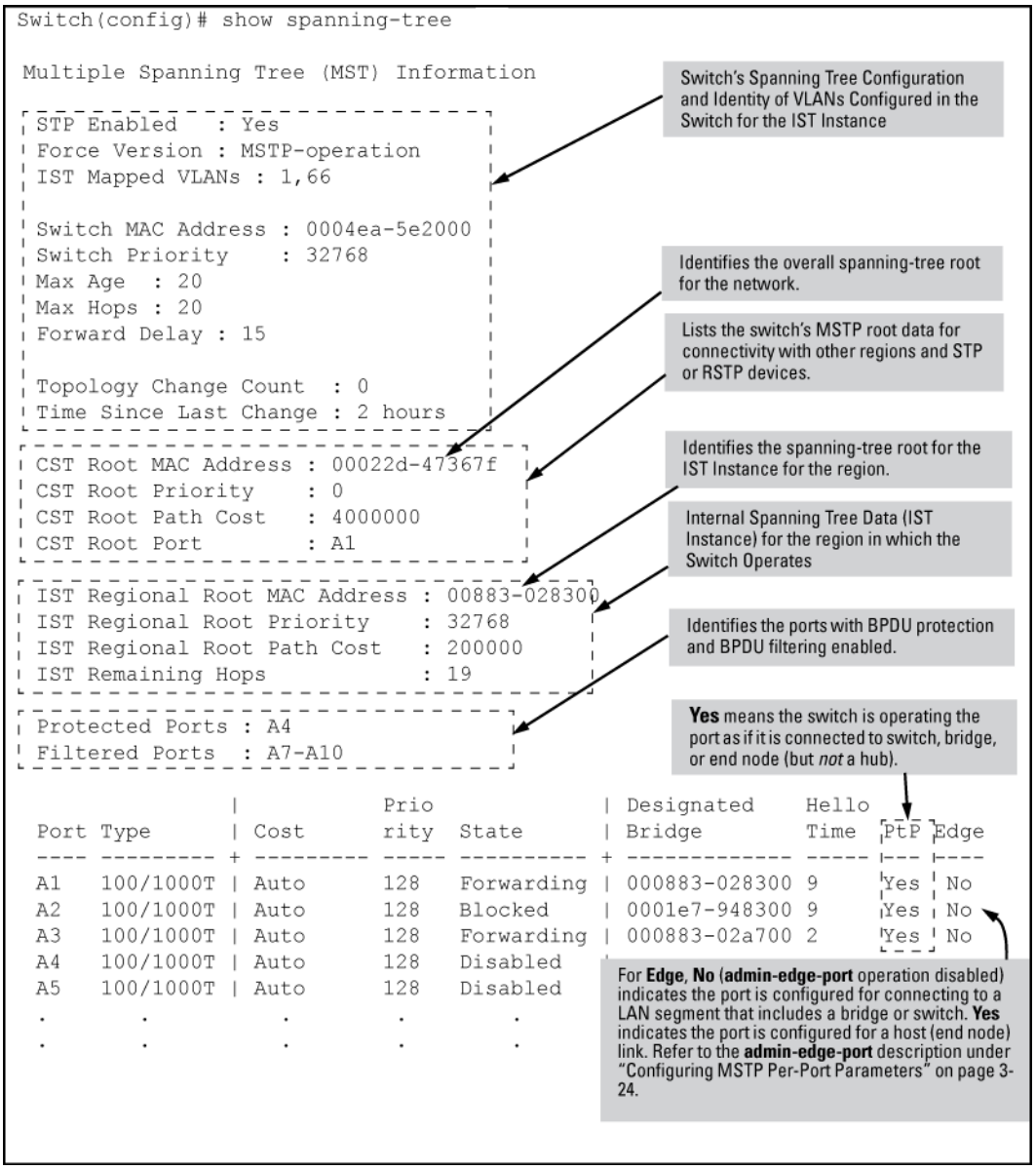
```
show spanning-tree
```

Displays the switch's global and regional spanning-tree status, plus the per-port spanning-tree operation at the regional level.

Values for the following parameters appear only for ports connected to active devices: `Designated Bridge`, `Hello Time`, `PtP`, and `Edge`.

Example

Figure 36 *Output from show spanning-tree command*



Viewing internet IGMP status (CLI)

The switch uses the CLI to display the following IGMP status on a per-VLAN basis:

Viewing VLAN information (CLI)

Show command	Output
`show vlan`	Lists: ■ Maximum number of VLANs to support ■ Existing VLANs ■ Status (static or dynamic) ■ Primary VLAN

Show command	Output
`show vlan <vlan-id>`	For the specified VLAN, lists: ■ Name, VID, and status (static/dynamic) ■ Per-port mode (tagged, untagged, forbid, no/auto) ■ "Unknown VLAN" setting (Learn, Block, Disable) ■ Port status (up/down)

Examples

Suppose that your switch has the following VLANs:

Ports	VLAN	VID
A1-A12	DEFAULT_VLAN	1
A1, A2	VLAN-33	33
A3, A4	VLAN-44	44

The next three examples show how you could list data on the above VLANs.

Listing the VLAN ID (vid) and status for specific ports

```
Switch# show vlan ports A1-A2

 Status and Counters = VLAN Information - for ports A1,A2

  802.1Q VLAN ID Name         Status
  -------------- ------------ ------
  1              DEFAULT_VLAN Static
  33             VLAN-33      Static
```

Note: Because ports A1 and A2 are not members of VLAN-44, it does not appear in this listing.

VLAN listing for the entire switch

```
Switch# show vlan
 Status and Counters = VLAN Information

 VLAN support : Yes
 Maximum VLANs to support : 9
 Primary VLAN: DEFAULT_VLAN

 802.1Q VLAN ID Name         Status
 -------------- ------------ ------
 1              DEFAULT_VLAN Static
 33             VLAN-33      Static
 44             VLAN-44      Static
```

Port listing for an individual VLAN

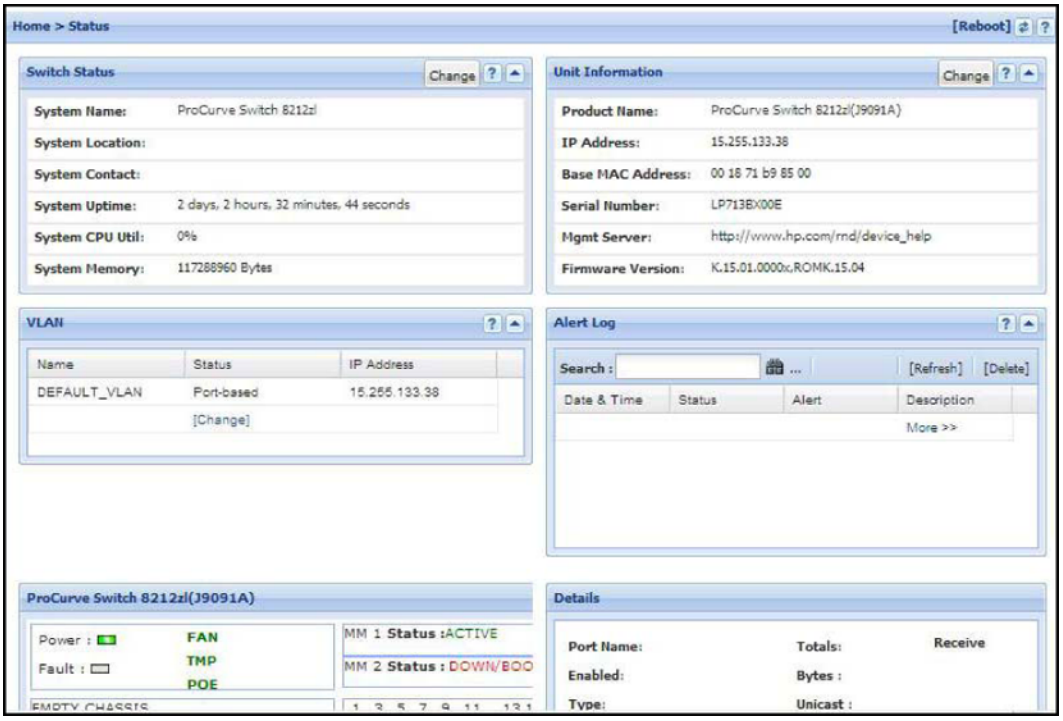
```
switch(config)# show vlan 1

 Status and Counters - VLAN Information - VLAN 1

  VLAN ID : 1
  Name : DEFAULT_VLAN
```

```
  Status : Static
  Voice : Yes
  Jumbo : No

  Port Information Mode     Unknown VLAN Status
  ---------------- -------- ------------ ------
  A1               Untagged Learn        Up
  A2               Untagged Learn        Up
  A3               Untagged Learn        Up
  A4               Untagged Learn        Down
  A5               Untagged Learn        Up
  A6               Untagged Learn        Up
  A7               Untagged Learn        Up
```

WebAgent status information

The WebAgent Status screen provides an overview of the status of the switch. Scroll down to view more details. For information about this screen, click on **?** in the upper right corner of the WebAgent screen. For an example of a status screen, see Figure 37: Example: WebAgent status screen.

Figure 37 *Example: WebAgent status screen*



Compatibility mode for v2 zl and zl modules

In the following context, v2 zl modules are the second version of the current zl modules.

Compatibility Mode allows the inter-operation of v2 zl modules with zl modules in a chassis switch. When in Compatibility Mode, the switch accepts either v2 zl or zl modules. The default is Compatibility Mode enabled. If Compatibility Mode is disabled by executing the `no allow-v1-modules` command, the switch will only power up v2 zl modules.

allow-v2-modules

Syntax

`no allow-v2-modules`

Enables Compatibility Mode for interoperation of v2 zl and zl modules in the same chassis.

allow-v2-modules

```
switch(config)# allow-v2-modules
This will erase the configuration and reboot the switch.
Continue (y/n)?
```

The `no` form of the command disables Compatibility Mode. Only the v2 zl modules are powered up. Defaults to enabled.

no allow-v2-modules

```
switch(config)# no allow-v2-modules
This command will disable all V2 modules and reboot the switch.
Continue (y/n)? y
```

Port Status

The WebAgent and the console interface show the same port status data.

show interfaces brief

Syntax

`show interfaces brief`

Description

View the port status.

Accessing port and trunk group statistics

Use the CLI to view port counter summary reports, and to view detailed traffic summary for specific ports.

Trunk bandwidth utilization

- Trunk interface counters display the accumulated statistics over the trunk members' ports since the time they are added into trunk.
- Bandwidth utilization for trunks is calculated by averaging the value of the sum of bandwidth utilization for each trunk member in the last 5 minute interval .

show interfaces trunk-utilization

Syntax

`show interfaces trunk-utilization`

Description

Shows the bandwidth utilization calculations for all trunk members.

Command context

operator or manager

Example

Show bandwidth utilization for trunks.

```
Switch(config)# show interfaces trunk-utilization

Status and Counters - Port Utilization

                         Rx                          Tx
 Port      | --------------------------- | ---------------------------
           | Kbits/sec   Pkts/sec  Util  | Kbits/sec  Pkts/sec   Util
 --------  ---------- ----- + ---------- ---------- ---------  -----
 Trk1      | 0          0          0     | 0          0          0
 Trk2      | 0          0          0     | 0          0          0
 Trk10     | 0          0          0     | 0          0          0
```

Statistic interactions of interface counters

Interface counters are cleared using the command `clear statistics`. When certain actions are taken to ports and trunks, the outcome of the `clear` command differs.

Table 30: *Statistic interactions*

Action taken	Trigger	Interaction with interface counter
Adding Port into trunk	CLI/SNMP	▪ Interface counters for this port will be cleared across all sessions. ▪ Average rate counters are not cleared.
Removing Port from trunk	CLI/SNMP	▪ Interface counters for this port will be cleared across all sessions. ▪ Average rate counters are not cleared.
Trunk port coming Up	CLI enable	▪ No change in counters. ▪ Interface counters for this port are not cleared. ▪ Average rate counters are not cleared. Counters will start from 0 when the trunk port comes up.
Trunk port coming Up	Cable connect	▪ No change in counters. ▪ Interface counters for this port are not cleared. ▪ Average rate counters are not cleared. Counters will start from 0 when the trunk port comes up.
Trunk port going Down	CLI disable	▪ Interface counters for this port are not cleared. ▪ Average rate counters are cleared.
Trunk port go ing Down	Cable disconnect	▪ Interface counters for this port are not cleared. ▪ Average rate counters are cleared.
Trunk port going Down	Module crash/module reload	▪ Interface counters for this port are not cleared. ▪ Average rate counters are cleared.
Trunk port going Down	Save power - off	▪ Interface counters for this port are not cleared. ▪ Average rate counters are cleared.

Action taken	Trigger	Interaction with interface counter
Trunk port going Down	Stacking member reboot/crash/shutdown.	■ Interface counters for this port are not cleared. ■ Average rate counters of this port is not cleared. ■ Utilization for the port is cleared. ■ Utilization for the trunk group is updated accordingly
Trunk port going Down	Module remove/member remove.	■ Statistics for removed trunk port can not be accessed as the port is removed. ■ Interface counters for the trunk group is updated. ■ Utilization for the trunk group is updated.
Clear statistics on physical port which is part of trunk	CLI	■ Not allowed. ■ The error message `Module not present for port or invalid port: <PORT-NUM>` displays when the command `clear statistics` is executed on a port which part of a trunk.
Clear statistics on trunk.	CLI	■ Interface counters for physical ports which are part of trunk will be cleared. ■ Average rate counters are not cleared.

Reset port counters

When troubleshooting network issues, you can clear all counters and statistics without rebooting the switch using the `clear statistics global` command or using the menu.

SNMP displays the counter and statistics totals accumulated since the last reboot, and it is not affected by the `clear statistics global` command or the `clear statistics <PORT-LIST>` command. Clearing statistics initiates an SNMP trap.

Once cleared, statistics cannot be reintroduced.

clear statistics

Syntax

```
clear statistics [<PORT-LIST>|global]
```

Description

This command clears all counters and statistics for all interfaces except SNMP.

Parameters and options

<PORT-LIST>

Clears the counters and statistics for specific ports.

global

Clears all counters and statistics for all interfaces except SNMP.

MAC address tables

MAC address views and searches

You can view and search MAC addresses using the CLI or the menu.

show mac-add detail

Syntax

`show mac-address detail`

Description

Shows the age of the learned MAC addresses in the MAC table. The age of a specific MAC-address will be displayed in `dd:hr:min:sec.msec` format.

Command context

`manager`

Examples

`show mac-add detail` on a specified switch.

```
switch# show mac-add detail

Status and Counters - Port Address Table

  MAC Address       Port                             VLAN Age (d:h:m:s.ms)
  ----------------- -------------------------------- ---- ----------------
  3c4a92-31c100     F23                              1    0000:00:00:00.34
  9cb654-ce6169     A2                               1    0000:00:02:37.93
  c09134-cd2740     F23                              1    0000:00:00:00.28
  c09134-cd277d     F23                              1    0000:00:00:23.62
  f0921c-85b0e0     F24                              1    0000:00:00:08.29
  f0921c-85b0e9     F24                              1    0000:00:00:09.47
```

`show mac-add detail` for Vxlan Tunnel supporting and non-supporting platforms.

```
switch# show mac-address detail

Status and Counters - Port Address Table
  MAC Address       Port                             VLAN Age (d:h:m:s.ms)
  ----------------- -------------------------------- ---- ----------------
  f0921c-b6e940     L22                              1    0000:00:23:26.93
  0180c2-00000f     A24                              50   0000:00:00:00.00
  d18cc2-00000f     A24                              50   0001:21:43:59.92
  e18dd2-00000f     A24                              50   0000:18:23:24.22
```

`show mac-add detail` for platforms not supporting Vxlan Tunnels.

```
stack-Switch# show mac-address detail

Status and Counters - Port Address Table
  MAC Address   Port   VLAN Age (d:h:m:s.ms)
  ------------- ------ ---- ----------------
  009c02-d80f28 1/2    1    0000:00:00:30.18
  3464a9-abe500 1/2    1    0030:07:01:20.23
```

show mac-address

Syntax

```
show mac-address [vlan <VLAN-ID> ] [<PORT-LIST>] [<MAC-ADDR>] [TUNNEL-ID]
```

Description

Lists all MAC addresses on the switch and their corresponding port numbers. You can also choose to list specific addresses and ports, or addresses and ports on a VLAN. The switches operate with a multiple forwarding database architecture.

Command context

```
manager
```

Parameters

`vlan <VLAN-ID>`

Show MAC addresses learned on a specified VLAN.

`PORT-LIST`

Show MAC addresses learned on the specified ports.

`<MAC-ADDR>`

Show the specified port for a specified MAC address.

`TUNNEL-ID`

Show MAC addresses learned on the specified VXLAN tunnel.

Usage

`show mac-address`

Lists all learned MAC addresses on the switch and their corresponding port numbers.

`show mac-address a1-a4,a6`

Lists all learned MAC addresses on one or more ports and their corresponding port numbers.

`show mac-address vlan 100`

Lists all learned MAC addresses on a VLAN and their corresponding port numbers.

show mac-address <MAC-ADDRESS> detail

Syntax

Syntax

```
show mac-address <MAC-ADDRESS> detail
```

Description

Specifies the age and existing details of the specific mac address given.

```
manager
```

Parameters

`<MAC-ADDRESS>`

Specifies the mac-address being requested in detail.

Examples

Show mac-address detail for **f0921c-b6e97e**.

```
switch# show mac-address f0921c-b6e97e detail

 Status and Counters - Port Address Table
  MAC Address       Port                             VLAN Age (d:h:m:s.ms)
  ----------------- -------------------------------- ---- ---------------
  f0921c-b6e97e     L22                              1    0000:00:00:30.18
```

Show mac-address detail for a stacked switch.

```
switch-Stack# show mac-address 009c02-d80f28 detail
 Status and Counters - Port Address Table
  MAC Address   Port   VLAN Age (d:h:m:s.ms)
  ------------- ------ ---- ---------------
  009c02-d80f28 1/2    1    0000:00:00:30.18
```

Finding the port connection for a specific device on a VLAN

This feature uses a device's MAC address that you enter to identify the port used by that device.

Procedure

1. Proceeding from the figure above, press **[S]** (for **Search**), to display the following prompt:

   ```
   Enter MAC address: _
   ```

2. Enter the MAC address you want to locate and press **[Enter]**.

   The address and port number are highlighted if found. If the switch does not find the MAC address on the currently selected VLAN, it leaves the MAC address listing empty.

3. Press **[P]** (for **Prev page**) to return to the full address table listing.

Determining whether a specific device is connected to the selected port

Proceeding from Step 2, above:

Procedure

1. Press **[S]** (for **Search**), to display the following prompt:

   ```
   Enter MAC address: _
   ```

2. Enter the MAC address you want to locate and press **[Enter]**.

   The address is highlighted if found. If the switch does not find the address, it leaves the MAC address listing empty.

3. Press **[P]** (for **Prev page**) to return to the previous per-port listing.

MSTP data

show spanning-tree

Syntax

```
show spanning-tree
```

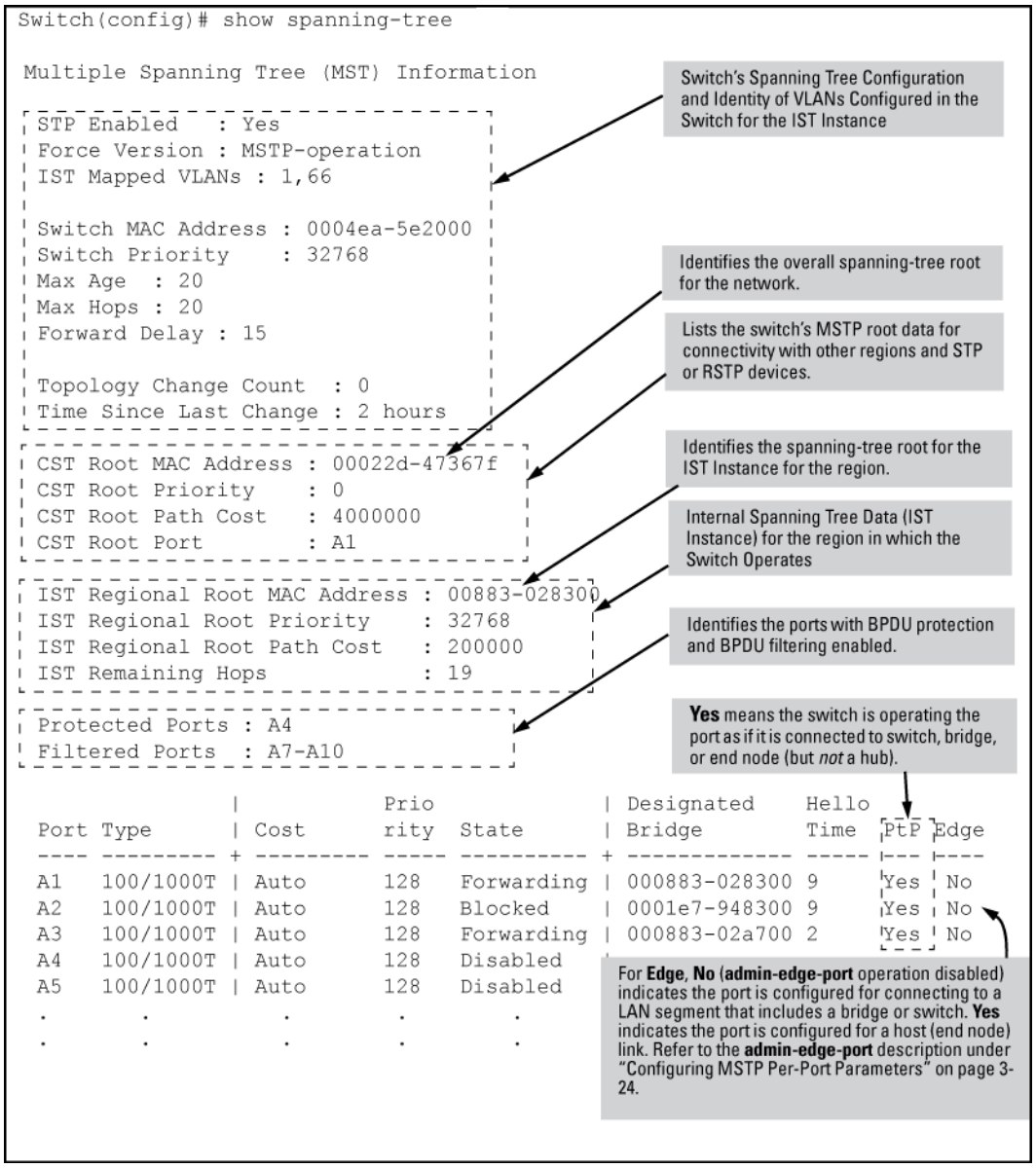
Description

Displays the global and regional spanning-tree status for the switch, and displays the per-port spanning-tree operation at the regional level.

Values for the following parameters appear only for ports connected to active devices: `Designated Bridge`, `Hello Time`, `PtP`, and `Edge`.

show spanning-tree command output

Figure 38 *show spanning-tree command output*



IP IGMP status

show ip igmp

Syntax

```
show ip igmp <VLAN-ID> [config] [group <IP-ADDR>|groups] [statistics]
```

Description

Global command that lists IGMP status for all VLANs configured in the switch, including:

- VLAN ID (VID) and name
- Querier address
- Active group addresses per VLAN
- Number of report and query packets per group
- Querier access port per VLAN

Parameters and options

config

Displays the IGMP configuration information, including VLAN ID, VLAN name, status, forwarding, and Querier information.

vlan-id

Per-VLAN command listing above, IGMP status for specified VLAN (VID).

group *<IP-ADDR>*

Lists the ports currently participating in the specified group, with port type, Access type, Age Timer data and Leave Timer data.

groups

Displays VLAN-ID, group address, uptime, expiration time, multicast filter type, and the last reporter for IGMP groups.

statistics

Displays IGMP operational information, such as VLAN IDs and names, and filtered and flooding statistics.

Output from show ip igmp config command

```
Switch(config)# show ip igmp config

 IGMP Service

                       IGMP    Forward with  Querier Querier
 VLAN ID VLAN Name     Enabled High Priority Allowed Interval
 ------- ------------ ------- ------------- ------- --------
 1       DEFAULT_VLAN No      No            Yes     125
 2       VLAN2        Yes     No            Yes     125
 12      New_Vlan     No      No            Yes     125
```

IGMP statistical information

```
switch(vlan-2)# show ip igmp statistics

 IGMP Service Statistics

  Total VLANs with IGMP enabled               : 1
```

```
 Current count of multicast groups joined    : 1


IGMP Joined Groups Statistics

 VLAN ID VLAN Name                         Filtered     Flood
 ------- --------------------------------- ------------ ------------
 2       VLAN2                             2            1
```

VLAN information

show vlan

Syntax

`show vlan <VLAN-ID>`

Description

Lists the maximum number of VLANs to support, existing VLANS, VLAN status (static or dynamic), and primary VLAN.

Parameters

<VLAN-ID>

Lists the following for the specified VLAN:

- Name, VID, and status (static/dynamic)
- Per-port mode (tagged, untagged, forbid, no/auto)
- "Unknown VLAN" setting (Learn, Block, Disable)
- Port status (up/down)

List data on specific VLANs

The next three figures show how you can list data for the following VLANs:

Ports	VLAN	VID
A1-A12	DEFAULT_VLAN	1
A1, A2	VLAN-33	33
A3, A4	VLAN-44	44

Figure 39 *Listing the VLAN ID (vid) and status for specific ports*

```
Switch# show vlan ports A1-A2

 Status and Counters = VLAN Information - for ports A1,A2

  802.1Q VLAN ID Name          Status
  -------------- ------------- -------
  1              DEFAULT_VLAN  Static
  33             VLAN-33       Static
```

Because ports A1 and A2 are not members of VLAN-44, it does not appear in this listing.

Figure 40 *Example of VLAN listing for the entire switch*

```
Switch# show vlan
 Status and Counters - VLAN Information

  VLAN support : Yes
  Maximum VLANs to support : 9
  Primary VLAN: DEFAULT_VLAN

  802.1Q VLAN ID Name          Status
  -------------- ------------- -------
  1              DEFAULT_VLAN  Static
  33             VLAN-33       Static
  44             VLAN-44       Static
```

Figure 41 *Port listing for an individual VLAN*

```
Switch(config)# show vlan 1

 Status and Counters - VLAN Information - VLAN 1

  VLAN ID : 1
  Name : DEFAULT_VLAN
  Status : Static
  Voice : Yes
  Jumbo : No

  Port Information Mode     Unknown VLAN Status
  ---------------- -------- ------------ ----------
  A1               Untagged Learn        Up
  A2               Tagged   Learn        Up
  A3               Untagged Learn        Up
  A4               Untagged Learn        Down
  A5               Untagged Learn        Up
  A6               Untagged Learn        Up
  A7               Untagged Learn        Up
```

Configuring local mirroring

To configure a local mirroring session in which the mirroring source and destination are on the same switch, follow these general steps:

1. Determine the session and local destination port:
   a. Session number (1) and (optional) alphanumeric name
   b. Exit port (any port on the switch except a monitored interface used to mirror traffic)

Hewlett Packard Enterprise strongly discourages connecting a mirroring exit port to a network because doing so can result in serious network performance problems. Only connect an exit port to a network analyzer, IDS, or other network edge device that has no connection to other network resources.

2. Enter the `mirror-port port number` command to configure the session.
3. Determine the traffic to be selected for mirroring by any of the following methods and the appropriate configuration level (mesh and switch).
4. Enter the `monitor` command to assign one or more source interfaces to the session.

After you complete step 4, the switch begins mirroring traffic to the configured exit port.

The following commands configure mirroring for a local session in which the mirroring source and destination are on the same switch.

- The `mirror` command identifies the destination in a mirroring session.
- The `interface` and `vlan` commands identify the mirroring source, including source interface, traffic direction, and traffic-selection criteria for a specified session.

With no **allow-v2-modules** specified in the configuration of a switch with V3 modules on KB firmware, Egress VLAN ACLs do not filter mirrored traffic. You must use a port ACL to filter mirrored traffic.

Local mirroring sessions

Syntax

```
no mirror-port <EXIT-PORT-#>
```

Description

Configure local mirroring sessions.

Parameters and options

`mirror-port <EXIT-PORT-#>`

When used with `mirror-port <EXIT-PORT-#>` command, removes the mirroring session and any mirroring source previously assigned to that session by the following commands.

Traffic-direction criteria

interface monitor all

Syntax

```
no [interface <PORT> |<TRUNK>] monitor
```

Mirror policy for inbound traffic

class [ipv4|ipv6]

Syntax

```
class [ipv4|ipv6] <CLASSNAME> no [seq-number] [match|ignore] <IP-PROTOCOL> <SOURCE-ADDRESS> <DESTINATION-ADDRESS>][precedence <PRECEDENCE-VALUE>][tos <TOS-VALUE>][ip-dscp <CODEPOINTS>][vlan <VLAN-ID>]
```

Description

Configures the mirroring policy for inbound traffic on the switch.

policy mirror

Syntax

```
policy mirror <POLICY-NAME> no <SEQ-NUMBER> [class [ipv4|ipv6]
<CLASSNAME> action mirror <SESSION>] [action mirror <SESSION>] no default-class action
mirror <SESSION> no [interface <PORT/TRUNK>| vlan <VID-#>]
service-policy <MIRROR-POLICY-NAME>
in
```

Description

The `no [interface <PORT/TRUNK>| vlan <VID-#>] service-policy <MIRROR-POLICY-NAME> in` command removes the mirroring policy from a port, VLAN, trunk, or mesh interface for a specified session, but leaves the session available for other assignments.

Parameters and options

`mirror <SESSION>`

Accepts either a number (1 to 4) or a name. To use a name, you must first configure the `name <NAME-STR>` parameter option for the specified mirroring session using the `policy mirror` command.

MAC-based criteria to select traffic

monitor mac

Syntax

```
monitor mac  <MAC-ADDR> [src|dst|both] mirror session
no monitor mac  <MAC-ADDR> [src|dst|both] mirror session
```

Description

Configures traffic using MAC-based criteria. Use the `no` form of the complete command syntax (for example, `no monitor mac 112233-445566 src mirror 3`) to remove a MAC address as mirroring criteria from an active session on the switch without removing the session itself.

Parameters

`mirror`

Enter the `monitor mac mirror` command at the global configuration level.

Remote mirroring destination on a remote switch

Syntax

```
mirror endpoint ip <SRC-IP> <SRC-UDP-PORT > <DST-IP> <EXIT-PORT> [truncation]
```

Description

Configures a remote mirroring destination on a remote switch.

Parameters and options

Remote mirroring destination on a local switch

mirror remote ip

Syntax

```
mirror <SESSION> remote ip <SRC-IP> <SRC-UDP-PORT> <DST-IP>
```

Description

Configures a remote mirroring destination on a local switch.

Parameters and options

Local mirroring destination on the local switch

mirror port

Syntax

```
mirror <SESSION> port <EXIT-PORT>
```

Description

Configures a local mirroring destination on a local switch.

Parameters and options

Monitored traffic

interface

Syntax

```
interface <PORT/TRUNK/MESH>
```

Description

Parameters and options

monitor all

Syntax

```
monitor all [in|out|both] mirror <SESSION> [no-tag-added]
monitor ip access-group ACL-NAME in mirror <SESSION>
monitor mac <MAC-ADDR> [src|dest|both] mirror
show monitor [endpoint|<SESSION-NUMBER>|name <SESSION-NAME>
```

service-policy

Syntax

```
service-policy <mirror-policy-name> in
```

Destination mirror on a remote switch

mirror endpoint

Syntax

```
mirror endpoint ip <SRC-IP-ADDR> <SRC-UDP-PORT> <DST-IP-ADDR> port <EXIT-PORT>
```

Description

Enter this command on a remote switch to configure the exit port to use in a remote mirroring session. to configure the mirroring source on the local switch.

The `mirror endpoint ip` command configures:

- The unique UDP port number to be used for the mirroring session on the source switch. The recommended port range is from 7933 to 65535.
- The IP address of the source switch to use in the session.
- The IP address and exit-port number on the remote (endpoint) switch.

In a remote mirroring endpoint, the IP address of exit port and the remote destination switch can belong to different VLANs.

Source mirror on the local switch

mirror remote ip

Syntax

```
mirror <SESSION> remote ip <SRC-IP> <SRC-UDP-PORT> <DST-IP>
```

Description

Configures a remote mirroring destination on a local switch.

Parameters and options

Traffic-direction criteria

Configure ACL criteria to select inbound

interface monitor ip access-group

Syntax

```
no [interface <PORT> <TRUNK> <MESH>|vlan <VID-#>] monitor ip access—group <ACL—
NAME> inmirror [1-4|<NAME-STR>] [1 — 4|<NAME-STR . . .>]
```

Configuring a destination switch in a remote mirroring session

When configuring a remote mirroring session, **always** configure the destination switch first. Configuring the source switch first can result in a large volume of mirrored, IPv4-encapsulated traffic arriving at the destination without an exit path, which can slow switch performance.

Syntax

`mirror endpoint ip` *`src-ipsrc-udp-portdst-ipexit-port-#`* `no mirror endpoint ip` *`src-ipsrc-udp-portdst-ip`*

Used on a destination switch to configure the remote endpoint of a mirroring session. The command uniquely associates the mirrored traffic from the desired session on a monitored source with a remote exit port on the destination switch. You must use the same set of source and destination parameters used when you configure the same session on both the source and destination switches.

For a given mirroring session, the same *`src-ip`*, *`src-udp-port`* and *`dst-ip`* values must be entered with the `mirror endpoint ip` command on the destination switch, and later with the `mirror remote ip` command on the source switch.

Do not remove the configuration of a remote mirroring endpoint support for a given session if there are source switches currently configured to mirror traffic to the endpoint.

`src-ip`	Must exactly match the *`src-ip`* address you configure on the source switch for the remote session.
`src-udp-port`	Must exactly match the *`src-udp-port`* value you configure on the source switch for the remote session. The recommended port range is 7933 to 65535.This setting associates the monitored source with the desired remote endpoint in the remote session by using the same, unique UDP port number to identify the session on the source and remote switches.
`dst-ip`	Must exactly match the *`dst-ip`* setting you configure on the source switch for the remote session.
`exit-port-#`	Exit port for mirrored traffic in the remote session, to which a traffic analyzer or IDS is connected.

The `no` form of the command deletes the mirroring endpoint for the configured session on the remote destination switch.

Configuring a source switch in a local mirroring session

Enter the `mirror port` command on the source switch to configure an exit port on the same switch. To create the mirroring session, use the information gathered in High-level overview of the mirror configuration process on page 392.

Syntax

`mirror-port` *`<PORT-NUM>`*
`no mirror-port` *`<PORT-NUM>`*

The `no` form of the command removes the mirroring session and any mirroring source previously assigned to that session.

Assigns the exit port to use for the specified mirroring session. You must execute command from the global configuration level.

```
 switch(config)# mirror-port
[ethernet] PORT-NUM   Define the mirror port for diagnostic purposes.
switch(config)# mirror-port 1
switch(config)# interface 2
switch(eth-2)# monitor
switch(eth-2)# interface 3
swicth(eth-3)# monitor
```

```
switch(eth-3)# show monitor

Network Monitoring Port

  Mirror Port: 1

  Monitoring sources
  ------------------
  2
  3
```

```
switch(config)# show running-config

Running configuration:

; J9855A Configuration Editor; Created on release #YA.16.0x.0000x
; Ver #14:01.44.00.04.19.02.13.98.82.34.61.18.28.f3.84.9c.63.ff.37.27:45
hostname "switch"
mirror-port 1
interface 2
   monitor
   exit
interface 3
   monitor
   exit
snmp-server community "public" unrestricted
vlan 1
   name "DEFAULT_VLAN"
   untagged 1-50
   ip address dhcp-bootp
   exit
```

Configuring a source switch in a remote mirroring session

Syntax

`no mirror 1 - 4 [name name-str] remote ip src-ipsrc-udp-portdst-ip [truncation]`

Used on the source switch to uniquely associate the mirrored traffic in the specified session with a remote destination switch. You must configure the same source and destination parameters when you configure the same session on both the source and destination switches. (If multiple remote sessions use the same source and destination IP addresses, each session must use a unique UDP port value.)

When you execute this command, the following message is displayed:

```
Caution: Please configure destination switch first.
          Do you want to continue [y/n]?
```

- If you have not yet configured the session on the remote destination switch, follow the configuration procedure in Configure a mirroring destination on a remote switch on page 392 before using this command.
- If you have already configured the session on the remote destination switch, enter **y** (for "yes") to complete this command.

`1 - 4`	Identifies the mirroring session created by this command.
`name` *`name-str`*	Optional alphanumeric name string used as an additional session identifier (up to 15 characters.)
`src-ip`	The IP address of the VLAN or subnet on which the traffic to be mirrored enters or leaves the switch.
`src-udp-port`	Associates the remote session with a UDP port number. When multiple sessions have the same source IP address *`src-ip`* and destination IP address *`dst-ip`*, the UDP port number must be unique in each session. The UDP port number used for a given session should be in the range of 7933 to 65535. **CAUTION:** UDP port numbers below 7933 are reserved for various IP applications. Using them for mirroring can result in the interruption of other IP functions and in non-mirrored traffic being received on the destination switch and sent to a device connected to the remote exit port. The configured UDP port number is included in the frames mirrored from the source switch to the remote destination switch (`mirror endpoint`), and enables the remote switch to match the frames to the exit port configured for the combined UDP port number, source IP address, and destination IP address..
`dst-ip`	For the remote session specified in the command, this is the IP address of the VLAN or subnet on which the remote exit port exists. (The exit port to which a traffic analyzer or IDS is connected is configured on the remote switch in section.) .)
`[truncation]`	Enables truncation of oversize frames, causing the part of the frame in excess of the MTU size to be truncated. Unless truncation is enabled, oversize frames are dropped. The frame size is truncated to a multiple of 18 bytes–for example, if the MTU is 1000 bytes, the frame is truncated to 990 bytes (55 * 18 bytes.)

The `no` form of the command removes the mirroring session and any mirroring source previously assigned to the session. To preserve the session while deleting a monitored source assigned to it.

Selecting all traffic on a port interface for mirroring according to traffic direction

Syntax

`no interface` *`port/trunk/mesh`* `monitor [in | out | both] [mirror 1 |` *`name-str`*`] [{1 |` *`name-str`*`} | {1 |` *`name-str`*`} | {1 |` *`name-str`*`}] [no-tag-added]`

Assigns a mirroring source to a previously configured mirroring session on a source switch by specifying the port, trunk, and/or mesh sources to use, the direction of traffic to mirror, and the session.

`interface` *`port/trunk/mesh`*	Identifies the source ports, static trunks, and/or mesh on which to mirror traffic. Use a hyphen for a range of consecutive ports or trunks (`a5-a8`, `Trk2-Trk4`.)

	Use a comma to separate non-contiguous interfaces (`b11`, `b14`, `Trk4`, `Trk7`.)
monitor all [in | out | both]	For the interface specified by *`port/trunk/mesh`* , selects traffic to mirror based on whether the traffic is entering or leaving the switch on the interface: ■ `in`: Mirrors entering traffic. ■ `out`: Mirrors exiting traffic. ■ `both`: Mirrors traffic entering and exiting. If you enter the `monitor all` command without selection criteria or a session identifier, the command applies by default to session 1
mirror [1 | *`name-str`*]	Assigns the traffic specified by the interface and direction to a session by number or–if configured–by name. The session must have been previously configured. Depending on how many sessions are already configured on the switch, you can use the same command to assign the specified source to up to four sessions, for example, `interface a1 monitor all in mirror 1`. ■ `1` : Configures the port traffic to be mirrored in the specified session number. ■ `[name` *`name-str`*`]`: Optional; configures the port traffic to be mirrored in the specified session name. The string can be used interchangeably with the session number when using this command to assign a mirroring source to a session.
`[no-tag-added]`	Prevents a VLAN tag from being added to the mirrored copy of an outbound packet sent to a local or remote mirroring destination.

The `no` form of the command removes a mirroring source assigned to the session, but does not remove the session itself. This enables you to repurpose a session by removing an unwanted mirroring source and adding another in its place.

Selecting all traffic on a VLAN interface for mirroring according to traffic direction

Syntax

`vlan` *`vid-#`* `monitor all [in | out | both] [mirror 1 - 4 |` *`name-str`*`] [{1 - 4 |` *`name-str`*`} | {1 - 4 |` *`name-str`*`} | {1 - 4 |` *`name-str`*`}]`

This command assigns a monitored VLAN source to a previously configured mirroring session on a source switch by specifying the VLAN ID, the direction of traffic to mirror, and the session.

`vlan` *`vid-#`*	Identifies the VLAN on which to mirror traffic.
`monitor all [in | out | both]`	Uses the direction of traffic on the specified *`vid-#`* to select traffic to mirror. If you enter the `monitor all` command without selection criteria or a session identifier, the command applies by default to session 1.
`mirror [1 - 4 |` *`name-str`*`]`	Assigns the VLAN traffic defined by the VLAN ID and traffic direction to a session number or name.

	Depending on how many sessions are already configured on the switch, you can use the same command to assign the specified VLAN source to up to four sessions, for example, `interface a1 monitor all in mirror 1 2 4`. ■ `1 - 4`: Configures the selected VLAN traffic to be mirrored in the specified session number. ■ `[name name-str]`: Optional; configures the selected port traffic to be mirrored in the specified session name. The string can be used interchangeably with the session number when using this command to assign a mirroring source to a session. To configure an alphanumeric name for a mirroring session, see the command description under Configuring a source switch in a remote mirroring session on page 374.

Assigning a VLAN to a mirroring session precludes assigning any other mirroring sources to the same session. If a VLAN is already assigned to a given mirroring session, using this command to assign another VLAN to the same mirroring session results in the second assignment replacing the first. Also, if there are other (port, trunk, or mesh) mirroring sources already assigned to a session, the switch displays a message similar to:

```
Mirror source port exists on session N. Can not add mirror
source VLAN.
```

The `no` form of the command removes a mirroring source assigned to the session, but does not remove the session itself. This allows you to repurpose a session by removing an unwanted mirroring source and adding another in its place.

Configuring a MAC address to filter mirrored traffic on an interface

Enter the `monitor mac mirror` command at the global configuration level.

Syntax

`no monitor mac mac-addr [src | dest | both] {mirror 1 - 4 | name-str} [1 - 4 | name-str] [1 - 4 | name-str] [1 - 4 | name-str]`

Use this command to configure a source and/or destination MAC address as criteria for selecting traffic in one or more mirroring sessions on the switch. The MAC address you enter is configured to mirror inbound (`src`), outbound (`dest`), or both inbound and outbound (`both`) traffic on any port or learned VLAN on the switch.

`monitor mac mac-addr` Configures the MAC address as selection criteria for mirroring traffic on any port or learned VLAN on the switch.	
{src | dest | both}	Specifies how the MAC address is used to filter and mirror packets in inbound and/or outbound traffic on the interfaces on which the mirroring session is applied: ■ `src`: Mirrors all packets in inbound traffic that contain the specified MAC address as source address. ■ `dest`: Mirrors all packets in outbound traffic that contain the specified MAC address as destination address. **NOTE:** The MAC address of the switch is not supported as either the source or destination MAC address used to select mirrored traffic.

	▪ `both`: Mirrors all packets in both inbound and outbound traffic that contain the specified MAC address as either source or destination address.
mirror [1 - 4 | *name-str*]	Assigns the inbound and/or outbound traffic filtered by the specified MAC address to a previously configured mirroring session. The session is identified by a number or (if configured) a name. Depending on how many sessions are configured on the switch, you can use the same command to configure a MAC address as mirroring criteria in up to four sessions. To identify a session, you can enter either its name or number; for example: `mirror 1 2 3 traffsrc4` `1 - 4`: Specifies a mirroring session by number, for which the configured MAC address is used to select and mirror inbound and/or outbound traffic.

Packets that are sent or received on an interface configured with a mirroring session and that contain the MAC address as source and/or destination address are mirrored to a previously configured destination device.

To remove a MAC address as selection criteria in a mirroring session, you must enter the complete Command syntax, for example, `no monitor mac 998877-665544 dest mirror 4`.

The `no` form of the command removes the MAC address as a mirroring criteria from an active session, but does not remove the session itself. This enables you to repurpose a session by removing an unwanted mirroring criteria and adding another in its place.

Configuring classifier-based mirroring

For more information and a list of general steps for the process beginning with this command, see the information about restrictions on classifier-based mirroring.

Context: Global configuration

Syntax

`no class [ipv4 | ipv6 classname]`

Defines the name of a traffic class and specifies whether a policy is to be applied to IPv4 or IPv6 packets, where *`classname`* is a text string (64 characters maximum.)

After you enter the `class` command, you enter the class configuration context to specify match criteria. A traffic class contains a series of `match` and `ignore` commands, which specify the criteria used to classify packets.

To configure a default traffic class, use the `default-class` command as described below. A default class manages the packets that do not match the match/ignore criteria in any other classes in a policy.

Context: Class configuration

Syntax

`no seq-number [match | ignore ip-protocolsource-addressdestination-address] [ip-dscp codepoint] [precedence precedence-value] [tos tos-value] [vlan vlan-id]`

For detailed information about how to enter `match` and `ignore` commands to configure a traffic class, the *Advanced Traffic Management Guide*.

Context: Global configuration

Syntax

`no policy mirror policy-name`

Defines the name of a mirroring policy and enters the policy configuration context.

A traffic policy consists of one or more classes and one or more mirroring actions configured for each class of traffic. The configured actions are executed on packets that match a `match` statement in a class. No policy action is performed on packets that match an `ignore` statement.

Context: Policy configuration

Syntax

`no seq-number class [ipv4 | ipv6 classname] action mirror session`

Defines the mirroring action to be applied on a pre-configured IPv4 or IPv6 traffic class when a packet matches the `match` criteria in the traffic class. You can enter multiple `class action mirror` statements in a policy.

`[seq-number]`	The (optional)`seq-number` parameter sequentially orders the mirroring actions that you enter in a policy configuration. Actions are executed on matching packets in numerical order. Default: Mirroring action statements are numbered in increments of 10, starting at 10.
`class [ipv4 | ipv6 classname]`	Defines the preconfigured traffic class on which the mirroring actions in the policy are executed and specifies whether the mirroring policy is applied to IPv4 or IPv6 traffic in the class. The classname is a text string (64 characters maximum.)
`action mirror session`	Configures mirroring for the destination and session specified by the `session` parameter.

Context: Policy configuration

Syntax

`no default-class action mirror session [action mirror session ...]`

Configures a default class that allows packets that are not matched nor ignored by any of the class configurations in a mirroring policy to be mirrored to the destination configured for the specified session.

Applying a mirroring policy on a port or VLAN interface

Enter one of the following `service-policy` commands from the global configuration context.

Context: Global configuration

Syntax

`interface <PORT-LIST> service-policy policy-name in`

Configures the specified ports with a mirroring policy that is applied to inbound traffic on each interface.

Separate individual port numbers in a series with a comma, for example, `a1,b4,d3`. Enter a range of ports by using a dash, for example, `a1-a5`.

The mirroring policy name you enter must be the same as the policy name you configured with the `policy mirror` command.

Syntax

`vlan vlan-id service-policy policy-name in`

Configures a mirroring policy on the specified VLAN that is applied to inbound traffic on the VLAN interface.

Valid VLAN ID numbers range from 1 to 4094.

The mirroring policy name you enter must be the same as the policy name you configured with the `policy mirror` command in the syntax policy mirror.

Viewing a classifier-based mirroring configuration

To display information about a classifier-based mirroring configuration or statistics on one or more mirroring policies, enter one of the following commands:

Syntax

`show class [ipv4 class-name | ipv6 class-name | config]`

Syntax

`show policy [policy-name | config]`

Syntax

`show policy resources`

Syntax

`show statistics policy [policy-name] [interface port-num | vlan vid in]`

Viewing all mirroring session configured on the switch

Syntax

`show monitor`

If a monitored source for a mirror session is configured on the switch, the following information is displayed. Otherwise, the output displays: Mirroring is currently disabled. Mirror port configured on the switch is shown:

```
switch(config) # show monitor

Network Monitoring Port

Mirror Port: 16

Monitoring sources
  ------------------
  2
  5
```

Viewing the remote endpoints configured on the switch

Syntax

`show monitor endpoint`

Displays the remote mirroring endpoints configured on the switch. Information on local sessions configured on the switch is not displayed. (To view the configuration of a local session, use the `show monitor [1-4 | name <name-str>]` command)

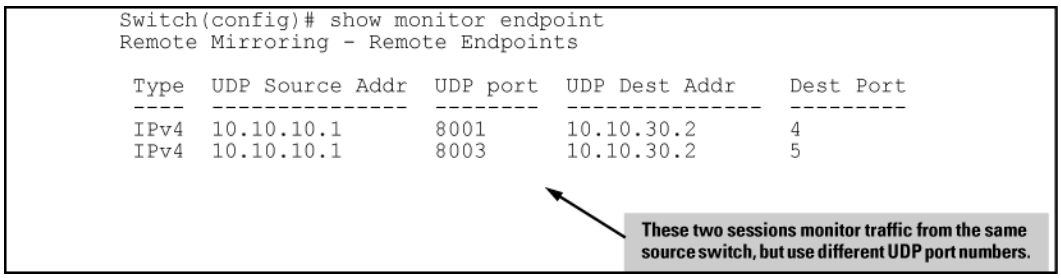
Type	Indicates whether the session is a `port` (local) or `IPv4` (remote) mirroring session.

show monitor endpoint	The IP address configured for the source VLAN or subnet on which the monitored source interface exists. In the configuration of a remote session, the same UDP source address must be configured on the source and destination switches.
UDP port	The unique UDP port number that identifies a remote session. In the configuration of a remote session, the same UDP port number must be configured on the source and destination switches.
UDP Dest Addr	The IP address configured for the destination VLAN or subnet on which the remote exit port exists. In the configuration of a remote session, the same UDP destination address must be configured on the source and destination switches.
Dest Port	fies the exit port for a remote session on a remote destination switch.

Example

In the following figure, the `show monitor endpoint` output shows that the switch is configured as the remote endpoint (destination) for two remote sessions from the same monitored source interface.

Figure 42 *Displaying the configuration of remote mirroring endpoints on the switch*



Viewing the mirroring configuration for a specific session

Syntax

`show monitor [1 | name name-str]`

Displays detailed configuration information for a specified local or remote mirroring session on a source switch.

Session	Displays the session.
Session Name	Displays the name of the session, if configured.
Policy	Indicates whether the source is using a classifier-based mirroring policy to select inbound IPv4 or IPv6 traffic for mirroring.
Mirroring Destination	For a local mirroring session, displays the port configured as the exit port on the source switch. For a remote mirroring session, displays `IPv4`, which indicates mirroring to a remote (endpoint) switch.
UDP Source Addr	The IP address configured for the source VLAN or subnet on which the monitored source interface exists. In the configuration of a remote session, the same UDP source address must be configured on the source and destination switches.

UDP port	The unique UDP port number that identifies a remote session. In the configuration of a remote session, the same UDP port number must be configured on the source and destination switches.
UDP Dest Addr	The IP address configured for the destination VLAN or subnet on which the remote exit port exists. In the configuration of a remote session, the same UDP destination address must be configured on the source and destination switches.
Status	For a remote session, displays current session activity: ■ active: The session is configured and is mirroring traffic. A remote path has been discovered to the destination. ■ inactive: The session is configured, but is not currently mirroring traffic. A remote path has **not** been discovered to the destination. ■ not defined: Mirroring is not configured for this session.
Monitoring Sources	For the specified local or remote session, displays the source (port, trunk, or VLAN) interface and the MAC address (if configured) used to select mirrored traffic.
Direction	For the selected interface, indicates whether mirrored traffic is entering the switch (`in`), leaving the switch (`out`), or `both`.

Viewing a remote mirroring session

After you configure session 2 for remote mirroring (Figure 43: Configuring a remote mirroring session and monitored source), you can enter the `show monitor 2` command to verify the configuration (Figure 44: Displaying the Configuration of a Remote Mirroring Session.)

Figure 43 *Configuring a remote mirroring session and monitored source*

```
Switch(config)# mirror 2 name test-10 remote ip 10.10.10.1 8010 10.10.30.2
Caution: Please configure destination switch first.
         Do you want to continue [y/n]? y
HP Switch(config)# interface b1 monitor all both mirror 2
```

Figure 44 *Displaying the Configuration of a Remote Mirroring Session*

```
Switch(config)# show monitor 2
Network Monitoring

   Session: 2    Session Name: test-10
   Policy: no policy relationship exists

      Mirror Destination:  IPv4
         UDP Source Addr  UDP port  UDP Dest Addr    Status
         ---------------  --------  ---------------  --------
         10.10.10.1       8010      10.10.30.2       active

      Monitoring Sources  Direction
      ------------------  ---------
      Port: B1            Both
```

If no monitored (source) interface is configured for a mirroring session, no information is displayed in the Monitoring Sources and Direction columns.

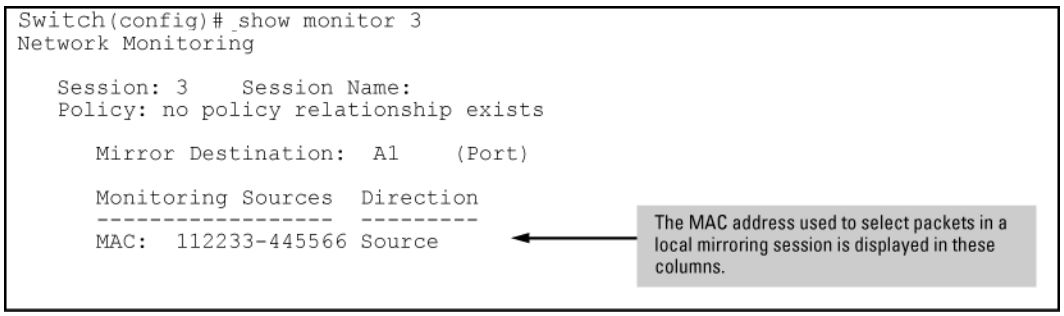
Viewing a MAC-based mirroring session

After you configure a MAC-based mirroring session (Figure 45: Configuring a MAC-based mirroring session), you can enter the `show monitor 3` command to verify the configuration (Figure 46: Displaying a MAC-based mirroring session.)

Figure 45 *Configuring a MAC-based mirroring session*

```
Switch(config)# mirror 3 port a1
Switch# monitor mac 112233-445566 src mirror 3
```

Figure 46 *Displaying a MAC-based mirroring session*



Viewing a local mirroring session

When used to display the configuration of a local session, the `show monitor` command displays a subset of the information displayed for a remote mirroring session.

Example

Figure 47: Displaying the configuration of a local mirroring session displays a local mirroring configuration for a session configured as follows:

- Session number: 1
- Session name: Detail
- Classifier-based mirroring policy, "MirrorAdminTraffic", is used to select inbound traffic on port B1.
- Mirrored traffic is sent to exit port B3.

Figure 47 *Displaying the configuration of a local mirroring session*

```
Switch(config)# show monitor 1
Network Monitoring

   Session: 1    Session Name: Detail
   Policy: MirrorAdminTraffic

      Mirror Destination:  B3    (Port)

      Monitoring Sources  Direction
      ------------------  ---------
      Port: B1            In
```

Viewing information on a classifier-based mirroring session

In the following example, a classifier-based mirroring policy (`mirrorAdminTraffic`) mirrors selected inbound IPv4 packets on VLAN 5 to the destination device configured for mirroring session 3.

Figure 48 *Configuring a classifier-based mirroring policy in a local mirroring session*

```
Switch(config)# mirror 3 port c1
Caution: Please configure destination switch first.
         Do you want to continue [y/n]? y
HP Switch(config)# class ipv4 AdminTraffic
HP Switch(config-class)# match ip 15.29.61.1 0.63.255.255 0.0.0.0
255.255.255.255
HP Switch(config-class)# match ip 0.0.0.0 255.255.255.255 15.29.61.1
0.63.255.255
HP Switch(config-class)# exit
HP Switch(config)# policy mirror MirrorAdminTraffic
HP Switch(config-policy)# class ipv4 AdminTraffic action mirror 3
HP Switch(config-policy)# exit
HP Switch(config)# vlan 5 service-policy MirrorAdminTraffic in
```

Displaying a classifier-based policy in a local mirroring session

```
switch(config)# show monitor 3

Network Monitoring

   Session: 3   Session Name:
   Policy: MirrorAdminTraffic

     Mirror Destination:  C1   (Port)

     Monitoring Sources  Direction
     ------------------  ---------
     VLAN: 5             Source
```

Viewing information about a classifier-based mirroring with classname configuration

Syntax

```
show class ipv4 classname
show class ipv6 classname
show class config
```

`ipv4 classname`	Lists the statements that make up the IPv4 class identified by *`classname`*.
`ipv6 classname`	Lists the statements that make up the IPv6 class identified by *`classname`*.
`config`	Displays all classes, both IPv4 and IPv6, and lists the statements that make up each class.

Additional variants of the `show class …` command provide information on classes that are members of policies that have been applied to ports or VLANs.

Figure 49 *show class output for a mirroring policy*

```
Switch(config)# show class ipv4 AdminTraffic

Statements for Class ipv4 "AdminTraffic"

 10 match ip 15.29.16.1 0.63.255.255 0.0.0.0 255.255.255.255
 20 match ip 0.0.0.0 255.255.255.255 15.29.16.1 0.63.255.255
```

Viewing information about a classifier-based mirroring with policy-name configuration

Syntax

`show policy` *`policy-name`*
`show policy config`

`policy-name`	Lists the statements that make up the specified policy.
`config`	Displays the names of all policies defined for the switch and lists the statements that make up each policy.

Additional variants of the `show policy` command provide information on policies that have been applied to ports or VLANs.

Figure 50 *show policy output for a mirroring policy*

```
Switch(config)# show policy MirrorAdminTraffic

Statements for Policy "MirrorAdminTraffic"

     10 class ipv4 "AdminTraffic" action mirror 3
```

Viewing resource usage for mirroring policies

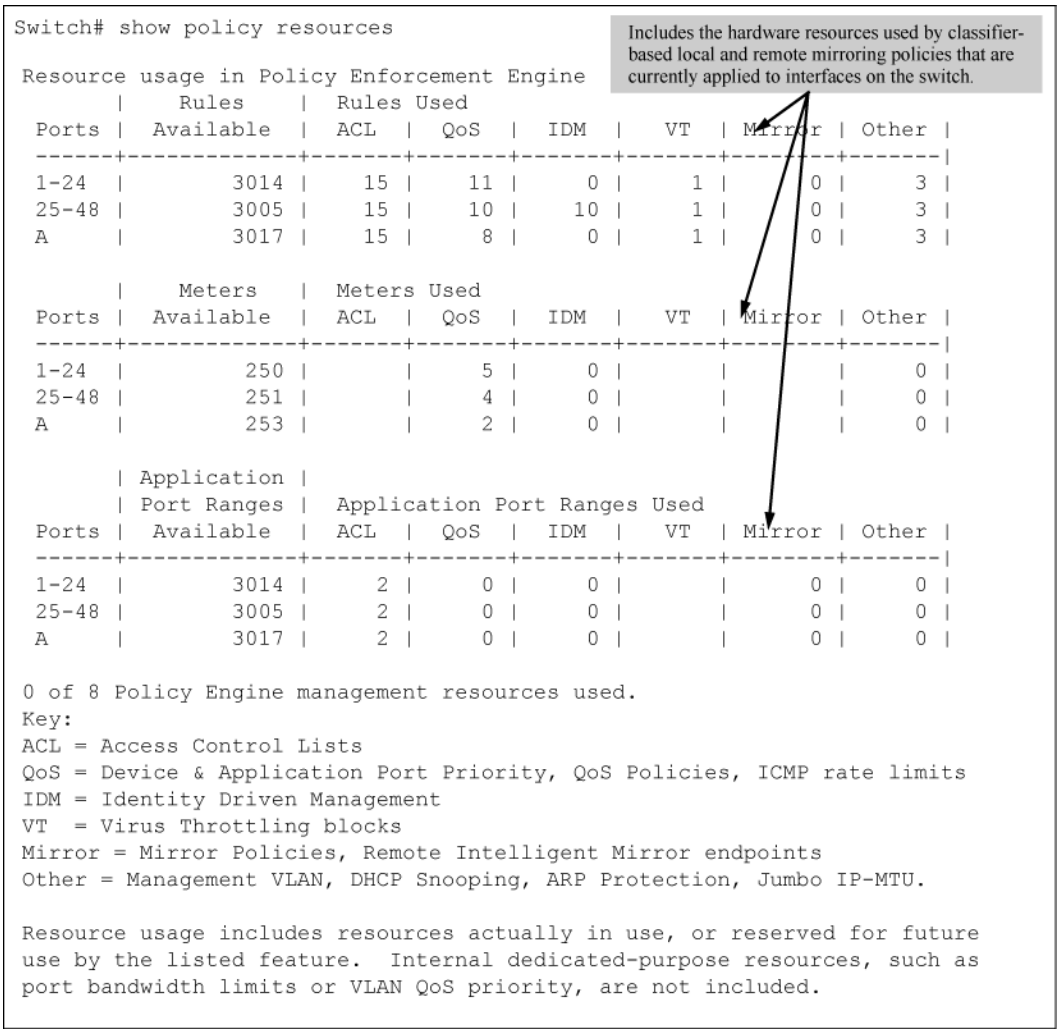
Syntax

`show policy resources`

Displays the number of hardware resources (rules, meters, and application port ranges) used by classifier-based mirroring policies (local and remote) that are currently applied to interfaces on the switch, as well as QoS policies and other software features.

The information displayed is the same as the output of the `show qos resources` and `show access-list resources` commands.

Figure 51 *Displaying the hardware resources used by currently configured mirroring policies*




```
Switch# show policy resources

 Resource usage in Policy Enforcement Engine
        |    Rules     |  Rules Used
  Ports |  Available   |  ACL   |  QoS   |  IDM   |   VT   | Mirror | Other |
  ------+--------------+--------+--------+--------+--------+--------+-------|
  1-24  |         3014 |     15 |     11 |      0 |      1 |      0 |     3 |
  25-48 |         3005 |     15 |     10 |     10 |      1 |      0 |     3 |
  A     |         3017 |     15 |      8 |      0 |      1 |      0 |     3 |

        |    Meters    |  Meters Used
  Ports |  Available   |  ACL   |  QoS   |  IDM   |   VT   | Mirror | Other |
  ------+--------------+--------+--------+--------+--------+--------+-------|
  1-24  |          250 |        |      5 |      0 |        |        |     0 |
  25-48 |          251 |        |      4 |      0 |        |        |     0 |
  A     |          253 |        |      2 |      0 |        |        |     0 |

        | Application  |
        | Port Ranges  |  Application Port Ranges Used
  Ports |  Available   |  ACL   |  QoS   |  IDM   |   VT   | Mirror | Other |
  ------+--------------+--------+--------+--------+--------+--------+-------|
  1-24  |         3014 |      2 |      0 |      0 |        |      0 |     0 |
  25-48 |         3005 |      2 |      0 |      0 |        |      0 |     0 |
  A     |         3017 |      2 |      0 |      0 |        |      0 |     0 |

 0 of 8 Policy Engine management resources used.
 Key:
 ACL = Access Control Lists
 QoS = Device & Application Port Priority, QoS Policies, ICMP rate limits
 IDM = Identity Driven Management
 VT  = Virus Throttling blocks
 Mirror = Mirror Policies, Remote Intelligent Mirror endpoints
 Other = Management VLAN, DHCP Snooping, ARP Protection, Jumbo IP-MTU.

 Resource usage includes resources actually in use, or reserved for future
 use by the listed feature.  Internal dedicated-purpose resources, such as
 port bandwidth limits or VLAN QoS priority, are not included.
```

Viewing the mirroring configurations in the running configuration file

Use the `show run` command to view the current mirroring configurations on the switch. In the `show run` command output, information about mirroring sources in configured sessions begins with the `mirror` keyword; monitored source interfaces are listed per-interface.

Compatibility mode

The following table shows how the v2 zl and zl modules behave in various combinations and situations when Compatibility mode is enabled and when it is disabled.

Table 32: Table 31: Compatibility mode enabled/disabled comparisons

Modules	Compatibility mode enabled	Compatibility mode disabled
v2 zl modules only	Can insert zl module and the module will come up. Any v2 zl modules are limited to the zl configuration capacities.	v2 zl modules are at full capacity. zl modules are not allowed to power up.
Mixed v2 zl and zl modules	Can insert zl module and the module will come up. Any v2 zl modules are limited to the zl configuration capacities. If compatibility mode is disabled, the zl modules go down.	ZL modules are not allowed to power up.
zl modules only	Same as exists already. If a v2 zl module is inserted, it operates in the same mode as the zl module, but with performance increases.	The Management Module is the only module that powers up.
	In Compatibility Mode, no v2 zl features are allowed, whether the modules are all v2 zl or not.	If Compatibility Mode is disabled and then enabled, the startup config is erased and the chassis reboots.

Traffic mirroring overview

Traffic mirroring (Intelligent Mirroring) allows you to mirror (send a copy of) network traffic received or transmitted on a switch interface to a local or remote destination, such as a traffic analyzer or IDS.)

Traffic mirroring provides the following benefits:

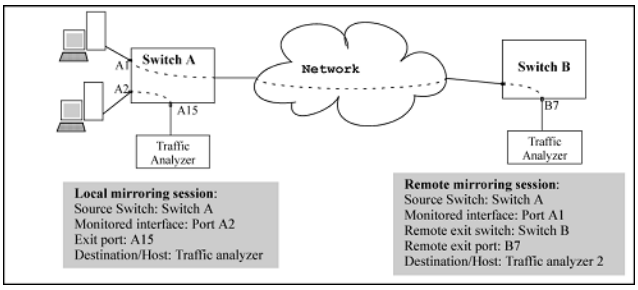
- Allows you to monitor the traffic flow on specific source interfaces.
- Helps in analyzing and debugging problems in network operation resulting from a misbehaving network or an individual client. The mirroring of selected traffic to an external device makes it easier to diagnose a network problem from a centralized location in a topology spread across a campus.

Mirroring overview

Figure 52: Local and remote sessions showing mirroring terms shows an example of the terms used to describe the configuration of a sample local and remote mirroring session:

- In the local session, inbound traffic entering Switch A is monitored on port A2 and mirrored to a destination (host), traffic analyzer 1, through exit port A15 on the switch.A local mirroring session means that the monitored interface (A2) and exit port (A15) are on the same switch.
- In the remote session, inbound traffic entering Switch A is monitored on port A1. A mirrored copy of monitored traffic is routed through the network to a remote mirroring endpoint: exit port B7 on Switch B. A destination device, traffic analyzer 2, is connected to the remote exit port.A remote mirroring session means that:
  - The monitored interface (A1) and exit port (B7) are on different switches.
  - Mirrored traffic can be bridged or routed from a source switch to a remote switch.

Figure 52 *Local and remote sessions showing mirroring terms*



Mirroring destinations

Traffic mirroring supports destination devices that are connected to the local switch or to a remote switch:

Traffic can be copied to a destination (host) device connected to the same switch as the mirroring source in a local mirroring session. You can configure up to four exit ports to which destination devices are connected.

Mirroring sources and sessions

Traffic mirroring supports the configuration of port in up to **four** mirroring sessions on a switch. Each session can have one or more sources (ports and/or static trunks) that monitor traffic entering and/or leaving the switch.

NOTE

Using the CLI, you can make full use of the switch's local and remote mirroring capabilities.

Mirroring sessions

A mirroring session consists of a mirroring source and destination (endpoint.) Although a mirroring source can be one of several interfaces, as mentioned above, for any session, the destination must be a single (exit) port. The exit port cannot be a trunk.

You can map multiple mirroring sessions to the same exit port, which provides flexibility in distributing hosts, such as traffic analyzers or an IDS. In a remote mirroring endpoint, the IP address of the exit port and the remote destination switch.

Mirroring sessions can have the same or a different destination. You can configure an exit port on the local (source) switch and/or on a remote switch as the destination in a mirroring session. When configuring a mirroring destination, consider the following options:

- You can segregate traffic by type, direction, or source.

Mirroring session limits

A switch running software release K.12.**xx** or greater supports the following:

- A maximum of one mirroring (local and remote) sessions.

Selecting mirrored traffic

You can use any of the following options to select the traffic to be mirrored on a port, trunk, mesh, or VLAN interface in a local or remote session:

- All traffic

  Monitors all traffic entering or leaving the switch on one or more interfaces (inbound and outbound.)

- Direction-based traffic selection

  Monitors traffic that is either entering or leaving the switch (inbound or outbound.) Monitoring traffic in only one direction improves operation by reducing the amount of traffic sent to a mirroring destination.
- MAC-based traffic selection

  Monitors only traffic with a matching source and/or destination MAC address in packet headers entering and/or leaving the switch on one or more interfaces (inbound and/or outbound.)
- Classifier-based service policy

  Provides a finer granularity of match criteria to zoom in on a subset of a monitored port or VLAN traffic (IPv4 or IPv6) and select it for local or remote mirroring (inbound only.)

Deprecation of ACL-based traffic selection

The use of ACLs for selecting traffic in a mirroring session has been deprecated and is replaced by the use of advanced classifier-based service policies.

As with ACL criteria, classifier-based match/ignore criteria allow you to limit a mirroring session to selected inbound packets on a given port or VLAN interface (instead of mirroring all inbound traffic on the interface.)

The following commands have been deprecated:

- `interface` *`port/trunk/mesh`* `monitor ip access-group` *`acl-name`* `in mirror [1 - 4 |` *`name-str`*`]`
- `vlan` *`vid-#`* `monitor ip access-group` *`acl-name`* `in mirror [1 - 4 |` *`name-str`*`]`

After you install and boot release K.14.01 or greater, ACL-based local and remote mirroring sessions configured on a port or VLAN interface are automatically converted to classifier-based mirroring policies.

If you are running software release K.13.XX or earlier, ACL permit/deny criteria are supported to select IP traffic entering a switch to mirror in a local or remote session, using specified source and/or destination criteria.

Mirrored traffic destinations

Local destinations

A local mirroring traffic destination is a port on the same switch as the source of the traffic being mirrored.

Remote destinations

A remote mirroring traffic destination is an switch configured to operate as the exit switch for mirrored traffic sessions originating on other switches.

After you configure a mirroring session with traffic-selection criteria and a destination, the switch immediately starts to mirror traffic to each destination device connected to an exit port. In a remote mirroring session that uses IPv4 encapsulation, if the intended exit switch is not already configured as the destination for the session, its performance may be adversely affected by the stream of mirrored traffic. For this reason, Switch strongly recommends that you configure the exit switch for a remote mirroring session before configuring the source switch for the same session.

Monitored traffic sources

You can configure mirroring for traffic entering or leaving the switch on:

Ports and static trunks

Provides the flexibility for mirroring on individual ports, groups of ports, static port trunks, or any combination of these.

Criteria for selecting mirrored traffic

On the monitored sources listed above, you can configure the following criteria to select the traffic you want to mirror:

- Direction of traffic movement (entering or leaving the switch, or both.)
- Type of IPv4 or IPv6 traffic entering the switch, as defined by a classifier-based service policy.
- Source and/or destination MAC addresses in packet headers.

Mirroring configuration

The table below shows the different types of mirroring that you can configure using the CLI, Menu, and SNMP interfaces.

Table 33: *Mirroring configuration options*

Monitoring interface and configuration level	Traffic selection criteria	Traffic direction		
		CLI config	Menu and web i/f config 1	Snmp config
Port(s) Trunk(s) Mesh	All traffic	Not Applicable	Not Applicable	Not Applicable

Configuration notes

Using the CLI, you can configure all mirroring options on a switch.

You can use the CLI can configure sessions 1 to 4 for local or remote mirroring in any combination, and override a Menu configuration of session 1.

You can also use SNMP configure sessions 1 to 4 for local or remote mirroring in any combination and override a Menu configuration of session 1, **except** that SNMP cannot be used to configure a classifier-based mirroring policy.

Remote mirroring endpoint and intermediate devices

The remote mirroring endpoint that is used in a remote mirroring session must be an switch that supports the mirroring functions described in this chapter. (A remote mirroring endpoint consists of the remote switch and exit port connected to a destination device.) Because remote mirroring on an switch uses IPv4 to encapsulate mirrored traffic sent to a remote endpoint switch, the intermediate switches and routers in a layer 2/3 domain can be from any vendor if they support IPv4.

The following restrictions apply to remote endpoint switches and intermediate devices in a network configured for traffic mirroring:

- The exit port for a mirroring destination must be an individual port and **not** a trunk, mesh, or VLAN interface.
- A switch mirrors traffic on static trunks, but not on dynamic LACP trunks.

- A switch mirrors traffic at line rate. When mirroring multiple interfaces in networks with high-traffic levels, it is possible to copy more traffic to a mirroring destination than the link supports. However, some mirrored traffic may not reach the destination. If you are mirroring a high-traffic volume, you can reduce the risk of oversubscribing a single exit port by:
  - Directing traffic from different session sources to multiple exit ports.
  - Configuring an exit port with a higher bandwidth than the monitored source port.

Remote mirroring overview

To configure a remote mirroring session in which the mirroring source and destination are on different switches, follow these general steps:

After you complete step on page 391, the switch begins mirroring traffic to the remote destination (endpoint) configured for the session.

1. Determine the IP addressing, UDP port number, and destination (exit) port number for the remote session:
   a. Source VLAN or subnet IP address on the source switch.
   b. Destination VLAN or subnet IP address on the destination switch.
   c. Random UDP port number for the session (7933-65535.)
   d. Remote mirroring endpoint: Exit port and IP address of the remote destination switch (In a remote mirroring endpoint, the IP address of the exit port and remote switch can belong to different VLANs. Any loopback IP address can be used except the default loopback address 127.0.0.1.)

   Requirement: For remote mirroring, the same IP addressing and UDP port number must be configured on both the source and destination switches.
2. On the remote destination (endpoint) switch, enter the `mirror endpoint` command with the information from step on page 391 to configure a mirroring session for a specific exit port.
3. Determine the session (1 to 4) and (optional) alphanumeric name to use on the **source** switch.
4. Determine the traffic to be filtered by any of the following selection methods and the appropriate configuration level (VLAN, port, mesh, trunk, global):
   a. Direction: inbound, outbound, or both.
   b. Classifier-based mirroring policy: inbound only for IPv4 or IPv6 traffic.
   c. MAC source and/or destination address: inbound, outbound, or both.
5. On the **source** switch:
   a. Enter the `mirror` command with the session number (1 to 4) and the IP addresses and UDP port number from step on page 391 to configure a mirroring session. If desired, enter the `[truncation]` parameter to allow oversize packets to be truncated rather than dropped.
   b. Enter one of the following commands to configure one or more of the traffic-selection methods in step on page 391 for the configured session:
   `interface` *`port/trunk/mesh`* `[monitor | service-policy` *`policy-name`* `in] vlan` *`vid`* `[monitor | service-policy` *`policy-name`* `in] monitor mac` *`mac-addr`*

After you complete 5b, the switch begins mirroring traffic to the remote destination (endpoint) configured for the session.

Quick reference to remote mirroring setup

Commands to configure mirroring for a remote session in which the mirroring source and destination are on different switches:

- The `mirror` command identifies the destination in a mirroring session.
- The `interface` and `vlan` commands identify the monitored interface, traffic direction, and traffic-selection criteria for a specified session.

When configuring a remote mirroring session, always configure the destination switch first. Configuring the source switch first can result in a large volume of mirrored, IPv4-encapsulated traffic arriving at the destination without an exit path, which can slow switch performance.

High-level overview of the mirror configuration process

Determine the mirroring session and destination

For a local mirroring session

Determine the port number for the exit port (such as A5, B10, and so forth).

For a remote mirroring session

Determine the following information and then go to.

- The IP address of the VLAN or subnet on which the exit port exists on the destination switch.
- The port number of the remote exit port on the remote destination switch. (In a remote mirroring endpoint, the IP address of the exit port and the remote destination switch can belong to different VLANs.)
- The IP address of the VLAN or subnet on which the mirrored traffic enters or leaves the source switch.

Although the switch supports the use of UDP port numbers from 1 to 65535, UDP port numbers below 7933 are reserved for various IP applications. Using these port numbers for mirroring can result in an interruption of other IP functions, and in non-mirrored traffic being received on the destination (endpoint) switch and sent to the device connected to the remote exit port.

- The unique UDP port number to use for the session on the source switch. (The recommended port range is from 7933 to 65535.)

Configure a mirroring destination on a remote switch

This step is required only if you are configuring a remote mirroring session in which the exit port is on a different switch than the monitored (source) interface.

For remote mirroring, you must configure the **destination** switch to recognize each mirroring session and forward mirrored traffic to an exit port before you configure the **source** switch. Configure the destination switch with the values you determined for remote mirroring in Determine the mirroring session and destination on page 392.

NOTE

A remote destination switch can support up to 32 remote mirroring endpoints (exit ports connected to a destination device in a remote mirroring session.)

Configure a destination switch in a remote mirroring session

Enter the `mirror endpoint ip` command on the remote switch to configure the switch as a remote endpoint for a mirroring session with a different source switch.

Configure a mirroring session on the source switch

To configure local mirroring, exit port number is all that is required.

If the exit port for a mirroring destination is on a remote switch instead of the local (source) switch, you must enter the source IP address, destination IP address, and UDP port number for the remote mirroring session. You may also wish to enable frame truncation to allow oversize frames to be truncated rather than dropped.

Frames that exceed the maximum size (MTU) are either dropped or truncated, according to the setting of the `[truncation]` parameter in the `mirror` command.

Frames that are near the MTU size may become oversize when the 54-byte remote mirroring tunnel header is added for transport between source switch and destination switch.

(The addition of the header is a frequent cause for frames becoming oversize, but note that all oversize frames, whatever the cause of their excess size, are dropped or truncated.) If a frame is truncated, bytes are removed from the end of the frame. This may cause the checksum in the original frame header to fail. Some protocol analyzers may flag such a checksum mismatch as an alert.

NOTE

Note that if you enable jumbo frames to allow large frames to be transmitted, you must enable jumbo frames on all switches in the path between source and destination switches.

Configure a source switch in a remote mirroring session

Enter the `mirror remote ip` command on the source switch to configure a remote destination switch for a mirroring session on the source switch. The source IP address, UDP port number, and destination IP address that you enter must be the same values that you entered with the `mirror endpoint ip` command.

CAUTION

After you configure a mirroring session with traffic-selection criteria and a destination, the switch immediately starts to mirror traffic to the destination device connected to each exit port. In a remote mirroring session that uses IPv4 encapsulation, if the remote (endpoint) switch is not already configured as the destination for the session, its performance may be adversely affected by the stream of mirrored traffic. For this reason, Hewlett Packard Enterprise strongly recommends that you configure the endpoint switch in a remote mirroring session, as described on the previous page in the section titled "For a remote mirroring session", before using the `mirror remote ip` command in this section to configure the mirroring source for the same session.

Configure the monitored traffic in a mirror session

This step configures one or more interfaces on a source switch with traffic-selection criteria to select the traffic to be mirrored in a local or remote session configured in section.

Traffic selection options

To configure traffic mirroring, specify the source interface, traffic direction, and criteria to be used to select the traffic to be mirrored by using the following options:

- Interface type
  - Port, trunk, and/or mesh
  - VLAN
  - Switch (global configuration level)
- Traffic direction and selection criteria
  - All inbound and/or outbound traffic on a port or VLAN interface
  - Only inbound IP traffic selected with an ACL (deprecated in software release K.14.01 and greater)
  - Only inbound IPv4 or IPv6 traffic selected with a classifier-based mirroring policy
  - All inbound and/or outbound traffic selected by MAC source and/or destination address

The different ways to configure traffic-selection criteria on a monitored interface are described in the following sections.

Mirroring-source restrictions

In a mirroring session, you can configure any of the following sources of mirrored traffic:

- Multiple port and trunk, and/or mesh interfaces
- One VLAN

  If you configure a VLAN as the source interface in a mirroring session and assign a second VLAN to the session, the second VLAN overwrites the first VLAN as the source of mirrored traffic.
- One classifier-based policy

  If you configure a mirroring policy on a port or VLAN interface to mirror inbound traffic in a session, you cannot configure a port, trunk, mesh, ACL, or VLAN as an additional source of mirrored traffic in the session.
- Up to 320 MAC addresses (used to select traffic according to source, destination MAC address, or both) in all mirroring sessions configured on a switch

About selecting all inbound/outbound traffic to mirror

If you have already configured session 1 with a local or remote destination, you can enter the `vlan vid monitor` or `interface port monitor` command without additional parameters for traffic-selection criteria and session number to configure mirroring for all inbound and outbound traffic on the specified VLAN or port interfaces in session 1 with the preconfigured destination.

If you have already configured session 1 with a local destination, you can enter the `vlan vid monitor` or `interface port monitor` command without additional parameters for traffic-selection criteria and session number to configure mirroring for all inbound and outbound traffic on the specified VLAN or port interfaces in session 1 with the preconfigured destination.

Untagged mirrored packets

Although a VLAN tag is added (by default) to the mirrored copy of untagged outbound packets to indicate the source VLAN of the packet, it is sometimes desirable to have mirrored packets look exactly like the original packet. The `no-tag-added` parameter gives you the option of not tagging mirrored copies of outbound packets, as shown in Figure 53: Mirroring commands with the no-tag-added option and Figure 54: Displaying a mirror session configuration with the no-tag-added option.

Figure 53 *Mirroring commands with the no-tag-added option*

```
Switch(config)#interface 3 monitor all in mirror 1 no-tag-added

Switch(config)#interface mesh monitor all both mirror 1 no-tag-added
```

Figure 54 *Displaying a mirror session configuration with the no-tag-added option*

```
Switch# show monitor 1

Network Monitoring

   Session: 1   Session Name:
   ACL: no ACL relationship exists

      Mirror Destination: 48
      Untagged traffic  : untagged    <-- Indicates the no-tag-added option is configured.
      Monitoring Sources  Direction
      ------------------  ---------
      Port: 3             Both
```

About using SNMP to configure no-tag-added

The MIB object hpicfBridgeDontTagWithVlan is used to implement the `no-tag-added` option, as shown below:

```
hpicfBridgeDontTagWithVlan OBJECT-TYPE
   SYNTAX INTEGER
     {
     enabled(1),
     disabled(2)
    }
   MAX-ACCESS  read-write
   STATUS   current
   DESCRIPTION
    "This oid mentions whether VLAN tag is part of the
   mirror'ed copy of the packet. The value 'enabled'
   denotes that the VLAN tag shouldn't be part
   of the mirror'ed copy; 'disabled' does put
   the VLAN tag in the mirror'ed copy. Only one
   logical port is allowed.
   This object is persistent and when written
   the entity
     SHOULD save the change to non-volatile storage."
   DEFVAL { 2 }
  ::= { hpicfBridgeMirrorSessionEntry 2 }
```

Operating notes

- Tunneled node profile can be created using CLI and SNMP.
- The tunneled node profile supports configuring of:
  - Primary controller (both IPv4 and IPv6).
  - Backup controller (both IPv4 and IPv6).
  - Heartbeat keepalive timeout – range 1-40 seconds.
- Only one tunneled node profile can be created.
- The tunneled-node profile can be applied to a physical port only via CLI and SNMP.
- The maximum number of physical ports to which the profile may be applied is:

  - Aruba 5400R Switch Series (non-VSF): 256
  - Aruba 5400R Switch Series (VSF): 512
- High availability (HA) will be supported for the tunneled node related configuration.
- A tunnel, associated with a port, is up when the following conditions are met. A tunnel is down when either of the conditions are not met.
  - Either the primary or backup controller is reachable.
  - A boot strap message response is received from the controller.
- Heartbeat between the switch and controller fails when the controller does not respond after five attempts. All tunnels are brought down with a heartbeat failure.
- A tunnel up or down status is logged for each tunnel node port in the event log.
- The `show tech` command dumps all user-mode and test-mode command outputs.
- To reach the Aruba controller, the VLAN must have a manual IP configured.
- With the exception of the 802.1x BPDU, the switch consumes all other BPDUs.
- The controller cluster cannot have mix of IPv4 and IPv6 nodes.
- IPv6 addresses are not allowed for both Primary and Backup controllers when in Port-Based Tunnels.

About selecting inbound/outbound traffic using a MAC address

Use the `monitor mac mirror` command at the global configuration level to apply a source and/or destination MAC address as the selection criteria used in a local or remote mirroring session.

While classifier-based mirroring allows you to mirror traffic using a policy to specify IP addresses as selection criteria, MAC-based mirroring allows you monitor switch traffic using a source and/or destination MAC address. You can apply MAC-based mirroring in one or more mirroring sessions on the switch to monitor:

- Inbound traffic
- Outbound traffic
- Both inbound and outbound traffic

MAC-based mirroring is useful in Switch Network Immunity security solutions that provide detection and response to malicious traffic at the network edge. After isolating a malicious MAC address, a security administrator can mirror all traffic sent to and received from the suspicious address for troubleshooting and traffic analysis.

The MAC address that you enter with the `monitor mac mirror` command is configured to select traffic for mirroring from all ports and learned VLANs on the switch. Therefore, a suspicions MAC address used in wireless applications can be continuously monitored as it re-appears in switch traffic on different ports or VLAN interfaces.

You can configure MAC-based mirroring from the CLI or an SNMP management station and use it to mirror:

- All inbound and outbound traffic from a group of hosts to one destination device.
- Inbound and/or outbound traffic from each host to a different destination device.
- Inbound and outbound traffic from all monitored hosts separately on two destination devices: mirroring all inbound traffic to one device and all outbound traffic to another device.

Restrictions

The following restrictions apply to MAC-based mirroring:

- Up to 320 different MAC addresses are supported for traffic selection in all mirroring sessions configured on the switch.
- A destination MAC address is not supported as mirroring criteria for routed traffic, because in routed packets, the destination MAC address is changed to the next-hop address when the packet is forwarded. Therefore, the destination MAC address that you want to mirror will not appear in routed packet headers.

  This restriction also applies to the destination MAC address of a host that is directly connected to a routing switch. (Normally, a host is connected to an edge switch, which is directly connected to the router.)

  To mirror routed traffic, we recommend that you use classifier-based policies to select IPv4 or IPv6 traffic for mirroring, as described in.
- On a switch, you can use a MAC address only once as a source MAC address and only once as a destination MAC address to filter mirrored traffic.

  For example, after you enter the following commands:

  ```
  monitor mac 111111-222222 src mirror 1
  monitor mac 111111-222222 dest mirror 2
  ```

  The following commands are not supported:

  ```
  monitor mac 111111-222222 src mirror 3
  monitor mac 111111-222222 dest mirror 4
  ```

  In addition, if you enter the `monitor mac 111111-222222 both mirror 1` command, you cannot use the MAC address `111111-222222` in any other `monitor mac mirror` configuration commands on the switch.
- To re-use a MAC address that has already been configured as a source and/or destination address for traffic selection in a mirror session, you must first remove the configuration by entering the `no` form of the command and then re-enter the MAC address in a new `monitor mac mirror` command.

  For example, if you have already configured MAC address `111111-222222` to filter inbound and outbound mirrored traffic, and you decide to use it to filter only inbound traffic in a mirror session, you could enter the following commands:

  ```
  monitor mac 111111-222222 both mirror 1
  no monitor mac 111111-222222 both mirror 1
  monitor mac 111111-222222 src mirror 1
  ```
- A mirroring session in which you configure MAC-based mirroring is not supported on a port, trunk, mesh, or VLAN interface on which a mirroring session with a classifier-based mirroring policy is configured.

About selecting inbound traffic using advanced classifier-based mirroring

In addition to the traffic selection options, traffic mirroring supports the use of advanced classifier-based functions that provide:

- A finer granularity for selecting the inbound IP traffic that you want to mirror on an individual port or VLAN interface (instead of mirroring all inbound traffic on the interface)
- Support for mirroring both IPv4 and IPv6 traffic
- The ability to re-use the same traffic classes in different software-feature configurations; for example, you can apply both a QoS rate-limiting and mirroring policy on the same class of traffic.

Classifier-based mirroring policies provide greater precision when analyzing and debugging a network traffic problem. Using multiple match criteria, you can finely select and define the classes of traffic that you want to mirror on a traffic analyzer or IDS device.

Classifier-based mirroring configuration

1. Evaluate the types of traffic in your network and identify the traffic types that you want to mirror.
2. Create an IPv4 or IPv6 traffic class using the `class` command to select the packets that you want to mirror in a session on a preconfigured local or remote destination device.

   A traffic class consists of match criteria, which consist of match and ignore commands.

   - `match` commands define the values that header fields must contain for a packet to belong to the class and be managed by policy actions.
   - `ignore` commands define the values which, if contained in header fields, exclude a packet from the policy actions configured for the class.

   Be sure to enter match/ignore statements in the precise order in which you want their criteria to be used to check packets.

   The following match criteria are supported in match/ignore statements for inbound IPv4/IPv6 traffic:

   - IP source address (IPv4 and IPv6)
   - IP destination address (IPv4 and IPv6)
   - IP protocol (such as ICMP or SNMP)
   - Layer 3 IP precedence bits
   - Layer 3 DSCP codepoint
   - Layer 4 TCP/UDP application port (including TCP flags)
   - VLAN ID

   Enter one or more match or ignore commands from the class configuration context to filter traffic and determine the packets on which policy actions will be performed.
3. Create a mirroring policy to configure the session and destination device to which specified classes of inbound traffic are sent by entering the `policy mirror` command from the global configuration context.

   Be sure to enter each class and its associated mirroring actions in the precise order in which you want packets to be checked and processed.

   To configure the mirroring actions that you want to execute on packets that match the criteria in a specified class, enter one or more class action mirror commands from the policy configuration context.

   You can configure only one mirroring session (destination) for each class. However, you can configure the same mirroring session for different classes.

   A packet that matches the match criteria in a class is mirrored to the exit (local or remote) port that has been previously configured for the session, where session value is 1 or a text string (if you configured the session with a name when you entered the `mirror` command.)

   Prerequisite: The local or remote exit port for a session must be already configured before you enter the `mirror session` parameter in a class action statement:

   - In a local mirroring session, the exit port is configured with the `mirror <session-number> port` command

- In a remote mirroring session, the remote exit port is configured with the `mirror endpoint ip` and `mirror <session-number> remote ip` commands.

Restriction: In a policy, you can configure only one mirroring session per class. However, you can configure the same session for different classes.

Mirroring is not executed on packets that match ignore criteria in a class.

The execution of mirroring actions is performed in the order in which the classes are numerically listed in the policy.

The complete no form of the `class action mirror` command or the `no <seq-number>` command removes a class and mirroring action from the policy configuration.

To manage packets that do not match the match or ignore criteria in any class in the policy, and therefore have no mirroring actions performed on them, you can enter an optional default class. The default class is placed at the end of a policy configuration and specifies the mirroring actions to perform on packets that are neither matched nor ignored.

4. (Optional) To configure a default-class in a policy, enter the `default-class` command at the end of a policy configuration and specify one or more actions to be executed on packets that are not matched and not ignored.

   Prerequisite: The local or remote exit port for a session must be already configured with a destination device before you enter the `mirror <session>` parameter in a default-class action statement.

5. Apply the mirroring policy to inbound traffic on a port (`interface service-policy in` command) or VLAN (`vlan service-policy in` command) interface.

After you apply a mirroring policy for one or more preconfigured sessions on a port or VLAN interface, the switch immediately starts to use the traffic-selection criteria and exit port to mirror traffic to the destination device connected to each exit port.

In a remote mirroring session that uses IPv4 encapsulation, if the remote switch is not already configured as the destination for the session, its performance may be adversely affected by the stream of mirrored traffic.

For this reason, Hewlett Packard Enterprise strongly recommends that you first configure the exit switch in a remote mirroring session before you apply a mirroring service policy on a port or VLAN interface.

Restrictions: The following restrictions apply to a mirroring service policy:

- Only one mirroring policy is supported on a port or VLAN interface.
- If you apply a mirroring policy to a port or VLAN interface on which a mirroring policy is already configured, the new policy replaces the existing one.
- A mirroring policy is supported only on inbound traffic.

Because only one mirroring policy is supported on a port or VLAN interface, ensure that the policy you want to apply contains all the required classes and actions for your configuration.

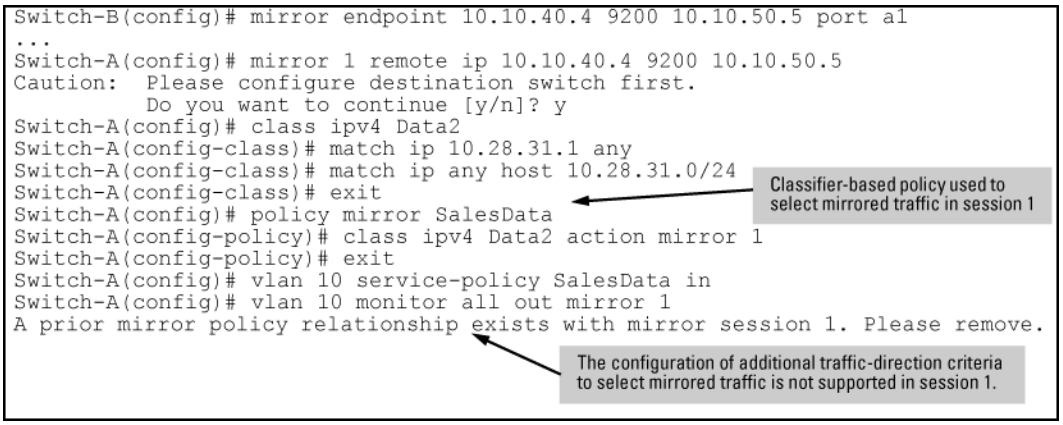
Classifier-based mirroring restrictions

The following restrictions apply to mirroring policies configured with the classifier-based model:

- A mirroring policy is supported only on **inbound** IPv4 or IPv6 traffic.
- A mirroring policy is not supported on a meshed port interface. (Classifier-based policies are supported only on a port, VLAN, or trunk interface.)

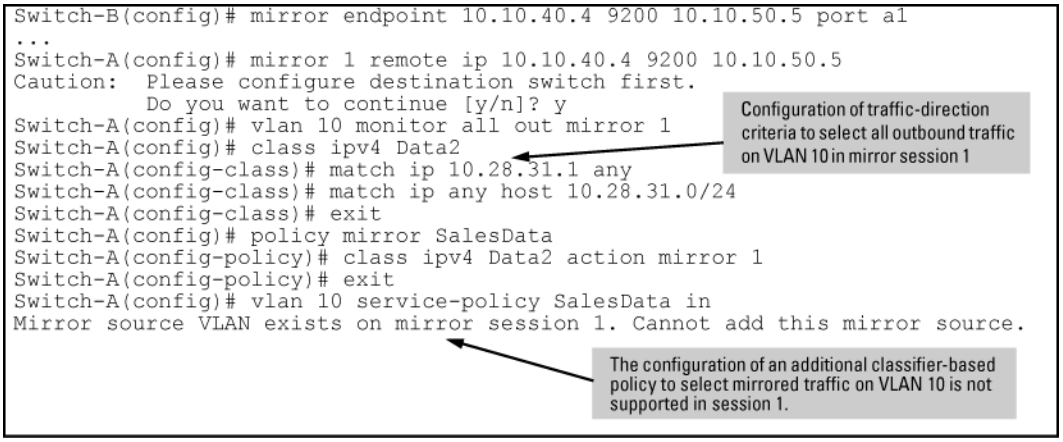
- Only one classifier-based mirroring policy is supported on a port or VLAN interface. You can, however, apply a classifier-based policy of a different type, such as QoS.
- You can enter multiple `class action mirror` statements in a policy.
  - You can configure only one mirroring session (destination) for each class.
  - You can configure the same mirroring session for different classes.
- If a mirroring session is configured with a classifier-based mirroring policy on a port or VLAN interface, no other traffic-selection criteria (MAC-based or all inbound and/or outbound traffic) can be added to the session.

Figure 55 *Mirroring configuration in which only a mirroring policy is supported*



- If a mirroring session is already configured with one or more traffic-selection criteria (MAC-based or all inbound and/or outbound traffic), the session does not support the addition of a classifier-based policy.

Figure 56 *Mirroring configuration in which only traffic-selection criteria are supported*



About applying multiple mirroring sessions to an interface

You can apply a mirroring policy to an interface that is already configured with another traffic-selection method (MAC-based or all inbound and/or outbound traffic) for a different mirroring session.

The classifier-based policy provides a finer level of granularity that allows you to zoom in on a subset of port or VLAN traffic and select it for local or remote mirroring.

In the following example, traffic on Port b1 is used as the mirroring source for two different, local mirroring sessions:

- All inbound and outbound traffic on Ports b1, b2, and b3 is mirrored in session 4.
- Only selected voice traffic on Port b1 is mirrored in session 2.

Figure 57 *Example of applying multiple sessions to the same interface*

```
Switch(config)# mirror 4 port a2
Switch(config)# interface b1-b3 monitor all both mirror 4
Switch(config)# mirror 2 port b4
Switch(config)# class ipv4 voice
Switch(config-class)# match ip any any ip-dscp ef
Switch(config-class)# exit
Switch(config)# policy mirror IPphones
Switch(config-policy)# class ipv4 voice action mirror 2
Switch(config-policy)# exit
Switch(config)# interface b1 service-policy IPphones in
```

Mirroring configuration examples

Local mirroring using traffic-direction criteria

An administrator wants to mirror the inbound traffic from workstation "X" on port A5 and workstation "Y" on port B17 to a traffic analyzer connected to port C24 (see Figure 58: Local mirroring topology .) In this case, the administrator chooses "1" as the session number. (Any unused session number from 1 to 4 is valid.) Because the switch provides both the source and destination for the traffic to monitor, local mirroring can be used. In this case, the command sequence is:

- Configure the local mirroring session, including the exit port.
- Configure the monitored source interfaces for the session.

Figure 58 *Local mirroring topology*

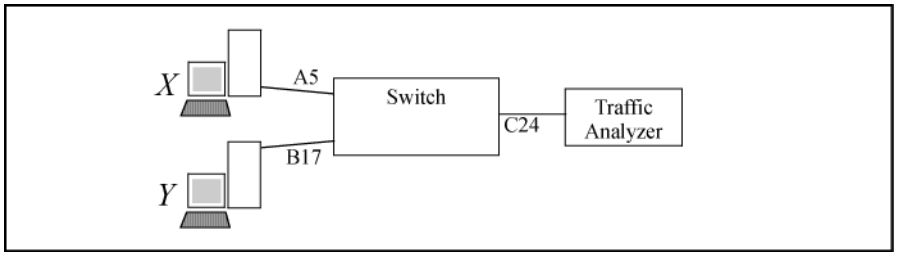
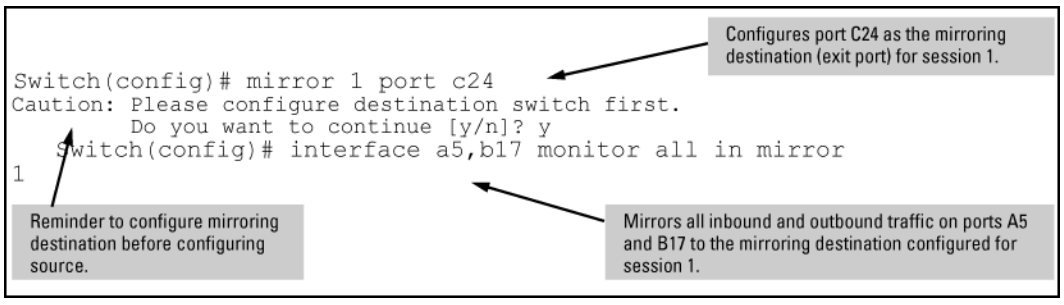


Figure 59 *Configuring a local mirroring session for all inbound and outbound port traffic*

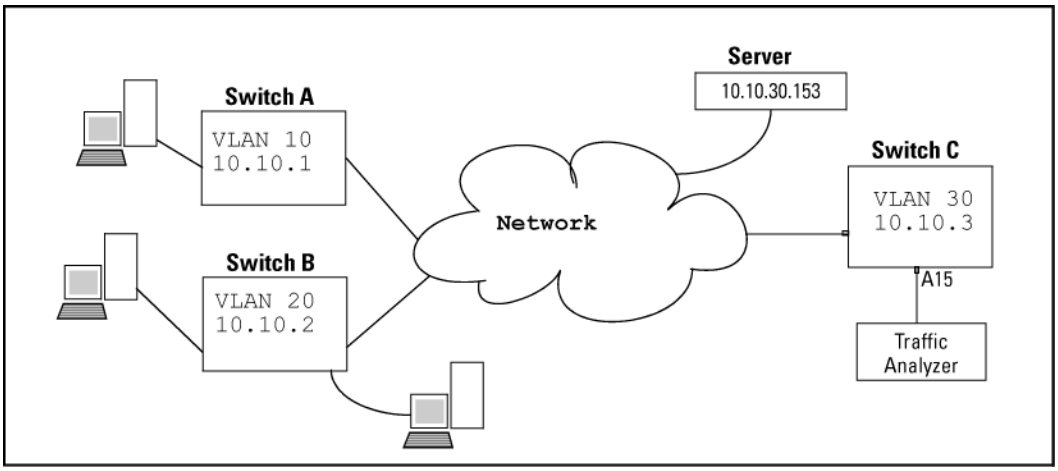


Remote mirroring using a classifier-based policy

In the network shown in the figure below, an administrator has connected a traffic analyzer to port A15 (in VLAN 30) on switch C to monitor the TCP traffic to the server at 10.10.30.153 from workstations connected to switches A and B. Remote mirroring sessions are configured on switches A and B, and a remote mirroring

endpoint on switch C. TCP traffic is routed through the network to the server from VLANs 10 and 20 on VLAN 30.

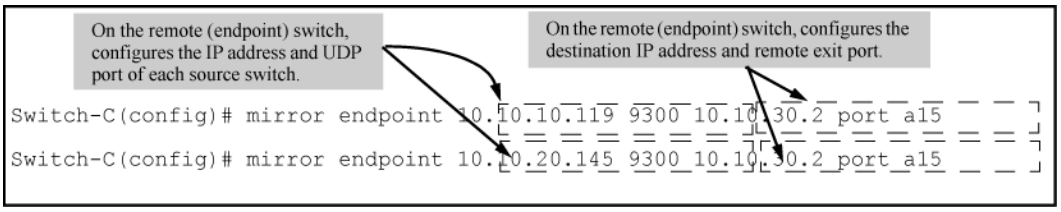
Figure 60 *Sample topology in a remote mirroring session*



To configure this remote mirroring session using a classifier-based policy to select inbound TCP traffic on two VLAN interfaces, take the following steps:

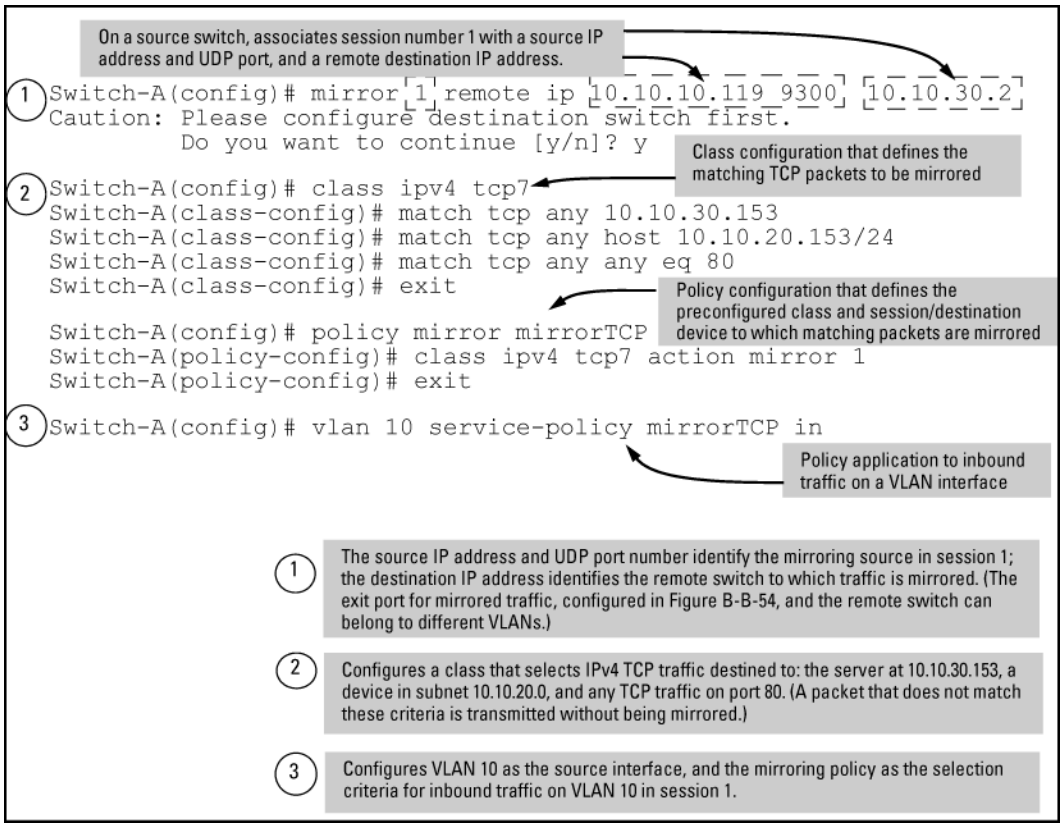
1. On remote switch C, configure a remote mirroring endpoint using port A15 as the exit port (as described in Configure a mirroring destination on a remote switch.)

   Figure 61 *Configuring a remote mirroring endpoint: remote switch and exit port*

2. On source switch A, configure an association between the remote mirroring endpoint on switch C and a mirroring session on switch A (as described in Configure a mirroring session on the source switch.)
3. On switch A, configure a classifier-based mirroring policy to select inbound TCP traffic destined to the server at 10.10.30.153, and apply the policy to the interfaces of VLAN 10 (as described in Configure a destination switch in a remote mirroring session.)

Figure 62 *Configuring a classifier-based policy on source switch A*



4. On source switch B, repeat steps 2 and 3:
   a. Configure an association between the remote mirroring endpoint on switch C and a mirroring session on switch B.
   b. Configure a classifier-based mirroring policy to select inbound TCP traffic destined to the server at 10.10.30.153, and apply the policy to a VLAN interface for VLAN 20.

Because the remote session has mirroring sources on different switches, you can use the same session number (1) for both sessions.

Figure 63 *Configuring a classifier-based policy on source switch B*

The configuration of remote-mirroring session 1 on Switch B is the same as on Switch A (figure B-55), except for the difference in source VLAN and source IP address. Note that on different switches, the UDP port number (9300) can be the same.

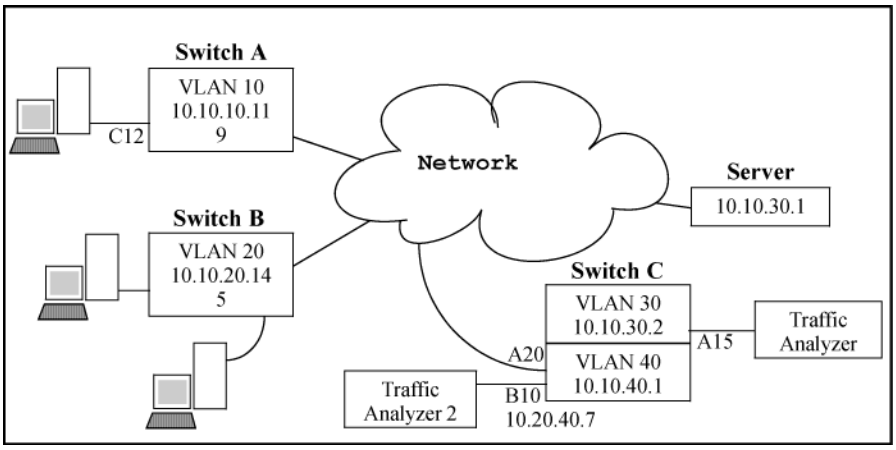
```
Switch-B(config)# mirror 1 remote ip 10.10.20.145 9300 10.10.30.2
Caution: Please configure destination switch first.
        Do you want to continue [y/n]? y
Switch-B(config)# class ipv4 tcp7
Switch-B(class-config)# match tcp any 10.10.30.153
Switch-B(class-config)# match tcp any host 10.10.20.153/24
Switch-B(class-config)# match tcp any any eq 80
Switch-B(class-config)# exit
Switch-B(config)# policy mirror mirrorTCP
Switch-B(policy-config)# class ipv4 tcp7 mirror 1
Switch-B(policy-config)# exit
Switch-B(config)# vlan 20 service-policy mirrorTCP in
```

Remote mirroring using traffic-direction criteria

In the network shown in the figure below, the administrator connects another traffic analyzer to port B10 (in VLAN 40) on switch C to monitor all traffic entering switch A on port C12. For this mirroring configuration, the administrator configures a mirroring destination (with a remote exit port of B10) on switch C, and a remote mirroring session on switch A.

If the mirroring configuration in the proceeding example is enabled, it is necessary to use a different session number (2) and UDP port number (9400.) (The IP address of the remote exit port [10.10.40.7] connected to traffic analyzer 2 [exit port B10] can belong to a different VLAN than the destination IP address of the VLAN used to reach remote switch C [10.20.40.1]).

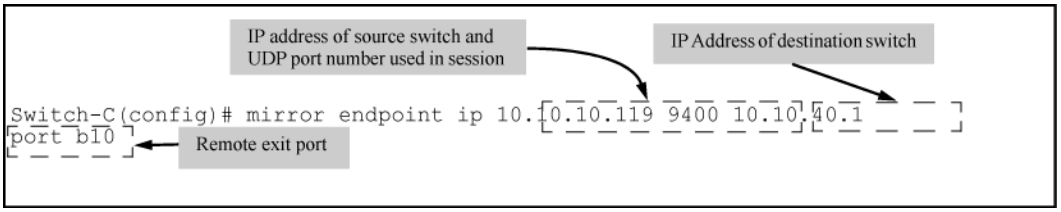
Figure 64 *Sample topology for remote mirroring from a port interface*



To configure this remote mirroring session using a directional-based traffic selection on a port interface, the operator must take the following steps:

1. On remote switch C, configure the remote mirroring endpoint using port B10 as the exit port for a traffic analyzer (as described in Configure a mirroring destination on a remote switch):

   Figure 65 *Configuring a remote mirroring endpoint*

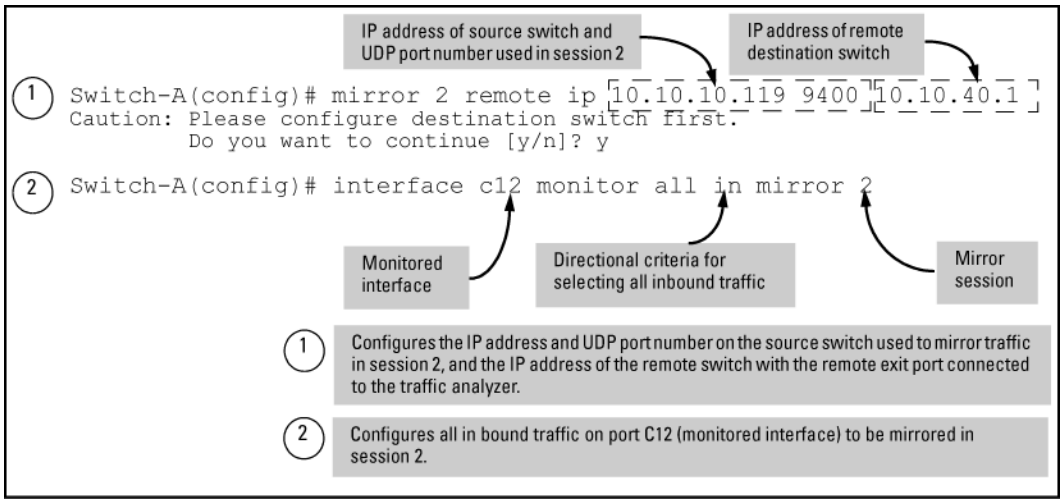
2. On source switch A, configure session 2 to use UDP port 9400 to reach the remote mirroring endpoint on switch C (10.10.40.1):

   ```
   mirror 2 remote ip 10.10.10.119 9400 10.10.40.1
   ```

3. On source switch A, configure the local port C12 to select all inbound traffic to send to the preconfigured mirroring destination for session 2:

   ```
   interface c12 monitor all in mirror 2
   ```

Figure 66 *Configuring a remote mirroring session for inbound port traffic*



Maximum supported frame size

The IPv4 encapsulation of mirrored traffic adds a 54-byte header to each mirrored frame. If a resulting frame exceeds the MTU allowed in the network, the frame is dropped or truncated.

Oversized mirroring frames are dropped or truncated, according to the setting of the `[truncation]` parameter in the `mirror` command. Also, remote mirroring does not allow downstream devices in a mirroring path to fragment mirrored frames.

If jumbo frames are enabled on the mirroring source switch, the mirroring destination switch and all downstream devices connecting the source switch to the mirroring destination must be configured to support jumbo frames.

Enabling jumbo frames to increase the mirroring path MTU

On 1-Gbps and 10-Gbps ports in the mirroring path, you can reduce the number of dropped frames by enabling jumbo frames on all intermediate switches and routers. (The MTU on the switches covered by this manual is 9220 bytes for frames having an 802.1Q VLAN tag, and 9216 bytes for untagged frames.)

Table 34: *Maximum frame sizes for mirroring*

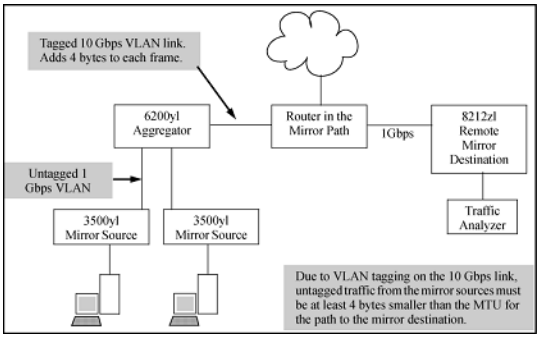
	Frame type configuration	Maximum frame size	VLAN tag	Frame mirrored to local port	Frame mirrored to remote port	
				Data	Data	IPv4 header
Untagged	Non-jumbo (default config.)	1518	0	1518	1464	54
	Jumbo[1] on all VLANs	9216	0	9216	9162	54
	Jumbo[1] On all but source VLAN	1518	0	n/a	1464	54
Tagged	Non-jumbo	1522	4	1522	1468	54
	Jumbo[1]on all VLANs	9220	4	9218	9164	54
	Jumbo[1] On all but source VLAN	1522	4	n/a[2]	1468	54

Effect of downstream VLAN tagging on untagged, mirrored traffic

In a remote mirroring application, if mirrored traffic leaves the switch without 802.1Q VLAN tagging, but is forwarded through a downstream device that adds 802.1Q VLAN tags, the MTU for untagged mirrored frames leaving the source switch is reduced below the values shown in Maximum frame sizes for mirroring.

For example, if the MTU on the path to the destination is 1522 bytes, untagged mirrored frames leaving the source switch cannot exceed 1518 bytes. Likewise, if the MTU on the path to the destination is 9220 bytes, untagged mirrored frames leaving the source switch cannot exceed 9216 bytes.

Figure 67 *Effect of downstream VLAN tagging on the MTU for mirrored traffic*



1

Jumbo frames are allowed on ports operating at or above 1 Gbps

Operating notes for traffic mirroring

- Mirroring dropped traffic

  When an interface is configured to mirror traffic to a local or remote destination, packets are mirrored regardless of whether the traffic is dropped while on the interface. For example, if an ACL is configured on a VLAN with a `deny` ACE that eliminates packets from a Telnet application, the switch still mirrors the Telnet packets that are received on the interface and subsequently dropped.

- Mirroring and spanning tree

  Mirroring is performed regardless of the STP state of a port or trunk. This means, for example, that inbound traffic on a port blocked by STP can still be monitored for STP packets during the STP setup phase.

- Tagged and untagged frames

  For a frame entering or leaving the switch on a mirrored port, the mirrored copy retains the tagged or untagged state the original frame carried when it entered into or exited from the switch. (The tagged or untagged VLAN membership of ports in the path leading to the mirroring destination does not affect the tagged or untagged status of the mirrored copy itself.)

  Thus, if a tagged frame arrives on a mirrored port, the mirrored copy is also tagged, regardless of the status of ports in the destination path. If a frame exits from the switch on a mirrored port that is a tagged member of a VLAN, the mirrored copy is also tagged for the same reason.

  To prevent a VLAN tag from being added to the mirrored copy of an outbound packet sent to a mirroring destination, you must enter the `no-tag-added` parameter when you configure a port, trunk, or mesh interface to select mirrored traffic.

- Effect of IGMP on mirroring

  If both inbound and outbound mirroring is operating when IGMP is enabled on a VLAN, two copies of mirrored IGMP frames may appear at the mirroring destination.

- Mirrored traffic not encrypted

  Mirrored traffic undergoes IPv4 encapsulation, but mirrored encapsulated traffic is not encrypted.

- IPv4 header added

  The IPv4 encapsulation of mirrored traffic adds a 54-byte header to each mirrored frame. If a resulting frame exceeds the maximum MTU allowed in the network, it is dropped or truncated (according to the setting of the `[truncation]` parameter in the `mirror` command.)

  To reduce the number of dropped frames, enable jumbo frames in the mirroring path, including all intermediate switches and/or routers. (The MTU on the switch is 9220 bytes, which includes 4 bytes for the 802.1Q VLAN tag.)

- Intercepted or injected traffic

  The mirroring feature does not protect against either mirrored traffic being intercepted or traffic being injected into a mirrored stream by an intermediate host.

- Inbound mirrored IPv4-encapsulated frames are not mirrored

  The switch does not mirror IPv4-encapsulated mirrored frames that it receives on an interface. This prevents duplicate mirrored frames in configurations where the port connecting the switch to the network path for a mirroring destination is also a port whose inbound or outbound traffic is being mirrored.

  For example, if traffic leaving the switch through ports B5, B6, and B7 is being mirrored through port B7 to a network analyzer, the mirrored frames from traffic on ports B5 and B6 will not be mirrored a second time as they pass through port B7.

- Switch operation as both destination and source

  A switch configured as a remote destination switch can also be configured to mirror traffic to one of its own ports (local mirroring) or to a destination on another switch (remote mirroring.)

- Monitor command note

  If session 1 is already configured with a destination, you can enter the `no vlan <VID>monitor` or `no interface <PORT> monitor` command without mirroring criteria and a mirror session number. In this case, the switch automatically configures or removes mirroring for inbound and outbound traffic from the specified VLAN or ports to the destination configured for session 1.

- Loss of connectivity suspends remote mirroring

  When a remote mirroring session is configured on a source switch, the switch sends an ARP request to the configured destination approximately every 60 seconds. If the source switch fails to receive the expected ARP response from the destination for the session, transmission of mirrored traffic in the session halts. However, because the source switch continues to send ARP requests for each configured remote session, link restoration or discovery of another path to the destination enables the source switch to resume transmitting the session's mirrored traffic after a successful ARP response cycle occurs.

  Note that if a link's connectivity is repeatedly interrupted ("link toggling"), little or no mirrored traffic may be allowed for sessions using that link. To verify the status of any mirroring session configured on the source switch, use the `show monitor` command.

Troubleshooting traffic mirroring

Cause

If mirrored traffic does not reach the configured remote destination (endpoint) switch or remote exit port, check the following configurations:

- The configured remote exit port must not be a member of a trunk or mesh.
- If the destination for mirrored traffic is on a different VLAN than the source, routing must be correctly configured along the path from the source to the destination.

A mirroring exit port should be connected only to a network analyzer, IDS, or other network edge device that has no connection to other network resources. Configuring a mirroring exit port connection to a network can result in serious network performance problems, and is strongly discouraged.

Interface monitoring features

You can designate monitoring of inbound and outbound traffic on:

Ports and static trunks: Allows monitoring of individual ports, groups of contiguous ports, and static port trunks.

The switch monitors network activity by copying all traffic inbound and outbound on the specified interfaces to the designated monitoring port, to which a network analyzer can be attached.

If a tagged packet arrives on a monitored port, the packet will remain tagged when it goes out a monitored port even if that port is configured as untagged. If the packet is untagged, it will remain untagged going out the monitor port. The monitor port state (tagged or untagged) does not affect the tagging of the packet. However, egress mirroring does not reflect the tagged or untagged characteristic to the mirror port, instead it reflects the tagged or untagged characteristic of the mirror port.

When both inbound and outbound monitoring is done, and IGMP is enabled on any VLAN, you may get two copies of IGMP packets on the monitored port.
Port trunks cannot be used as a monitoring port.
The switch can monitor static LACP trunks, but not dynamic LACP trunks.
It is possible, when monitoring multiple interfaces in networks with high traffic levels, to copy more traffic to a monitor port than the link can support. In this case, some packets may not be copied to the monitor port.

Configuring port and static trunk monitoring (CLI)

You must use the following configuration sequence to configure port and static trunk monitoring in the CLI:

1. Assign a monitoring (mirror) port.
2. Designate the port(s) and/or static trunk(s) to monitor.

Displaying the monitoring configuration

Syntax

`show monitor`

This command lists the port assigned to receive monitored traffic and the ports and/or trunks being monitored.

For example, if you assign port 5 as the monitoring port and configure the switch to monitor ports 2-4, `show monitor` displays the following:

Monitored port listing

```
switch(config)# show monitor

 Network Monitoring Port

  Mirror Port: 5 [1]

  Monitoring sources [2]
  ------------------
  2
  3
  4
```

[1]Port receiving monitored traffic.

[2]Monitored Ports

Configuring the monitor port

Syntax

`no mirror-port [< port-num >]`

This command assigns or removes a monitoring port, and must be executed from the global configuration level. Removing the monitor port disables port monitoring and resets the monitoring parameters to their factory-default settings.

For example, to assign port 6 as the monitoring port:

```
switch(config)# mirror-port 6
```

To turn off monitoring:

```
switch(config)# no mirror-port
```

Selecting or removing monitoring source interfaces

After you configure a monitor port you can use either the global configuration level or the interface context level to select ports, static trunks, or VLANs as monitoring sources. You can also use either level to remove monitoring sources.

Syntax

```
no interface <monitor-list> monitor
```

<*monitor-list*>	Includes port numbers and static trunk names such as **4, 7, 5-8, trk1**.

Individual ports and static trunks can be monitored at the same time. However, if you configure the switch to monitor a VLAN, all other interfaces are removed from monitoring. Also, you can configure only one VLAN at a time for monitoring.

Elements in the monitor list can include port numbers and static trunk names at the same time.

For example, with a port such as port 5 configured as the monitoring (mirror) port, you would use either of the following commands to select these interfaces for monitoring:

- Ports 6-9, and 14
- Trunk 2

Selecting ports and static trunks as monitoring sources

```
switch(config)# int 6-9, 14 trk2, monitor
```

To monitor a VLAN:

Configuring VLAN monitoring

```
switch(config)# vlan 20 monitor
switch(config)# show monitor

 Network Monitoring Port

  Mirror Port: 5

  Monitoring sources
  ------------------
  VLAN_20
```

Disabling monitoring at the interface context and the global config level

```
switch(eth-1-3, 5)# no int 5 monitor [1]
switch(eth-1-3, 5)# no monitor

switch(config)# no int 5 monitor [2]
switch(config)# no int 1-3, 5 monitor
```

- [1]These two commands show how to disable monitoring at the interface context level for a single port or all ports in an interface context level.
- [2]These two commands show how to disable monitoring at the global config level for a single port or a group of ports.

Show Aruba Switch Memory

Syntax

`show system memory`

Description

Displays system RAM and flash memory size.

Command context

`manager and operator`

Usage

You can execute this command in various command contexts. The following example explains the command usage.

Examples

To view the system memory status, execute the `show system memory` command.

```
Switch# show system memory

RAM and Flash - System Memory Information

  System Name           : Switch

  VSF-Member :1

    Product SKU         : J9851A
    Flash Size          : 1 GB
    RAM Size            : 4 GB

  VSF-Member :2

    Product SKU         : J9851A
    Flash Size          : 1 GB
    RAM Size            : 4 GB
```

To view the system memory status within the STACK context, execute the `show system memory` command.

```
Switch (STACK)# show system memory

RAM and Flash - System Memory Information

  System Name           : Switch

  Member :1

    Product SKU         : JL072A
    Flash Size          : 1 GB
    RAM Size            : 4 GB

  Member :2

    Product SKU         : JL076A
    Flash Size          : 1 GB
    RAM Size            : 4 GB

  Member :3
```

```
    Product SKU         : JL074A
    Flash Size          : 1 GB
    RAM Size            : 4 GB

  Member :4

    Product SKU         : JL076A
    Flash Size          : 1 GB
    RAM Size            : 4 GB

  Member :5

    Product SKU         : JL075A
    Flash Size          : 1 GB
    RAM Size            : 4 GB
```

To view the system memory status within the Standalone context, execute the `show system memory` command.

```
Switch(Standalone)# show system memory

RAM and Flash - System Memory Information

  System Name         : Switch
  Product SKU         : J9779A
  Flash Size          : 128 MB
  RAM Size            : 256 MB
```

Fans

There are three fan types:

- Power supply fans
- Fan-tray fans
- Stacking switch fans

show system fans

Syntax

`show system fans`

Description

Shows the state, status, and location of system fans.

Command context

`manager and operator`

Usage

Command can be executed using various command contexts. See examples for use of command context PoEP and VSF.

Examples

The state of all system fans is shown by using the command `show system fans`.

```
Switch# show system fans

Fan Information
  Num   | State       | Failures | Location
-------+-------------+----------+----------
Fan-1   | Fan OK      |   0      | Fan Tray
Fan-2   | Fan OK      |   0      | Fan Tray
Fan-3   | Fan OK      |   0      | Fan Tray
Fan-4   | Fan OK      |   0      | Fan Tray
Fan-5   | Fan OK      |   0      | Fan Tray
Fan-6   | Fan OK      |   0      | Fan Tray
Fan-7   | Fan Removed |   0      | PS 1
Fan-8   | Fan Failed  |   2      | PS 2
Fan-9   | Fan OK      |   0      | PS 3
Fan-10 | Fan OK      |   0      | PS 4

1 / 10 Fans in Failure State
1 / 10 Fans have been in Failure State
```

The state of all system fans within the PoEP context is shown by using the command `show system fans`.

```
Switch(PoEP)# show system fans

Fan Information
  Num   | State       | Failures | Location
-------+-------------+----------+--------------------
Fan-1   | Fan OK      |   0      | Chassis
Fan-2   | Fan OK      |   0      | Chassis
Fan-3   | Fan OK      |   0      | Chassis
Fan-4   | Fan Removed |   0      | PS 1
Fan-5   | Fan Failed  |   2      | PS 2

1 / 5 Fans in Failure State
1 / 5 Fans have been in Failure State
```

The state of all stacked switch system fans is shown by using the command `show system fans` within the `stacked` context.

```
Switch(stacked)# show system fans

Fan Information
Member  1

  Num   | State       | Failures | Location
-------+-------------+----------+--------------------
Sys-1   | Fan OK      |   0      | Chassis
Sys-2   | Fan OK      |   0      | Chassis
Sys-3   | Fan OK      |   0      | Chassis
Sys-4   | Fan Removed |   0      | PS 1
Sys-5   | Fan Failed  |   2      | PS 2

0 / 5 Fans in Failure State
0 / 5 Fans have been in Failure State

Member  2

  Num   | State       | Failures | Location
-------+-------------+----------+--------------------
Sys-1   | Fan OK      |   0      | Chassis
Sys-2   | Fan OK      |   0      | Chassis
Sys-3   | Fan OK      |   0      | Chassis
Sys-4   | Fan OK      |   0      | PS 1
Sys-5   | Fan OK      |   0      | PS 2
```

```
0 / 5 Fans in Failure State
0 / 5 Fans have been in Failure State
```

The state of all VSF switch members system fans is shown by using the command `show system fans` from within the VSF context.

```
VSF-Switch# show system fans

Fan Information
VSF-Member  1

  Num   | State       | Failures | Location
--------+-------------+----------+---------
Sys-1   | Fan OK      |   0      | Fan Tray
Sys-2   | Fan OK      |   0      | Fan Tray
Sys-3   | Fan OK      |   0      | Fan Tray
Sys-4   | Fan OK      |   0      | Fan Tray
Sys-5   | Fan Removed |   0      | PS 1
Sys-6   | Fan Failed  |   2      | PS 2

1 / 6 Fans in Failure State
1 / 6 Fans have been in Failure State

VSF-Member  2

  Num   | State       | Failures | Location
--------+-------------+----------+---------
Sys-1   | Fan OK      |   0      | Fan Tray
Sys-2   | Fan OK      |   0      | Fan Tray
Sys-3   | Fan OK      |   0      | Fan Tray
Sys-4   | Fan OK      |   0      | Fan Tray
Sys-5   | Fan OK      |   0      | PS 1
Sys-6   | Fan OK      |   0      | PS 2

0 / 6 Fans in Failure State
0 / 6 Fans have been in Failure State
```

show system power-supply

Syntax

```
show system power-supply [detailed | fahrenheit]
```

Description

Shows power supply information in either full detail or full detail in Fahrenheit only. Default temperature is displayed in degrees Celsius.

Command context

```
manager and operator
```

Parameters

`detailed`

Shows detailed switch power supply sensor information.

`fahrenheit`

Shows detailed switch power supply sensor information with temperatures in degrees Fahrenheit.

Usage

- The `show system power-supply detailed` command shows detailed information for the local power supplies only.
- The `show system power-supply detailed` command shows detailed information for power supplies in the `powered` state only.

Examples

Use of the command `show system power-supply` shows the power supply status for all active switches.

```
Switch# show system power-supply

Power Supply Status:

 PS#    Model      Serial          State         AC/DC  + V    Wattage
 ---- --------- ------------ ----------------- -------------- ---------
   1   J9828A    IN30G4D009   Powered           AC 120V/240V      700
   2   J9828A    IN30G4D00C   Powered           AC 120V/240V      700
   3                          Not Present       -- ---------        0
   4   J9830A    IN43G4G05H   Powered           AC 120V/240V     2750

   3 /  4 supply bays delivering power.
   Total power: 4150 W
```

Use of the command `show system power-supply detailed` shows the power supply status in detail for all active switches.

```
Switch# show system power-supply detailed

 Status and Counters - Power Supply Detailed Information

  PS# Model   Serial      State        Status
  --- ------- ----------- ------------ -------------------------------------
  1   J9828A  IN30G4D009  Powered      AC Power Consumption : 44 Watts
                                       AC MAIN Voltage      : 209 Volts
                                       Power Supplied       : 31 Watts
                                       Power Capacity       : 700 Watts
                                       Inlet Temp (C/F)     : 27.0C/80.6F
                                       Internal Temp (C/F)  : 30.5C/86.0F
                                       Fan 1 Speed          : 1600 RPM (47%)
                                       Fan 2 Speed          : 1600 RPM (47%)

  2   J9828A  IN30G4D00C  Powered      AC Power Consumption : 46 Watts
                                       AC MAIN Voltage      : 209 Volts
                                       Power Supplied       : 21 Watts
                                       Power Capacity       : 700 Watts
                                       Inlet Temp (C/F)     : 27.7C/80.6F
                                       Internal Temp (C/F)  : 32.5C/89.6F
                                       Fan 1 Speed          : 1600 RPM (47%)
                                       Fan 2 Speed          : 1600 RPM (47%)

  3                       Not Present

  4   J9830A  IN43G4G05H  Powered      AC Power Consumption : 90 Watts
                                       AC MAIN/AUX Voltage  : 210/118 Volts
                                       Power Supplied       : 16 Watts
                                       Power Capacity       : 2750 Watts
                                       Inlet Temp (C/F)     : 30.9C/86.0F
                                       Internal Temp (C/F)  : 65.6C/149.0F
                                       Fan 1 Speed          : 2000 RPM (37%)
                                       Fan 2 Speed          : 1950 RPM (36%)
```

```
   3 /  4 supply bays delivering power.
   Currently supplying 68 W / 4150 W total power.
```

Use of the command `show system power-supply fahrenheit` shows the power supply status in Fahrenheit for all active switches.

```
Switch# show system power-supply detailed fahrenheit
Power Supply Status:
 Mem PS# Model   Serial      State        Status
 --- --- ------- ----------- ------------ ----------------------------------
 1   1   J9830A  IN5BGZ81KZ  Powered      Power Consumption   : 95 Watts
                                          AC MAIN/AUX Voltage : 118/208 Volts
                                          Inlet/Internal Temp : 85.6F/87.7F
                                          Fan 1 Speed (util)  : 1650RPM (20%)
                                          Fan 2 Speed (util)  : 1600RPM (19%)

 1   2   J9829A  IN5BGZ81KX  Powered      Power Consumption   : 51 Watts
                                          AC Input Voltage    : 208 Volts
                                          Inlet/Internal Temp : 85.6F/87.7F
                                          Fan 1 Speed (util)  : 1650RPM (20%)
                                          Fan 2 Speed (util)  : 1600RPM (19%)

 1   3   J9828A  IN5BGZ81KY  Powered      Power Consumption   : 43 Watts
                                          AC Input Voltage    : 119 Volts
                                          Inlet/Internal Temp : 85.6F/87.7F
                                          Fan 1 Speed (util)  : 1650RPM (20%)
                                          Fan 2 Speed (util)  : 1600RPM (19%)

 1   4                       Not Present

 2   1   J9830A  IN5BGZ81KZ  Powered      Power Consumption   : 95 Watts
                                          AC MAIN/AUX Voltage : 118/208 Volts
                                          Inlet/Internal Temp : 85.6F/87.7F
                                          Fan 1 Speed (util)  : 1650RPM (20%)
                                          Fan 2 Speed (util)  : 1600RPM (19%)

 2   2   J9829A  IN5BGZ81KX  Powered      Power Consumption   : 51 Watts
                                          AC Input Voltage    : 208 Volts
                                          Inlet/Internal Temp : 85.6F/87.7F
                                          Fan 1 Speed (util)  : 1650RPM (20%)
                                          Fan 2 Speed (util)  : 1600RPM (19%)

 2   3   J9828A  IN5BGZ81KY  Powered      Power Consumption   : 43 Watts
                                          AC Input Voltage    : 119 Volts
                                          Inlet/Internal Temp : 85.6F/87.7F
                                          Fan 1 Speed (util)  : 1650RPM (20%)
                                          Fan 2 Speed (util)  : 1600RPM (19%)
 2   4                       Not Present
-------------------------------------------------------------------------------
   6 / 8 supply bays delivering power.
   Total Input Power: 378 Watts
```

Use of the command `show system power-supply detailed` shows the power supply status all active switches including a nonpowered J9830A PSU.

```
switch# show system power-supply detailed

 Status and Counters - Power Supply Detailed Information

  PS# Model   Serial      State        Status
  --- ------- ----------- ------------ ------------------------------------
  1   J9828A  IN30G4D009  Powered      AC Power Consumption : 44 Watts
```

```
                                    AC MAIN Voltage      : 209 Volts
                                    Power Supplied       : 31 Watts
                                    Power Capacity       : 700 Watts
                                    Inlet Temp (C/F)     : 27.0C/80.6F
                                    Internal Temp (C/F)  : 30.5C/86.0F
                                    Fan 1 Speed          : 1600 RPM
                                    Fan 2 Speed          : 1600 RPM

 2   J9828A  IN30G4D00C  Powered    AC Power Consumption : 46 Watts
                                    AC MAIN Voltage      : 209 Volts
                                    Power Supplied       : 21 Watts
                                    Power Capacity       : 700 Watts
                                    Inlet Temp (C/F)     : 27.7C/80.6F
                                    Internal Temp (C/F)  : 32.5C/89.6F
                                    Fan 1 Speed          : 1600 RPM
                                    Fan 2 Speed          : 1600 RPM

 3                      Not Present

 4   J9830A  IN43G4G05H  Aux Not Powered


  2 /  4 supply bays delivering power.
  Currently supplying 68 W / 4150 W total power.
```

Use of the command `show system power-supply` shows the power supply status all active switches with power supply #2 showing permanent failure.

```
switch# show system power-supply

Power Supply Status:

 PS#    Model      Serial          State          AC/DC  + V    Wattage
 ---- --------- ------------ ----------------- -------------- ---------
   1                         Not Present       -- ---------        0
   2   J9829A    IN30G4D00C  Permanent Failure  AC 120V/240V     1100
   3   J9829A    IN30G4D00D  Powered           -- ---------       1100
   4   J9829A    IN43G4G05H  Powered           AC 120V/240V      1100

   3 /  4 supply bays delivering power.
   Total power: 3300 W
```

Table 35: *Field key for output of show system power-supply detailed*

Field	Description
AC Power Consumption	Actual power consumed from AC input
AC MAIN/AUX Voltage	Actual voltage measured on AC Input: ■ Two voltages are displayed for PS#4, as the J9830A includes two AC input IEC connectors. ■ Most power-supplies contain a single AC Input IEC connector and are labeled MAIN.
Power Supplied	Actual voltage being supplied from the power-supply to the switch for general power and PoE.
Power Capacity	The maximum power that the power-supply can provide to the switch.
Inlet Temp (C/F)	The thermal sensor at the inlet of the power-supply - shown in both Celsius and Fahrenheit

Field	Description
Internal Temp (C/F)	The thermal sensor internal to the power-supply (will vary depending upon the model) - shown in both Celsius and Fahrenheit. **NOTE:** There is no "Output Temperature Sensor" on either the 5400R or 3810M switches.
Fan Speed	Shows the current fan speed in RPM and the percent of total fan speed utilization. For PSUs that contain more than one fan, a separate line will be included for each.
Currently Supplying	A summary of the total power being supplied and the total capacity (same summary as seen on the command `show system power-supply`).

Fan failures and SNMP traps

Power supply fan-fault

Power supply events indicating an internal fan-fault are reported by SNMP traps issued up to 10 seconds after the corresponding power supply fan fault occures.

For single event power supply fan faults, a corresponding SNMP trap is issued.

Single event and corresponding SNMP trap issued for a power supply fan-fault and recovery

Shown is a fan-fault (fan 1 of 2) and spontaneous recovery a few seconds after within power supply in bay number 2. The event is issued as informative (I).

```
I 11/30/16 14:01:59 02778 chassis: AM1: Internal power supply 2: Fan 1 OK.
```

Fan-tray fan-fault events

For single event fan-tray fan-faults, the corresponding SNMP traps are issued only for fans within the fan-tray.

Single event and corresponding SNMP trap issued for a fan-tray fan-fault and recovery

Shown is a fan-tray fan-fault (fan number 3) and spontaneous recovery a few seconds after. The event is issued as "Informative" (I).

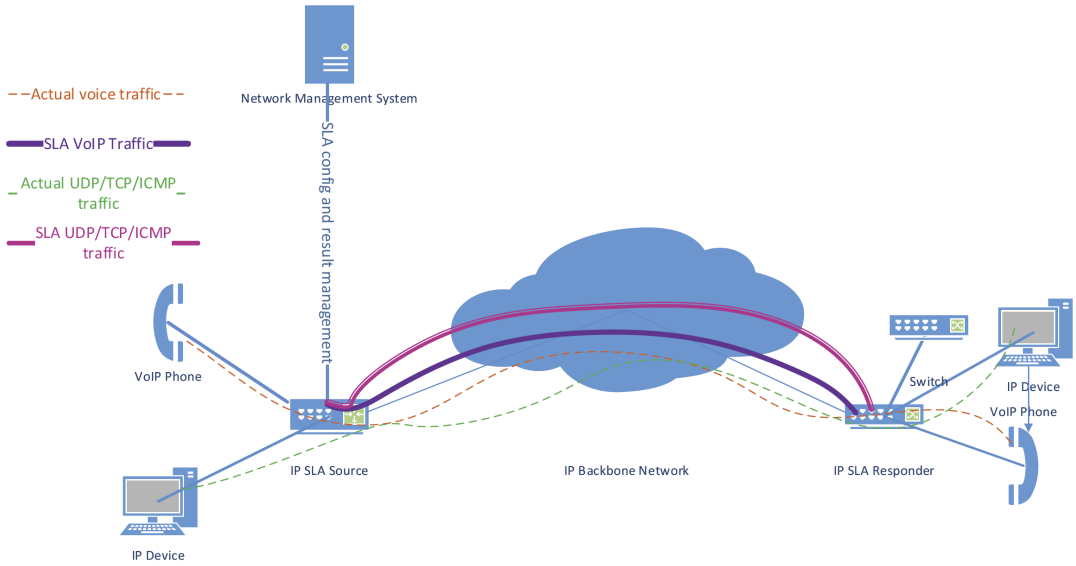
```
I 11/30/16 14:03:08 00070 chassis: AM1: Fan OK: Fan: 3  Failures: 1
```

Shown is a fan-tray fan-fault (fan number 3) failure. The event is issued as a "Warning" (w).

```
W 11/30/16 14:02:38 00070 chassis: AM1: Fan failure: Fan: 3 Failures: 1
```

Overview

IP Service Level Agreement (IP SLA) is a feature that helps administrators collect information about network performance in real time. With increasing pressure on maintaining agreed-upon Service Level Agreements on Enterprises and ISPs alike, IP SLA serves as a useful tool.



Any IP SLA test involves a source node and a destination node. For all discussions in this document, the source is always an AOS-S switch with IP SLA support. As shown in the diagram above, a destination can, in most cases, be any IP-enabled device. For some SLA types that expect a nonstandard response to a test packet, an “SLA responder” must be configured. An “SLA responder” is nothing but an AOS-S switch with IP SLA configurations on it that enable it to respond to the test packet.

The IP SLA feature provides:

- Application-aware monitoring that simulates actual protocol packets.
- Predictable measures that aid in ease of deployment and help with assessment of existing network performance.
- Accurate measures of delay and packet loss for time-sensitive applications.
- End-to-end measurements to represent actual user experience.

We support the following SLA types:

- UDP Echo, including connectivity testing of transport layer (UDP) services, Round-Trip-Time (RTT) measurement, one-way delay, and packet loss details.
- ICMP Echo, including connectivity testing, RTT measurement, and packet loss details.

- TCP Connect, including connectivity testing of transport layer (TCP) services, and handshake time measurement.
- DHCP, which measures the round-trip time taken to discover a DHCP Server and obtain a leased IP address from it.
- DNS, which measures the time taken for a DNS resolution. This measures the difference between the time taken to send a request to the DNS server and the time the IP SLA source receives a reply.
- User Datagram Protocol (UDP) Jitter, which measures RTT, one way jitter and one way delays.
- UDP Jitter for VoIP, which measures RTT, one way jitter, one way delays, ICPIF (Impairment Calculated Planning Impairment Factor) and MOS (Mean Opinion Score).

Limitations for IPSLA support on Aruba switches:

- IP SLA is not enabled for IPv6.
- DHCP SLA supports DHCPv4 only.
- IP SLA tests cannot be initiated over OOBM interfaces.
- History results for the configured IP SLAs will not be available after a switchover or a reboot.
- Maximum number of IP SLAs that can be configured varies based on the type of SLA test.
- When there are multiple IP SLAs configured with destination as hostname, the DNS resolution happens serially. There can be a delay in sending the test probe (which will be sent only after successful DNS resolution).
- For TCP Connect SLA type, the four-tuple (source IP/port, destination IP/port) must be unique.
- System clocks between the source and the responder must be synchronized with NTP if One Way Delay parameters have to be calculated for UDP Echo tests.
- Timeout for probes is 3 seconds for all SLA types and is not configurable.
- Transient spikes in RTT occur during the tests (in the source and the responder) if processor usage is high. Consider average result values over a period of time rather than point-in-time results. This is not applicable for UDP Jitter nor Jitter for VoIP.

Entity	Limit
Maximum number of SLAs enabled.	50
Maximum history bucket size per SLA.[1]	50
Number of responders that can be configured.	10

The following are operational restrictions with respect to IP SLA jitter implementation:

- Feature is supported only on v3-based platforms.
- No history results are stored.
- IPSLA Jitter and Jitter for VoIP initiator and responder is only supported on 5400R with v3 modules (noncompatibility mode), 3810, and 2930F switches.

- The maximum number of Jitter responder sessions (UDP Jitter + Jitter For VoIP) supported is 10. The maximum number of Jitter initiator sessions (UDP Jitter + Jitter For VoIP) supported is 5.
- IMC (Intelligent Management Center) supports below IP SLA:
  - DHCP
- Measurement of RTT and jitter values is in milliseconds.
- IPv6 SLA for UDP jitter and VoIP is not supported.
- UDP jitter and UDP jitter for VoIP tests are not supported over Tunnel, Trunk, and OOBM interfaces.
- UDP jitter and UDP jitter for VoIP results are not carried forward across failover or a device reboot.
- History bucket size cannot be configured for UDP jitter and VoIP tests. Results are aggregated for the last 25 probes.
- System clocks between the source and the responder must be synchronized with NTP if One Way Delay parameters have to be calculated for UDP Jitter & UDP Jitter for VoIP tests.
- The UDP jitter and UDP jitter for VoIP feature on AOS-S switch has the following limited interoperability with Comware 7 SLA v2 version:
  - One Way packet drops (SD packet loss and DS packet loss) on the Comware Jitter initiator is not reported when interoperating with Aruba Jitter Responder.
- IP SLA responder or initiator implementation is not interoperable with Cisco's IP SLA feature.

[1]Not applicable for UDP Jitter and Jitter for VoIP.

Troubleshooting approaches

Cause

Use these approaches to diagnose switch problems:

- Check the HPE website for software updates that may have solved your problem: http://www.hpe.com/networking
- Check the switch LEDs for indications of proper switch operation:
  - Each switch port has a Link LED that should light whenever an active network device is connected to the port.
  - Problems with the switch hardware and software are indicated by flashing the Fault and other switch LEDs.For a description of the LED behavior and information on using the LEDs for reference, see the installation guide shipped with the switch.
- Check the network topology/installation. For topology information, see the installation guide shipped with the switch.
- Check cables for damage, correct type, and proper connections. You should also use a cable tester to check your cables for compliance to the relevant IEEE 802.3 specification. For correct cable types and connector pin-outs, see the installation guide shipped with the switch.
- Use the Port Utilization Graph and Alert Log in the WebAgent included in the switch to help isolate problems. These tools are available through the WebAgent:
  - Port Utilization Graph
  - Alert log

- Port Status and Port Counters screens
- Diagnostic tools (Link test, Ping test, configuration file browser)

- For help in isolating problems, use the easy-to-access switch console built into the switch or Telnet to the switch console. For operating information on the Menu and CLI interfaces included in the console, see chapters 3 and 4. These tools are available through the switch console:
  - Status and Counters screens
  - Event Log
  - Diagnostics tools (Link test, Ping test, configuration file browser, and advanced user commands)

Browser or Telnet access problems

Cannot access the WebAgent

- Access may be disabled by the Web Agent Enabled parameter in the switch console. Check the setting on this parameter by selecting:

  2. Switch Configuration

  1. System Information

- The switch may not have the correct IP address, subnet mask, or gateway. Verify by connecting a console to the switch's Console port and selecting:

  2. Switch Configuration

  5. IP Configuration

If DHCP/Bootp is used to configure the switch, the IP addressing can be verified by selecting:

1. Status and Counters...

2. Switch Management Address Information

Also check the DHCP/Bootp server configuration to verify correct IP addressing.

- If you are using DHCP to acquire the IP address for the switch, the IP address "lease time" may have expired so that the IP address has changed. For more information on how to "reserve" an IP address, see the documentation for the DHCP application that you are using.
- If one or more IP-authorized managers are configured, the switch allows inbound telnet access only to a device having an authorized IP address. For more information on IP Authorized managers, see the access security guide for your switch.
- Java™ applets may not be running on the web browser. They are required for the switch WebAgent to operate correctly. Refer to the online Help on your web browser for how to run the Java applets.

Cannot Telnet into the switch console from a station on the network

- Off-subnet management stations can lose Telnet access if you enable routing without first configuring a static (default) route. That is, the switch uses the IP default gateway only while operating as a Layer 2 device. While routing is enabled on the switch, the IP default gateway is not used. You can avoid this problem by using the ip route command to configure a static (default) route before enabling routing. For

more information, see "IP Routing Features" in the multicast and routing guide for your switch.

- Telnet access may be disabled by the `Inbound Telnet Enabled` parameter in the System Information screen of the menu interface:

  2. Switch Configuration

  1. System Information

- The switch may not have the correct IP address, subnet mask, or gateway. Verify by connecting a console to the switch's Console port and selecting:

  2. Switch Configuration

  5. IP Configuration

- If you are using DHCP to acquire the IP address for the switch, the IP address "lease time" may have expired so that the IP address has changed. For more information on how to "reserve" an IP address, see the documentation for the DHCP application that you are using.
- If one or more IP-authorized managers are configured, the switch allows inbound telnet access only to a device having an authorized IP address. For more information on IP Authorized managers, see the access security guide for your switch.

Unusual network activity

Network activity that fails to meet accepted norms may indicate a hardware problem with one or more of the network components, possibly including the switch. Such problems can also be caused by a network loop or simply too much traffic for the network as it is currently designed and implemented. Unusual network activity is usually indicated by the LEDs on the front of the switch or measured with the switchconsole interface or with a network management tool. For information on using LEDs to identify unusual network activity, see the installation guide you received with the switch.

A topology loop can also cause excessive network activity. The Event Log "FFI" messages can be indicative of this type of problem.

General problems

The network runs slow; processes fail; users cannot access servers or other devices

Broadcast storms may be occurring in the network. These may be caused by redundant links between nodes.

- If you are configuring a port trunk, finish configuring the ports in the trunk before connecting the related cables. Otherwise you may inadvertently create a number of redundant links (that is, topology loops) that will cause broadcast storms.
- Turn on STP to block redundant links
- Check for FFI messages in the Event Log

Duplicate IP addresses

This is indicated by this Event Log message:

```
ip: Invalid ARP source: IP address on IP address
```

where both instances of *`IP address`* are the same address, indicating that the switch's IP address has been duplicated somewhere on the network.

Duplicate IP addresses in a DHCP network

If you use a DHCP server to assign IP addresses in your network, and you find a device with a valid IP address that does not appear to communicate properly with the server or other devices, a duplicate IP address may have been issued by the server. This can occur if a client has not released a DHCP-assigned IP address after the intended expiration time and the server "leases" the address to another device. This can also happen, For example, if the server is first configured to issue IP addresses with an unlimited duration, and then is subsequently configured to issue IP addresses that will expire after a limited duration. One solution is to configure "reservations" in the DHCP server for specific IP addresses to be assigned to devices having specific MAC addresses. For more information, see the documentation for the DHCP server.

One indication of a duplicate IP address in a DHCP network is this Event Log message:

```
ip: Invalid ARP source: <IP-address> on <IP-address>
```

where both instances of *IP-address* are the same address, indicating that the IP address has been duplicated somewhere on the network.

The switch has been configured for DHCP/Bootp operation, but has not received a DHCP or Bootp reply

When the switch is first configured for DHCP/Bootp operation, or if it is rebooted with this configuration, it immediately begins sending request packets on the network. If the switch does not receive a reply to its DHCP/Bootp requests, it continues to periodically send request packets, but with decreasing frequency. Thus, if a DHCP or Bootp server is not available or accessible to the switch when DHCP/Bootp is first configured, the switch may not immediately receive the desired configuration.

After verifying that the server has become accessible to the switch, reboot the switch to re-start the process.

802.1Q Prioritization problems

Ports configured for non-default prioritization (level 1 to 7) are not performing the specified action

If the ports were placed in a trunk group after being configured for non-default prioritization, the priority setting was automatically reset to zero (the default). Ports in a trunk group operate only at the default priority setting.

Addressing ACL problems

ACLs are properly configured and assigned to VLANs, but the switch is not using the ACLs to filter IP layer 3 packets

ACL filtering on the switches applies only to routed packets and packets having a destination IP address (DA) on the switch itself.

Also, the switch applies assigned ACLs only at the point where traffic enters or leaves the switch on a VLAN. Ensure that you have correctly applied your ACLs ("in" and/or "out") to the appropriate VLANs.

The switch does not allow management access from a device on the same VLAN

The implicit `deny any` function that the switch automatically applies as the last entry in any ACL always blocks packets having the same DA as the switch's IP address on the same VLAN. That is, bridged packets with the switch itself as the destination are blocked as a security measure.

To preempt this action, edit the ACL to include an ACE that permits access to the switch's DA on that VLAN from the management device.

Error (Invalid input) when entering an IP address

When using the "host" option in the Command syntax, ensure that you are not including a mask in either dotted decimal or CIDR format. Using the "host" option implies a specific host device and therefore does not permit any mask entry.

Correctly and incorrectly specifying a single host

```
switch(config)# access-list 6 permit host 10.28.100.100 1

switch(config)# access-list 6 permit host 10.28.100.100 255.255.255.255 2
Invalid input: 255.255.255.255

switch(config)# access-list 6 permit host 10.28.100.100/32 3
Invalid input: 10.28.100.100/32
```

[1]Correct.

[2]Incorrect. No mask needed to specify a single host.

[3]Incorrect. No mask needed to specify a single host.

Apparent failure to log all "deny" matches

Where the `log` statement is included in multiple ACEs configured with a "deny" option, a large volume of "deny" matches generating logging messages in a short period of time can impact switch performance. If it appears that the switch is not consistently logging all "deny" matches, try reducing the number of logging actions by removing the `log` statement from some ACEs configured with the "deny" action.

The switch does not allow any routed access from a specific host, group of hosts, or subnet

The implicit `deny any` function that the switch automatically applies as the last entry in any ACL may be blocking all access by devices not specifically permitted by an entry in an ACL affecting those sources. If you are using the ACL to block specific hosts, a group of hosts, or a subnet, but want to allow any access not specifically permitted, insert `permit any` as the last explicit entry in the ACL.

The switch is not performing routing functions on a VLAN

Two possible causes of this problem are:

- Routing is not enabled.
- An ACL may be blocking access to the VLAN (on a switch covered in this guide). Ensure that the switch's IP address on the VLAN is not blocked by one of the ACE entries in an ACL applied to that VLAN. A common mistake is to either not explicitly permit the switch's IP address as a DA or to use a wildcard ACL mask in a `deny` statement that happens to include the switch's IP address. For an example of this problem, see section "General ACL Operating Notes" in the "Access Control Lists (ACLs)" of the latest access security guide for your switch.

Routing through a gateway on the switch fails

Configuring a "deny" ACE that includes a gateway address can block traffic attempting to use the gateway as a next-hop.

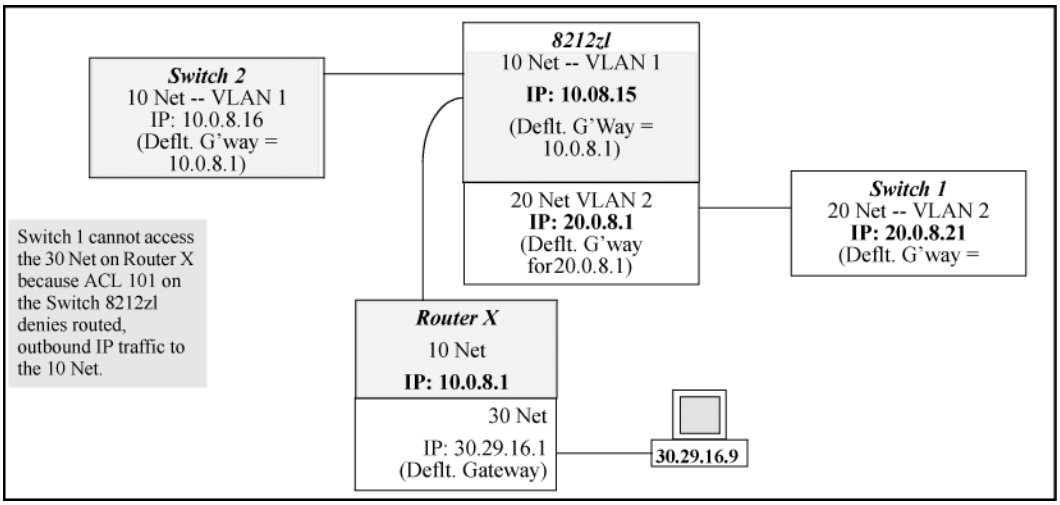
Remote gateway case

Configuring ACL "101" (example below) and applying it outbound on VLAN 1 in the figure below includes the router gateway (10.0.8.1) needed by devices on other networks. This can prevent the switch from sending ARP

and other messages to the gateway router to support traffic from authorized remote networks.

In Figure 68: Inadvertently blocking a gateway, this ACE (see data in bold below) denies access to the 10 Net's 10.0.8.1 router gateway needed by the 20 Net (Subnet mask is 255.255.255.0). See ACE blocking an entire subnet on page 426.

Figure 68 *Inadvertently blocking a gateway*



To avoid inadvertently blocking the remote gateway for authorized traffic from another network (such as the 20 Net in this example):

Procedure

1. Configure an ACE that specifically permits authorized traffic from the remote network.
2. Configure narrowly defined ACEs to block unwanted IP traffic that would otherwise use the gateway; such ACEs might deny traffic for a particular application, particular hosts, or an entire subnet.
3. Configure a "permit any" ACE to specifically allow any IP traffic to move through the gateway.

ACE blocking an entire subnet

```
switch(config)# access-list config

ip access-list extended "101"
  deny ip 0.0.0.0 255.255.255.255 10.0.8.30 0.0.0.255
  permit ip 0.0.0.0 255.255.255.255 0.0.0.00 255.255.255.255
  exit
```

Local gateway case

If you use the switch as a gateway for traffic you want routed between subnets, use these general steps to avoid blocking the gateway for authorized applications:

Procedure:

1. Configure gateway security first for routing with specific permit and deny statements.
2. Permit authorized traffic.
3. Deny any unauthorized traffic that you have not already denied in step step on page 426.

IGMP-related problems

IP multicast (IGMP) traffic that is directed by IGMP does not reach IGMP hosts or a multicast router connected to a port

IGMP must be enabled on the switch and the affected port must be configured for "Auto" or "Forward" operation.

IP multicast traffic floods out all ports; IGMP does not appear to filter traffic

The IGMP feature does not operate if the switch or VLAN does not have an IP address configured manually or obtained through DHCP/Bootp. To verify whether an IP address is configured for the switch or VLAN, do one of the following:

- **Try using the WebAgent**: If you can access the WebAgent, then an IP address is configured.
- **Try to telnet to the switch console**: If you can Telnet to the switch, an IP address is configured.
- **Use the switch console interface**: From the Main Menu, check the Management Address Information screen by clicking on:
  1. **Status and Counters**
  2. **Switch Management Address Information**

LACP-related problems

Unable to enable LACP on a port with the interface <port-number> lacp command

In this case, the switch displays the following message:
`Operation is not allowed for a trunked port.`

You cannot enable LACP on a port while it is configured as a static `Trunk` port. To enable LACP on a static-trunked port:

Procedure

1. Use the `no trunk <port-number>` command to disable the static trunk assignment.
2. Execute `interface <port-number> lacp .`

Removing a port from a trunk without first disabling the port can create a traffic loop that can slow down or halt your network. Before removing a port from a trunk, Hewlett Packard Enterprise recommends that you either disable the port or disconnect it from the LAN.

Port-based access control (802.1X)-related problems

To list the 802.1X port-access Event Log messages stored on the switch, use `show log 802`.

See also Radius-related problems.

The switch does not receive a response to RADIUS authentication requests

In this case, the switch attempts authentication using the secondary method configured for the type of access you are using (console, Telnet, or SSH).

There can be several reasons for not receiving a response to an authentication request. Do the following:

- Use `ping` to ensure that the switch has access to the configured RADIUS servers.
- Verify that the switch is using the correct encryption key (RADIUS secret key) for each server.
- Verify that the switch has the correct IP address for each RADIUS server.
- Ensure that the `radius-server timeout` period is long enough for network conditions.

The switch does not authenticate a client even though the RADIUS server is properly configured and providing a response to the authentication request

If the RADIUS server configuration for authenticating the client includes a VLAN assignment, ensure that the VLAN exists as a static VLAN on the switch. See "How 802.1X Authentication Affects VLAN Operation" in the access security guide for your switch.

During RADIUS-authenticated client sessions, access to a VLAN on the port used for the client sessions is lost

If the affected VLAN is configured as untagged on the port, it may be temporarily blocked on that port during an 802.1X session. This is because the switch has temporarily assigned another VLAN as untagged on the port to support the client access, as specified in the response from the RADIUS server. See "How 802.1X Authentication Affects VLAN Operation" in the access security guide for your switch.

The switch appears to be properly configured as a supplicant, but cannot gain access to the intended authenticator port on the switch to which it is connected

If `aaa authentication port-access` is configured for Local, ensure that you have entered the local **login** (operator-level) username and password of the authenticator switch into the `identity` and `secret` parameters of the supplicant configuration. If instead, you enter the enable (manager-level) username and password, access will be denied.

The supplicant statistics listing shows multiple ports with the same authenticator MAC address

The link to the authenticator may have been moved from one port to another without the supplicant statistics having been cleared from the first port. See "Note on Supplicant Statistics" in the chapter on Port-Based and User-Based Access Control in the access security guide for your switch.

The show port-access authenticator <port-list> command shows one or more ports remain open after they have been configured with control unauthorized

802.1X is not active on the switch. After you execute `aaa port-access authenticator active`, all ports configured with `control unauthorized` should be listed as `Closed`.

Authenticator ports remain "open" until activated

```
switch(config)# show port-access authenticator e 9
 Port Access Authenticator Status
  Port-access authenticator activated no : No
              Access Authenticator Authenticator
  Port Status Control  State Backend  State
  ---- ------ -------- -------------- --------------
  9    Open[1]   FU       Force Auth     Idle

switch(config)# show port-access authenticator active
switch(config)# show port-access authenticator e 9
 Port Access Authenticator Status
  Port-access authenticator activated no : Yes
```

```
              Access Authenticator Authenticator
  Port Status Control  State Backend  State
  ---- ------ -------- -------------- --------------
  9    Closed FU       Force Unauth   Idle
```

[1]Port A9 shows an “Open” status even though Access Control is set to Unauthorized (Force Auth). This is because the port-access authenticator has not yet been activated.

RADIUS server fails to respond to a request for service, even though the server's IP address is correctly configured in the switch

Use `show radius` to verify that the encryption key (RADIUS secret key) the switch is using is correct for the server being contacted. If the switch has only a global key configured, it either must match the server key or you must configure a server-specific key. If the switch already has a server-specific key assigned to the server's IP address, it overrides the global key and must match the server key.

Displaying encryption keys

```
switch(config)# show radius
 Status and Counters - General RADIUS Information
  Deadtime(min) : 0
  Timeout(secs) : 5
  Retransmit Attempts : 3
  Global Encryption Key : My-Global-Key
  Dynamic Authorization UDP Port : 3799

                  Auth Acct DM/ Time
  Server IP Addr  Port Port CoA Window Encryption Key
  --------------- ---- ---- --- ------ ---------------
  10.33.18.119    1812 1813           119-only-key
```

Also, ensure that the switch port used to access the RADIUS server is not blocked by an 802.1X configuration on that port. For example, `show port-access authenticator <port-list>` gives you the status for the specified ports. Also, ensure that other factors, such as port security or any 802.1X configuration on the RADIUS server are not blocking the link.

The authorized MAC address on a port that is configured for both 802.1X and port security either changes or is re-acquired after execution of aaa port-access authenticator <port-list> initialize

If the port is force-authorized with `aaa port-access authenticator <port-list> control authorized` command and port security is enabled on the port, then executing `initialize` causes the port to clear the learned address and learn a new address from the first packet it receives after you execute `initialize`.

A trunked port configured for 802.1X is blocked

If you are using RADIUS authentication and the RADIUS server specifies a VLAN for the port, the switch allows authentication, but blocks the port. To eliminate this problem, either remove the port from the trunk or reconfigure the RADIUS server to avoid specifying a VLAN.

QoS-related problems

Loss of communication when using VLAN-tagged traffic

If you cannot communicate with a device in a tagged VLAN environment, ensure that the device either supports VLAN tagged traffic or is connected to a VLAN port that is configured as `Untagged`.

Radius-related problems

The switch does not receive a response to RADIUS authentication requests

In this case, the switch attempts authentication using the secondary method configured for the type of access you are using (console, Telnet, or SSH).

There can be several reasons for not receiving a response to an authentication request. Do the following:

- Use `ping` to ensure that the switch has access to the configured RADIUS server.
- Verify that the switch is using the correct encryption key for the designated server.
- Verify that the switch has the correct IP address for the RADIUS server.
- Ensure that the `radius-server timeout` period is long enough for network conditions.
- Verify that the switch is using the same UDP port number as the server.

Because of an inconsistency between the Windows XP 802.1x supplicant timeout value and the switch default timeout value, which is 5, when adding a backup RADIUS server, set the switch radius-server timeout value to 4. Otherwise, the switch may not failover properly to the backup RADIUS server.

RADIUS server fails to respond to a request for service, even though the server's IP address is correctly configured in the switch

Use `show radius` to verify that the encryption key (RADIUS secret key) the switch is using is correct for the server being contacted. If the switch has only a global key configured, it either must match the server key or you must configure a server-specific key. If the switch already has a server-specific key assigned to the server's IP address, it overrides the global key and must match the server key.

Displaying encryption keys

```
switch(config)# show radius
 Status and Counters - General RADIUS Information
  Deadtime(min) : 0
  Timeout(secs) : 5
  Retransmit Attempts : 3
  Global Encryption Key : My-Global-Key
  Dynamic Authorization UDP Port : 3799

                  Auth Acct DM/ Time
  Server IP Addr  Port Port CoA Window Encryption Key
  --------------- ---- ---- --- ------ ---------------
  10.33.18.119    1812 1813           119-only-key
```

Also, ensure that the switch port used to access the RADIUS server is not blocked by an 802.1X configuration on that port. For example, `show port-access authenticator <port-list>` gives you the status for the specified ports. Also, ensure that other factors, such as port security or any 802.1X configuration on the RADIUS server are not blocking the link.

MSTP and fast-uplink problems

If you enable MSTP, Hewlett Packard Enterprise recommends that you leave the remainder of the MSTP parameter settings at their default values until you have had an opportunity to evaluate MSTP performance in your network. Because incorrect MSTP settings can adversely affect network performance, you should avoid making changes without having a strong understanding of how MSTP operates. To learn the details of MSTP operation, see the IEEE802.1s standard.

Broadcast storms appearing in the network

This can occur when there are physical loops (redundant links) in the topology. Where this exists, you should enable MSTP on all bridging devices in the topology to detect the loop.

STP blocks a link in a VLAN even though there are no redundant links in that VLAN

In 802.1Q-compliant switches, MSTP blocks redundant physical links even if they are in separate VLANs. A solution is to use only one, multiple-VLAN (tagged) link between the devices. Also, if ports are available, you can improve the bandwidth in this situation by using a port trunk. See "Spanning Tree Operation with VLANs" in "Static Virtual LANs (VLANs)" in the advanced traffic management guide for your switch.

Fast-uplink troubleshooting

Some of the problems that can result from incorrect use of fast-uplink MSTP include temporary loops and generation of duplicate packets.

Problem sources can include:

- Fast-uplink is configured on a switch that is the MSTP root device.
- Either the `Hello Time` or the `Max Age` setting (or both) is too long on one or more switches. Return the `Hello Time` and `Max Age` settings to their default values (2 seconds and 20 seconds, respectively, on a switch).
- A "downlink" port is connected to a switch that is further away (in hop count) from the root device than the switch port on which fast-uplink MSTP is configured.
- Two edge switches are directly linked to each other with a fast-uplink (Mode = `Uplink`) connection.
- Fast uplink is configured on both ends of a link.
- A switch serving as a backup MSTP root switch has ports configured for fast-uplink MSTP and has become the root device because of a failure in the original root device.

SSH-related problems

Switch access refused to a client

Even though you have placed the client's public key in a text file and copied the file (using the `copy tftp pub-key-file` command) into the switch, the switch refuses to allow the client to have access. If the source SSH client is an SSHv2 application, the public key may be in the PEM format, which the switch (SSHv1) does not interpret. Check the SSH client application for a utility that can convert the PEM-formatted key into an ASCII-formatted key.

Executing IP SSH does not enable SSH on the switch

The switch does not have a host key. Verify by executing `show ip host-public-key`. If you see the message `ssh cannot be enabled until a host key is configured (use 'crypto' command)`. you need to generate an SSH key pair for the switch. To do so, execute `crypto key generate` (see "Generating the switch's public and private key pair" in the SSH chapter of the access security guide for your switch.)

Switch does not detect a client's public key that does appear in the switch's public key file (show ip client-public-key)

The client's public key entry in the public key file may be preceded by another entry that does not terminate with a new line (CR). In this case, the switch interprets the next sequential key entry as simply a comment attached to the preceding key entry. Where a public key file has more than one entry, ensure that all entries terminate with a new line (CR). While this is optional for the last entry in the file, not adding a new line to the last entry creates an error potential if you either add another key to the file at a later time or change the order of the keys in the file.

An attempt to copy a client public-key file into the switch has failed and the switch lists one of the following messages

```
Download failed: overlength key in key file.
Download failed: too many keys in key file.
Download failed: one or more keys is not a valid RSA public key.
```

The public key file you are trying to download has one of the following problems:

- A key in the file is too long. The maximum key length is 1024 characters, including spaces. This could also mean that two or more keys are merged together instead of being separated by a <CR> <LF>.
- There are more than ten public keys in the key file.
- One or more keys in the file is corrupted or is not a valid rsa public key.

Client ceases to respond ("hangs") during connection phase

The switch does not support data compression in an SSH session. Clients often have compression turned on by default, but then disable it during the negotiation phase. A client that does not recognize the compression-request FAILURE response may fail when attempting to connect. Ensure that compression is turned **off** before attempting a connection to prevent this problem.

TACACS-related problems

All users are locked out of access to the switch

If the switch is functioning properly, but no username/password pairs result in console or Telnet access to the switch, the problem may be caused by how the TACACS+ server and/or the switch are configured. Use one of the following methods to recover:

- Access the TACACS+ server application and adjust or remove the configuration parameters controlling access to the switch.
- If the above method does not work, try eliminating configuration changes in the switch that have not been saved to flash (boot-up configuration) by causing the switch to reboot from the boot-up configuration (which includes only the configuration changes made prior to the last `write memory` command.) If you did not use `write memory` to save the authentication configuration to flash, pressing the `Reset` button reboots the switch with the boot-up configuration.

- Disconnect the switch from network access to any TACACS+ servers and then log in to the switch using either Telnet or direct console port access. Because the switch cannot access a TACACS+ server, it defaults to local authentication. You can then use the switch's local Operator or Manager username/password pair to log on.
- As a last resort, use the `Clear`/`Reset` button combination to reset the switch to its factory default boot-up configuration. Taking this step means you will have to reconfigure the switch to return it to operation in your network.

No communication between the switch and the TACACS+ server application

If the switch can access the server device (that is, it can `ping` the server), a configuration error may be the problem. Some possibilities include:

- The server IP address configured with the switch's `tacacs-serverhost` command may not be correct. (Use the switch's `show tacacs-server` command to list the TACACS+ server IP address.)
- The encryption key configured in the server does not match the encryption key configured in the switch (by using the `tacacs-server key` command). Verify the key in the server and compare it to the key configured in the switch. (Use `show tacacs-server` to list the global key. Use `show config` or `show config running` to list any server-specific keys.)
- The accessible TACACS+ servers are not configured to provide service to the switch.

Access is denied even though the username/password pair is correct

Some reasons for denial include the following parameters controlled by your TACACS+ server application:

- The account has expired.
- The access attempt is through a port that is not allowed for the account.
- The time quota for the account has been exhausted.
- The time credit for the account has expired.
- The access attempt is outside of the time frame allowed for the account.
- The allowed number of concurrent logins for the account has been exceeded.

For more help, see the documentation provided with your TACACS+ server application.

Unknown users allowed to login to the switch

Your TACACS+ application may be configured to allow access to unknown users by assigning them the privileges included in a *default user* profile. See the documentation provided with your TACACS+ server application.

System allows fewer login attempts than specified in the switch configuration

Your TACACS+ server application may be configured to allow fewer login attempts than you have configured in the switch with the `aaa authentication num-attempts` command.

TimeP, SNTP, or Gateway problems

The switch cannot find the time server or the configured gateway

TimeP, SNTP, and Gateway access are through the primary VLAN, which in the default configuration is the DEFAULT_VLAN. If the primary VLAN has been moved to another VLAN, it may be disabled or does not have

ports assigned to it.

VLAN-related problems

Monitor port

When using the monitor port in a multiple-VLAN environment, the switch handles broadcast, multicast, and unicast traffic output from the monitor port as follows:

- If the monitor port is configured for tagged VLAN operation on the same VLAN as the traffic from monitored ports, the traffic output from the monitor port carries the same VLAN tag.
- If the monitor port is configured for untagged VLAN operation on the same VLAN as the traffic from the monitored ports, the traffic output from the monitor port is untagged.
- If the monitor port is not a member of the same VLAN as the traffic from the monitored ports, traffic from the monitored ports does not go out the monitor port.

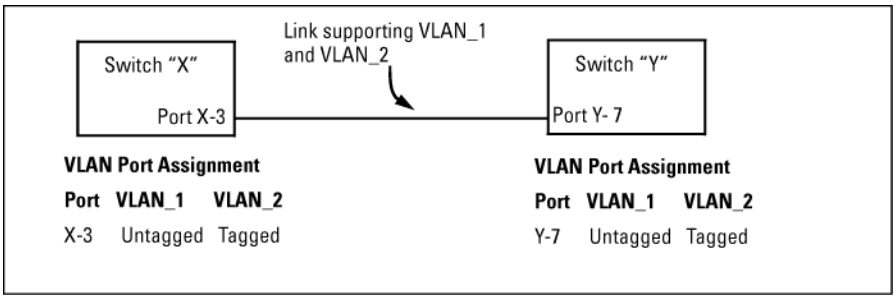
None of the devices assigned to one or more VLANs on an 802.1Q-compliant switch are being recognized

If multiple VLANs are being used on ports connecting 802.1Q-compliant devices, inconsistent VLAN IDs may have been assigned to one or more VLANs. For a given VLAN, the same VLAN ID must be used on all connected 802.1Q-compliant devices.

Link configured for multiple VLANs does not support traffic for one or more VLANs

One or more VLANs may not be properly configured as "Tagged" or "Untagged." A VLAN assigned to a port connecting two 802.1Q-compliant devices must be configured the same on both ports. For example, VLAN_1 and VLAN_2 use the same link between switch "X" and switch "Y," as shown in Figure 69: Example: correct VLAN port assignments on a link.

Figure 69 *Example: correct VLAN port assignments on a link*



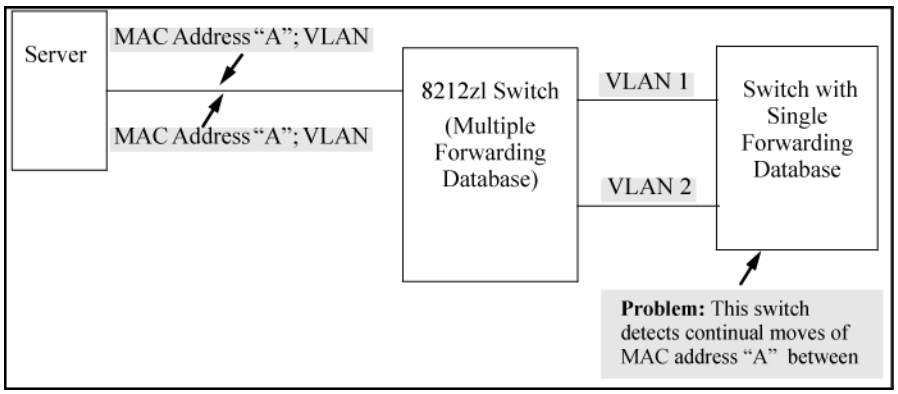
- If VLAN_1 (VID=1) is configured as "Untagged" on port 3 on switch "X," it must also be configured as "Untagged" on port 7 on switch "Y." Make sure that the VLAN ID (VID) is the same on both switches.
- Similarly, if VLAN_2 (VID=2) is configured as "Tagged" on the link port on switch "A," it must also be configured as "Tagged" on the link port on switch "B." Make sure that the VLAN ID (VID) is the same on both switches.

Duplicate MAC addresses across VLANs

The switches operate with multiple forwarding databases. Thus, duplicate MAC addresses occurring on different VLANs can appear where a device having one MAC address is a member of more than one 802.1Q VLAN, and the switch port to which the device is linked is using VLANs (instead of MSTP or trunking) to establish redundant links to another switch. If the other device sends traffic over multiple VLANs, its MAC address consistently appears in multiple VLANs on the switch port to which it is linked.

Be aware that attempting to create redundant paths through the use of VLANs causes problems with some switches. One symptom is that a duplicate MAC address appears in the Port Address Table of one port and then later appears on another port. While the switches have multiple forwarding databases and thus do not have this problem, some switches with a single forwarding database for all VLANs may produce the impression that a connected device is moving among ports because packets with the same MAC address but different VLANs are received on different ports. You can avoid this problem by creating redundant paths using port trunks or spanning tree.

Figure 70 *Example: duplicate MAC address*



Disabled overlapping subnet configuration

Previous software versions allowed configuration of VLAN IP addresses in overlapping subnets which can cause incorrect routing of packets and result in IP communication failure. As of software version WB.15.09, overlapping subnet configurations are no longer allowed. An overlapping subnet is determined by the configuration order. The subnet that is configured first is valid, but any subsequent IP addresses that overlap are not allowed.

When the switch is booted into software version WB.15.09 or later, and the configuration file includes overlapping subnets, the following occurs:

- The event log provides an error message in the format:
  `ip: VLANx : IP initialization failed for vlan x.`

  For a multinetted VLAN (multiple IP addresses assigned to the VLAN), only the IP addresses that are overlapping subnets are removed. The other IP addresses on the VLAN are retained and function correctly. The error message can be somewhat misleading; the IP addresses on the VLAN that are not overlapping are initialized correctly.
- The output of the `show ip` command correctly indicates that the overlapping IP address does not exist on the VLANs that have error messages in the event log.
- The output of the `show running-config` command incorrectly indicates that the overlapping IP address is configured. In An IP address that is not actually configured on the VLAN on page 435, the IP address shown in VLAN6 is not actually configured on the VLAN; it has been removed.

An IP address that is not actually configured on the VLAN

```
switch(config)# show running-config

.
.
.
  vlan 5
```

```
    name "VLAN5"
    ip address 11.22.33.1 255.0.0.0
    exit
  vlan 6
    name "VLAN6"
    ip address 11.23.34.1 255.255.255.0
    exit
```

The information is retained in the config file to allow you to boot up the switch and have it function as it did when it was configured with earlier software that allows overlapping subnets.If you attempt to remove the overlapping subnet from the VLAN, the switch displays an error message similar to:

```
The IP address <ip-address> is not configured on this VLAN
```

This occurs because the overlapping IP address has been removed and is not visible to the switch. To resolve this:

- Enter the `show ip` command to determine which addresses are visible to the switch.
- Remove the erroneous IP addresses from the config file by entering the `no ip address` command to remove all the IP addresses from the specific VLAN. Be sure to document the other valid IP addresses on that VLAN so they can be restored after removing the erroneous IP addresses from the config file.

If you go back to a software version prior to WB.15.09 before removing the overlapping IP address, the prior software version enables the overlapping IP subnet.

Fan failure

Whenever a fan failure occurs, the Fan/Fault LEDs blink amber and a log entry is recorded. During a fan failure, all operational fans are automatically set to the maximum operating speed until the fan failure has been resolved. At that time, the fan speed is reset to the minimum operating speed.

Mitigating flapping transceivers

In traditional switches, the state of a link is driven directly by the reported state of the port, which is required for rapid detection of link faults. However, the consequence of this is that a marginal transceiver, optical, or wire cabling, one that "flaps" up and down several times per second, can cause STP and other protocols to react poorly, resulting in a network outage. The link-flap option expands the functionality of the existing fault finder function to include a "link-flap" event and a new action of "warn-and-disable." Together, these additions allow the errant condition to be detected, and the port in question can be optionally disabled.

Syntax

```
fault-finder <link-flap> sensitivity {<low | medium | high} > action {<warn | warn-and-disable>}
```

Default settings: Sensitivity = Medium; Action = Warn

Sensitivity thresholds are static. In a 10-second window, if more than the threshold number of link state transitions (up or down) are detected, the event is triggered. The 10-second window is statically determined, that is, the counters are reset every 10 seconds, as opposed to being a sliding window. The counters are polled twice per second (every 500 milliseconds), and the event is triggered if the sensitivity threshold is crossed at that time.

The sensitivity thresholds are:

High	3 transitions in 10 seconds

Medium	6 transitions in 10 seconds
Low	10 transitions in 10 seconds

Configuring the link-flap event and corresponding action applies to all ports and port types (it is a global setting per FFI event type). Note that normal link transition protocols may prevent link state changes from occurring fast enough to trigger the event for some port types, configurations, and sensitivity settings.

When the link-flap threshold is met for a port configured for `warn` (For example, `fault-finder link-flapsensitivity medium action warn`), the following message is seen in the switch event log.

```
02672 FFI: port <number>-Excessive link state transitions
```

When the link-flap threshold is met for a port configured for warn-and-disable (For example, `fault-finder linkflap sensitivity medium action warn-and-disable`), the following messages are seen in the switch event log.

```
02672 FFI: port <number>-Excessive link state transitions
02673 FFI: port <number>-Port disabled by Fault-finder.
02674 FFI: port <number>-Administrator action required to re-enable.
```

The warn-and-disable action is available for all fault-finder events on an individual basis. It may be used, For example, to disable a port when excessive broadcasts are received. Because the fault-generated disabling of a port requires operator intervention to re-enable the port, such configuration should be used with care. For example, link-flap-initiated disablement is not desired on ports that are at the client edge of the network, because link state changes there are frequent and expected.

Hewlett Packard Enterprise does not recommend automatic disabling of a port at the core or distribution layers when excessive broadcasts are detected, because of the potential to disable large parts of the network that may be uninvolved and for the opportunity to create a denial-of-service attack.

Fault-finder link-flap

Syntax

In the config context:

```
no fault-finder link-flap [ethernet] PORT-LIST action warn | warn-and-disable SECONDS
sensitivity low | medium | high
```

Description

Configures the link-flap on a port. The default value is `warn`.

Parameter

link-flap

Configure link-flap control.

warn

Log the event only.

warn-and-disable

Log the event and disable the port.

seconds

Re-enable the port after waiting for the specified number of seconds. The default value is 0, which indicates that the port will not be automatically enabled.

sensitivity

Indicate the sensitivity of the link-flap control threshold within a 10-second interval.

- Low indicates 10 link-flaps.
- Medium indicates 6 link-flaps.
- High indicates 3 link-flaps.

action

Configure the action taken when a fault is detected.

ethernet *PORT-LIST*

Enable link-flap control on a list of ports.

warn

Warn about faults found.

warn-and-disable

Warn and disable faulty component.

seconds

Configure the number of seconds for which the port remains disabled. A value of 0 means that the port will remain disabled until manually re-enabled.

sensitivity

Configure the fault sensitivity level.

low

Low sensitivity.

medium

Medium sensitivity.

high

High sensitivity.

Subcommand Syntax

```
no fault-finder link-flap ethernet PORT-LIST
```

Description

To remove the current configuration of link-flap on a port.

Usage

Enable a link Fault-Finder check and set parameters for it. These commands may be repeated to enable additional checks. The default sensitivity is medium and the default action is warn.

```
no fault-finder all | fault sensitivity low | medium | high action warn | warn-and-
disable
no fault-finder link-flap sensitivity low | medium | high action warn | warn-and-
disable
no fault-finder link-flap PORT-LIST action warn | warn-and-disable SECONDS sensitivity
low | medium | high
```

Configure ports for link-flap detection with high sensitivity

Configure ports A1 to A5 for link-flap detection with sensitivity of high (3 flaps over 10s) and to log and disable port for 65535s if the link-flap threshold is exceeded.

```
switch(config)# fault-finder link-flap ethernet A1-A5 action warn-and-disable 65535
sensitivity high
```

Configure ports for link-flap detection with medium sensitivity

Configure ports A8 for link-flap detection with sensitivity of medium (6 flaps over 10s) and to log and disable port if the link-flap threshold is exceeded. User will need to re-enable the port if disabled.

```
switch(config)# fault-finder link-flap ethernet A8 action warn-and-disable 0
sensitivity medium
```

Configure ports for link-flap detection with low sensitivity

Configure ports A22 for link-flap detection with sensitivity of low (10 flaps over 10s) and to log if the link-flap threshold is exceeded

```
switch(config)# fault-finder link-flap ethernet A22 action warn sensitivity low
```

Disable link-flap detection

Disable link-flap detection for port A5

```
switch(config)# no fault-finder link-flap ethernet A5
```

Show fault-finder link-flap

Syntax

`show fault-finder link-flap ethernet` *`PORT-LIST`*

Description

Display the link-flap control configuration.

Show fault-finder link-flap

```
switch# show fault-finder link-flap A1

         Link   | Port                                  Disable    Disable Time
  Port   Flap   | Status Sensitivity Action              Timer      Left
  ------ ------ + ------ ----------- ------------------ ---------- ------------
  A1     Yes      Down      Low         warn-and-disable 65535      45303

switch# show fault-finder link-flap
         Link   | Port                                    Disable    Disable Time
  Port   Flap   | Status Sensitivity Action                Timer      Left
  ------ ------ + ------ ----------- -------------------- ---------- ------------
  A1     Yes      Down      Low         warn-and-disable   65535      45303
  A5     No       Up        None        None                 -          -
  A22    Yes      Down      Low         warn-and-disable     -          -
  A23    Yes      Down      High        warn-and-disable   100          -
```

This example displays only the list of ports configured via the above per-port config commands, does not include the global configuration ports.

Restrictions

- Per port configuration for options - link-flap only. Global settings for other options.
- No support for menu interface.

- No support for Web UI.
- No support for trunks.

Viewing transceiver information

This features provides the ability to view diagnostic monitoring information for transceivers with Diagnostic Optical Monitoring (DOM) support. The following table indicates the support level for specific transceivers:

Product #	Description	Support[1]
J8436A	10GbE X2-SC SR Optic	V
J8437A	10GbE X2-SC LR Optic	V
J8440B	10GbE X2-CX4 Xcver	NA
J8440C	10GbE X2-CX4 Xcver	NA
J4858A	Gigabit-SX-LC Mini-GBIC	V
J4858B	Gigabit-SX-LC Mini-GBIC	V
J4858C	Gigabit-SX-LC Mini-GBIC	V (some)
J9054B	100-FX SFP-LC Transceiver	N
J8177C	Gigabit 1000Base-T Mini-GBIC	NA
J9150A	10GbE SFP+ SR Transceiver	D
J9151A	10GbE SFP+ LR Transceiver	D
J9152A	10GbE SFP+ LRM Transceiver	D
J9153A	10GbE SFP+ ER Transceiver	D
J9144A	10GbE X2-SC LRM Transceiver	D
J8438A	10Gbe X2-SC ER Transceiver	D
JH233A	40G QSFP+ MPO eSR4 Transceiver	V
JH232A	40G QSFP+ LC LR4 SM Transceiver	V
JL308A	40G QSFP+BIDI	V
JH231A	40G QSFP+ MPO SR4 Transceiver	V

Not all transceivers support Digital Optical Monitoring. If DOM appears in the Diagnostic Support field of the `show interfaces transceiver detail` command, or the hpicfTransceiverMIB hpicfXcvrDiagnostics MIB object, DOM is supported for that transceiver.

[1]Support indicators:

- V - Validated to respond to DOM requests
- N - No support of DOM
- D - Documented by the component suppliers as supporting DOM
- NA - Not applicable to the transceiver (copper transceiver)

Viewing information about transceivers (CLI)

Syntax

`show interfaces transceiver [port-list] [detail]`

Displays information about the transceivers. If a port is specified, displays information for the transceiver in that port.

[detail]	Displays detailed transceiver information.

MIB support

The hpicfTransceiver MIB is available for displaying transceiver information.

Viewing transceiver information

The transceiver information displayed depends on the `show` command executed.

The output for `show interfaces transceiver[port-list]` is shown below. You can specify multiple ports, separated by commas, and the information for each transceiver will display.

Output for a specified transceiver

```
switch(config)# show interfaces transceiver 21

Transceiver Technical information:

                     Product      Serial             Part
 Port    Type        Number       Number             Number
 ------- ----------- ------------ ------------------ ----------
 21      1000SX      J4858C       MY050VM9WB         1990-3657
```

If there is no transceiver in the port specified in the command, the output displays as shown below.

Output when no transceiver is present in specified interface

```
switch(config)# show interfaces transceiver 22

 No Transceiver found on interface 22
```

When no ports are specified, information for all transceivers found is displayed.

Output when no ports are specified

```
switch(config)# show interfaces transceiver

 Transceiver Technical information:

                      Product      Serial             Part
  Port    Type        Number       Number             Number
  ------- ----------- ------------ ------------------ ----------
```

```
  21      1000SX      J4858C       MY050VM9WB         1990-3657
  22      1000SX      J4858B       P834DIP2
```

You can specify `all` for `port-list` as shown below.

Output when “all” is specified

```
switch(config)# show interfaces transceiver all

 No Transceiver found on interface 1

 No Transceiver found on interface 2
.
.
.
 No Transceiver found on interface 24

 Transceiver Technical information:

                      Product      Serial              Part
  Port    Type        Number       Number              Number
  ------- ----------- ------------ ------------------- ----------
  21      1000SX      J4858C       MY050VM9WB          1990-3657
  22      1000SX      J4858B       P834DIP2
```

Information displayed with the detail parameter

When the `show interfaces transceiver [port-list] detail` command is executed, the following information displays.

Table 36: *General transceiver information*

Parameter	Description
Interface Index	The switch interface number
Transceiver-type	Pluggable transceiver type
Transceiver model	Pluggable transceiver model
Connector-type	Type of connector of the transceiver
Wavelength	For an optical transceiver: the central wavelength of the laser sent, in nm. If the transceiver supports multiple wavelengths, the values will be separated by a comma.
Transfer Distance	Link-length supported by the transceiver in meters. The corresponding transfer medium is shown in brackets following the transfer distance value, For example, 50um multimode fiber. If the transceiver supports multiple transfer media, the values are separated by a comma.
Diagnostic Support	Shows whether the transceiver supports diagnostics: **None** Supported **DOM** Supported **VCT** Supported

Parameter	Description
Serial Number	Serial number of the transceiver

The information in the next three tables is only displayed when the transceiver supports DOM.

Table 37: *DOM information*

Parameter	Description
Temperature	Transceiver temperature (in degrees Centigrade)
Voltage	Supply voltage in transceiver (Volts)
Bias	Laser bias current (mA)
RX power	Rx power (mW and dBm))
TX power	Tx power (mW and dBm)

The alarm information for GBIC/SFP transceivers is shown in this table.

Table 38: *Alarm and error information (GBIC/SFP transceivers only)*

Alarm	Description
RX loss of signal	Incoming (RX) signal is lost
RX power high	Incoming (RX) power level is high
RX power low	Incoming (RX) power level is low
TX fault	Transmit (TX) fault
TX bias high	TX bias current is high
TX bias low	TX bias current is low
TX power high	TX power is high
TX power low	TX power is low
Temp high	Temperature is high
Temp low	Temperature is low
Voltage High	Voltage is high
Voltage Low	Voltage is low

The alarm information for XENPAK transceivers is shown in this table.

Table 39: *Alarm and error information (XENPAK transceivers)*

Alarm	Description
WIS local fault	WAN Interface Sublayer local fault
Receive optical power fault	Receive optical power fault
PMA/PMD receiver local fault	Physical Medium Attachment/Physical Medium Dependent receiver local fault
PCS receiver local fault	Physical Coding Sublayer receiver local fault
PHY XS receive local fault	PHY Extended Sublayer receive local fault
RX power high	RX power is high
RX power low	RX power is low
Laser bias current fault	Laser bias current fault
Laser temperature fault	Laser temperature fault
Laser output power fault	Laser output power fault
TX fault	TX fault
PMA/PMD transmitter local fault	PMA/PMD transmitter local fault
PCS Transmit local fault	PCS transmit local fault
PHY XS transmit local fault	PHY SX transmit local fault
TX bias high	TX bias current is high
TX bias low	TX bias current is low
TX power high	TX power is high
TX power low	TX power is low
Temp high	Temperature is high
Temp low	Temperature is low

Detailed information for a 1000SX Mini-GBIC transceiver

An example of the output for the `show interfaces transceiver [port-list] detail` for a 1000SX transceiver is shown below.

```
switch(config)# show interfaces transceiver 21 detail

 Transceiver in 21
  Interface index    : 21
  Type               : 1000SX
  Model              : J4858C
  Connector type     : LC
```

```
 Wavelength          : 850nm
 Transfer distance   : 300m (50um), 150m (62.5um),
 Diagnostic support  : DOM
 Serial number       : MY050VM9WB

Status
 Temperature : 50.111C
 Voltage     : 3.1234V
 TX Bias     : 6mA
 TX Power    : 0.2650mW, -5.768dBm
 RX Power    : 0.3892mW, -4.098dBm

Time stamp   :  Mon Mar 7 14:22:13 2011
```

Detailed information for a 10GbE-LR transceiver

An example of the output for a 10GbE-LR transceiver is shown below.

```
switch(config)# show interfaces transceiver 23 detail

 Transceiver in 23
  Interface Index   : 24
  Type              : 10GbE-LR
  Model             : J8437A
  Connector type    : SC
  Wavelength        : Channel #0: 1310nm, #1:0nm, #2:0nm, #3:0nm
  Transfer distance : 10000m (SM)
  Diagnostic support: DOM
  Serial number     : ED456SS987

 Status
  Temperature : 32.754C
  TX Bias     : 42.700mA
  TX Power    : 0.5192mW, -2.847dBm
  RX Power    : 0.0040mW, -23.979dBm

 Recent Alarms:

  Rx power low alarm
  Rx power low warning

 Recent errors:
  Receive optical power fault
  PMA/PMD receiver local fault
  PMA/PMD transmitter local fault
  PCS receive local fault
  PHY XS transmit local fault

 Time stamp : Mon Mar 7 16:26:06 2013
```

Viewing transceiver information for copper transceivers with VCT support

This feature provides the ability to view diagnostic monitoring information for copper transceivers with Virtual Cable Test (VCT) support. The cable quality of the copper cables connected between transceivers can be ascertained using the transceiver cable diagnostics. Results of the diagnostics are displayed with the appropriate CLI show commands and with SNMP using the hpicfTransceiver MIB.

The J8177C 1000Base-T Mini-GBIC is supported.

Testing the Cable

Enter the `test cable-diagnostics` command in any context to begin cable diagnostics for the transceiver. The diagnostic attempts to identify cable faults. The tests may take a few seconds to complete for each interface. There is the potential of link loss during the diagnostic.

Syntax

`test cable-diagnostics [port-list]`

Invokes cable diagnostics and displays the results.

Output from test cable-diagnostics command

```
Switch # test cable-diagnostics a23-a24

 The 'test cable-diagnostics' command will cause a loss of link and will take a few
seconds per
 interface to complete.

 Continue (Y/N)? y


MDI  Cable     Distance  Pair  Pair      MDI
 Port  Pair  Status     to Fault  Skew  Polarity  Mode
 ----- ----- ---------- --------- ----- --------- ------
 A23   1-2   OK         0 m       6 ns  Normal    MDIX
       3-6   OK         0 m       0 ns  Normal
       4-5   OK         0 m       6 ns  Normal    MDIX
       7-8   OK         0 m       6 ns  Normal
 A24   1-2   Short      2 m
       3-6   Impedance  3 m
       4-5   Impedance  3 m
       7-8   Open       1 m
```

Copper cable diagnostic test results

```
switch# show interfaces transceiver a23 detail

 Transceiver in A23
  Interface Index   : 23
  Type              : 1000T-sfp
  Model             : J8177C
  Connector Type    : RJ45
  Wavelength        : n/a
  Transfer Distance : 100m (copper),
  Diagnostic Support : VCT
  Serial Number     : US051HF099

  Link Status       : Up
  Speed             : 1000
  Duplex            : Full

       MDI   Cable      Distance  Pair  Pair      MDI
 Port  Pair  Status     to Fault  Skew  Polarity  Mode
 ----- ----- ---------- --------- ----- --------- -----
 A23   1-2   OK         0 m       6 ns  Normal    MDIX
       3-6   OK         0 m       0 ns  Normal
       4-5   OK         0 m       6 ns  Normal    MDIX
       7-8   OK         0 m       6 ns  Normal

   Test Last Run   : Fri Apr 22 20:33:23 2011
```

Table 40: *General transceiver information*

Parameter	Description
Interface Index	The switch interface number
Transceiver-type	Pluggable transceiver type
Transceiver model	Pluggable transceiver model
Connector-type	Type of connector of the transceiver
Wavelength	For an optical transceiver: the central wavelength of the laser sent, in nm. If the transceiver supports multiple wavelengths, the values will be separated by a comma. An electrical transceiver value is displayed as N/A.
Transfer Distance	Link-length supported by the transceiver in meters. The corresponding transfer medium is shown in brackets following the transfer distance value, For example, 50um multimode fiber. If the transceiver supports multiple transfer media, the values are separated by a comma.
Diagnostic Support	Shows whether the transceiver supports diagnostics: **None** Supported **DOM** Supported **VCT** Supported
Serial Number	Serial number of the transceiver
Link Status	Link up or down
Speed	Speed of transceiver in Mbps
Duplex	Type of duplexing
Cable Status	Values are OK, Open, Short, or Impedance
Distance to Fault	The distance in meters to a cable fault (accuracy is +/- 2 meters); displays 0 (zero) if there is no fault
Pair Skew	Difference in propagation between the fastest and slowest wire pairs
Pair Polarity	Signals on a wire pair are polarized, with one wire carrying the positive signal and one carrying the negative signal.
MDI Mode	The MDI crossover status of the two wire pairs (1&2, 3&6, 4&5, 7&8), will be either MDI or MDIX

Viewing transceiver information

The transceiver information displayed depends on the `show` command executed.

The output for `show interfaces transceiver[port-list]` is shown below. You can specify multiple ports, separated by commas, and the information for each transceiver will display.

Output for a specified transceiver

```
switch(config)# show interfaces transceiver 21

Transceiver Technical information:

                     Product      Serial             Part
 Port    Type        Number       Number             Number
 ------- ----------- ------------ ------------------ ----------
 21      1000SX      J4858C       MY050VM9WB         1990-3657
```

If there is no transceiver in the port specified in the command, the output displays as shown below.

Output when no transceiver is present in specified interface

```
switch(config)# show interfaces transceiver 22

 No Transceiver found on interface 22
```

When no ports are specified, information for all transceivers found is displayed.

Output when no ports are specified

```
switch(config)# show interfaces transceiver

 Transceiver Technical information:

                      Product      Serial             Part
  Port    Type        Number       Number             Number
  ------- ----------- ------------ ------------------ ----------
  21      1000SX      J4858C       MY050VM9WB         1990-3657
  22      1000SX      J4858B       P834DIP2
```

You can specify `all` for `port-list` as shown below.

Output when “all” is specified

```
switch(config)# show interfaces transceiver all

 No Transceiver found on interface 1

 No Transceiver found on interface 2
.
.
.
 No Transceiver found on interface 24

 Transceiver Technical information:

                      Product      Serial             Part
  Port    Type        Number       Number             Number
  ------- ----------- ------------ ------------------ ----------
  21      1000SX      J4858C       MY050VM9WB         1990-3657
  22      1000SX      J4858B       P834DIP2
```

Using the Event Log for troubleshooting switch problems

The Event Log records operating events in single- or double-line entries and serves as a tool to isolate and troubleshoot problems.

Once the log has received 2000 entries, it discards the oldest message each time a new message is received. The Event Log window contains 14 log entry lines. You can scroll through it to view any part of the log.

Once the log has received 2000 entries, it discards the oldest message each time a new message is received. The Event Log window contains 14 log-entry lines. You can scroll through it to view any part of the log.

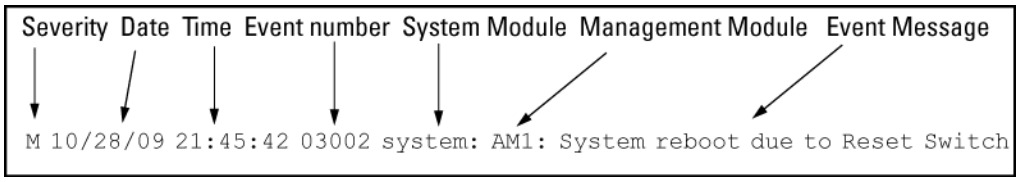
The Event Log is erased if power to the switch is interrupted or if you enter the boot system command. The contents of the Event Log are not erased if you:

- Reboot the switch by choosing the **Reboot Switch** option from the menu interface.
- Enter the `reload` command from the CLI.

Event Log entries

As shown in Figure 71: Format of an event log entry, each Event Log entry is composed of six or seven fields, depending on whether numbering is turned on or not:

Figure 71 *Format of an event log entry*



Item	Description
Severity	One of the following codes (from highest to lowest severity): **M**–(major) indicates that a fatal switch error has occurred. **E**–(error) indicates that an error condition occurred on the switch. **W**–(warning) indicates that a switch service has behaved unexpectedly. **I**–(information) provides information on normal switch operation. **D**–(debug) is reserved for internal diagnostic information.
Date	The date in the format **mm/dd/yy** when an entry is recorded in the log.
Time	The time in the format **hh:mm:ss** when an entry is recorded in the log.
Event number	The number assigned to an event. You can turn event numbering on and off with the `no log-number` command.
System module	The internal module (such as "ports:" for port manager) that generated a log entry. If VLANs are configured, a VLAN name also appears for an event that is specific to an individual VLAN.
Event message	A brief description of the operating event.

Table 41: *Event Log system modules*

System module	Description	Documented in Switch hardware/software guide
802.1x	802.1X authentication: Provides access control on a per-client or per-port basis:	*Access Security Guide*

System module	Description	Documented in Switch hardware/software guide
	■ Client-level security that allows LAN access to 802.1X clients (up to 32 per port) with valid user credentials ■ Port-level security that allows LAN access only on ports on which a single 802.1X-capable client (supplicant) has entered valid RADIUS user credentials	
acl	ACLs: Filter layer-3 IP traffic to or from a host to block unwanted IP traffic and block or limit other protocol traffic such as TCP, UDP, IGMP, and ICMP. ACEs specify the filter criteria and an action (permit or deny) to take on a packet if it meets the criteria.	*Advanced Traffic Management Guide*
addrmgr	Address Table Manager: Manages MAC addresses that the switch has learned and are stored in the switch's address table.	*Management and Configuration Guide*
arp-protect	Dynamic ARP Protection: Protects the network from ARP cache poisoning. Only valid ARP requests and responses are relayed or used to update the local ARP cache. ARP packets with invalid IP-to-MAC address bindings advertised in the source protocol address and source physical address fields are discarded.	*Access Security Guide*
auth	Authorization: A connected client must receive authorization through web, AMC, RADIUS-based, TACACS+-based, or 802.1X authentication before it can send traffic to the switch.	*Access Security Guide*
cdp	Cisco Discovery Protocol: Supports reading CDP packets received from neighbor devices, enabling a switch to learn about adjacent CDP devices. HPE does not support the transmission of CDP packets to neighbor devices.	*Management and Configuration Guide*
chassis	Hardware operation, including modules and ports, power supply, fans, transceivers, CPU interrupt errors, switch temperature, and so on. Chassis messages include events on Power Over Ethernet (POE) operation.	*Installation and Getting Started Guide* *Management and Configuration Guide*
connfilt	Connection-rate filtering: Used on the network edge to protect the network from attack by worm-like malicious code by detecting hosts that are generating IP traffic that exhibits this behavior and (optionally) either throttling or dropping all IP traffic from the offending hosts.Connection-rate filtering messages include events on virus throttling. Virus throttling uses connection-rate filtering to stop the propagation of malicious agents.	*Access Security Guide*

System module	Description	Documented in Switch hardware/software guide
console	Console interface used to monitor switch and port status, reconfigure the switch, and read the event log through an in-band Telnet or out-of-band connection.	*Installation and Getting Started Guide*
cos	Class of Service (CoS): Provides priority handling of packets traversing the switch, based on the IEEE 802.1p priority carried by each packet.CoS messages also include QoS events. The QoS feature classifies and prioritizes traffic throughout a network, establishing an end-to-end traffic priority policy to manage available bandwidth and improve throughput of important data.	*Advanced Traffic Management Guide*
dca	Dynamic Configuration Arbiter (DCA) determines the client-specific parameters that are assigned in an authentication session.	*Access Security Guide*
dhcp	Dynamic Host Configuration Protocol (DHCP) server configuration: Switch is automatically configured from a DHCP (Bootp) server, including IP address, subnet mask, default gateway, Timep Server address, and TFTP server address.	*Management and Configuration Guide*
dhcp v6c	DHCP for IPv6 prefix assignment	*IPv6 Configuration Guide*
dhcpr	DHCP relay: Forwards client-originated DHCP packets to a DHCP network server.	*Advanced Traffic Management Guide*
download	Download operation for copying a software version or files to the switch.	*Management and Configuration Guide*
dhcp-snoop	DHCP snooping: Protects your network from common DHCP attacks, such as address spoofing and repeated address requests.	*Access Security Guide*
dma	Direct Access Memory (DMA): Transmits and receives packets between the CPU and the switch.	–
fault	Fault Detection facility, including response policy and the sensitivity level at which a network problem should generate an alert.	*Management and Configuration Guide*
fdr-log	FDR collects information that is “interesting” at the time of the crash, as well as when the switch is misbehaving, but has not crashed. Runtime logs are written to FDR memory while the switch is running, and crashtime logs are collected and stored in the FDR buffer during a switch crash.	*Management and Configuration Guide*
ffi	Find, Fix, and Inform: Event or alert log messages indicating a possible topology loop that causes excessive network activity and results in the network running slow. FFI messages include events on transceiver connections with other network devices.	*Installation and Getting Started Guide* *Management and Configuration Guide*

System module	Description	Documented in Switch hardware/software guide
garp	Generic Attribute Registration Protocol (GARP), defined in the IEEE 802.1D-1998 standard.	*Advanced Traffic Management Guide*
gvrp	GARP VLAN Registration Protocol (GVRP): Manages dynamic 802.1Q VLAN operations, in which the switch creates temporary VLAN membership on a port to provide a link to another port in the same VLAN on another device.	*Advanced Traffic Management Guide*
hpesp	Management module that maintains communication between switch ports.	*Installation and Getting Started Guide*
idm	Identity-driven Management: Optional management application used to monitor and control access to switch.	*Advanced Traffic Management Guide*
igmp	Internet Group Management Protocol: Reduces unnecessary bandwidth usage for multicast traffic transmitted from multimedia applications on a per-port basis.	*Multicast and Routing Guide*
inst-mon	Instrumentation Monitor: Identifies attacks on the switch by generating alerts for detected anomalies.	*Access Security Guide*
ip	IP addressing: Configures the switch with an IP address and subnet mask to communicate on the network and support remote management access; configures multiple IP addresses on a VLAN; enables IP routing on the switch.	*Management and Configuration Guide* *Multicast and Routing Guide*
ipaddrmgr	IP Address Manager: Programs IP routing information in switch hardware.	*Multicast and Routing Guide*
iplock	IP Lockdown: Prevents IP source address spoofing on a per-port and per-VLAN basis by forwarding only the IP packets in VLAN traffic that contain a known source IP address and MAC address binding for the port.	*Access Security Guide*
ipx	Novell Netware protocol filtering: On the basis of protocol type, the switch can forward or drop traffic to a specific set of destination ports on the switch.	*Access Security Guide*
kms	Key Management System: Configures and maintains security information (keys) for all routing protocols, including a timing mechanism for activating and deactivating an individual protocol.	*Access Security Guide*
lacp	LACP trunks: The switch can either automatically establish an 802.3ad-compliant trunk group or provide a manually configured, static LACP trunk.	*Management and Configuration Guide*

System module	Description	Documented in Switch hardware/software guide
ldbal	Load balancing in LACP port trunks or 802.1s Multiple Spanning Tree protocol (MSTP) that uses VLANs in a network to improve network resource utilization and maintain a loop-free environment.Load-balancing messages also include switch meshing events. The switch meshing feature provides redundant links, improved bandwidth use, and support for different port types and speeds.	*Management and Configuration Guide* *Advanced Traffic Management Guide*
lldp	Link-Layer Discovery Protocol: Supports transmitting LLDP packets to neighbor devices and reading LLDP packets received from neighbor devices, enabling a switch to advertise itself to adjacent devices and to learn about adjacent LLDP devices.	*Management and Configuration Guide*
loop_protect	Loop protection: Detects the formation of loops when an unmanaged device on the network drops spanning tree packets and provides protection by transmitting loop protocol packets out ports on which loop protection has been enabled.	*Advanced Traffic Management Guide*
macauth	Web and MAC authentication: Port-based security employed on the network edge to protect private networks and the switch itself from unauthorized access using one of the following interfaces: ■ Web page login to authenticate users for access to the network ■ RADIUS server that uses a device's MAC address for authentication	*Access Security Guide*
maclock	MAC lockdown and MAC lockout ■ MAC lockdown prevents station movement and MAC address "hijacking" by requiring a MAC address to be used only on an assigned port on the switch. MAC Lockdown also restricts the client device to a specific VLAN. ■ MAC lockout blocks a specific MAC address so that the switch drops all traffic to or from the specified address.	*Access Security Guide*
mgr	Windows-based network management solutions for managing and monitoring performance of the switches.	*Management and Configuration Guide*
mld	Multicast Listener Discovery (MLD): IPv6 protocol used by a router to discover the presence of multicast listeners. MLD can also optimize IPv6 multicast traffic flow with the snooping feature.	*Multicast and Routing Guide*
mtm	Multicast Traffic Manager (MTM): Controls and coordinates L3 multicast traffic for upper layer protocols.	*Multicast and Routing Guide*

System module	Description	Documented in Switch hardware/software guide
netinet	Network Internet: Monitors the creation of a route or an Address Resolution Protocol (ARP) entry and sends a log message in case of failure.	*Advanced Traffic Management Guide*
pagp	Ports Aggregation Protocol (PAgP): Obsolete. Replaced by LACP (802.3ad).	–
ports	Port status and port configuration features, including mode (speed and duplex), flow control, broadcast limit, jumbo packets, and security settings. Port messages include events on POE operation and transceiver connections with other network devices.	*Installation and Getting Started Guide* *Management and Configuration Guide* *Access Security Guide*
radius	RADIUS (Remote Authentication Dial-In User Service) authentication and accounting: A network server is used to authenticate user-connection requests on the switch and collect accounting information to track network resource usage.	*Access Security Guide*
ratelim	Rate-limiting: Enables a port to limit the amount of bandwidth a user or device may utilize for inbound traffic on the switch.	*Management and Configuration Guide*
sflow	Flow sampling: sFlow is an industry standard sampling technology, defined by RFC 3176, used to continuously monitor traffic flows on all ports providing network-wide visibility into the use of the network.	*Management and Configuration Guide*
snmp	Simple Network Management Protocol: Allows you to manage the switch from a network management station, including support for security features, event reporting, flow sampling, and standard MIBs.	*Management and Configuration Guide*
sntp	Simple Network Time Protocol: Synchronizes and ensures a uniform time among interoperating devices.	*Management and Configuration Guide*
ssh	Secure Shell version 2 (SSHv2): Provides remote access to management functions on a switch via encrypted paths between the switch and management station clients capable of SSH operation.SSH messages also include events from the Secure File Transfer Protocol (SFTP) feature. SFTP provides a secure alternative to TFTP for transferring sensitive information, such as switch configuration files, to and from the switch in an SSH session.	*Access Security Guide*
ssl	Secure Socket Layer Version 3 (SSLv3), including Transport Layer Security (TLSv1) support: Provides remote web access to a switch via encrypted paths between the switch and management station clients capable of SSL/TLS operation.	*Access Security Guide*

System module	Description	Documented in Switch hardware/software guide
stack	Stack management: Uses a single IP address and standard network cabling to manage a group (up to 16) of switches in the same IP subnet (broadcast domain), resulting in a reduced number of IP addresses and simplified management of small workgroups for scaling your network to handle increased bandwidth demand.	*Advanced Traffic Management Guide*
stp	Multiple-instance spanning tree protocol/MSTP (802.1s): Ensures that only one active path exists between any two nodes in a group of VLANs in the network. MSTP operation is designed to avoid loops and broadcast storms of duplicate messages that can bring down the network.	*Advanced Traffic Management Guide*
system	Switch management, including system configuration, switch bootup, activation of boot ROM image, memory buffers, traffic and security filters. System messages also include events from management interfaces (menu and CLI) used to reconfigure the switch and monitor switch status and performance.	*Basic Operation Guide* *Access Security Guide*
tacacs	TACACS+ authentication: A central server is used to control access to the switches (and other TACACS-aware devices) in the network through a switch's console port (local access) or Telnet (remote access).	*Access Security Guide*
tcp	Transmission Control Protocol: A transport protocol that runs on IP and is used to set up connections.	*Advanced Traffic Management Guide*
telnet	Session established on the switch from a remote device through the Telnet virtual terminal protocol.	*Basic Operation Guide*
tftp	Trivial File Transfer Protocol: Supports the download of files to the switch from a TFTP network server.	*Basic Operation Guide*
timep	Time Protocol: Synchronizes and ensures a uniform time among interoperating devices.	*Management and Configuration Guide*
udld	Uni-directional Link Detection: Monitors a link between two switches and blocks the ports on both ends of the link if the link fails at any point between the two devices.	*Access Security Guide*
udpf	UDP broadcast forwarding: Supports the forwarding of client requests sent as limited IP broadcasts addressed to a UDP application port on a network server.	*Multicast and Routing Guide*
update	Updates (TFTP or serial) to HPE switch software and updates to running-config and start-up config files	*Basic Operation Guide*

System module	Description	Documented in Switch hardware/software guide
vlan	Static 802.1Q VLAN operations, including port-and protocol-based configurations that group users by logical function instead of physical location ■ A port-based VLAN creates a layer-2 broadcast domain comprising member ports that bridge IPv4 traffic among themselves. ■ A protocol-based VLAN creates a layer-3 broadcast domain for traffic of a particular routing protocol, and comprises member ports that bridge traffic of the specified protocol type among themselves. VLAN messages include events from management interfaces (menu and CLI) used to reconfigure the switch and monitor switch status and performance.	*Advanced Traffic Management Guide*
xmodem	Xmodem: Binary transfer feature that supports the download of software files from a PC or UNIX workstation.	*Basic Operation Guide*

Using the CLI

Syntax

`show logging [-a, -b, -r, -s, -t, -m, -e, -p, -w, -i, -d, command, filter] [< option-str >]`

By default, the `show logging` command displays the log messages recorded since the last reboot in chronological order:

`-a`	Displays all recorded log messages, including those before the last reboot.
`-b`	Displays log events as the time since the last reboot instead of in a date/time format.
`-r`	Displays all recorded log messages, with themost recent entries listed first (reverse order).
`-s`	Displays the active management module (AM) and standby management module (SM) log events.
`-t`	Displays the log events with a granularity of 10 milliseconds.
`-m`	Displays only major log events.
`-e`	Displays only error event class.
`-p`	Displays only performance log events.
`-w`	Displays only warning log events.
`-i`	Displays only informational log events.
`-d`	Displays only debug log events.

`command`	Displays only command logs.
`filter`	Displays only log filter configuration and status information.
<option-str>	Displays all Event Log entries that contain the specified text. Use an *<option-str>* value with `-a` or `-r` to further filter `show logging` command output.

Example

To display all Event Log messages that have "system" in the message text or module name, enter the following command:

```
switch# show logging -a system
```

To display all Event Log messages recorded since the last reboot that have the word "system" in the message text or module name, enter:

```
switch# show logging system
```

Clearing Event Log entries

Syntax

`clear logging [command]`

Removes all entries from the event log display output.

Use the `clear logging` command to hide, but not erase, Event Log entries displayed in `show logging` command output. Only new entries generated after you enter the command will be displayed.

To redisplay all hidden entries, including Event Log entries recorded prior to the last reboot, enter the `show logging -a` command.

The `command` option removes all entries from the command log.

Turning event numbering on

Syntax

`no log-numbers`

Turns event numbering on and off

Using log throttling to reduce duplicate Event Log and SNMP messages

A recurring event can generate a series of duplicate Event Log messages and SNMP traps in a relatively short time. As a result, the Event Log and any configured SNMP trap receivers may be flooded with excessive, exactly identical messages. To help reduce this problem, the switch uses **log throttle periods** to regulate (throttle) duplicate messages for recurring events, and maintains a counter to record how many times it detects duplicates of a particular event since the last system reboot.

When the first instance of a particular event or condition generates a message, the switch initiates a log throttle period that applies to all recurrences of that event. If the logged event recurs during the log throttle period, the switch increments the counter initiated by the first instance of the event, but does not generate a new message.

If the logged event repeats again after the log throttle period expires, the switch generates a duplicate of the first message, increments the counter, and starts a new log throttle period during which any additional instances of the event are counted, but not logged. Thus, for a particular recurring event, the switch displays

only one message in the Event Log for each log throttle period in which the event reoccurs. Also, each logged instance of the event message includes counter data showing how many times the event has occurred since the last reboot. The switch manages messages to SNMP trap receivers in the same way.

Log throttle periods

The length of the log throttle period differs according to an event's severity level:

Severity level	Log throttle period
I (Information)	6000 Seconds
W (Warning)	600 Seconds
D (Debug)	60 Seconds
M (Major)	6 Seconds

Example

Suppose that you configure VLAN 100 on the switch to support PIM operation, but do not configure an IP address. If PIM attempts to use VLAN 100, the switch generates the first instance of the following Event Log message and counter.

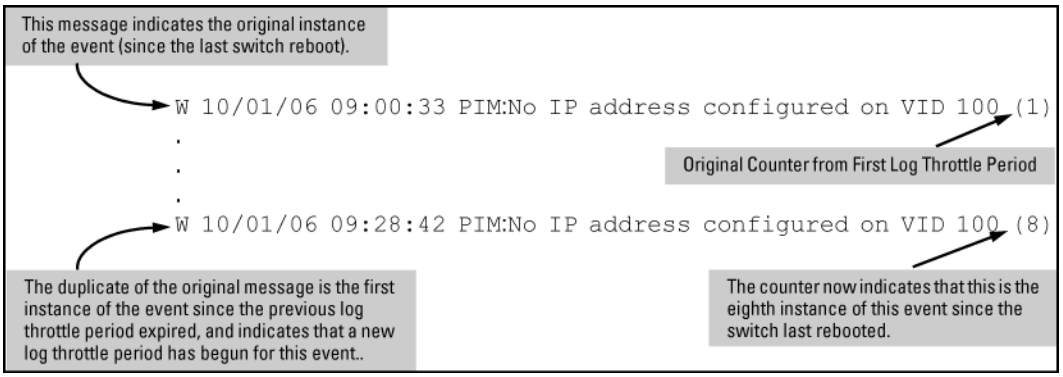
In The first instance of an event message and counter on page 458 the counter (1) indicates that this is the first instance of this event since the switch last rebooted.

The first instance of an event message and counter

```
W 10/01/12 09:00:33 PIM:No IP address configured on VID 100 (1)
```

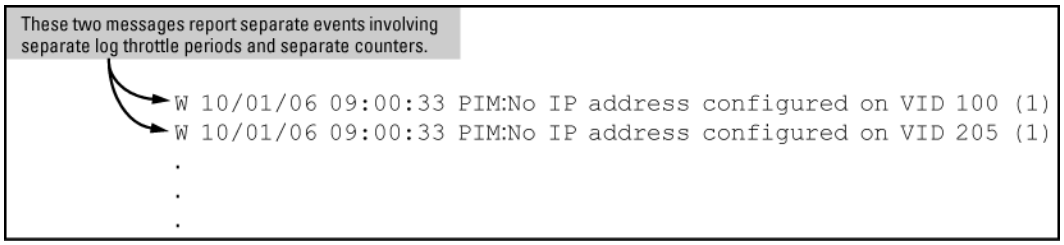
If PIM operation causes the same event to occur six more times during the initial log throttle period, there are no further entries in the Event Log. However, if the event occurs again after the log throttle period has expired, the switch repeats the message (with an updated counter) and starts a new log throttle period.

Figure 72 *Duplicate messages over multiple log throttling periods*



Note that if the same type of event occurs under different circumstances, the switch handles these as unrelated events for the purpose of Event Log messages. For example, if PIM operation simultaneously detects that VLANs 100 and 205 are configured without IP addresses, you see log messages similar to the following:

Figure 73 *Example: log messages generated by unrelated events of the same type*



Example of event counter operation

Suppose the switch detects the following after a reboot:

- Three duplicate instances of the PIM "Send error" during the first log throttle period for this event
- Five more instances of the same Send error during the second log throttle period for this event
- Four instances of the same Send error during the third log throttle period for this event

In this case, the duplicate message appears three times in the Event Log (once for each log throttle period for the event being described), and the duplicate message counter increments as shown in the following table. (The same operation applies for messages sent to any configured SNMP trap receivers.)

Table 42: *How the duplicate message counter increments*

Instances during 1st log throttle period	Instances during 2nd log throttle period	Instances during 3rd log throttle period	Duplicate message counter[1]
3			1
	5		4
		4	9

[1]This value always comprises the first instance of the duplicate message in the current log throttle period plus all previous occurrences of the duplicate message occurring since the switch last rebooted.

Reporting information about changes to the running configuration

Syslog can be used for sending notifications to a remote syslog server about changes made to the running configuration. The notifications in the syslog messages are sent in ASCII format and contain this information:

- Notice-Type: Describes the syslog notification as a “running config change”.
- Event-ID: Identifier for the running config change event that occurred on the switch.
- Config-Method: The source for the running config change.
- Device-Name: The managed device.
- User-Name: User who made the running config change.
- Remote-IP-Address: IP address of a remote host from which the user is connected.

Syntax

```
no logging notify <running-config-change> [transmission-interval <0-4294967295>
```

Enables sending the running configuration change notifications to the syslog server.

The `no` form of the command disables sending the running configuration changes to the syslog server.

Default: Disabled

<*running-config-change*>	Mandatory option for the notify parameter. Specifies the type of notification to send.
`transmission-interval <0-4294967295>`	Specifies the time interval (in seconds) between the transmission of two consecutive notifications. Running config changes occurring within the specified interval will not generate syslog notifications.

A value of zero means there is no limit; a notification is sent for every running config change.

Default: Zero

Sending running config changes to the syslog server

```
switch(config)# logging notify running-config-change
transmission-interval 10
```

Debug/syslog operation

While the Event Log records switch-level progress, status, and warning messages on the switch, the debug/system logging (**syslog**) feature provides a way to record Event Log and debug messages on a remote device. For example, you can send messages about routing misconfigurations and other network protocol details to an external device, and later use them to debug network-level problems.

Debug/syslog messaging

The debug/syslog feature allows you to specify the types of Event Log and debug messages that you want to send to an external device. You can perform the following operations:

- Use the `debug` commandto configure messaging reports for the following event types:
  - ACL "deny" matches
  - Dynamic ARP protection events
  - DHCP snooping events
  - DIPLD events
  - Events recorded in the switch's Event Log
  - IP routing events (IPv4 and IPv6)
  - LACP events
  - LLDP events
  - SNMP events
  - SSH events
- Use the `logging` commandto select a subset of Event Log messages to send to an external device for debugging purposes according to:
  - Severity level
  - System module

Hostname in syslog messages

The syslog now messages the sender identified by hostname.

The hostname field identifies the switch that originally sends the syslog message. Configurable through the CLI and SNMP, the format of the hostname field supports the following formats:

- ip-address: The IP address of the sending interface will be used as the message origin identifier. This is the default format for the origin identifier. The IP address of the sending interface (in dotted decimal notation) is the default format.
- hostname: The hostname of the sending switch will be used as the message origin identifier.
- none: No origin identifier will be embedded in the syslog message. Nilvalue is used as defined by "-".

This configuration is system-wide, not per syslog server. There is no support for fully-qualified domain name.

Logging

Use the `logging` command select a subset of Event Log messages to send to an external device for debugging purposes according to severity level or system module.

Syntax

```
logging command | domain-name | facility | filter | <IP-ADDR> | <IPV6-ADDR> | notify |
origin-id [ip-address|hostname|none] | priority-descr | severity | system-module |
prefix <ASCII-STR>
no logging command | domain-name | facility | <IP-ADDR> | <IPV6-ADDR> | notify |
origin-id [ip-address|hostname|none] | priority-descr | severity | system-module |
prefix <ASCII-STR>
```

`command`

Enables local command logging.

`domain-name`

Adds a hostname to the list of receiving syslog servers.

`facility`

Specifies the syslog facility value that is used for all syslog servers.

Use the command `no logging <facility>` to set the facility back to defaults.

`filter`

Creates a filter to restrict which events are logged.

`IP-ADDR`

Adds an IPv4 address to the list of receiving syslog servers.

Use of no without an IP address specified will remove all IP addresses from the list of syslog receivers. If an IP address is specified, that receiver will be removed.

`IPV6-ADDR`

Adds an IPv6 address to the list of receiving syslog servers.

Use of no without an IP address specified will remove all IP addresses from the list of syslog receivers. If an IP address is specified, that receiver will be removed. Both link-local with zone ID and global IPv6 addresses are supported.

`notify`

Specifies the notification types to be sent to the syslog server.

origin-id [ip-address | hostname | none]

Specifies the origin information in the syslog messages with the option origin-id.

Use the logging origin-id command with following parameters:

- **ip-address:** The IP address of the sending interface will be used as the message origin identifier. This is the default format for the origin identifier. The IP address of the sending interface (in dotted decimal notation) is the default format.
- **hostname:** The hostname of the sending switch will be used as the message origin identifier.
- **none:** No origin identifier will be embedded in the syslog message. Nil value is used as defined by "-"..

Use the `no logging origin-id` command to reset the hostname field content back to default (IPaddress).

priority-descr

A text string associated with the values of facility, severity, and system-module.

severity

Specifies the severity for event messages to be filtered and sent to the syslog server.

Use the command `no logging <severity>` to set the severity back to default.

system-module

Event messages of the specified system module (subsystem) sent to the syslog server.

hostname

Sets the hostname of the device as the origin-id.

prefix

Adds a text string to the message content. The configured string is added to the logs along with the switch IP address or hostname sent to the Syslog servers. The text string can be up to 48 ASCII characters, excluding space.

When the syslog server receives messages from the switch, the IPv6 address of the switch is partly displayed.

Example:

Configured Host Ipv6 Address: 2001::1

Expected Syslog message:

```
Syslog message: USER.INFO: Oct 11 02:40:02 2001::1 00025 ip: ST1CMDR: VLAN60:
ip address 30.1.1.1/24 configured on vlan 60
```

Actual Truncated syslog message:

```
Syslog message: USER.INFO: Oct 11 02:40:02 2001:: 00025 ip: ST1CMDR: VLAN60:
ip address 30.1.1.1/24 configured on vlan 60
```

Use the command in the following example to set the origin-id to the hostname.

Setting the origin-id to the hostname

```
switch(config)# logging origin-id hostname
```

The following syslog message will occur:

```
<14> Jan 1 00:15:35 2910al-24G 00076 ports: port 2 is now on-line
```

Use the command in the following example to set the origin-id to none (nilvalue).

Setting the origin-id to none (nilvalue)

```
switch(config)# logging origin-id none
```

The following syslog message will occur:

```
<14> Jan 1 00:15:35 - 00076 ports: port 2 is now on-line
```

Use any of the commands in the following example to set the origin-id to ip-address (default).

Setting the origin-id to ip-address (default)

```
switch(config)# logging origin-id ip-address

switch(config)# no logging origin-id hostname

switch(config)# no logging origin-id none
```

The following syslog message will occur:

```
<14> Jan 1 00:15:35 169.254.230.236 00076 ports: port 2 is now on-line
```

Use the command in the following example to configure a user-defined prefix.

Setting the prefix

```
switch(config)# logging origin-id ip-address

switch(config)# logging prefix ArubaOS16_10_xxxx
```

The following syslog message will occur:

```
Oct 08 11:35:48 20.1.1.2 20.1.1.2 ArubaOS16_10_xxxx 00435 ports: port 24 is Blocked by
STP
```

SNMP MIB

SNMP support will be provided through the following MIB objects.

HpicfSyslogOriginId = textual-convention

Description

This textual convention enumerates the origin identifier of syslog message.

Syntax integer

ip-address

hostname

none

Status

current

hpicfSyslogOriginId OBJECT-TYPE

Description

Specifies the content of a Hostname field in the header of a syslog message.

Syntax

HpicfSyslogOriginId

Max-access

read-write

Status

current

Default

ip-address

hpicfSwitchSnmpEnabledTrapEventList OBJECT-TYPE

Description

Configures the event-list that needs to be send as trap together with RMON logging.

Syntax

OCTET STRING (SIZE (876))

MAX-ACCESS

read-create

STATUS

current

Debug/syslog destination devices

To use debug/syslog messaging, you must configure an external device as the logging destination by using the `logging` and `debug destination` commands. For more information, see Debug destinations on page 472 and Configuring a syslog server on page 474.

A debug/syslog destination device can be a syslog server and/or a console session. You can configure debug and logging messages to be sent to:

- Up to six syslog servers
- A CLI session through a direct RS-232 console connection, or a Telnet or SSH session

Debug/syslog configuration commands

Event notification logging	–	Automatically sends switch-level event messages to the switch's Event Log. Debug and syslog do not affect this operation, but add the capability of directing Event Log messaging to an external device.
`logging` command	*<syslog-ip-addr>*	Enables syslog messaging to be sent to the specified IP address. IPv4 and IPv6 are supported.
	`facility`	(Optional) The `logging facility` command specifies the destination (facility) subsystem used on a syslog server for debug reports.
	`priority-desc`	A text string associated with the values of facility, severity, and system-module.
	`neighbor-adjacency [detail]`	Enables or disables OSPFv3 (IPv6) adjacency logging. Must be executed in OSPFv3 context. The `detail` option displays all the adjacency state transitions and adjacency-related errors.
	`severity`	Sends Event Log messages of equal or greater severity than the specified value to configured debug destinations. (The default setting is to send Event Log messages from all severity levels.)
	`system-module`	Sends Event Log messages from the specified system module to configured debug destinations. The severity filter is also applied to the system-module messages you select. The default setting is to send Event Log messages from all system modules. To restore the default setting, enter the `no logging system-module <system-module>` or `logging system-module all-pass` commands.
`debug` Command	`acl`	Sends ACL syslog logging to configured debug destinations. When there is a match with a "deny" statement, directs the resulting message to the configured debug destinations.
	`all`	Sends debug logging to configured debug destinations for all ACL, Event Log, IP-OSPF, and IP-RIP options.
	`cdp`	Displays CDP information.

	destination	logging: Disables or re-enables syslog logging on one or more syslog servers configured with the logging *syslog-ip-addr* command.session: Assigns or re-assigns destination status to the terminal device that was most recently used to request debug output.buffer: Enables syslog logging to send the debug message types specified by the debug <*debug-type*> command to a buffer in switch memory.
	event	Sends standard Event Log messages to configured debug destinations. (The same messages are also sent to the switch's Event Log, regardless of whether you enable this option.)
	ip	fib: Displays IP Forwarding Information Base messages and events.forwarding: Sends IPv4 forwarding messages to the debug destinations.ospf: Sends OSPF event logging to the debug destinations.ospfv3: Enables debug messages for OSPFv3.packet: Sends IPv4 packet messages to the debug destinations. pim [packet [filter {source < *ip-addr* > | vlan <*vid* >}]] : Enables or disables tracing of PIM messages.: When PIM debugging is enabled, the following message displays: `PIM Debugging can be extremely CPU intensive when run on a device with an existing high CPU load or on a switch with more than 10 PIM-enabled VLANs. In high load situations, the switch may suffer from protocol starvation, high latency, or even reload. When debugging a switch with more than 10 PIM-enabled VLANs, the "vlan" option in "debug ip pim packet" should be utilized. Debugging should only be used temporarily while troubleshooting problems. Customers are advised to exercise caution when running this command in a highstress production network.` pbr: Logs a message when a PBR policy is applied, when the action in a class goes active or when it goes inactive.rip: Sends RIP event logging to the debug destinations.
	ipv6	dhcpv6-client: Sends DHCPv6 client debug messages to the configured debug destination.dhcpv6-relay: Sends DHCPv6 relay debug messages to the configured debug destination.forwarding: Sends IPv6 forwarding messages to the debug destination(s)nd: Sends IPv6 debug messages for IPv6 neighbor discovery to the configured debug destinations.
	lacp	event: Sends messages related to change events.packet: Sends messages when BPDUs are exchanged.
	lldp	Sends LLDP debug messages to the debug destinations.
	security	Sends security messages to the debug destination.
	services	Displays debug messages on the services module.
	snmp	Sends snmp messages to the debug destination.

Using the Debug/Syslog feature, you can perform the following operations:

- Configure the switch to send Event Log messages to one or more Syslog servers. In addition, you can configure the messages to be sent to the User log facility (default) or to another log facility on configured Syslog servers.
- Configure the switch to send Event Log messages to the current management- access session (serial-connect CLI, Telnet CLI, or SSH).
- Disable all Syslog debug logging while retaining the Syslog addresses from the switch configuration. This allows you to configure Syslog messaging and then disable and re-enable it as needed.
- Display the current debug configuration. If Syslog logging is currently active, the list f configured Syslog servers is displayed.
- Display the current Syslog server list when Syslog logging is disabled.

Configuring debug/syslog operation

Procedure:

1. To use a syslog server as the destination device for debug messaging, follow these steps:
   a. Enter the `logging <syslog-ip-addr>` command at the global configuration level to configure the syslog server IP address and enable syslog logging. Optionally, you may also specify the destination subsystem to be used on the syslog server by entering the `logging facility` command.If no other syslog server IP addresses are configured, entering the `logging` command enables both debug messaging to a syslog server and the event debug message type. As a result, the switch automatically sends Event Log messages to the syslog server, regardless of other debug types that may be configured.
   b. Re-enter the `logging` command in Step 1a to configure additional syslog servers. You can configure up to a total of six servers. (When multiple server IP addresses are configured, the switch sends the debug message types that you configure in step on page 467 to all IP addresses.)
2. To use a CLI session on a destination device for debug messaging:
   a. Set up a serial, Telnet, or SSH connection to access the switch's CLI.
   b. Enter the `debug destination session` command at the manager level.
3. Enable the types of debug messages to be sent to configured syslog servers, the current session device, or both by entering the `debug <debug-type>` command and selecting the desired options.

   Repeat this step if necessary to enable multiple debug message types.

   By default, Event Log messages are sent to configured debug destination devices. To block Event Log messages from being sent, enter the `no debug event` command.
4. If necessary, enable a subset of Event Log messages to be sent to configured syslog servers by specifying a severity level, a system module, or both using the following commands:

   ```
   switch(config)# logging severity <debug | major | error | warning | info>
   switch(config)# logging system-module <system-module>
   ```

   To display a list of valid values for each command, enter `logging severity` or `loggingsystem-module` followed by `?` or pressing the Tab key.

The severity levels in order from the highest to lowest severity are major, error, warning, info, and debug. For a list of valid values for the `logging system-module <system-module>` command, see Table 41: Event Log system modules.

5. If you configure system-module, severity-level values, or both to filter Event Log messages, when you finish troubleshooting, you may want to reset these values to their default settings so that the switch sends all Event Log messages to configured debug destinations (syslog servers, CLI session, or both).

   To remove a configured setting and restore the default values that send all Event Log messages, enter one or both of the following commands:

```
switch(config)# no logging severity <debug | major | error | warning | info>
switch(config)# no logging system-module <system-module>
```

If you configure a severity-level, system-module, logging destination, or logging facility value and save the settings to the startup configuration (For example, by entering the write memory command), the debug settings are saved after a system reboot (power cycle or reboot) and re-activated on the switch. As a result, after switch startup, one of the following situations may occur:

- Only a partial set of Event Log messages may be sent to configured debug destinations.
- Messages may be sent to a previously configured syslog server used in an earlier debugging session.

Viewing a debug/syslog configuration

Use the `show debug` command to display the currently configured settings for:

- Debug message types and Event Log message filters (severity level and system module) sent to debug destinations
- Debug destinations (syslog servers or CLI session) and syslog server facility to be used

Syntax

`show debug`

Displays the currently configured debug logging destinations and message types selected for debugging purposes. (If no syslog server address is configured with the `logging <syslog-ip-addr>` command, no `show debug` command output is displayed.)

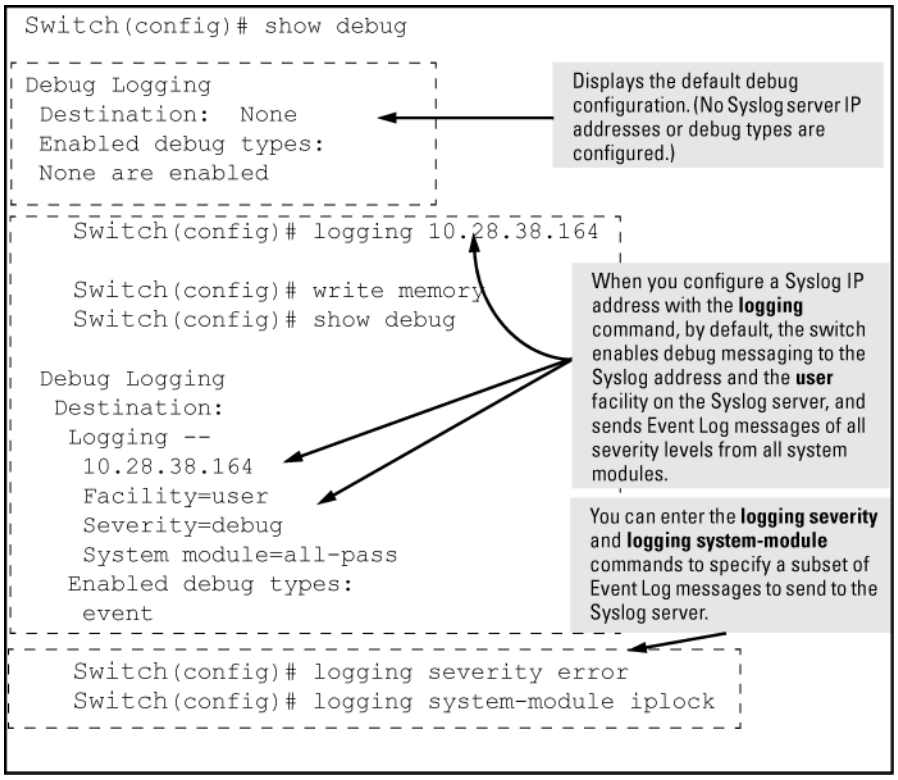
Output of the show debug command

```
switch(config)# show debug

 Debug Logging
  Destination:
   Logging --
    10.28.38.164
    Facility=kern
    Severity=warning
    System module=all-pass
   Enabled debug types:
    event
```

Example

In the following example, no syslog servers are configured on the switch (default setting). When you configure a syslog server, debug logging is enabled to send Event Log messages to the server. To limit the Event Log messages sent to the syslog server, specify a set of messages by entering the `logging severity` and `logging system-module` commands.

Figure 74 *Syslog configuration to receive event log messages from specified system module and severity levels*



As shown at the top of Figure 74: Syslog configuration to receive event log messages from specified system module and severity levels, if you enter the `show debug` command when no syslog server IP address is configured, the configuration settings for syslog server facility, Event Log severity level, and system module are not displayed. However, after you configure a syslog server address and enable syslog logging, all debug and logging settings are displayed with the `show debug` command.

If you do not want Event Log messages sent to syslog servers, you can block the messages from being sent by entering the `no debug event` command. (There is no effect on the normal logging of messages in the switch's Event Log.)

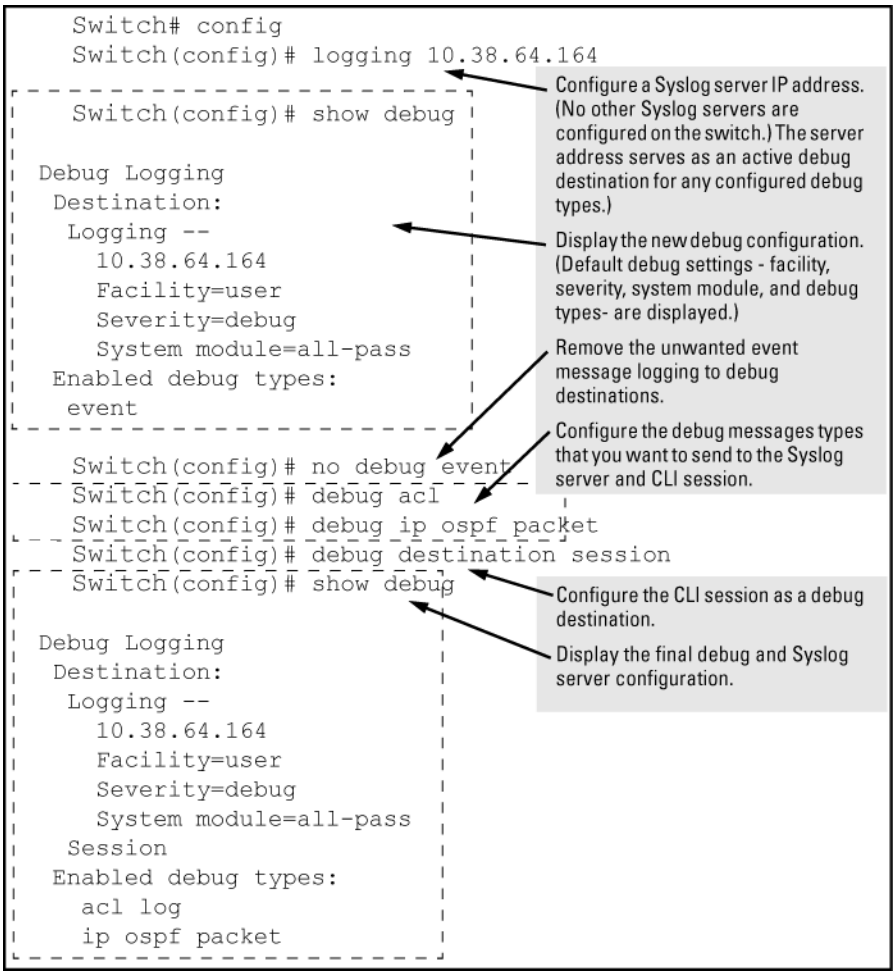
Example

The next example shows how to configure:

- Debug logging of ACL and IP-OSPF packet messages on a syslog server at 18.38.64.164 (with user as the default logging facility).
- Display of these messages in the CLI session of your terminal device's management access to the switch.
- Blocking Event Log messages from being sent from the switch to the syslog server and a CLI session.

To configure syslog operation in these ways with the debug/syslog feature disabled on the switch, enter the commands shown in Figure 75: Debug/syslog configuration for multiple debug types and multiple destinations.

Figure 75 *Debug/syslog configuration for multiple debug types and multiple destinations*



Debug command

At the manager level, use the `debug` command to perform two main functions:

- Specify the types of event messages to be sent to an external destination.
- Specify the destinations to which selected message types are sent.

By default, no debug destination is enabled and only Event Log messages are enabled to be sent.

To configure a syslog server, use the `logging <syslog-ip-addr>` command. For more information, see Configuring a syslog server on page 474.

Debug messages

Syntax

`no debug <debug-type>`

`acl`		When a match occurs on an ACL "deny" ACE (with `log` configured), the switch sends an ACL message to configured debug destinations. For information on ACLs, see the "Access Control Lists (ACLs)" in the latest version of the following guides: ■ IPv4 ACLs: access security guide ■ IPv6 ACLs: IPv6 configuration guide **NOTE:** ACE matches (hits) for permit and deny entries can be tracked using the `show statistics <aclv4|aclv6>`command. (Default: Disabled–ACL messages for traffic that matches "deny" entries are not sent.)
`all`		Configures the switch to send all debug message types to configured debug destinations.(Default: Disabled–No debug messages are sent.)
`cdp`		Sends CDP information to configured debug destinations.
`destination`		`logging`–Disables or re-enables syslog logging on one or more syslog servers configured with the `logging <syslog-ip-addr>` command.`session`–Assigns or re-assigns destination status to the terminal device that was most recently used to request debug output.`buffer`–Enables syslog logging to send the debug message types specified by the `debug <debug-type>` command to a buffer in switch memory.For more information on these options, see Debug destinations on page 472.
`event`		Configures the switch to send Event Log messages to configured debug destinations. **NOTE:** This value does not affect the reception of event notification messages in the Event Log on the switch. Event Log messages are automatically enabled to be sent to debug destinations in these conditions: ■ If no syslog server address is configured and you enter the `logging <syslog-ip-addr>` command to configure a destination address. ■ If at least one syslog server address is configured in the startup configuration, and the switch is rebooted or reset. Event log messages are the default type of debug message sent to configured debug destinations.
`ip [fib | forwarding | packet | rip]`		Sends IP messages to configured destinations.
	`ip [fib [events]]`	For the configured debug destinations:`events`–Sends IP forwarding information base events.
	`ip [packet]`	Enables the specified PIM message type.

	`ip [rip [database | event | trigger]]`	`rip {<database | event | trigger>}` –Enables the specified RIP message type for the configured destination(s). `database`–Displays database changes. `event`–Displays RIP events. `trigger`–Displays trigger messages.
`ipv6 [dhcpv6-client | pnd | acket]`		**NOTE:** See the "IPv6 Diagnostic and Troubleshooting" in the IPv6 configuration guide for your switch for more detailed IPv6 debug options. When no debug options are included, displays debug messages for all IPv6 debug options. `dhcpv6-client [events | packet]`–Displays DHCPv6 client event and packet data.`nd`–Displays debug messages for IPv6 neighbor discovery.`packet`–Displays IPv6 packet messages.
`lldp`		Enables all LLDP message types for the configured destinations.
`security [arp-protect | dhcp-snooping | dynamic-ip-lockdown | port-access | port-security | radius-server | ssh | tacacs-server | user-profile-mib]`		`arp-protect`– Sends dynamic ARP protection debug messages to configured debug destinations.`dhcp-snooping`–Sends DHCP snooping debug messages to configured debug destinations. `agent`–Displays DHCP snooping agent messages. `event`–Displays DHCP snooping event messages. `packet`–Displays DHCP snooping packet messages. `dynamic-ip-lockdown`–Sends dynamic IP lockdown debug messages to the debug destination.`port-access`–Sends port-access debug messages to the debug destination.`radius-server`–Sends RADIUS debug messages to the debug destination.`ssh`–Sends SSH debug messages at the specified level to the debug destination. The levels are fatal, error, info, verbose, debug, debug2, and debug3.`tacacs-server`–Sends TACACS debug messages to the debug destination.`user-profile-mib`–Sends user profile MIB debug messages to the debug destination.
`services <slot-id-range>`		Displays debug messages on the services module. Enter an alphabetic module ID or range of module IDs for the <*slot-id-range*> parameter.
`snmp <pdu>`		Displays the SNMP debug messages.`pdu`–Displays SNMP pdu debug messages.

Debug destinations

Use the `debug destination` command to enable (and disable)syslog messaging on a syslog server or to a CLI session for specified types of debug and Event Log messages.

Syntax

`no debug destination {<logging | session | buffer>}`

`logging`	Enables syslog logging to configured syslog servers so that the debug message types specified by the `debug <debug-type>` command (see Debug messages on page 470) are sent.(Default: Logging disabled)To configure a syslog server IP address, see Configuring a syslog server on page 474. **NOTE:** Debug messages from the switches covered in this guide have a debug severity level. Because the default configuration of some syslog servers ignores syslog messages with the debug severity level, ensure that the syslog servers you want to use to receive debug messages are configured to accept the debug level. For more information, see Operating notes for debug and Syslog on page 479.
`session`	Enables transmission of event notification messages to the CLI session that most recently executed this command. The session can be on any one terminal emulation device with serial, Telnet, or SSH access to the CLI at the Manager level prompt (`switch#_`).If more than one terminal device has a console session with the CLI, you can redirect the destination from the current device to another device. Do so by executing `debug destination session` in the CLI on the terminal device on which you now want to display event messages.Event message types received on the selected CLI session are configured with the `debug <debug-type>` command.
`buffer`	Enables syslog logging to send the debug message types specified by the `debug <debug-type>` command to a buffer in switch memory.To view the debug messages stored in the switch buffer, enter the `show debug buffer` command.

Logging command

At the global configuration level, the `logging`command allows you to enable debug logging on specified syslog servers and select a subset of Event Log messages to send for debugging purposes according to:

- Severity level
- System module

By specifying both a severity level and system module, you can use both configured settings to filter the Event Log messages you want to use to troubleshoot switch or network error conditions.

After you configure a syslog server and a severity level and/or system module to filter the Event Log messages that are sent, if you save these settings to the startup configuration file by entering the `write memory` command, these debug and logging settings are automatically re-activated after a switch reboot or power recycle. The debug settings and destinations configured in your previous troubleshooting session will then be applied to the current session, which may not be desirable.

After a reboot, messages remain in the Event Log and are not deleted. However, after a power recycle, all Event Log messages are deleted.

If you configure a severity level, system module, or both to temporarily filter Event Log messages, be sure to reset the values to their default settings by entering the `no` form of the following commands to ensure that Event Log messages of all severity levels and from all system modules are sent to configured syslog servers:

```
switch(config)# no logging severity <debug | major | error | warning | info>
switch(config)# no logging system-module <system-module>
```

Configuring a syslog server

Syslog is a client-server logging tool that allows a client switch to send event notification messages to a networked device operating with syslog server software. Messages sent to a syslog server can be stored to a file for later debugging analysis.

To use the syslog feature, you must install and configure a syslog server application on a networked host accessible to the switch. For instructions, see the documentation for the syslog server application.

To configure a syslog service, use the `logging <syslog-ip-addr>` command as shown below.

When you configure a syslog server, Event Log messages are automatically enabled to be sent to the server. To reconfigure this setting, use the following commands:

- `debug`

  Specifies additional debug message types (see Debug messages on page 470).

- `logging`

  Configures the system module or severity level used to filter the Event Log messages sent to configured syslog servers. (See Configuring the severity level for Event Log messages sent to a syslog server on page 477 and Configuring the system module used to select the Event Log messages sent to a syslog server on page 478.)

To display the currently configured syslog servers as well as the types of debug messages and the severity-level and system-module filters used to specify the Event Log messages that are sent, enter the `show debug` command (See Debug/syslog configuration commands on page 465).

Syntax

`no logging <syslog-ip-addr>`

Enables or disables syslog messaging to the specified IP address. You can configure up to six addresses. If you configure an address when none are already configured, this command enables destination logging (syslog) and the Event debug type. Therefore, at a minimum, the switch begins sending Event Log messages to configured syslog servers. The ACL, IP-OSPF, and/or IP-RIP message types are also sent to the syslog servers if they are currently enabled as debug types. (See Debug messages on page 470.)

`no logging`	Removes all currently configured syslog logging destinations from the running configuration.Using this form of the command to delete the only remaining syslog server address disables debug destination logging on the switch, but the default Event debug type does not change.
`no logging <syslog-ip-address>`	Removes only the specified syslog logging destination from the running configuration.Removing all configured syslog destinations with the `no logging` command (or a specified syslog server destination with the `no logging <syslog-ip-address>` command) does not delete the syslog server IP addresses stored in the startup configuration.

Deleting syslog addresses in the startup configuration

Enter a `no logging` command followed by the `write memory` command.

Verifying the deletion of a syslog server address

Display the startup configuration by entering the `show config` command.

Blocking the messages sent to configured syslog servers from the currently configured debug message type

Enter the `no debug <debug-type>` command. (See Debug messages.)

Disabling syslog logging on the switch without deleting configured server addresses

Enter the `no debug destination logging` command. Note that, unlike the case in which no syslog servers are configured, if one or more syslog servers are already configured and syslog messaging is disabled, configuring a new server address does not re-enable syslog messaging. To re-enable syslog messaging, you must enter the `debug destination logging` command.

Sending logging messages using TCP

Syntax

`no logging <ip-addr> [udp 1024-49151 | tcp 1024-49151]`

Allows the configuration of the UDP or TCP transport protocol for the transmission of logging messages to a syslog server.

Specifying a destination port with UDP or TCP is optional.

Default ports: UDP port is 514

TCP port is 1470

Default Transport Protocol: UDP

Because TCP is a connection-oriented protocol, a connection must be present before the logging information is sent. This helps ensure that the logging message will reach the syslog server. Each configured syslog server needs its own connection. You can configure the destination port that is used for the transmission of the logging messages.

Configuring TCP for logging message transmission using the default port

```
switch(config)# logging 192.123.4.5 tcp
```

(Default TCP port 1470 is used.)

Configuring TCP for logging message transmission using a specified port

```
switch(config)# logging 192.123.4.5 9514
```

(TCP port 9514 is used.)

Configuring UDP for logging message transmission using the default port

```
switch(config)# logging 192.123.4.5 udp
```

(Default UDP port 514 is used.)

Configuring UDP for logging message transmission using a specified port

```
switch(config)# logging 192.123.4.5 9512
```

(UDP port 9512 is used.)

Syntax

`no logging facility <facility-name>`

The logging facility specifies the destination subsystem used in a configured syslog server. (All configured syslog servers must use the same subsystem.) Hewlett Packard Enterprise recommends the default (user) subsystem unless your application specifically requires another subsystem. Options include:

`user`	(default) Random user-level messages
`kern`	Kernel messages
`mail`	Mail system
`daemon`	System daemons
`auth`	Security/authorization messages
`syslog`	Messages generated internally by syslog
`lpr`	Line-printer subsystem
`news`	Netnews subsystem
`uucp`	uucp subsystem
`cron`	cron/at subsystem
`sys9`	cron/at subsystem
`sys10 - sys14`	Reserved for system use
`local10 - local17`	Reserved for system use

Use the `no` form of the command to remove the configured facility and reconfigure the default (user) value.

Adding a description for a Syslog server

You can associate a user-friendly description with each of the IP addresses (IPv4 only) configured for syslog using the CLI or SNMP.

The Hewlett Packard Enterprise MIB hpicfSyslog.mib allows the configuration and monitoring of syslog for SNMP (RFC 3164 supported).

Entering the `no logging` command removes ALL the syslog server addresses without a verification prompt.

The CLI command is:

Syntax

```
logging <ip-addr> [control-descr ZZZZTRISHZZZZ <text_string>]
 no logging <ip-addr> [control-descr]
```

An optional user-friendly description that can be associated with a server IP address. If no description is entered, this is blank. If <*text_string*> contains white space, use quotes around the string. IPv4 addresses only.

Use the `no` form of the command to remove the description. Limit: 255 characters

To remove the description using SNMP, set the description to an empty string.

The logging command with a control description

```
switch(config)# logging 10.10.10.2 control-descr syslog_one
```

Adding a priority description

This description can be added with the CLI or SNMP. The CLI command is:

Syntax

```
logging priority-descr <text_string>
 no logging priority-descr
```

Provides a user-friendly description for the combined filter values of `severity` and `system module`. If no description is entered, this is blank.

If *`text_string`* contains white space, use quotes around the string.

Use the `no` form of the command to remove the description.

Limit: 255 characters

The logging command with a priority description

```
switch(config)# logging priority-descr severe-pri
```

A notification is sent to the SNMP agent if there are any changes to the syslog parameters, either through the CLI or with SNMP.

Configuring the severity level for Event Log messages sent to a syslog server

Event Log messages are entered with one of the following severity levels (from highest to lowest):

`Major`	A fatal error condition has occurred on the switch.
`Error`	An error condition has occurred on the switch.
`Warning`	A switch service has behaved unexpectedly.
`Information`	Information on a normal switch event.
`Debug`	Reserved for switch internal diagnostic information.

Using the `logging severity` command, you can select a set of Event Log messages according to their severity level and send them to a syslog server. Messages of the selected and higher severity will be sent. To configure a syslog server, see Configuring a syslog server on page 474.

Syntax

`no logging severity {< major | error | warning | info | debug >}`

Configures the switch to send all Event Log messages with a severity level equal to or higher than the specified value to all configured Syslog servers.

Default: `debug` (Reports messages of all severity levels.)

Use the `no` form of the command to remove the configured severity level and reconfigure the default value, which sends Event Log messages of all severity levels to syslog servers.

The severity setting does not affect event notification messages that the switch normally sends to the Event Log. All messages remain recorded in the Event Log.

Configuring the system module used to select the Event Log messages sent to a syslog server

Event Log messages contain the name of the system module that reported the event. Using the `logging system-module` command, you can select a set of Event Log messages according to the originating system module and send them to a syslog server.

Syntax

`no logging system-module <system-module>`

Configures the switch to send all Event Log messages being logged from the specified system module to configured syslog servers. (To configure a syslog server, see Configuring a syslog server on page 474.)

See Table 41: Event Log system modules for the correct value to enter for each system module.

Default: `all-pass` (Reports all Event Log messages.)

Use the `no` form of the command to remove the configured system module value and reconfigure the default value, which sends Event Log messages from all system modules to syslog servers.

You can select messages from only one system module to be sent to a syslog server; you cannot configure messages from multiple system modules to be sent. If you re-enter the command with a different system module name, the currently configured value is replaced with the new one.

This setting has no effect on event notification messages that the switch normally sends to the Event Log.

Enabling local command logging

Use this command to enable local command logging. This satisfies the NDcPP certification requirement that:

- All administrative actions (commands) are logged locally.
- Local command log storage can be enabled and disabled.
- The identity of the user causing an event is logged.
- When the command log is exhausted by 80% and wraparound occurs, the event is logged and a trap is generated.
- Log messages have a maximum of 240 characters (the RMON event maximum string length) and are stored in the command log buffer.
- Log messages greater than the maximum length are truncated and are not stored in the command log buffer.

Syntax

```
no logging command
```

Operating notes for debug and Syslog

- Rebooting the switch or pressing the `Reset` button resets the debug configuration.

Debug option	Effect of a reboot or reset
logging (debug destination)	If syslog server IP addresses are stored in the startup-config file, they are saved across a reboot and the logging destination option remains enabled. Otherwise, the logging destination is disabled.
session (debug destination)	Disabled.
ACL (debug type)	Disabled.
All (debug type)	Disabled.
event (debug type)	If a syslog server IP address is configured in the startup-config file, the sending of Event Log messages is reset to `enabled`, regardless of the last active setting. If no syslog server is configured, the sending of Event Log messages is `disabled`.
IP (debug type)	Disabled.

- Debug commands do not affect normal message output to the Event Log.

  Using the `debug event` command, you can specify that Event Log messages are sent to the debug destinations you configure (CLI session, syslog servers, or both) in addition to the Event Log.

- Ensure that your syslog servers accept debug messages.

  All syslog messages resulting from a debug operation have a "debug" severity level. If you configure the switch to send debug messages to a syslog server, ensure that the server's syslog application is configured to accept the "debug" severity level. (The default configuration for some syslog applications ignores the "debug" severity level.)

- Duplicate IP addresses are not stored in the list of syslog servers.
- If the default severity value is in effect, all messages that have severities greater than the default value are passed to syslog. For example, if the default severity is "debug," all messages that have severities greater than debug are passed to syslog.
- There is a limit of six syslog servers. All syslog servers are sent the same messages using the same filter parameters. An error is generated for an attempt to add more than six syslog servers.

Diagnostic tools

Port auto-negotiation

When a link LED does not light (indicating loss of link between two devices), the most common reason is a failure of port auto-negotiation between the connecting ports. If a link LED fails to light when you connect the

switch to a port on another device, do the following:

Procedure

1. Ensure that the switch port and the port on the attached end-node are both set to `Auto` mode.
2. If the attached end-node does not have an `Auto` mode setting, you must manually configure the switch port to the same setting as the end-node port.

Ping and link tests

The ping test and the link test are point-to-point tests between your switch and another IEEE 802.3-compliant device on your network. These tests can tell you whether the switch is communicating properly with another device.

NOTE

To respond to a ping test or a link test, the device you are trying to reach must be IEEE 802.3-compliant.

Ping test

A test of the path between the switch and another device on the same or another IP network that can respond to IP packets (ICMP Echo Requests). To use the `ping` (or `traceroute`) command with host names or fully qualified domain names, see DNS resolver on page 496.

Link test

A test of the connection between the switch and a designated network device on the same LAN (or VLAN, if configured). During the link test, IEEE 802.2 test packets are sent to the designated network device in the same VLAN or broadcast domain. The remote device must be able to respond with an 802.2 Test Response Packet.

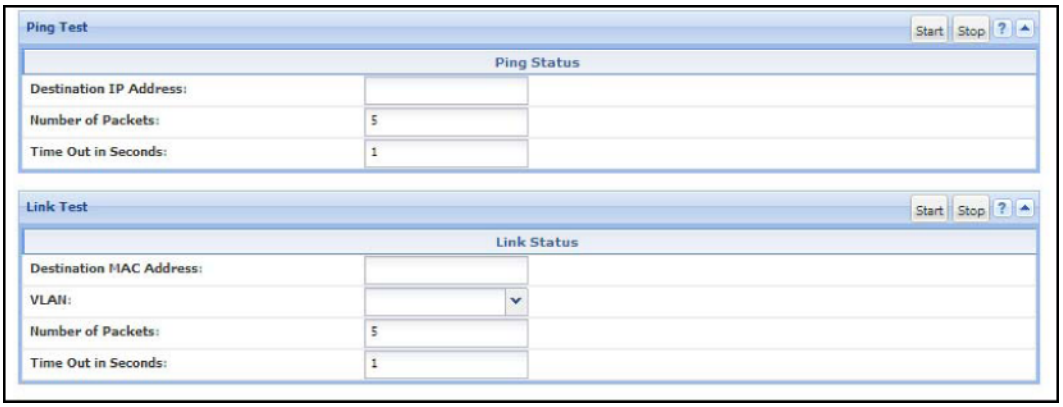
Executing ping or link tests (WebAgent)

To start a ping or link test in the WebAgent:

1. In the navigation pane, click **Troubleshooting**.
2. Click **Ping/Link Test**.
3. Click **Start**.
4. To halt a link or ping test before it concludes, click **Stop**.

For an example of the text screens, see Figure 1: Ping test and link test screen on the WebAgent.

Figure 1 *Ping test and link test screen on the WebAgent*



- **Destination IP Address** is the network address of the target, or destination, device to which you want to test a connection with the switch. An IP address is in the X.X.X.X format where X is a decimal number between 0 and 255.
- **Number of Packets to Send** is the number of times you want the switch to attempt to test a connection.
- **Timeout in Seconds** is the number of seconds to allow per attempt to test a connection before determining that the current attempt has failed.

Testing the path between the switch and another device on an IP network

The ping test uses ICMP echo requests and ICMP echo replies to determine if another device is alive. It also measures the amount of time it takes to receive a reply from the specified destination. The `ping` command has several extended commands that allow advanced checking of destination availability.

Syntax

```
ping {<ip-address | hostname | switch-num>} [repetitions <1-10000>] [timeout <1-60>]
[{source <ip-address> | <vlan-id>}] [data-size <0-65471>] [data-fill <0-1024>]
ping6 {<ip-address | hostname | [switch-num>]} [repetitions <1-10000>] [timeout <1-60>]
[{source <ip-address> | <vlan-id>}] [data-size <0-65471>] [data-fill <0-1024>]
```

Sends ICMP echo requests to determine if another device is alive.

`{< ip-address | hostname >}`	Target IP address or hostname of the destination node being pinged
`repetitions <1-10000>`	Number of ping packets sent to the destination address. Default: 1
`timeout <1-60>`	Timeout interval in seconds; the ECHO REPLY must be received before this time interval expires for the ping to be successful. Default: 5
`source {< ip-addr | hostname>}`	Source IP address or hostname. The source IP address must be owned by the router. If a VLAN is specified, the IP address associated with the specified VLAN is used.
`data-size <0-65471>`	Size of packet sent. Default: 0 (zero)
`data-fill <0-1024>`	The data pattern in the packet. Default: Zero length string

Ping tests

```
switch# ping 10.10.10.10
10.10.10.10 is alive, time = 15 ms

switch# ping 10.10.10.10 repetitions 3
10.10.10.10 is alive, iteration 1, time = 15 ms
10.10.10.10 is alive, iteration 1, time = 15 ms
10.10.10.10 is alive, iteration 1, time = 15 ms

switch# ping 10.10.10.10 timeout 2
10.10.10.10 is alive, time = 10 ms

switch# ping 10.11.12.13
The destination address is unreachable.
```

Halting a ping test

To halt a ping test before it concludes, press **[Ctrl][C]**.

To use the `ping` (or `traceroute`) command with host names or fully qualified domain names, see DNS resolver on page 496.

Issuing single or multiple link tests

Single or multiple link tests can have varying repetitions and timeout periods. The defaults are:

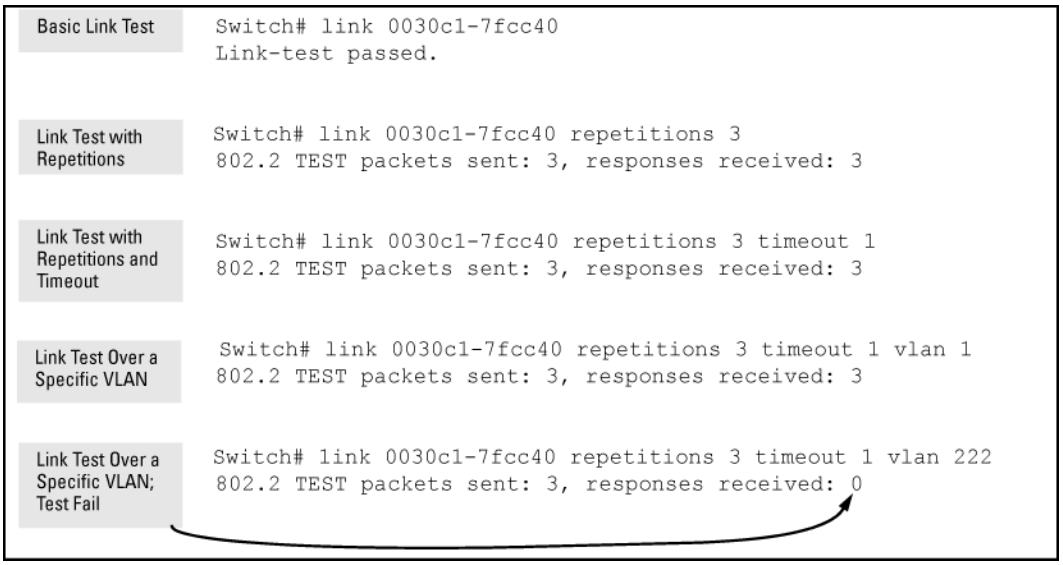
- Repetitions: 1 (1 to 999)
- Timeout: 5 seconds (1 to 256 seconds)

Syntax

```
link <mac-address> [repetitions <1-999>] [timeout <1-256>] [vlan < vlan-id >]
```

Example

Figure 76 *Link tests*



Tracing the route from the switch to a host address

The `traceroute` command enables you to trace the route from the switch to a host address.

This command outputs information for each (router) hop between the switch and the destination address. Note that every time you execute `traceroute`, it uses the same default settings unless you specify otherwise for that instance of the command.

Syntax

```
traceroute {< ip-address | hostname >} [maxttl <1-255>] [minttl <1-255>]
[probes <1-5>] [source {<ip-address | source-vlan <vid> | loopback <0-7>}]
 [dstport <1-34000>] [srcport <1-34000>] [ip-option {<record-route |
loose-source-route | strict-source-route | include-timestamp |
include-timestamp-and-address | include timestamp-from>}] [< timeout 1-120>]
```

Lists the IP address or hostname of each hop in the route, plus the time in microseconds for the `traceroute` packet reply to the switch for each hop.

`{< ip-address | hostname >}`	The IP address or hostname of the device to which to send the traceroute.
`[minttl < 1-255 >]`	For the current instance of `traceroute`, changes the minimum number of hops allowed for each probe packet sent along the route. ■ If `minttl` is greater than the actual number of hops, the output includes only the hops at and above the `minttl` threshold. (The hops below the threshold are not listed.) ■ If `minttl` matches the actual number of hops, only that hop is shown in the output. ■ If `minttl` is less than the actual number of hops, all hops are listed. For any instance of `traceroute`, if you want a `minttl` value other than the default, you must specify that value.(Default: 1)
`[maxttl < 1-255 >]`	For the current instance of `traceroute`, changes the maximum number of hops allowed for each probe packet sent along the route. If the destination address is further from the switch than `maxttl` allows, `traceroute` lists the IP addresses for all hops it detects up to the `maxttl` limit. For any instance of `traceroute`, if you want a `maxttl` value other than the default, you must specify that value.(Default: 30)
`[probes < 1-5 >]`	For the current instance of `traceroute`, changes the number of queries the switch sends for each hop in the route. For any instance of `traceroute`, if you want a probes value other than the default, you must specify that value.(Default: 3)
`[source {< ip-addr | vid | loopback <0-7> >}]`	The source IPv4 address, VLAN ID, or Loopback address.
`[dstport < 1-34000 >]`	Destination port.
`[srcport < 1-34000 >]`	Source port.

`[ip-option]`	Specify an IP option, such as loose or strict source routing, or an include-timestamp option: `[include-timestamp]`: Adds the timestamp option to the IP header. The timestamp displays the amount of travel time to and from a host.Default: 9 `[include-timestamp-and-address]`: Records the intermediate router's timestamp and IP address.Default: 4 `[loose-source-route <IP-addr>]` : Prompts for the IP address of each source IP on the path.It allows you to specify the IP addresses that you want the ping packet to go through; the packet may go through other IP addresses as well. `[record-route <1-9>]` : Displays the IP addresses of the interfaces that the ping packet goes through on its way to the destination and on the way back.When specified without loose or strict recording, the source route is not recorded. The source route is automatically recorded when loose or strict source routing is enabled.Default: 9 `[strict-source-route <IP-addr>]` : Restricts the ping packet to only those IP addresses that have been specified and no other addresses. `[timeout <1-120>]`: For the current instance of `traceroute`, changes the timeout period the switch waits for each probe of a hop in the route.For any instance of `traceroute`, if you want a timeout value other than the default, you must specify that value.(Default: 5 seconds)

NOTE

For information about `traceroute6`, see the IPv6 configuration guide for your switch.

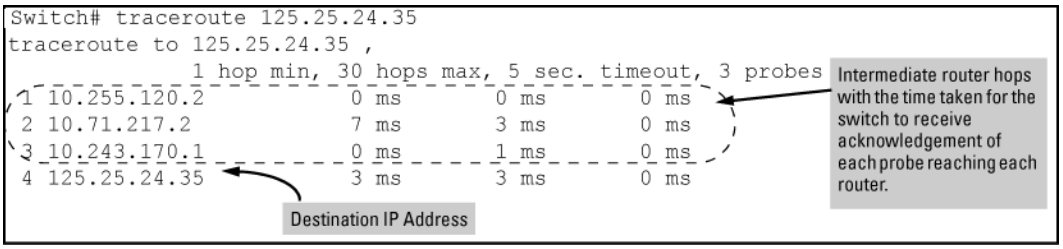
Halting an ongoing traceroute search

Press the **[Ctrl][C]** keys.

A low maxttl causes traceroute to halt before reaching the destination address

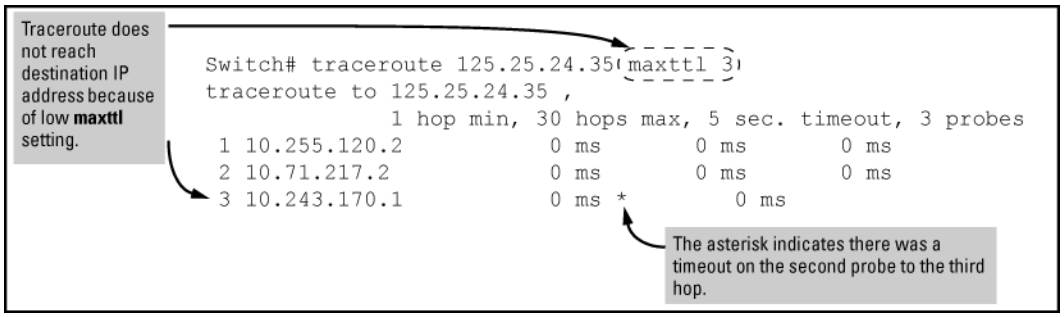
Executing `traceroute` with its default values for a destination IP address that is four hops away produces a result similar to this:

Figure 77 *A completed traceroute enquiry*



Continuing from the previous example (Figure 77: A completed traceroute enquiry), executing *`traceroute`* with an insufficient *`maxttl`* for the actual hop count produces an output similar to this:

Figure 78 *Incomplete traceroute because of low maxttl setting*



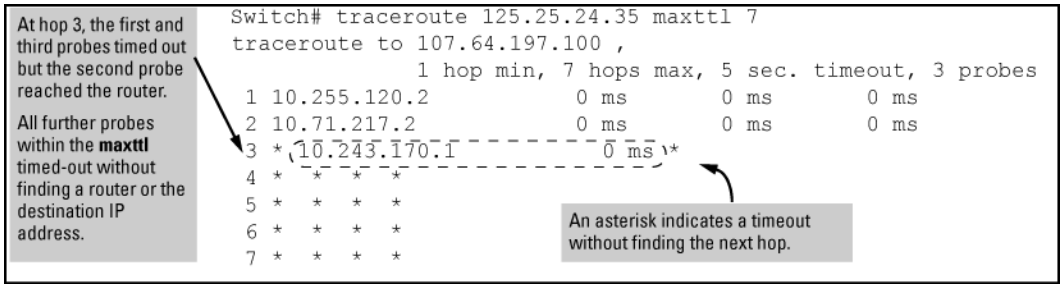
If a network condition prevents traceroute from reaching the destination

Common reasons for `traceroute` failing to reach a destination include:

- Timeouts (indicated by one asterisk per probe, per hop)
- Unreachable hosts
- Unreachable networks
- Interference from firewalls
- Hosts configured to avoid responding

Executing `traceroute` where the route becomes blocked or otherwise fails results in an output marked by timeouts for all probes beyond the last detected hop. For example, with a maximum hop count of 7 (`maxttl` = 7), where the route becomes blocked or otherwise fails, the output appears similar to this:

Figure 79 *Traceroute failing to reach the destination address*



Viewing switch configuration and operation

In some troubleshooting scenarios, you may need to view the switch configuration to diagnose a problem. The complete switch configuration is contained in a file that you can browse from the CLI using the commands described in this section.

Viewing the startup or running configuration file

Syntax

`write terminal`

Displays the running configuration.

`show config`	Displays the startup configuration.
`show running-config`	Displays the running-config file.

For more information and examples of how to use these commands, see “Switch Memory and Configuration” in the *Basic Operation Guide*.

Viewing the configuration file (WebAgent)

To display the running configuration using the WebAgent:

1. In the navigation pane, click **Troubleshooting**.
2. Click **Configuration Report**.
3. Use the right-side scroll bar to scroll through the configuration listing.

Viewing a summary of switch operational data

Syntax

`show tech`

By default, the `show tech` command displays a single output of switch operating and running-configuration data from several internal switch sources, including:

- Image stamp (software version data)
- Running configuration
- Event Log listing
- Boot history
- Port settings
- Status and counters – port status
- IP routes
- Status and counters – VLAN information
- GVRP support
- Load balancing (trunk and LACP)

: The show tech command shows sample output from the `show tech` command.

The show tech command

```
switch# show tech

 show system

  Status and Counters - General System Information

   System Name         : Switch
   System Contact      :
   System Location     :

   MAC Age Time (sec) : 300
```

```
   Time Zone          : 0
   Daylight Time Rule : None

   Software revision  : XX.14.xx     Base MAC Addr  : 001871-c42f00
   ROM Version        : XX.12.12     Serial Number  : SG641SU00L

   Up Time            : 23 hours    Memory - Total :
   CPU Util (%)       : 10                    Free :

   IP Mgmt - Pkts Rx  : 759         Packet - Total : 6750
             Pkts Tx  : 2             Buffers Free : 5086
                                            Lowest : 4961
                                            Missed : 0

show flash
Image       Size(Bytes)   Date  Version
-----       -----------  ------ --------
```

To specify the data displayed by the `show tech` command, use the `copy show tech` command.

Saving show tech command output to a text file

When you enter the `show tech` command, a summary of switch operational data is sent to your terminal emulator. You can use your terminal emulator's text capture features to save the `show tech` data to a text file for viewing, printing, or sending to an associate to diagnose a problem.

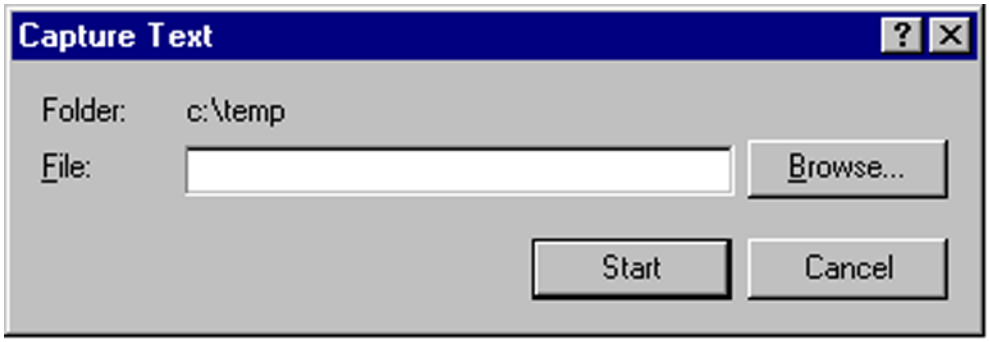
For example, if your terminal emulator is the Hyperterminal application available with Microsoft® Windows® software, you can copy the `show tech` output to a file and then use either Microsoft Word or Notepad to display the data. (In this case, Microsoft Word provides the data in an easier-to-read format.)

The following example uses the Microsoft Windows terminal emulator. If you are using a different terminal emulator application, see the documentation provided with the application.

Procedure

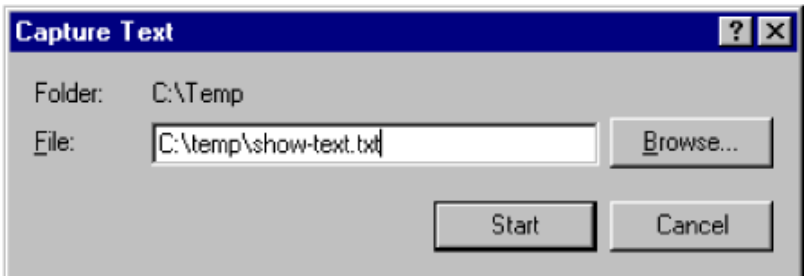
1. In Hyperterminal, click on `Transfer|Capture Text…`.

   Figure 80 *Capture text window of the Hyperterminal application*

2. In the `File` field, enter the path and file name in which you want to store the `show tech` output.

Figure 81 *Entering a path and filename for saving show tech output*



3. Click **[Start]** to create and open the text file.
4. From the global configuration context, enter the `show tech` command:
   `switch# show tech`

   The `show tech` command output is copied into the text file and displayed on the terminal emulator screen. When the command output stops and displays `-- MORE --`, press the Space bar to display and copy more information. The CLI prompt appears when the command output finishes.
5. Click on `Transfer|Capture Text|Stop` in HyperTerminal to stop copying data and save the text file.

   If you do not stop HyperTerminal from copying command output into the text file, additional unwanted data can be copied from the HyperTerminal screen.
6. To access the file, open it in Microsoft Word, Notepad, or a similar text editor.

Customizing show tech command output

Use the `copy show tech` command to customize the detailed switch information displayed with the `show tech` command to suit your troubleshooting needs.

To customize the information displayed with the `show tech` command:

Procedure

1. Determine the information that you want to gather to troubleshoot a problem in switch operation.
2. Enter the `copy show tech` command to specify the data files that contain the information you want to view.

Syntax

`copy <source> show-tech`

Specifies the operational and configuration data from one or more source files to be displayed by the `show tech` command. Enter the command once for each data file that you want to include in the display.

Default: Displays data from all source files, where <*source*> can be any one of the following values:

`command-output "<command>"`	Includes the output of a specified command in `show-tech` command output. Enter the command name between double-quotation marks, For example, `copy "show system" show-tech`.

`crash-data [slot-id | master]`	Includes the crash data from all management and interface modules in `show tech` command output. To limit the amount of crash data displayed, specify an installed module or management modules, where: ■ `slot-id`: Includes the crash data from an installed module. Valid slot IDs are the letters `a` through `h`. ■ `master`: Includes the crash data from both management modules.
`crash-log [slot-id | master]`	Includes the crash logs from all management and interface modules in `show tech` command output. To limit the amount of crash-log data displayed, specify an installed module or management modules, where: ■ `slot-id`: Includes the crash log from an installed module. Valid slot IDs are the letters `a` through `h`. ■ `master`: Includes the crash log from both management modules.
`event-log`	Copies the contents of the Event Log to `show tech` command output.
`running-config`	Includes the contents of the running configuration file in `show tech` command output
`startup-config`	Includes the contents of the startup configuration file in `show tech` command output.
`tftp config {<startup-config | running-config} <ip-addr> <remote-file> {<pc | unix>}`	Downloads the contents of a configuration file from a remote host to `show tech` command output, where: ■ `<ip-addr>`: Specifies the IP address of the remote host device. ■ `<remote-file>`: Specifies the pathname on the remote host for the configuration file whose contents you want to include in the command output. ■ `pc|unix`: Specifies whether the remote host is a DOS-based PC or UNIX workstation.
`xmodem config {<startup-config | config < filename > | command-file < >} {<pc | unix>}`	Copies the contents of a configuration file or ACL command file from a serially connected PC or UNIX workstation to `show tech` command output, where: ■ `startup-config`: Specifies the name of the startup configuration file on the connected device. ■ `config <filename>`: Specifies the pathname of a configuration file on the connected device. ■ `command-file <acl-filename.txt>`: Specifies the pathname of an ACL command file on the connected device. ■ `pc|unix`: Specifies whether the connected device is a DOS-based PC or UNIX workstation.

Viewing more information on switch operation

Use the following commands to display additional information on switch operation for troubleshooting purposes.

Syntax

`show boot-history`

Displays the crash information saved for each management module on the switch.

`show history`

Displays the current command history. This command output is used for reference or when you want to repeat a command (See Displaying the information you need to diagnose problems on page 492).

`show system-information`

Displays globally configured parameters and information on switch operation.

`show version`

Displays the software version currently running on the switch and the flash image from which the switch booted (primary or secondary). For more information, see "Displaying Management Information" in the "Redundancy (Switch 8212zl)" .

`show interfaces`

Displays information on the activity on all switch ports (see "Viewing Port Status and Configuring Port Parameters" in the "Port Status and Configuration").

`show interfaces-display`

Displays the same information as the `show interfaces` command and dynamically updates the output every three seconds. Press **Ctrl + C** to stop the dynamic updates of system information. Use the Arrow keys to view information that is off the screen.

Searching for text using pattern matching with show command

Selected portions of the output are displayed, depending on the parameters chosen.

Syntax

`show {< command option > | < include | exclude | begin >} <regular expression>`

Uses matching pattern searches to display selected portions of the output from a `show` command. There is no limit to the number of characters that can be matched. Only regular expressions are permitted; symbols such as the asterisk cannot be substituted to perform more general matching.

`include`	Only the lines that contain the matching pattern are displayed in the output.
`exclude`	Only the lines that contain the matching pattern are **not** displayed in the output.
`begin`	The display of the output begins with the line that contains the matching pattern.

Pattern matching is case-sensitive.

Following are examples of what portions of the running config file display depending on the option chosen.

Pattern matching with include option

```
switch(config)# show run | include ipv6[1]
   ipv6 enable
   ipv6 enable
ipv6 access-list "EH-01"
switch(config)#
```

Pattern matching with exclude option

```
switch(config)# show run | exclude ipv6[2]

Running configuration:
```

```
; J9299A Configuration Editor; Created on release #WB.15.XX

hostname "Switch"
snmp-server community "notpublic" Unrestricted
vlan 1
  name "DEFAULT_VLAN"
  untagged A1-A24,B1-B20
  ip address dhcp-bootp
  no untagged B21-B24
  exit
vlan 20
  name "VLAN20"
  untagged B21-B24
  no ip address
  exit
policy qos "michael"
  exit
  sequence 10 deny tcp 2001:db8:255::/48 2001:db8:125::/48
  exit
no autorun
password manager
```

Pattern matching with begin option

```
switch(config)# show run | begin ipv6[3]
   ipv6 enable
   no untagged 21-24
   exit
vlan 20
   name "VLAN20"
   untagged 21-24
   ipv6 enable
   no ip address
   exit
policy qos "michael"
   exit
ipv6 access-list "EH-01"
   sequence 10 deny tcp 2001:db8:255::/48 2001:db8:125::/48
   exit
no autorun
password manager
```

The following is an example of the `show arp` command output, and then the output displayed when the `include` option has the IP address of `15.255.128.1` as the regular expression.

The show arp command and pattern matching with the include option

```
switch(config)# show arp

 IP ARP table

  IP Address      MAC Address    Type    Port
  -------------   -------------- ------- ----
  15.255.128.1    00000c-07ac00  dynamic B1
  15.255.131.19   00a0c9-b1503d  dynamic
  15.255.133.150  000bcd-3cbeec  dynamic B1


switch(config)# show arp | include 15.255.128.1
  15.255.128.1    00000c-07ac00  dynamic B1
```

[1]Displays only lines that contain “ipv6”.

[2]Displays all lines that do not contain “ipv6”.

[3]Displays the running config beginning at the first line that contains “ipv6”.

Displaying the information you need to diagnose problems

Use the following commands in a troubleshooting session to more accurately display the information you need to diagnose a problem.

Syntax

`alias`

Creates a shortcut alias name for commonly used commands and command options.

Syntax

`kill`

Terminates a currently running, remote troubleshooting session. Use the `show ip ssh command` to list the current management sessions.

Syntax

`no page`

Toggles the paging mode for `show` commands between continuous listing and per-page listing.

Syntax

`repeat`

Repeatedly executes one or more commands so that you can see the results of multiple commands displayed over a period of time. To halt the command execution, press any key on the keyboard.

Syntax

`setup`

Displays the Switch Setup screen from the menu interface.

Restoring the factory-default configuration

As part of your troubleshooting process, it may become necessary to return the switch configuration to the factory default settings. This process:

- Momentarily interrupts the switch operation
- Clears any passwords
- Clears the console Event Log
- Resets the network counters to zero
- Performs a complete self test
- Reboots the switch into its factory default configuration, including deleting an IP address

There are two methods for resetting to the factory-default configuration:

- CLI
- `Clear`/`Reset` button combination

NOTE

Hewlett Packard Enterprise recommends that you save your configuration to a TFTP server before resetting the switch to its factory-default configuration. You can also save your configuration via Xmodem to a directly connected PC.

Resetting to the factory-default configuration

Using the CLI

Syntax

`show logging [-a, -b, -r, -s, -t, -m, -e, -p, -w, -i, -d, command, filter] [< option-str >]`

By default, the `show logging` command displays the log messages recorded since the last reboot in chronological order:

`-a`	Displays all recorded log messages, including those before the last reboot.
`-b`	Displays log events as the time since the last reboot instead of in a date/time format.
`-r`	Displays all recorded log messages, with themost recent entries listed first (reverse order).
`-s`	Displays the active management module (AM) and standby management module (SM) log events.
`-t`	Displays the log events with a granularity of 10 milliseconds.
`-m`	Displays only major log events.
`-e`	Displays only error event class.
`-p`	Displays only performance log events.
`-w`	Displays only warning log events.
`-i`	Displays only informational log events.
`-d`	Displays only debug log events.
`command`	Displays only command logs.
`filter`	Displays only log filter configuration and status information.
<option-str>	Displays all Event Log entries that contain the specified text. Use an *<option-str>* value with `-a` or `-r` to further filter `show logging` command output.

Example

To display all Event Log messages that have "system" in the message text or module name, enter the following command:

```
switch# show logging -a system
```

To display all Event Log messages recorded since the last reboot that have the word "system" in the message text or module name, enter:

```
switch# show logging system
```

Using Clear/Reset

Procedure

1. Using pointed objects, simultaneously press both the `Reset` and `Clear` buttons on the front of the switch.
2. Continue to press the `Clear` button while releasing the `Reset` button.
3. When the Self Test LED begins to flash, release the `Clear` button.

   The switch then completes its self test and begins operating with the configuration restored to the factory default settings.

Restoring a flash image

The switch can lose its operating system if either the primary or secondary flash image location is empty or contains a corrupted OS file and an operator uses the `erase flash` command to erase a good OS image file from the opposite flash location.

Recovering from an empty or corrupted flash state

Use the switch's console serial port to connect to a workstation or laptop computer that has the following:

- A terminal emulator program with Xmodem capability, such as the HyperTerminal program included in Windows PC software.
- A copy of a good OS image file for the switch

The following procedure requires the use of Xmodem and copies an OS image into primary flash only.

This procedure assumes you are using HyperTerminal as your terminal emulator. If you use a different terminal emulator, you may need to adapt this procedure to the operation of your particular emulator.

1. Start the terminal emulator program.

   Ensure that the terminal program is configured as follows:

   - Baud rate: 9600
   - No parity
   - 8 Bits
   - 1 stop bit
   - No flow control
2. Use the `Reset` button to reset the switch.

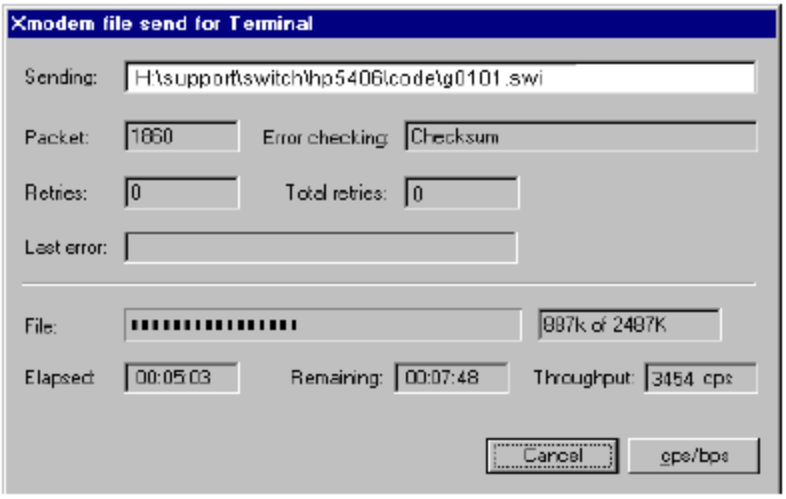
   The following prompt should then appear in the terminal emulator:

```
Enter h or ? for help.

=>
```

3. Because the OS file is large, you can increase the speed of the download by changing the switch console and terminal emulator baud rates to a high speed. For example:
   a. Change the switch baud rate to 115,200 Bps.
      ```
      => sp 115200
      ```
   b. Change the terminal emulator baud rate to match the switch speed:
      i. In HyperTerminal, select **Call|Disconnect**.
      ii. Select **File|Properties**.
      iii. Click on **Configure**.
      iv. Change the baud rate to **115200**.
      v. Click on **[OK]**, then in the next window, click on **[OK]** again.
      vi. Select **Call|Connect**.
      vii. Press **[Enter]** one or more times to display the => prompt.
4. Start the Console Download utility by entering `do` at the =prompt and pressing **[Enter]**:
   ```
   => do
   ```
5. You then see this prompt:
   ```
   You have invoked the console download utility.
   Do you wish to continue? (Y/N)>_
   ```
6. At the above prompt:
   a. Enter **y** (for Yes)
   b. Select **Transfer|File** in HyperTerminal.
   c. Enter the appropriate filename and path for the OS image.
   d. Select the **Xmodem** protocol (and not the 1k Xmodem protocol).
   e. Click on **[Send]**.

   If you are using HyperTerminal, you will see a screen similar to the following to indicate that the download is in progress:

Figure 82 *Example: Xmodem download in progress*



When the download completes, the switch reboots from primary flash using the OS image you downloaded in the preceding steps, plus the most recent startup-config file.

DNS resolver

The domain name system (DNS) resolver is designed for use in local network domains, where it enables the use of a host name or fully qualified domain name with DNS-compatible switch CLI commands.

DNS operation supports both IPv4 and IPv6 DNS resolution and multiple, prioritized DNS servers. (For information on IPv6 DNS resolution, see the latest IPv6 configuration guide for your switch.)

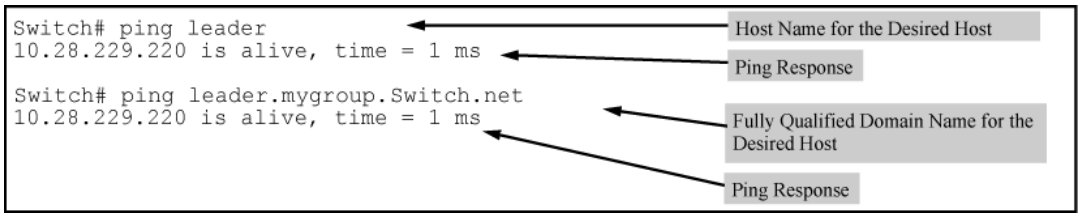
Basic operation

- When the switch is configured with only the IP address of a DNS server available to the switch, a DNS-compatible command, executed with a fully qualified domain name, can reach a device found in any domain accessible through the configured DNS server.
- When the switch is configured with both of the following:
  - The IP address of a DNS server available to the switch
  - The domain suffix of a domain available to the configured DNS server, then:
    - A DNS-compatible command that includes the host name of a device in the same domain as the configured domain suffix can reach that device.
    - A DNS-compatible command that includes a fully qualified domain name can reach a device in any domain that is available to the configured DNS server.

Example

Suppose the switch is configured with the domain suffix `mygroup.Switch.net` and the IP address for an accessible DNS server. If an operator wants to use the switch to ping a target host in this domain by using the DNS name "leader" (assigned by a DNS server to an IP address used in that domain), the operator can use either of the following commands:

Figure 83 *Example: using either a host name or a fully qualified domain name*



In the proceeding example, if the DNS server's IP address is configured on the switch, but a domain suffix is either not configured or is configured for a different domain than the target host, the fully qualified domain name **must** be used.

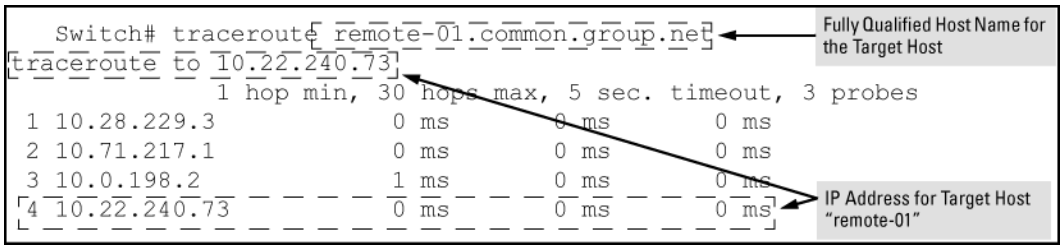
Note that if the target host is in a domain **other than** the domain configured on the switch:

- The host's domain must be reachable from the switch. This requires that the DNS server for the switch must be able to communicate with the DNS servers in the path to the domain in which the target host operates.
- The fully qualified domain name must be used, and the domain suffix must correspond to the domain in which the target host operates, regardless of the domain suffix configured in the switch.

Example

Suppose the switch is configured with the domain suffix `mygroup.Switch.net` and the IP address for an accessible DNS server in this same domain. This time, the operator wants to use the switch to trace the route to a host named "remote-01" in a different domain named `common.group.net`. Assuming this second domain is accessible to the DNS server already configured on the switch, a `traceroute` command using the target's fully qualified DNS name should succeed.

Figure 84 *Example: using the fully qualified domain name for an accessible target in another domain*



Configuring and using DNS resolution with DNS-compatible commands

The DNS-compatible commands include `ping` and `traceroute`.)

Procedure:

1. Determine the following:
   a. The IP address for a DNS server operating in a domain in your network.
   b. The priority (1 to 3) of the selected server, relative to other DNS servers in the domain.
   c. The domain name for an accessible domain in which there are hosts you want to reach with a DNS-compatible command. (This is the domain suffix in the fully qualified domain name for a given host operating in the selected domain. See Basic operation.) Note that if a domain suffix is not configured, fully qualified domain names can be used to resolve DNS-compatible commands.
   d. The host names assigned to target IP addresses in the DNS server for the specified domain.

2. Use the data from the first three bullets in step1 to configure the DNS entry on the switch.
3. Use a DNS-compatible command with the host name to reach the target devices.

Configuring a DNS entry

The switch allows up to two DNS server entries (IP addresses for DNS servers). One domain suffix can also be configured to support resolution of DNS names in that domain by using a host name only. Including the domain suffix enables the use of DNS-compatible commands with a target's host name instead of the target's fully qualified domain name.

Syntax

`no ip dns server-address priority <1-3> <ip-addr>`

Configures the access priority and IP address of a DNS server accessible to the switch. These settings specify:

- The relative priority of the DNS server when multiple servers are configured
- The IP address of the DNS server

These settings must be configured before a DNS-compatible command can be executed with host name criteria.

The switch supports two prioritized DNS server entries. Configuring another IP address for a priority that has already been assigned to an IP address is not allowed.

To replace one IP address at a given priority level with another address having the same priority, you must first use the `no` form of the command to remove the unwanted address. Also, only one instance of a given server address is allowed in the server list. Attempting to enter a duplicate of an existing entry at a different priority level is not allowed.

To change the priority of an existing server address, use the `no` form of the command to remove the entry, then re-enter the address with the new priority.

The `no` form of the command replaces the configured IP address with the null setting. (Default: null)

Syntax

`no ip dns domain-name <domain-name-suffix>`

This optional DNS command configures the domain suffix that is automatically appended to the host name entered with a DNS-compatible command. When the domain suffix and the IP address for a DNS server that can access that domain are both configured on the switch, you can execute a DNS-compatible command using only the host name of the desired target. (For an example, see Figure 83: Example: using either a host name or a fully qualified domain name.) In either of the following two instances, you must manually provide the domain identification by using a fully qualified DNS name with a DNS-compatible command:

- If the DNS server IP address is configured on the switch, but the domain suffix is not configured (null).
- The domain suffix configured on the switch is not the domain in which the target host exists.

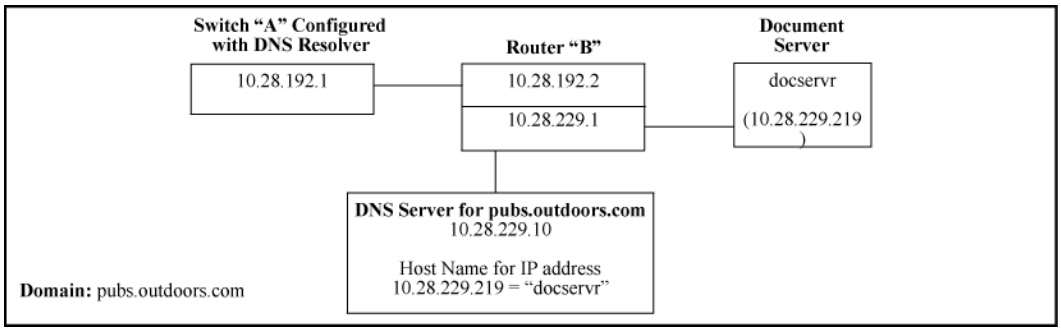
The switch supports one domain suffix entry and three DNS server IP address entries. (See the preceding command description.)

The `no` form of the command replaces the configured domain suffix with the null setting. (Default: null)

Using DNS names with ping and traceroute

In the network illustrated in Figure 85: Example: network domain, the switch at 10.28.192.1 is configured to use DNS names for DNS-compatible commands in the **pubs.outdoors.com** domain. The DNS server has been configured to assign the host name **docservr** to the IP address used by the document server (10.28.229.219).

Figure 85 *Example: network domain*



Configuring switch "A" with the domain name and the IP address of a DNS server for the domain enables the switch to use host names assigned to IP addresses in the domain to perform `ping` and `traceroute` actions on the devices in the domain. To summarize:

Entity	Identity
DNS server IP address	10.28.229.10
Domain name (and domain suffix for hosts in the domain)	pubs.outdoors.com
Host name assigned to 10.28.229.219 by the DNS server	docservr
Fully qualified domain name for the IP address used by the document server (10.28.229.219)	docservr.pubs.outdoors.com
Switch IP address	10.28.192.1
Document server IP address	10.28.229.219

With the above already configured, the following commands enable a DNS-compatible command with the host name `docserver` to reach the document server at 10.28.229.219.

Configuring switch "A" in example network domain to support DNS resolution

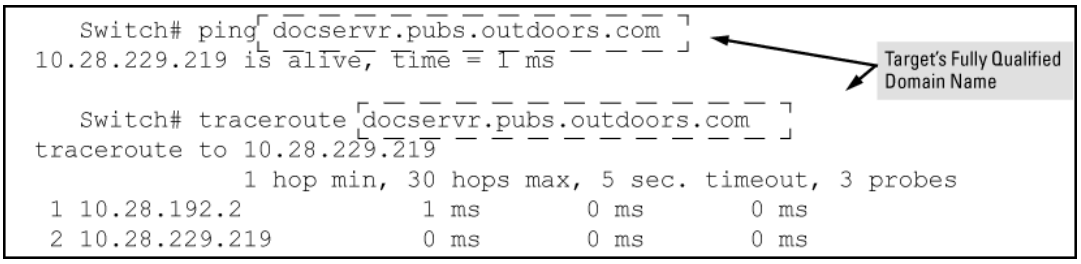
```
switch(config)# ip dns server-address 10.28.229.10
switch(config)# ip dns domain-name pbs.outdoors.com
```

Ping and traceroute execution for the network in example network domain

```
switch(config)# ping docservr
10.28.229.219 is alive, time = 1 ms

switch# traceroute docservr
traceroute to 10.28.229.219
             1 hop min, 30 hops max, 5 sec. timeout, 3 probes
 1 10.28.192.2 1          1 ms       0 ms       0 ms
 2 10.28.229.219 2        0 ms       0 ms       0 ms
```

As mentioned under the following example, if the DNS entry configured in the switch does not include the domain suffix for the desired target, you must use the target host's fully qualified domain name with DNS-compatible commands. For example, using the document server in Figure 86: Example: ping and traceroute execution when only the DNS server IP address is configured as a target:

Figure 86 *Example: ping and traceroute execution when only the DNS server IP address is configured*



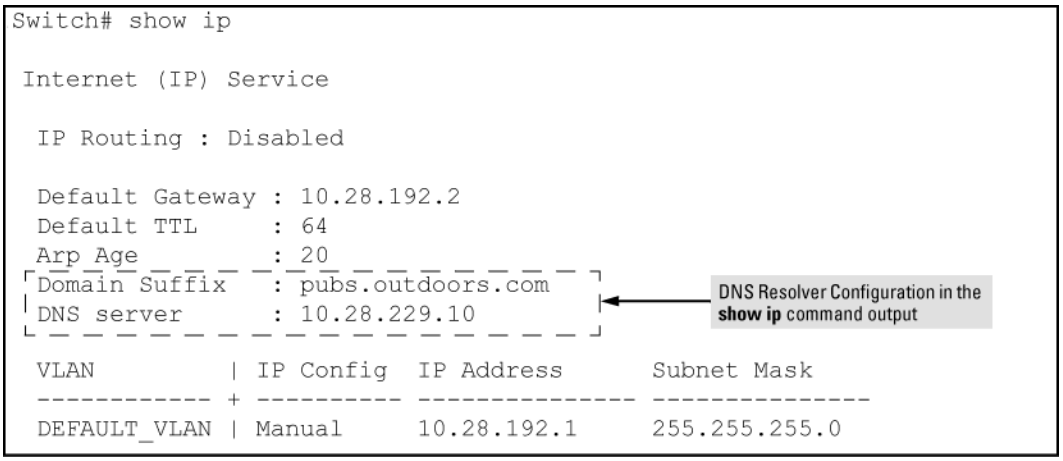
[1]First-Hop Router ("B")

[2]Traceroute Target

Viewing the current DNS configuration

The `show ip` command displays the current domain suffix and the IP address of the highest priority DNS server configured on the switch, along with other IP configuration information. If the switch configuration currently includes a non-default (non-null) DNS entry, it will also appear in the `show run` command output.

Figure 87 *Example: viewing the current DNS configuration*



Operating notes

- Tunneled node profile can be created using CLI and SNMP.
- The tunneled node profile supports configuring of:
  - Primary controller (both IPv4 and IPv6).
  - Backup controller (both IPv4 and IPv6).
  - Heartbeat keepalive timeout – range 1-40 seconds.
- Only one tunneled node profile can be created.
- The tunneled-node profile can be applied to a physical port only via CLI and SNMP.
- The maximum number of physical ports to which the profile may be applied is:

  - Aruba 5400R Switch Series (non-VSF): 256
  - Aruba 5400R Switch Series (VSF): 512
- High availability (HA) will be supported for the tunneled node related configuration.
- A tunnel, associated with a port, is up when the following conditions are met. A tunnel is down when either of the conditions are not met.
  - Either the primary or backup controller is reachable.
  - A boot strap message response is received from the controller.
- Heartbeat between the switch and controller fails when the controller does not respond after five attempts. All tunnels are brought down with a heartbeat failure.
- A tunnel up or down status is logged for each tunnel node port in the event log.
- The `show tech` command dumps all user-mode and test-mode command outputs.
- To reach the Aruba controller, the VLAN must have a manual IP configured.
- With the exception of the 802.1x BPDU, the switch consumes all other BPDUs.
- The controller cluster cannot have mix of IPv4 and IPv6 nodes.
- IPv6 addresses are not allowed for both Primary and Backup controllers when in Port-Based Tunnels.

Locating a switch (Locator LED)

To locate where a particular switch is physically installed, use the `chassislocate` command to activate the blue Locator LED on the switch's front panel.

Syntax

```
chassislocate [blink | on | off]
```

Locates a switch by using the blue Locate LED on the front panel.

`blink <1-1440>`	Blinks the chassis Locate LED for a specified number of minutes (Default: 30 minutes).
`on <1-1440>`	Turns the chassis Locate LED on for a specified number of minutes (Default: 30 minutes).
`off`	Turns the chassis Locate LED off.

Locating a switch with the chassislocate command

```
switch(config)# chassislocate
 blink <1-1440>       Blink the chassis locate led (default 30 minutes).
 off                  Turn the chassis locate led off.
 on <1-1440>          Turn the chassis locate led on (default 30 minutes).
switch(config)# chassislocate
```

For redundant management systems, if the active management module failsover, the Locator LED does not remain lit.

Overview

The Job Scheduler feature enables the user to schedule commands or jobs on the switch for one time or multiple times. This is similar in concept to the UNIX 'cron' utility. The user can schedule any CLI command that the user would otherwise enter interactively. This includes commands to enable or disable ports, LEDs, and Power-Over-Ethernet. Jobs can also be scheduled to be triggered by certain pre-defined events such as switch reboot. The only major restriction on commands scheduled is that, it should not prompt/ask for any user inputs.

Command

The following commands allow the user to configure NTP or show NTP configuration.

Job at | delay | enable | disable

Set schedule jobs using the options and set the count for the number of times the job is repeated.

Syntax

`job JOB NAME at | delay | enable | disable`

Description

Schedule a command to run automatically. Jobs can be scheduled to run once, multiple times on a recurring basis, or after certain events such as reboots. All commands run with manager privilege in configuration context.

The no form of the command deletes a scheduled job.

By default, jobs will be repeated an infinite number of times.

Restrictions

Jobs scheduled at any event will not be counted.

Jobs that are scheduled at the event reboot will not work in some multi management switches.

Range

- <1-1000>: is the value range for the `count` option.
- ([[DD:]HH:]MM): is the format used for the specific delay.

Parameters

count

Specify the number of times the job should run.

delay

Specify the delay before running the job.

enable

Enable a job that is disabled or expired.

disable

Disable a job. By default, a job is enabled.

Usage

```
job <JOB NAME> at <([DD:]HH:]MM on <WEEKDAY-LIST>)> config-save <COMMAND> count <1-1000>
job <JOB NAME> at <[HH:]MM on [MM/]DD> config-save <COMMAND> count <1-1000>
job <JOB NAME> at <EVENT> config-save <COMMAND>
job <JOB NAME> delay <([DD:]HH:]MM> config-save <COMMAND> count <1-1000>
job <JOB NAME> enable | disable
no job <JOB NAME>
```

Show job

Syntax

```
show job
```

Description

Show the jobs scheduled.

Show job

```
switch# show job

 Job Scheduler Status and Configuration

  Scheduler Status : Waiting for the system time to be set

                     Event or            Repeat  Save
  Name               Time                Count   Cfg  Command
  ------------------ ------------------- ------- ---- ------------
  Burrrrrrrrrrrr...  reboot              --    Yes chassislocate blink
  baz                reboot              --     No  show time
  foo                17:00 SxTWTxS       --     No  savepower led
  a1                 12:00               2      Yes sh time
  a2                 Every 2:14:30 days  75     Yes vlan 3
  a3                 Every 00:00:25 days 1      No  vlan 4
```

The scheduler does not run until the system time is set.

Show job <Name>

Syntax

```
show job JOB NAME
```

Description

Show the job by name.

Show job <JOB NAME>

```
switch# show job a1
```

```
Job Information

Job Name    : a1
Runs At     : 01:24
Config Save : No
Repeat Count: --
Job Status  : Enabled
Run Count   : 1
Error Count : 0
Command     : show time
Job Status  : Enabled

 Output from Last Run
 --------------------
 Tue Dec 15 01:24:00 2015


switch# show job a2

Job Information

Job Name    : a2
Runs At     : Every 2:14:30 days
Config Save : Yes
Repeat Count: 75
Run Count   : 0
Error Count : 0
Command     : vlan 3
Job Status  : Disabled

switch# show job foo


Job Information

Job Name    : foo
Runs At     : 17:00 SxTWTxS
Config Save : Yes
Repeat Count: --
Run Count   : 0
Error Count : 0
Command     : savepower led
Job Status  : Enabled
```

The configuration backup and restore without reboot supports the following features:

Interface Access (Telnet, Console/Serial, web)	Port Shutdown with Broadcast Storm
Access Control Lists (ACLs)	Source-Port Filters
AAA Authentication	TACACS+ Authentication
CoS (Class of Service)	Time Protocols (TimeP, SNTP)
Network Management Applications (SNMP)	Uni-directional Link Detection (UDLD)
Port Configuration	Virus Throttling (Connection-Rate Filtering)
Port Security	Web-based Authentication
Port-Based Access Control (802.1X)	Backplane stacking
Quality of Service (QoS)	Job Scheduler
Spanning Tree (STP, RSTP, MSTP, RPVST+)	Authorized IP Managers
VLANs	Authorized Manager List (Web, SSH, TFTP)
802.1Q VLAN Tagging	Auto MDIX Configuration
802.1X Port-Based Priority	DHCP Configuration
802.1X Multiple Authenticated Clients Per Port	Flow Control (802.3x)
IGMP	Friendly Port Names
LACP/Trunk	Guaranteed Minimum Bandwidth (GMB)
MAC Lockdown	IP Addressing
MAC-based Authentication	IP Routing
MAC Lockout	Jumbo Packets
LMA	LLDP
Multicast Filtering	LLDP-MED
Power over Ethernet (PoE and PoE+)	Loop Protection
Protocol Filters	MAC Address Management
RADIUS Authentication and Accounting	Management VLAN

RADIUS-Based Configuration	Passwords and Password Clear Protection/include-credentials
Encrypted-password	QoS: Strict-Priority Queuing
Port Monitoring	QoS: Turn on/off VLAN Precedence
Port Status	QoS: Egress Queue Rate-limiting
Rate-Limiting	CDP
Syslog	System Parameters (hostname, Banner)
System Information	Front-panel-security
Telnet Access	DLDP
Traffic/Security Filters	OOBM
VLAN Mirroring (1 static VLAN)/Port mirroring	Switch interconnect
Voice VLAN	Airwave Controller IP configuration
Web Authentication RADIUS Support	Aruba Central integration
Web UI	Captive portal commands
Log IP address of an ACL match	Consolidated Client View
access-list logtimer	IPsec for Zero Touch Provisioning
UFD: Uplink Failure Detection	Local User roles
Wake-on-LAN for a Specific VLAN	Port QoS Trust Mode
WebUI Inactivity Timer	Per-port Tunneled node
Control Plane Protection	Zero-touch provisioning - DHCP, Activate
Egress ACLs	ClearPass support
Device profile - switch auto configuration	HTTP redirection/Captive portal
Device profile: Auto configuration with Aruba AP detection	Device profile: LLDP Authentication Bypass with AP
Tunneled Node enhancement: fallback to switching	RADIUS Port Speed VSA
Rogue AP isolation	Dynamic ARP Protection
DHCP Option 82	Dynamic IP Lockdown
DHCP snooping	Eavesdrop Protection
Distributed Trunking	GVRP
RMON 1,2,3,9	Private VLANs

SavePower Features	IP SLA
sFlow	sys-debug acl
VxLAN	MAC Based VLANs (MBV)
Smartlink	RBAC: Role Based Access Control
Fault Finder extended to cover Flapping Transceiver Mitigation	RADIUS Service Tracking
Fault Finder (Per Port Enable)	sys-debug destination
SNMP Trap Throttling	Protocol VLANS

Overview

The traditional way of restoring a configuration from a backup configuration file required a switch reboot for the new configurations to be effective. There were network outages and a planned downtime for even minor changes. The switch configuration can now be restored from a backup configuration without reboot. It also provides hash of the current running configuration, which can be used for auditing.

The backup configuration can be created using the new command `cfg-backup`. An existing method of copying a configuration file from a remote location (for example, TFTP server) can also be used to backup a configuration or copied from flash.

More information

show hash on page 527

cfg-backup on page 511

cfg-restore config_bkp on page 520

Benefits of configuration restore without reboot

- Restores a new or modified configuration without reboot, with minimal network outage. Any NMS can use this method for configuration rebase workflows. Only configurations that were exported from the switch can be imported or restored on the switch.
- Restores the configuration without reboot from a backup configuration when the running configuration has functional issues, like misconfigurations from remote management stations.

Recommended scenarios

- Use the configuration restore feature for incremental configuration updates.
- Use the `force` option with `cfg-restore`, for commands which require reboot.
- Use the `verbose` option to get detailed progress on the configuration restore process.

More information

Force configuration restore

cfg-restore verbose

Use cases

- A user can switch to a new configuration without rebooting the switch.
- If a user loses connectivity after applying the new configuration, a job scheduler executes the job after a specific time frame. This restores the current configuration to the switch, without rebooting it.

More information

Switching to a new configuration on page 508

Rolling back to a stable configuration using job scheduler on page 509

Switching to a new configuration

Procedure

1. Back up the configuration using `cfg-backup running-config config <config_name>` command. In the following example, the configuration name used is stable. `cfg-backup running-config config stable`
2. Check the backup configuration using `show config files` command.

```
switch(config)# show config files

Configuration files:

id | act pri sec | name
---+-------------+--------
1  |  *   *   *  | config
2  |             | stable
3  |             |
4  |             |
5  |             |
```

3. Change the running configuration as required, and backup the new configuration as newfile. `cfg-backup running-config config newfile`

```
switch(config)# show config files

Configuration files:

 id | act pri sec | name
 ---+-------------+---------
  1 |  *   *   *  | config
  2 |             | stable
  3 |             | newfile
  4 |             |
  5 |             |
```

4. Check the difference between the newfile (running configuration) and stable (backed up configuration) using `cfg-restore flash stable diff` command. Based on the difference, apply the backed-up configuration using `cfg-restore flash stable` command.
5. Check the status of the configuration restore using `show cfg-restore status` command.

```
switch(config)# show cfg-restore status

 Status                 : Success
 Config File Name       : stable
 Source                 : Flash
 Time Taken             : 3 Seconds
 Last Run               : Tue Nov 28 18:24:09 2017

 Recovery Mode          : Enabled
 Failure Reason         : -

 Number of Add Commands    : 14
 Number of Remove Commands : 0

 Time Taken for Each Phase :
      Calculating diff     : 1 Seconds
      Adding commands      : 2 Seconds
      Removing commands    : 0 Seconds
```

Rolling back to a stable configuration using job scheduler

Procedure

1. Configure the job using `alias` with the required configuration.

   ```
   alias <name> <command-list>
   job <name> delay [[DD:]HH:]MM <command>
   ```

   To schedule a job execution with `cfg-restore` operation once after 15 minutes (00:00:15):

   ```
   alias "cfg_rollback" "cfg-restore flash stable"
   job "cfg_stable" delay 00:00:15 "cfg_rollback" count 1
   ```

2. Back up the current stable configuration using the command .

   ```
   cfg-backup running-config config <config_name>
   cfg-backup running-config config stable
   ```

3. Check the backup configuration using the command `show config files`.

   ```
   switch(config)# show config files

   Configuration files:

   id | act pri sec | name
   ---+-------------+-------
   1  |  *   *   *  | config
   2  |             | stable
   3  |             |
   4  |             |
   5  |             |
   ```

4. Edit the configuration as needed. If the user is still connected to the switch, the configuration is stable and the job which reloads the older configuration can be cancelled using the command `no job cfg_stable`.

   ```
   switch(config)# no job cfg_stable
   ```

5. If the user loses connectivity after applying the new configuration, the job scheduler executes the job after the 15-minute timer expires, and stable configuration is restored. Use the following commands to

check the output:

- `switch(config)# show job cfg_stable`
- `switch(config)# show cfg-restore status`

```
switch(config)# show job cfg_stable

 Job Information

  Job Name        : cfg_stable
  Runs At         : Every 00:00:15 days:hours:minutes
  Config Save     : No
  Repeat Count    : 1
  Job Status      : Enabled
  Running Status  : Active
  Run Count       : 0
  Error Count     : 0
  Skip Count      : 0
  Command         : cfg_rollback

switch(config)# show cfg-restore status
 Status                  : Success
 Config File Name        : stable
 Source                  : Flash
 Time Taken              : 9 Seconds
 Last Run                : Tue Nov 28 20:50:00 2017

 Recovery Mode           : Enabled
 Failure Reason          : -

 Number of Add Commands     : 27
 Number of Remove Commands  : 0

 Time Taken for Each Phase :
      Calculating diff      : 4 Seconds
      Adding commands       : 1 Seconds
      Removing commands     : 0 Seconds
```

If the configuration involves any sensitive information, backup and restore the configuration by enabling the `include-credentials` command.

Commands used in switch configuration restore without reboot

`cfg-backup`

Backs up the selected configuration to the flash file.

`show config files details`

Shows a detailed list of configuration files available in the flash.

`cfg-restore`

Restores the given configuration as the running configuration without reboot.

`show cfg-restore status`

Shows the status of latest restore performed.

`show cfg-restore latest-diff`

Views the list of configuration changes that are removed, modified, or added to the running configuration.

show hash

Shows the SHA ID of a startup or running configuration.

Configuration backup

The configuration backup creates a backup of the running or startup configuration of AOS-S switch on-demand to the flash storage on the switch. The maximum number of backup files supported has increased from three to five.

When you downgrade configuration backup files from five to three, and if the current number of files is either a four or five, an error message `Configuration file <name> stored in config index 5is not supported in lower image versions` is displayed.

cfg-backup

Syntax

`cfg-backup {running-config | startup-config} config <FILE-NAME>`

Description

Backs up the selected configuration to the flash file mentioned. When the firmware is downgraded to lower versions, the details of only three configuration files appear in the `show config files` command.

Command context

`config`

Parameters

running-config

Copies the running configuration to switch flash file.

startup-config

Copies the startup configuration to switch flash file.

flash

Name of the configuration file in flash.

Usage

`copy {startup-config | running-config} {sftp | tftp} <server address> <FILE-NAME>`

The existing `copy` command copies the startup and running configuration to the TFTP or SFTP server.

Examples

```
switch(config)# cfg-backup
 running-config       Backup the running configuration to the flash file
                      mentioned.
 startup-config       Backup the startup configuration to the flash file
                      mentioned.

switch(config)# cfg-backup {running-config | startup-config}
 config                Backup the named configuration file.
```

```
switch(config)# cfg-backup {running-config | startup-config} config
 ASCII-STR             Enter an ASCII string.
```

show config files

Syntax

```
show config files
```

Description

Shows a list of configuration files available in the flash.

Command context

```
config
```

Examples

```
switch# show config files
Configuration files:

 id | act pri sec | name
 ---+-------------+---------
  1 |  *   *   *  | config
  2 |             | add
  3 |             | modify
  4 |             | golden_config
  5 |             | poe2
```

To show the details of saved configuration files:

```
switch(config)# show config files
 details        Show details of saved configuration files.

switch(config)#show config files details

 Backup Configuration files:

 File Name      : config
 File ID        : 1
 File Size      : 35902 Bytes
 Last Modified  : Mon Jan 01 1990 00:09:28
 Version        : WC.16.xx

 File Name      : add
 File ID        : 2
 File Size      : 35902 Bytes
 Last Modified  : Mon Oct 23 2017 03:42:38
 Version        : WC.16.xx

 File Name      : modify
 File ID        : 3
 File Size      : 35902 Bytes
 Last Modified  : Mon Oct 23 2017 03:42:38
 Version        : WC.16.xx
```

To view the contents of a configuration file in the flash:

```
switch# show config add
```

```
; JL255A Configuration Editor; Created on release #WC.16.05.0000x
; Ver #12:08.1d.9b.3f.bf.bb.ef.7c.59.fc.6b.fb.9f.fc.ff.ff.37.ef:ba
hostname "switch"
module 1 type jl255a
snmp-server community "public" unrestricted
vlan 1
   name "DEFAULT_VLAN"
   no untagged 3-10
   untagged 1-2,11-28
   ip address dhcp-bootp
   exit
vlan 100
   name "VLAN100"
   untagged 3-5
   no ip address
   exit
vlan 200
name "VLAN200"
   untagged 6-10
   no ip address
   exit
```

Configuration restore without reboot

The `cfg-restore` without reboot command restores the configuration without reboot from a backup configuration to the running configuration of the switch.

The details about the difference between a running and a backup configuration can be displayed using `cfg-restore{flash | tftp | sftp} <FILE-NAME> diff` command.

More information

Configuration backup on page 511

Viewing the differences between a running configuration and a backup configuration on page 525

cfg-restore

Syntax

`cfg-restore {flash | tftp <IP-ADDRESS> | sftp <IP-ADDRESS>} <FILE-NAME> [diff | force | non-blocking | recovery-mode | verbose]`

Description

Restores the given configuration as the running configuration without reboot. If the configuration is not suitable to successfully restore without reboot, the command will return a failure message with details.

The restored configuration commands will be executed on a running configuration, so the name of the current active configuration does not change after configuration restore, except for the `force` option.

Command context

`config`

Parameters

`flash`

Copies file from flash.

tftp

Copies file from TFTP server.

sftp

Copies file from SFTP server.

<IP-ADDRESS>

IP address of the TFTP server.

<FILE-NAME>

Name of the backup configuration file to restore into the running configuration.

diff

Provides the list of changes that will be applied on the running configuration.

force

Forces a reboot if configuration in restored configuration requires a reboot. Applies the configuration with reboot if the configuration has reboot required commands or system-wide change commands. After a forced reboot, the name of the configuration changes.

non-blocking

Configuration restoration in non-blocking mode, where actual process happens in the background.

recovery-mode

Enables or disables recovery-mode. Recovery-mode is enabled by default and this retains the current running configuration if configuration restoration fails.

verbose

Provides the details of configuration restore status and the list of commands to be added or deleted.

Usage

- `cfg-restore flash <FILE-NAME> [non-blocking | diff | force | recovery-mode{enable | disable}]] | [verbose [force | [recovery-mode{enable | disable}] | [diff |force]`
- `cfg-restore tftp {<IPV4-ADDR> | <IPV6-ADDR> | <HOSTNAME-STR> <FILE-NAME> [non-blocking | diff | force | recovery-mode{enable | disable}]] | [verbose [force | [recovery-mode {enable | disable}]] | [diff |force]`
- `cfg-restore sftp {<IPV4-ADDR> | <IPV6-ADDR> | <HOSTNAME-STR> | user <name> {<IP-ADDRESS|IPV6-ADDRESS|HOSTNAME-STR>} | <USERNAME@>{<HOST-NAME> | <IPV4-ADDR> | <IPV6-ADDR>}} [port <1-65535>] <FILE-NAME> [non-blocking | diff | force | recovery-mode {enable | disable}]] | [verbose [force | [recovery-mode{enable | disable}]] | [diff |force]`

Examples

```
switch# cfg-restore
 flash              Copy file from flash.
 sftp               Copy file from SFTP Server.
 tftp               Copy file from TFTP Server.

switch# cfg-restore flash
 FILE-NAME          Name of the backup configuration file to restore into the running
                          configuration.

switch# cfg-restore flash config_file
```

```
 diff                Provide the list of changes that will be applied on the
                     running configuration.
 force               Apply the configuration with reboot if the
                     configuration has reboot required commands or
                     system-wide change commands present.
 non-blocking        Config restoration in non-blocking mode.
 recovery-mode       To enable/disable recovery-mode.
 verbose                   Provide the details of config restore status and the list of
commands to be added
                     or deleted.

switch# cfg-restore tftp
 HOSTNAME-STR        Specify hostname of TFTP Server.
 IP-ADDR             IP Address of the TFTP Server.
 IPV6-ADDR           IPV6 Address of the TFTP Server.

switch# cfg-restore tftp 10.100.0.12
 FILE-NAME           Name of the backup configuration file to restore into the running
                           configuration.

switch# cfg-restore tftp 10.100.0.12 config_file
 diff                 Provide the list of changes that will be applied on the
                      running configuration.
 force                Apply the configuration with reboot if the
                      configuration has reboot required commands or
                      system-wide change commands present.
 non-blocking         Config restoration in non-blocking mode.
 recovery-mode        To enable/disable recovery-mode.
 verbose                    Provide the details of config restore status and the list of
commands to be added
                      or deleted.

switch(config)# cfg-restore flash add non-blocking
 diff                 Provide the list of changes that will be applied on
                      the running configuration.
 force                Apply the configuration with reboot if the configuration has
reboot required commands or
                      system-wide change commands present.
 recovery-mode        To enable/disable recovery-mode.
```

Force configuration restore

The `cfg-restore` command fails if a reboot is required. The `Configuration restoration is not allowed as the configuration has reboot required commands` error is displayed, along with lines requiring a reboot. The force option in the `cfg-restore` command allows a user to force a reboot. The command is:

`cfg-restore {flash | tftp | sftp} <FILE-NAME> force.`

Before reboot, `config` is the active configuration. After the device reboots, the backup file becomes the new active configuration.

```
id | act pri sec | name
---+-------------+---------------
 1 |  *   *   *  | config
 2 |             | def
 3 |             | golden_config
 4 |             |
 5 |             |
```

```
switch(config)# cfg-restore flash golden_config
Current running-configuration will be replaced with 'golden_config'.
Continue (y/n)? y
Configuration restore is in progress, configuration changes are temporarily
```

```
 disabled.
Configuration restoration is not allowed as the configuration has reboot required
commands.

switch(config)# show cfg-restore status
 Status                 : Failed
 Config File Name       : golden_config
 Source                 : Flash
 Time Taken             : 5 Seconds
 Last Run               : Mon Oct 30 23:03:19 2017

 Recovery Mode          : Enabled
 Failure Reason         : Reboot required commands present.
 Command : console terminal none

 Number of Add Commands    : 0
 Number of Remove Commands : 1

Time Taken for Each Phase :
      Calculating diff     : 3 Seconds
      Adding commands      : 0 Seconds
      Removing commands    : 0 Seconds

switch# cfg-restore flash golden_config force
Device may be rebooted if the configuration file has reboot required or
system-wide change commands. Do you want to continue  (y/n)?
Current running-configuration will be replaced with 'golden_config'.
Continue (y/n)?
Configuration restore is in progress, configuration changes are temporarily
disabled.

Successfully applied configuration 'golden_config' to running configuration.

Rebooting switch...
```

In the preceding output, `Command : console terminal none` shows that `cfg-restore` failed because a reboot is required.

After the switch reboots and comes up, the `golden_config` becomes the active configuration.

In case of a switch reboot, the switch comes up with the configuration associated with the primary or secondary.

```
 id | act pri sec | name
 ---+-------------+-------------------------------------------------
  1 |      *   *  | config
  2 |             | def
  3 |  *          | golden_config
  4 |             |
  5 |             |


switch# show cfg-restore status
 Status                 : Success
 Config File Name       : default
 Source                 : Flash
 Time Taken             : 1 Seconds
 Last Run               : Mon Oct 23 07:17:03 2017

 Recovery Mode          : Enabled
 Failure Reason         : -
```

```
 Number of Add Commands    : 0
 Number of Remove Commands : 5

Time Taken for Each Phase :

      Calculating diff     : 1 Seconds
      Adding commands      : 0 Seconds
      Removing commands    : 0 Seconds
```

Time taken for adding and deleting commands is zero, as the switch reboots. It is similar to downloading a startup-configuration to the device.

cfg-restore non-blocking

Syntax

`cfg-restore {flash | tftp | sftp} <FILE-NAME> non-blocking`

Description

Performs restore in non-blocking mode.

Command context

`config`

Example

```
switch(config)# cfg-restore flash add non-blocking
Current running-configuration will be replaced with 'add'.
Continue (y/n)? y
Configuration restore is in progress, configuration changes are
temporarily disabled.
switch(config)#

switch(config)# show cfg-restore status
 Status                 : Success
 Config File Name       : add
 Source                 : Flash
 Time Taken             : 2 Seconds
 Last Run               : Sun Oct 22 22:09:02 2017

 Recovery Mode          : Enabled
 Failure Reason         : -

 Number of Add Commands    : 7
 Number of Remove Commands : 10

Time Taken for Each Phase :
      Calculating diff     : 1 Seconds
      Adding commands      : 0 Seconds
      Removing commands    : 0 Seconds
```

cfg-restore recovery-mode

Syntax

`cfg-restore {flash | tftp | sftp} <FILE-NAME> recovery-mode {enable | disable}`

Description

Restores the current running configuration, if a restore to the backup configuration fails. By default, recovery-mode is enabled.

Command context

`config`

Usage

To disable recovery mode, use `cfg-restore {flash | tftp | sftp} <FILE-NAME> recovery-mode disable`.

Example

With the following running configuration, a restore to the backup file `modify` fails, but this configuration will be retained as recovery mode is enabled.

```
switch(config)# show running-config

Running configuration:

; JL255A Configuration Editor;
; Ver #12:08.1d.9b.3f.bf.bb.ef.7c.59.fc.6b.fb.9f.fc.ff.ff.37.ef:ba
hostname "switch"
module 1 type jl255a
snmp-server community "public" unrestricted
vlan 1
   name "DEFAULT_VLAN"
   untagged 1-28
   ip address dhcp-bootp
   exit
vlan 10
   name "VLAN10"
   no ip address
   exit

switch(config)# show config modify
; JL255A Configuration Editor;
; Ver #12:08.1d.9b.3f.bf.bb.ef.7c.59.fc.6b.fb.9f.fc.ff.ff.37.ef:ba
hostname "switch"
module 1 type jl255a
ip default-gateway 172.20.0.1
snmp-server community "public" unrestricted
vlan 1
   name "DEFAULT_VLAN"
   untagged 1-28
   ip address dhcp-bootp
   exit
vlan 100
   name "VLAN100"
   no ip address
   exit

switch(config)# cfg-restore flash modify
Current running-configuration will be replaced with 'modify'.
Continue (y/n)? y
Configuration restore is in progress, configuration changes are
 temporarily disabled.

Configuration restore to config 'modify' failed, restored source
 configuration to running configuration.

switch(config)# show running-config
```

```
Running configuration:

; JL255A Configuration Editor;
; Ver #12:08.1d.9b.3f.bf.bb.ef.7c.59.fc.6b.fb.9f.fc.ff.ff.37.ef:ba
hostname "switch"
module 1 type jl255a
snmp-server community "public" unrestricted
vlan 1
   name "DEFAULT_VLAN"
   untagged 1-28
   ip address dhcp-bootp
   exit
vlan 10
   name "VLAN10"
   no ip address
   exit

switch(config)# cfg-restore flash modify recovery-mode disable
Current running-configuration will be replaced with 'modify'.
Continue (y/n)? y
Configuration restore is in progress, configuration changes are
 temporarily disabled.

Partially applied configuration 'modify' to running configuration.
switch(config)# show running-config

Running configuration:

; JL255A Configuration Editor;
; Ver #12:08.1d.9b.3f.bf.bb.ef.7c.59.fc.6b.fb.9f.fc.ff.ff.37.ef:ba
hostname "switch"
module 1 type jl255a
snmp-server community "public" unrestricted
vlan 1
   name "DEFAULT_VLAN"
   untagged 1-28
   ip address dhcp-bootp
   exit
vlan 100
   name "VLAN100"
   no ip address
   exit
```

cfg-restore verbose

Syntax

`cfg-restore {flash | tftp | sftp} <FILE-NAME> verbose`

Description

Provides the details of configuration restore status and the list of commands to be added or deleted along with `cfg-restore`.

Command context

`config`

Examples

```
switch(config)# cfg-restore flash config verbose
Current running-configuration will be replaced with 'config'.
```

```
Continue (y/n)? y

Configuration restore is in progress, configuration changes are temporarily disabled.

Configuration Restore Information:

 Status                 : Success
 Config File Name       : config
 Source                 : Flash
 Time Taken             : 6 Seconds
 Last Run               : Tue Nov  7 03:43:07 2017

 Recovery Mode          : Enabled
 Failure Reason         : -

 Number of Add Commands    : 0
 Number of Remove Commands : 12

Time Taken for Each Phase :
      Calculating diff     : 2 Seconds
      Adding commands      : 0 Seconds
      Removing commands    : 0 Seconds

Configuration delete list:

vlan 2
   name "VLAN2"
   no ip address
   exit
vlan 3
   name "VLAN3"
   no ip address
   exit
vlan 4
   name "VLAN4"
   no ip address
   exit
vlan 5
   name "VLAN5"
   no ip address
   exit

Successfully applied configuration 'config' to running configuration.
```

cfg-restore config_bkp

Syntax

`cfg-restore {tftp <ip-address> | sftp <ip-address>} config_bkp`

Description

Downloads and restores a configuration from the TFTP or SFTP server, without rebooting the switch.

The commands from the restored configuration will be executed on the running configuration. The name of the current active configuration will not change after a configuration restore.

Command context

`config`

Example

```
switch(config)# cfg-restore tftp
 HOSTNAME-STR          Specify hostname of TFTP Server.
 IP-ADDR               IP Address of the TFTP Server.
 IPV6-ADDR             IPV6 Address of the TFTP Server.

switch(config)# cfg-restore sftp
 HOSTNAME-STR          Specify hostname of the SFTP server.
 IP-ADDR               IP Address of the SFTP Server.
 IPV6-ADDR             IPV6 Address of the SFTP Server.
 user                  Specify username on the remote system information
 USER@IP-STR           Specify username along with remote system
                       information

switch(config)# cfg-restore tftp 10.100.0.12 pvos/tftp_2930_config_file
Current running-configuration will be replaced with 'tftp_2930_config_file'.
Continue (y/n)? y
Configuration restore is in progress, configuration changes are temporarily disabled.

Successfully applied configuration 'tftp_2930_config_file' to running configuration.

switch(config)# sh cfg-restore status
 Status                  : Success
 Config File Name        : tftp_2930_config_file
 Source                  : TFTP
 Time Taken              : 4 Seconds
 Last Run                : Wed Nov  8 21:11:10 2017

 Recovery Mode           : Enabled
 Failure Reason          : -

 Number of Add Commands    : 4
 Number of Remove Commands : 7

Time Taken for Each Phase :
      Calculating diff     : 1 Seconds
      Adding commands      : 0 Seconds
      Removing commands    : 0 Seconds

switch(config)# show config files

Configuration files:

 id | act pri sec | name
 ---+-------------+---------
  1 |  *   *   *  | config
  2 |             |
  3 |             |
  4 |             |
  5 |             |
```

Configuration restore with force option

Prerequisites

Back up the configuration using traditional `copy config` or `cfg-backup` commands.

Procedure

1. Execute the `show config files` command. By default, the `config` file provides all the associations.

   ```
   switch(config)# show config files
   ```

```
Configuration files:

 id | act pri sec | name
 ---+-------------+-------
  1 |  *   *   *  | config
  2 |             | file1
  3 |             | file2
  4 |             |
  5 |             |
```

2. Use `cfg-restore flash file1 force` command to see the configuration of file1.
   `switch(config)# cfg-restore flash file1 force`

   As the file1 configuration requires a reboot, a system reboot occurs. When the switch comes up, file1 is the new active configuration.

```
switch(config)# sh config files

Configuration files:

 id | act pri sec | name
 ---+-------------+---------
  1 |      *   *  | config
  2 |  *          | file1
  3 |             | file2
  4 |             |
  5 |             |
```

During a configuration restore with reboot, the association changes. To make the configuration as a default configuration for subsequent system reboots, use `startup-default [<primary|secondary>] config FILENAME` command.

For `startup-default config file1`:

```
switch(config)# show config files

Configuration files:

id | act pri sec | name
 --+-------------+---------
 1 |             | config
 2 |  *   *   *  | file1
 3 |             | file2
 4 |             |
 5 |             |
```

System reboot commands

Following commands require a system reboot:

- `secure-mode standard`
- `secure-mode enhanced`
- `mesh id [0-9]`
- `mesh [a-z | A-Z | 0-9]`
- `max-vlans <257-4094>`

- `no allow-v2-modules`
- `qinq (mixedvlan | svlan)`
- `qos queue-config`
- `terminal type (vt100 | ansi)`
- `console (flow-control | terminal)`
- `vsf member [0-9]`
- `vsf remove`
- `access-list grouping`
- `console baud-rate (speed-sense | 1200 | 2400 | 4800 | 9600 | 19200 | 38400 | 57600 | 115200)`

Systemwide change commands

Following commands change the system configuration:

- `module [0-9 | a-z | A-Z]`
- `module [0-9 | a-z | A-Z] type <type>`
- `igmp lookup-mode ip`
- `flexible-module [a-z | A-Z] type <type>`
- `stacking member [0-9] flexible-module [a-z | A-Z] type <type>`

Configuration restore without force option

If the two configuration files backed up are file1 and file2:

Prerequisites:

Backup the configuration using either the traditional `copy config` or the `cfg-backup` commands.

Procedure:

1. Execute the `show config files` command. By default, the `config` file provides all the associations.

```
switch(config)# show config files

Configuration files:

 id | act pri sec | name
 ---+-------------+-------
  1 |  *   *   *  | config
  2 |             | file1
  3 |             | file2
  4 |             |
  5 |             |
```

2. Use `cfg-restore flash file1` command to see the configuration of file1.

```
switch(config)# cfg-restore flash file1
```

Even after executing the previous command, associations will remain the same, but the running configuration is replaced by file1 configuration.

In a configuration restore without reboot, the association remains the same. The default `config` file is updated based on the configuration of the restored file.

show cfg-restore status

Syntax

```
show cfg-restore status
```

Description

Shows the status of latest restore performed. The running configuration is updated based on the configuration of the restored file.

Command context

```
config
```

Usage

```
show cfg-restore {status | latest-diff}
```

This command provides information on:

- how a restore is performed
- whether a flash file was used from SFTP or TFTP server
- the total time taken to restore
- the time when last restore was initiated
- whether a recovery-mode was enabled
- the number of add and delete commands
- reboot commands present (if any), and
- the split time taken for each phase

Examples

```
switch(config)# show cfg-restore
latest-diff Shows the difference between running and back-up
                      configuration.
                      status Show configuration restoration status.

switch(config)# show cfg-restore status
Status : [Failed| In progress | Success | Not Started]
Config File name : def
Source : [-|Tftp|sftp|Flash|REST]
Time taken : [-|20 Seconds.]
Last Run : [-|Tue March 07 22:12:16 2017.

Recovery Mode : Enabled
Failure Reason : -

Number of Add Commands : 0
```

```
Number of Remove Commands : 3

Time Taken for Each Phase :
       Calculating diff : 1 Seconds
       Adding commands : 0 Seconds
       Removing commands : 0 Seconds
```

If the configuration restoration fails, the line number and the failed commands are displayed:

```
switch(config)# show cfg-restore
Status : Failed
Config File name : def
Source : Flash
Time taken : 20 Seconds
Last Run : Sun Oct 22 20:22:54 2017

Recovery Mode : Enabled
Failure Reason : Add commands have been failed

Number of Add Commands : 0
Number of Remove Commands : 3

Time Taken for Each Phase :
       Calculating diff : 1 Seconds
       Adding commands : 0 Seconds
       Removing commands : 0 Seconds

Failed to remove commands:
 Line: 12 vlan 10
 Line: 15 no ipv6 nd snooping mac-check
Failed to add commands:
 Line: 10 icmp 10.100.0.12 source-inter vlan 1
 Line: 20 udp-echo 10.100.0.12 source vlan 1
```

The number of add and delete commands is calculated excluding the exit commands in the configuration file.

Viewing the differences between a running configuration and a backup configuration

Prerequisites

Use the `cfg-restore {flash | tftp | sftp} <FILE-NAME> diff` command to view the list of configuration changes that are removed, modified, or added to the running configuration.

Procedure

1. Execute the `show running-config` command to show the running configuration of the switch.

```
switch(config)# show running-config

Running configuration:

; JL255A Configuration Editor;
; Ver #12:08.1d.9b.3f.bf.bb.ef.7c.59.fc.6b.fb.9f.fc.ff.ff.37.ef:ba
hostname "switch"
module 1 type jl255a
snmp-server community "public" unrestricted
vlan 1
   name "DEFAULT_VLAN"
```

```
   no untagged 11-13,15-18
   untagged 1-10,14,19-28
   ip address dhcp-bootp
   exit
vlan 100
   name "VLAN100"
   untagged 11-13
   no ip address
   exit
vlan 300
   name "VLAN300"
   untagged 15-18
   no ip address
   exit
```

2. Execute the `show config golden_config` command to show the backup configuration of the switch.

```
switch(config)# show config golden_config
; JL255A Configuration Editor;
; Ver #12:08.1d.9b.3f.bf.bb.ef.7c.59.fc.6b.fb.9f.fc.ff.ff.37.ef:ba
hostname "switch"
module 1 type jl255a
; JL255A Configuration Editor;
; Ver #12:08.1d.9b.3f.bf.bb.ef.7c.59.fc.6b.fb.9f.fc.ff.ff.37.ef:ba
hostname "switch"
module 1 type jl255a
```

3. Execute the `cfg-restore flash golden_config diff` command to view the differences that will be applied.

```
switch# cfg-restore flash golden_config diff

Configuration delete list:

vlan 1
   no untagged 11-13,15-18
   untagged 3-10
   exit
vlan 100
   untagged 11-13
   exit
vlan 300
   name "VLAN300"

   untagged 15-18
   no ip address
   exit

Configuration add list:

vlan 1
   no untagged 3-10
   untagged 11-13,15-18
   exit
vlan 100
   untagged 3-5
   exit
vlan 200
   name "VLAN200"
   untagged 6-10
```

```
  no ip address
  exit
```

If the running and the backup configuration is the same, no difference will be displayed.

```
switch(config)# cfg-restore flash modify diff

Current config and backup config is identical.
```

4. Execute the `show cfg restore latest-diff` command to display the difference between the running and the backup configuration.

```
switch(config)# show cfg-restore
 latest-diff           Shows the difference between running and back-up
                       configuration.
 status                Show configuration restoration status.

switch(config)# show cfg-restore latest-diff

Configuration delete list:

ip default-gateway 172.20.0.1
vlan 100
   name "VLAN100"
   no ip address
   exit

Configuration add list:

vlan 10
   name "VLAN10"
   no ip address
   exit

switch(config)#
```

Show commands to show the SHA of a configuration

The `show` commands provide SHA details of the running and startup configurations.

show hash

Syntax

```
show {config | running-config} hash {recalculate}
```

Description

Shows SHA ID of startup or running configuration.

Command context

```
config
```

Examples

```
switch# show config
 config
 files                  List saved configuration files.
 hash                   Display the hash calculated for the startup
                        configuration.
 interface              Show the startup configuration for interfaces.
 oobm                   Show the startup configuration for OOBM.
```

To display the hash calculated for the startup configuration:

```
switch(config)# show config hash
The hash must be calculated.  This may take several minutes.

Continue (y/n)? y

Calculating hash...
Startup Configuration hash:

4f66 8b77 6b66 e5fb 0c12 f7fb 8ea6 b548 af2e 2e03

This hash is only valid for comparison to a baseline hash if
the configuration has not been explicitly changed (such as
with a CLI command) or implicitly changed (such as by the
removal of a hardware module).

switch(config)# show config hash
recalculate           Calculate hash (if needed) without prompting.

switch(config)# show config hash recalculate
Startup Configuration hash:

4f66 8b77 6b66 e5fb 0c12 f7fb 8ea6 b548 af2e 2e03

This hash is only valid for comparison to a baseline hash if
the configuration has not been explicitly changed (such as
with a CLI command) or implicitly changed (such as by the
removal of a hardware module).
```

To display the hash calculated for the running configuration:

```
switch(config)# show running-config hash
The hash must be calculated.  This may take several minutes.

Continue (y/n)? y

Calculating hash...
Running configuration hash:

6d88 0880 98af e8a8 b564 15cd 368e 4269 9d61 4bfa

This hash is only valid for comparison to a baseline hash if
the configuration has not been explicitly changed (such as
with a CLI command) or implicitly changed (such as by the
removal of a hardware module).
```

Scenarios that block the configuration restoration process

The configuration restoration process is blocked in the following scenarios:

- If the restored configuration file requires a reboot.
- If the restored configuration changes the entire configuration (for example, module add or remove).

More information

cfg-restore on page 513

Troubleshooting and support

Switch configuration restore without reboot feature provides CLI support to:

- display the number of commands with line number that failed to restore.
- display the delta between running configuration and the configuration to be restored.

More information

Viewing the differences between a running configuration and a backup configuration on page 525
show cfg-restore status on page 524

debug cfg-restore

Syntax

```
debug cfg-restore
```

Description

Debug logs display the commands executed by `cfg-restore`.

Command context

`config` and `manager`

Example

```
switch(config)# debug cfg-restore
switch(config)# debug destination buffer
switch(config)# show debug buffer
0000:01:39:51.58 CFG mCfgRestoreMgr:cfg-restore to config file "backup_conif"
   started.
0000:01:39:56.45 CFG mCfgRestoreMgr:cfg-restore diff calculated, number of
   commands to add =0 number of commands to delete = 3.
0000:01:39:56.45 CFG mCfgRestoreMgr:cfg-restore iteration count = 1.
0000:01:39:56.51 CFG mCfgRestoreMgr:Command executed = no vlan 2 tagged 9,
   Status = Success.
0000:01:39:56.51 CFG mCfgRestoreMgr:Command deleted = vlan 2 tagged 9.
0000:01:39:56.58 CFG mCfgRestoreMgr:Command executed = no vlan 3 tagged 9,
   Status = Success.
0000:01:39:56.58 CFG mCfgRestoreMgr:Command deleted = vlan 3 tagged 9.
0000:01:39:56.64 CFG mCfgRestoreMgr:Command executed = no vlan 4 tagged 9,
   Status = Success.
0000:01:39:56.65 CFG mCfgRestoreMgr:Command deleted = vlan 4 tagged 9.
0000:01:39:56.65 CFG mCfgRestoreMgr:cfg-restore iteration count = 2.
0000:01:39:59.38 CFG mCfgRestoreMgr:Successfully applied configuration
   'backup_conif' to running configuration.
** Total debug messages = 22
```

Virtual Technician is a set of tools aimed at aiding network switch administrators in diagnosing and caring for their networks. VT provides tools for switch diagnoses when faced with unforeseen issues.

To improve the Virtual Technician features of our devices have added the following tools:

- Cisco Discovery Protocol
- Enabling Debug tracing for MOCANA code
- User diagnostic crash via front panel security button
- User diagnostic crash via the serial console

Cisco Discovery Protocol (CDP)

Show cdp traffic

Syntax

```
show cdp traffic
```

Description

Displays the number of Cisco Discovery Protocol (CDP) packets transmitted, received and dropped.

CDP frame Statistics

```
Port No|Transmitted Frames|Received Frames|Discarded Frames|Error Frames
-------  -----------------  --------------   ---------------  ---------
A1               46                  26             6           7
A2               30                  35             7           9
A3              120                 420             670       670
```

Clear cdp counters

Syntax

```
clear cdp counters
```

Description

Allows a user to clear CDP statistics.

Clear cdp counters

```
Port No|Transmitted Frames|Received Frames|Discarded Frames|Error Frames
-------  -----------------  --------------   ---------------  ---------
A1          46                   26               6              7
```

```
A2          30                   35                  7               9
A3         120                  420                670             670
```

show cdp neighbors detail

Syntax

```
show cdp neighbors detail
```

Description

Shows CDP neighbors on specified port only.

```
show cdp neighbor detail

CDP neighbors information

  Port : 1/13
  Device ID : 0.0.0.0
  Address Type : IP
  Address      : 0.0.0.0
  Platform     :
  Capability   : Switch
  Device Port  : 00 1b 4f 49 e7 76
  Version      :

--------------------------------------------------------------------------------

  Port : 2/25
  Device ID : 94 18 82 55 50 20
  Address Type : IP
  Address      : 172.31.99.143
  Platform     : Aruba JL356A 2540-24G-PoE+-4SFP+ Switch, revision YC.16....
  Capability   : Switch
  Device Port  : 3
  Version      : Aruba JL356A 2540-24G-PoE+-4SFP+ Switch, revision YC.16....
```

Enable/Disable debug tracing for MOCANA code

Debug security

Syntax

```
debug security ssl
```

Description

Enables the debug tracing for MOCANA code.

Use the no parameter to disable debug tracing.

ssl

Display all SSL messages.

User diagnostic crash via Front Panel Security (FPS) button

Allows the switch's front panel **Clear** button to manually initiate a diagnostic reset. In the case of an application hang, this feature allows you to perform reliable diagnostics by debugging via the front panel **Clear** button. Diagnostic reset is controlled via Front Panel Security (FPS) options.

Front panel security password-clear

From the configure context:

Syntax

```
no front-panel-security password-clear <RESET-ON-CLEAR> | factory-reset | password-
recovery | diagnostic-reset <CLEAR-BUTTON | SERIAL-CONSOLE>
```

Description

Enable the ability to clear the password(s) and/or configuration via the front panel buttons.

no disables the password clear option.

Parameters

- If `password-clear` is disabled, the password(s) cannot be reset using the clear button on the front panel of the device.
- If `factory-reset` is disabled, the configuration/password(s) can not be reset using the clear and reset button combination at boot time.
- When `password-recovery` is enabled (and the front panel buttons disabled), a lost password can be recovered by contacting customer support.
- When `password-recovery` is disabled, there is no way to access a device after losing a password with the front panel buttons disabled.
- If `diagnostic-reset` is disabled, the user cannot perform a diagnostic switch reset on those rare events where the switch becomes unresponsive to user input because of unknown reason(s).
- If `diagnostic-reset` is enabled, the user can perform a diagnostic hard reset which will capture valuable diagnostic data and reset the switch.

Parameters

factory-reset

Enable/Disable factory-reset ability.

password-clear

Enable/Disable password clear.

password-recovery

Enable/Disable password recovery.

diagnostic-reset

Enable/Disable diagnostic reset.

Front-panel-security diagnostic-reset

From the configure context:

Syntax

`front-panel-security diagnostic-reset <CLEAR-BUTTON | SERIAL-CONSOLE>`

Description

Enables the diagnostic reset so that the switch can capture diagnostic data.

- To initiate diagnostic reset via the clear button, press the clear button for at least 30 seconds but not more than 40 seconds.
- To initiate diagnostic switch reset via the serial console, enter the diagnostic reset sequence on the serial console.

Parameters

Clear button

Enables the diagnostics by choosing the clear button option.

Serial console

Enables the diagnostics by choosing the serial console option.

no front-panel-security diagnostic-reset

From the configure context:

Syntax

`no front-panel-security diagnostic-reset`

Description

Disables the diagnostic reset feature so that the user is prevented from capturing diagnostic data and performing a diagnostic reset on the switch. Both the sub-options `reset-via-serial-console` and `reset-via-clear-button` will be disabled. This is necessary if the switch becomes unresponsive (hangs) for unknown reasons.

No front-panel-security diagnostic-reset

```
no front-panel-security diagnostic-reset

Clear Password       - Enabled
Reset-on-clear     - Disabled
Factory Reset        - Enabled
Password Recovery    - Enabled
Diagnostic Reset     - Disabled
```

Disabling the diagnostic reset prevents the switch from capturing diagnostic data on those rare events where the switch becomes unresponsive to user input because of unknown reasons. Ensure that you are familiar with the front panel security options before proceeding.

Front-panel-security diagnostic-reset clear-button

From the configure context:

Syntax

`front-panel-security diagnostic-reset clear-button`

Description

This command will enable diagnostic-reset via clear button. The user will be allowed to perform diagnostic reset by depressing the clear button for 30 seconds and not more than 40 seconds.

Front-panel-security diagnostic-rest clear-button

```
front-panel-security diagnostic-rest clear-button

Diagnostic Reset     - Enabled
clear-button        - Enabled
serial-console      -Disabled
```

Disabling the diagnostic reset prevents the switch from capturing diagnostic data on those rare events where the switch becomes unresponsive to user input because of unknown reasons. Ensure that you are familiar with the front panel security options before proceeding.

no front-panel-security diagnostic-reset clear-button

From the configure context:

Syntax

```
no front-panel-security diagnostic-reset clear-button
```

Description

Disables the diagnostic-reset via clear button.

Disabling the diagnostic reset prevents the switch from capturing diagnostic data on those rare events where the switch becomes unresponsive to user input because of unknown reasons. Ensure that you are familiar with the front panel security options before proceeding.

Show front-panel-security

Syntax

```
show front-panel-security
```

Parameters

Show front-panel-security

```
Clear Password    - Enabled
Reset -on-clear   - Disabled
Factory Reset     - Enabled
Password Recovery - Enabled
Diagnostic Reset  - Enabled
```

By default, user initiated diagnostic reset is enabled.

Diagnostic table

To accomplish this	Do this	Result
Soft Reset (Standalone switch)	Press and release the Reset button	The switch operating system is cleared gracefully (such as data transfer completion, temporary error conditions are cleared), then reboots and runs self tests.
Hard Reset (Standalone switch)	Press and hold the Reset button for more than 5 seconds (until all LEDs turn on), then release.	The switch reboots, similar to a power cycle. A hard reset is used, for example, when the switch CPU is in an unknown state or not responding.
Delete console and management access passwords	Press Clear for at least one second, but not longer than 5 seconds.	The switch deletes all access password.
Restore the factory default configuration	1. Press Clear and Reset simultaneously. 2. While continuing to press Clear, release Reset. 3. When the Test LED begins blinking (after approximately 25 seconds), release Clear.	The switch removes all configuration changes, restores the factory default configuration, and runs self test.
Diagnostic reset	1. Press Clear to 30-40 seconds. 2. When the test LED begins blinking (approximately after 30 seconds), release Clear. **NOTE:** Releasing the Clear button when TEST LED is not blinking (approximately after 40 seconds) will not honor the diagnostic reset request.	This initiates diagnostic reset, collects diagnostic information, and reboots the switch.
NOTE: These buttons are provided for the user's convenience. If switch security is a concern, ensure that the switch is installed in a secure location, such as a locked writing closet. To disable the buttons, use the `front-panel-security` command.		

FPS Error Log

Event	Message
RMON_BOOT_CRASH_RECORD1	Diagnostic reset sequence detected on serial console; user has initiated diagnostic reset. On detection on local serial

Event	Message
RMON_BOOT_CRASH_RECORD1	SMM: Diagnostic reset sequence detected on serial console; user has initiated diagnostic reset. On detection on SMM serial console and signaled to AMM
RMON_BOOT_CRASH_RECORD1	STKM: Diagnostic reset sequence detected on serial console; user has initiated diagnostic reset. On detection on non-commander serial console and signaled to commander
RMON_BOOT_CRASH_RECORD1	User has initiated diagnostic reset via the serial console. Sw_panic() message
RMON_BOOT_CRASH_RECORD1	SMM: User has initiated diagnostic reset via the serial console. Sw_panic() message when triggered via SMM
RMON_BOOT_CRASH_RECORD1	STKM: User has initiated diagnostic reset via the serial console. Sw_panic() message when triggered via non-commander
Console print	STKM: HA Sync in progress; user initiated diagnostic request via the serial console rejected. Retry after sometime. Printed on the device console. When standby is in sync state, we don't want to crash the commander. So we report to the user to retry later
Console print	STKM: Member is booting; user initiated diagnostic request via the serial console rejected. Retry after sometime. Printed on the device console. When the member is till booting, it doesn't have the commander member number, thus we can't issue UIDC on the commander. So we report to the user to retry later.

User initiated diagnostic crash via the serial console

Remotely triggers a diagnostic reset of the switch via a serial console. This reset reboots the switch and collects diagnostic data for debugging an application hang, a system hang or any other rare occurrence. Diagnostic reset is controlled via FPS options.

The serial sequence to initiate the User Initiated Diagnostic Reset via Serial console is Ctrl+S, Ctrl+T, Ctrl+Q, Ctrl+T, Ctrl+S.

Front-panel-security diagnostic-reset serial-console

In the configure context:

Syntax

```
front-panel-security diagnostic-reset serial-console
```

Enables the diagnostic-reset via serial console. Allows the user to perform diagnostic reset by keying-in diagnostic reset sequence.

Front-panel-security diagnostic-reset serial-console

```
front-panel-security diagnostic-reset serial-console

Diagnostic Reset     - Enabled
clear-button       - Disabled
serial-console     - Enabled
```

no front-panel-security diagnostic-reset serial-console

In the configure context:

Syntax

```
no front-panel-security diagnostic-reset serial-console
```

Description

Disables the diagnostic-reset via serial console.

No front-panel-security diagnostic-reset serial-console

```
no front-panel-security diagnostic-reset serial-console

Diagnostic Reset     - Disabled
```

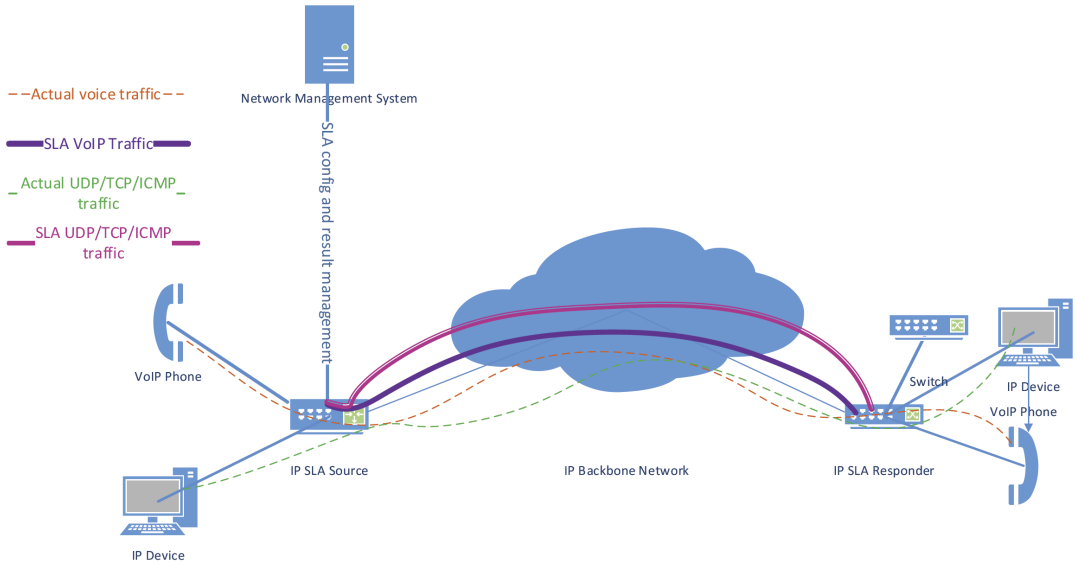
Disabling the diagnostic reset prevents the switch from capturing diagnostic data on those rare events where the switch becomes unresponsive to user input because of unknown reasons. Ensure that you are familiar with the front panel security options before proceeding.

Serial console error messages

Error	Message
RMON_BOOT_CRASH_RECORD1	Diagnostic reset sequence detected on serial console; user has initiated diagnostic reset.
RMON_BOOT_CRASH_RECORD1	SMM: Diagnostic reset sequence detected on serial console; user has initiated diagnostic reset.
RMON_BOOT_CRASH_RECORD1	STKM: Diagnostic reset sequence detected on serial console; user has initiated diagnostic reset.
RMON_BOOT_CRASH_RECORD1	User has initiated diagnostic reset via the serial console.
RMON_BOOT_CRASH_RECORD1	SMM: User has initiated diagnostic reset via the serial console.
RMON_BOOT_CRASH_RECORD1	STKM: User has initiated diagnostic reset via the serial console.
Console print	STKM: HA Sync in progress; user initiated diagnostic request via the serial console rejected. Retry after sometime.
Console print	STKM: Member is booting; user initiated diagnostic request via the serial console rejected. Retry after sometime.

Overview

IP Service Level Agreement (IP SLA) is a feature that helps administrators collect information about network performance in real time. With increasing pressure on maintaining agreed-upon Service Level Agreements on Enterprises and ISPs alike, IP SLA serves as a useful tool.



Any IP SLA test involves a source node and a destination node. For all discussions in this document, the source is always an AOS-S switch with IP SLA support. As shown in the diagram above, a destination can, in most cases, be any IP-enabled device. For some SLA types that expect a nonstandard response to a test packet, an “SLA responder” must be configured. An “SLA responder” is nothing but an AOS-S switch with IP SLA configurations on it that enable it to respond to the test packet.

The IP SLA feature provides:

- Application-aware monitoring that simulates actual protocol packets.
- Predictable measures that aid in ease of deployment and help with assessment of existing network performance.
- Accurate measures of delay and packet loss for time-sensitive applications.
- End-to-end measurements to represent actual user experience.

We support the following SLA types:

- UDP Echo, including connectivity testing of transport layer (UDP) services, Round-Trip-Time (RTT) measurement, one-way delay, and packet loss details.
- ICMP Echo, including connectivity testing, RTT measurement, and packet loss details.

- TCP Connect, including connectivity testing of transport layer (TCP) services, and handshake time measurement.
- DHCP, which measures the round-trip time taken to discover a DHCP Server and obtain a leased IP address from it.
- DNS, which measures the time taken for a DNS resolution. This measures the difference between the time taken to send a request to the DNS server and the time the IP SLA source receives a reply.
- User Datagram Protocol (UDP) Jitter, which measures RTT, one way jitter and one way delays.
- UDP Jitter for VoIP, which measures RTT, one way jitter, one way delays, ICPIF (Impairment Calculated Planning Impairment Factor) and MOS (Mean Opinion Score).

Limitations for IPSLA support on Aruba switches:

- IP SLA is not enabled for IPv6.
- DHCP SLA supports DHCPv4 only.
- IP SLA tests cannot be initiated over OOBM interfaces.
- History results for the configured IP SLAs will not be available after a switchover or a reboot.
- Maximum number of IP SLAs that can be configured varies based on the type of SLA test.
- When there are multiple IP SLAs configured with destination as hostname, the DNS resolution happens serially. There can be a delay in sending the test probe (which will be sent only after successful DNS resolution).
- For TCP Connect SLA type, the four-tuple (source IP/port, destination IP/port) must be unique.
- System clocks between the source and the responder must be synchronized with NTP if One Way Delay parameters have to be calculated for UDP Echo tests.
- Timeout for probes is 3 seconds for all SLA types and is not configurable.
- Transient spikes in RTT occur during the tests (in the source and the responder) if processor usage is high. Consider average result values over a period of time rather than point-in-time results. This is not applicable for UDP Jitter nor Jitter for VoIP.

Entity	Limit
Maximum number of SLAs enabled.	50
Maximum history bucket size per SLA.[1]	50
Number of responders that can be configured.	10

The following are operational restrictions with respect to IP SLA jitter implementation:

- Feature is supported only on v3-based platforms.
- No history results are stored.
- IPSLA Jitter and Jitter for VoIP initiator and responder is only supported on 5400R with v3 modules (noncompatibility mode), 3810, and 2930F switches.

- The maximum number of Jitter responder sessions (UDP Jitter + Jitter For VoIP) supported is 10. The maximum number of Jitter initiator sessions (UDP Jitter + Jitter For VoIP) supported is 5.
- IMC (Intelligent Management Center) supports below IP SLA:
  - DHCP
- Measurement of RTT and jitter values is in milliseconds.
- IPv6 SLA for UDP jitter and VoIP is not supported.
- UDP jitter and UDP jitter for VoIP tests are not supported over Tunnel, Trunk, and OOBM interfaces.
- UDP jitter and UDP jitter for VoIP results are not carried forward across failover or a device reboot.
- History bucket size cannot be configured for UDP jitter and VoIP tests. Results are aggregated for the last 25 probes.
- System clocks between the source and the responder must be synchronized with NTP if One Way Delay parameters have to be calculated for UDP Jitter & UDP Jitter for VoIP tests.
- The UDP jitter and UDP jitter for VoIP feature on AOS-S switch has the following limited interoperability with Comware 7 SLA v2 version:
  - One Way packet drops (SD packet loss and DS packet loss) on the Comware Jitter initiator is not reported when interoperating with Aruba Jitter Responder.
- IP SLA responder or initiator implementation is not interoperable with Cisco's IP SLA feature.

[1]Not applicable for UDP Jitter and Jitter for VoIP.

How IP SLA works

1. The source originates a test packet to the destination.
2. The destination responds to the test packet, at times embedding the needed information in the response packet.
3. Upon receiving the response, the source calculates the test results based on the timestamp, other packet parameters, and so on.
4. The source stores the results and updates the history records for the SLA.
5. The source reschedules the SLA for the next run.

For one-way delay calculations, the IP SLA sender and IP SLA responder must be NTP Time Synchronized.

Configuration commands

no ip-sla <ID>

Syntax

```
no ip-sla <ID>
```

Description

Configure the IP Service Level Agreement (SLA) parameters. The value of ID can range from 1-255.

Parameters

clear

Clear history records, message statistics, and threshold counters of particular SLA entry.

dhcp

Configure DHCP as the IP SLA test mechanism.

disable

Disable the IP SLA.

dns

Configure DNS as the IP SLA test mechanism.

enable

Enable the IP SLA.

history-size

Configure the number of history records to be stored for the IP SLA.

icmp-echo

Configure ICMP echo as the IP SLA test mechanism.

monitor

Configure monitoring parameters and respective threshold-action values.

schedule

Configure the start time, stop time, lifetime, and frequency of run for the IP SLA.

tcp-connect

Configure TCP connect as the IP SLA test mechanism.

tos

Configure the Type of Service value to be set in the test packet for the IP SLA.

udp-echo

Configure UDP echo as the IP SLA test mechanism.

On platforms that support Jitter and VOIP, the following options are also provided:

udp-jitter

Configure UDP jitter as the IP SLA test mechanism.

udp-jitter-voip

Configure UDP jitter for VoIP as the IP SLA test mechanism.

ip-sla <ID> clear

Syntax

```
ip-sla <ID> clear
```

Description

Clear history records, message statistics, and threshold counters of a particular SLA entry.

Parameters

records

Clear history records, message statistics, and threshold counters of particular SLA entry.

no ip-sla <ID> history-size

Syntax

```
no ip-sla <ID> history-size
```

Description

Configure the number of history records to be stored for the IP SLA. The maximum supported size is 50 and the default value for history-size is 25.

no ip-sla <ID> icmp-echo

Syntax

```
no ip-sla <ID> icmp-echo [<IP-ADDR> | <HOST-NAME>] [source <IP-ADDR>
| source-interface vlan <VLAN-ID>] [payload-size <SIZE>]
```

Description

Configure ICMP echo as the IP SLA test mechanism. Requires destination address/hostname and source address/vlan id for the IP SLA of ICMP-Echo SLA type.

payload-size

: Value can range from 1-1440. By default, payload-size is not set.

no ip-sla <ID> udp-echo

Syntax

```
no ip-sla <ID> udp-echo [destination [<IP-ADDR> | <HOST-NAME>]
<PORT-NUM>] [source <IP-ADDR> | <VLAN-ID>] [payload-size <SIZE>]
```

Description

Configure UDP echo as the IP SLA test mechanism. Requires destination address/hostname and source address/VLAN ID for the IP SLA of UDP-Echo SLA type.

- **PORT-NUM**: Value can range from 1024-65535.
- **payload-size**: Value can range from 1-1440. By default, payload-size is not set.

no ip-sla <ID> tcp-connect

Syntax

```
no ip-sla <ID> tcp-connect [destination [<IP-ADDR> | <HOST-NAME>]
<PORT-NUM>] [source [<IP-ADDR> | <VLAN-ID>] <PORT-NUM>]
```

Description

Configure TCP connect as the IP SLA test mechanism. Requires destination address/hostname and source address/VLAN ID for the IP SLA of TCP connect SLA type. The value of PORT-NUM can range from 1024-65535.

ip-sla <ID> monitor threshold-config

Syntax

```
ip-sla <ID> monitor threshold-config [rtt | srcTodstTime | dstToSrcTime]
threshold-type [immediate | consecutive <COUNT>] threshold-value <UPPER-LIMIT>
<LOWER-LIMIT> action-type [trap | log | trap-log | none]
no ip-sla <ID> monitor threshold-config [rtt | srcTodstTime | dstToSrcTime]
threshold-type [immediate | consecutive <COUNT>] threshold-value <UPPER-LIMIT>
<LOWER-LIMIT> action-type [trap | log | trap-log | none]
```

Description

Set upper and lower threshold parameters.

Parameters

- **threshold-type immediate**: Take action immediately when the monitored parameters cross the threshold upper limit (subsequent notifications for upper thresholds are not generated until the parameter values go lower than the configured lower threshold value).
- **threshold-type consecutive**: Take action after threshold is hit consecutively for number of times.
- **action-type**: Describes action to be taken when the upper threshold is crossed.
- **trap**: Send snmp-trap when configured threshold is hit.
- **log**: Only log the event when configured threshold is hit.
- **trap-log**: Send snmp-trap and log the event when configured threshold is hit.
- **none**: Take no action.

The command option threshold-config can be individually set for rtt, srcTodstTime, and dstToSrcTime.

no ip-sla <ID> monitor packet-loss

Syntax

```
no ip-sla <ID> monitor packet-loss threshold-type [immediate | consecutive
<COUNT>] action-type [trap | log | trap-log | none]
```

Description

Configure threshold-action values when packet loss happens.

- **threshold-type immediate**: Take action immediately when the monitored parameters cross the threshold upper limit (subsequent notifications for upper thresholds are not generated until the parameter values go lower than the configured lower threshold value).
- **threshold-type consecutive**: Take action after threshold is hit consecutively for number of times.
- **action-type**: Describes action to be taken when the upper threshold is crossed.
- **trap**: Send snmp-trap when configured threshold is hit.

- **log**: Only log the event when configured threshold is hit.
- **trap-log**: Send snmp-trap and log the event when configured threshold is hit.
- **none**: Take no action.

no ip-sla <ID> monitor test-completion

Syntax

```
no ip-sla <ID> monitor test-completion action-type [trap | log | trap-log | none]
```

Description

Configure action to be taken when test gets completed.

- **trap**: Send snmp-trap when configured threshold is hit.
- **log**: Only log the event when configured threshold is hit.
- **trap-log**: Send snmp-trap and log the event when configured threshold is hit.
- **none**: Take no action.

no ip-sla <ID> schedule

Syntax

```
no ip-sla <ID> schedule [[now | startTime <START-TIME>] [forever | stopTime <STOP-TIME>
| repetitions <NUM>] [frequency <FREQUENCY>
```

Description

Configure the start time, stop time, lifetime, and frequency of run for the IP SLA. The default value for the frequency of operation is 60 seconds.

no ip-sla <ID> tos

Syntax

```
no ip-sla <ID> tos <VALUE>
```

Description

Configure the Type of Service value to be set in the test packet for the IP SLA.

Valid values:

0-255

no ip-sla responder

Syntax

```
no ip-sla responder
```

Description

Configure SLA responder to respond to probe packets.

- **IP address**: local interface IP address
- **port**: takes L4 port numbers.
- **SLA types supported**: udp-echo, tcp-connect, UDP Jitter & Jitter For VoIP.

no ip-sla <ID> udp-jitter

Syntax

```
no ip-sla <ID> udp-jitter destination [<IP-ADDR> | <HOST-NAME>] <PORT-NUM> source [<IP-ADDR> | <VLAN-ID>] [payload-size <SIZE> num-of-packets <NUM> packet-interval <PKT-INTERVAL>]
```

Description

Configures the UDP Jitter test.

- **Payload-size**: Payload size of the test packet. Value can range from 68-8100. Default value is 68.
- **Num-of-packets**: Number of packets sent in one probe. Default is 10. Allowed range: 10-1000.
- **Packet-interval**: Inter packet gap in milliseconds.Time between consecutive packets within a probe. Default is 20ms. Allowed range: 10-60000

no ip-sla <ID> udp-jitter-voip

Syntax

```
no ip-sla <ID> udp-jitter-voip destination [<IP-ADDR> | <HOST-NAME>] <PORT-NUM> source [<IP-ADDR> | <VLAN-ID>] [codec-type <CODEC-TYPE> advantage-factor <ADV-FACTOR>]
```

Description

Configures the UDP Jitter for VoIP test.

- **Codec-type**: Codec to be used to encode the test VoIP packets. Available codecs: g711a, g711u, g729a. Default is g711a.
- **Advantage-factor**: Advantage factor to be configured for the test. Default is 0. Allowed range: 0-20.

Show commands

show ip-sla <ID>

Syntax

```
show ip-sla <ID>
```

Description

Show IP SLA configurations.

Parameters

history

Show the IP SLA results history.

message-statistics

Show the IP SLA message statistics.

results

Show the IP SLA results for UDP Jitter and UDP Jitter VoIP.

aggregated-results

Show the IP SLA aggregated results for UDP Jitter and UDP Jitter VOIP.

show ip-sla <ID>

```
SLA ID: 1
Status: [Enabled | Admin-disabled | Scheduled | Expired | Running]

SLA Type: [ICMP-echo | tcp-connect | UDP-echo | DHCP | DNS | udp-jitter | voip]

Destination Hostname: www.arubanetworks.com
Destination Address : 20.0.0.2
Source Address      : 20.0.0.1
History Bucket Size : 5
TOS: 32
Schedule:
      Frequency (seconds)       : 60
      Life                      : [Forever | 144 seconds]
      Start Time                : Tue Oct 27 22:12:16 2015
      Next Scheduled Run Time   : Tue Oct 27 22:43:16 2015

Threshold-Monitor is    : Enabled
      Threshold Config: RTT
      Threshold Type  : immediate
      Upper Threshold : 500 ms
     Lower Threshold : 100 ms
     Action Type     : Trap and Log

     Threshold Config: packet-loss
     Threshold Type  : consecutive (5)
     Action Type     : Trap

     Threshold Config: test-completion
     Action Type: None
```

show ip-sla <ID> history

Syntax

```
show ip-sla <ID> history
```

Description

Show the IP SLA results history.

show ip-sla <ID> history

```
SLA ID : 1

SLA Type : UDP-Echo

Minimum RTT (ms)        : 1
Maximum RTT (ms)        : 4294967282
Average RTT (ms)        : 3
Total RTT (ms)          : 315
RTT2 (sum of RTT squared): 63681

Start Time               Status  RTT      Description
```

```
------------------------ -------- ----      ------------
Mon Jan 1 00:51:28 1990 Failed  -        DMA tail drop detected.
Mon Jan 1 00:51:30 1990 Failed  -        SLA disabled before probe response arrived.
```

show ip-sla <ID> message-statistics

Syntax

```
show ip-sla <ID> message-statistics
```

Description

Show the IP SLA message statistics.

show ip-sla <ID> message-statistics

```
SLA ID : 1
Status : Running
SLA Type : UDP-Echo
Destination Address : 10.0.0.2
Source Address : 10.0.0.1
Destination Port : 2000
History Bucket Size : 25
Payload Size : 500
TOS : 0
Messages:
Destination Address Unreachable : 0
Probes Skipped Awaiting DNS Resolution : 0
DNS Resolution Failed : 0
No Route to Target : 0
Internal Error : 0
Local Interface is Down : 0
No Response from Target : 0
Successful Probes Sent : 3
Probe Response received : 3
Possibly Tail Dropped : 0
```

show ip-sla <ID> results

Syntax

```
show ip-sla <ID> results
```

Description

Shows the results for the last IPSLA UDP Jitter or UDP Jitter for VoIP test. Note this command is not valid for any other SLA type.

Switch (config)# sh ip-sla 1 results

```
Test Results for SLA ID: 1
Probe Id               : 10
SLA Type               : UDP-Jitter
Destination IP Address  : 10.2.2.2
Destination Port        : 4444
    Source IP Address   : 10.2.2.2
    Source Port                 : 5555

Number of Packets Sent             : 10
```

```
Number of Packets Received         : 10
Minimum Round Trip Time            : 15
Maximum Round Trip Time            : 32
Average Round Trip Time            : 17
Square-Sum of Round Trip Time      : 3235
Last Succeeded Probe Time          : 2008-05-29 13:56:17.6

Extended Results:
  Packet Loss in Test      : 0%

UDP-Jitter Results:
   RTT Number              : 10
   Min Positive SD         : 4        Min Positive DS           : 1
   Max Positive SD         : 21       Max Positive DS           : 28
   Positive SD Number      : 5        Positive DS Number                : 4
   Positive SD Sum         : 52       Positive DS Sum           : 38
   Positive SD Average     : 10       Positive DS Average       : 10
   Positive SD Square Sum  : 754      Positive DS Square Sum    : 460
   Min Negative SD         : 1        Min Negative DS           : 6
   Max Negative SD         : 13       Max Negative DS           : 22
   Negative SD Number      : 4        Negative DS Number                : 5
   Negative SD Sum         : 38       Negative DS Sum           : 52
   Negative SD Average     : 10       Negative DS Average       : 10
   Negative SD Square Sum  : 460      Negative DS Square Sum    : 754

One-way Results:
   Max SD Delay            : 15       Max DS Delay              : 16
   Min SD Delay            : 7        Min DS Delay              : 7
   Number of SD Delays     : 10       Number of DS Delay        s       : 10
   Sum of SD Delays        : 78       Sum of DS Delays          : 85
   Square Sum of SD Delays: 666       Square Sum of DS Delays   : 787


   For UDP Jitter for VoIP SLA, the following parameters are additionally shown:

Voice Scores:
   ICPIF
```

show ip-sla <ID> aggregated-results

Syntax

```
show ip-sla <ID> aggregated-results
```

Description

Shows the aggregated results for the last 25 probes conducted for an IPSLA UDP Jitter or UDP Jitter For VoIP SLA test. Note this command is not valid for any other SLA type.

Switch (config)# show ip-sla 1 aggregated-results

```
Test results for SLA ID: 1
SLA Type               : UDP-Jitter
Destination IP Address : 10.2.2.2
Destination Port                                          : 4444
Source IP Address      : 10.2.2.2
Source Port                                               : 5555
First Probe Start Time : 2008-05-29 13:56:17.6

Number of Packets Sent             : 10
Number of Packets Received         : 10
```

```
Minimum Round Trip Time            : 15
Maximum Round Trip Time            : 32
Average Round Trip Time            : 17
Square-Sum of Round Trip Time      : 3235

Aggregated Results for the Last 25 Probes

Extended Results:
  Packet Loss in Test      : 0%
  Probe Failure Reason     :

UDP-Jitter Results:
   RTT Number              : 10
   Min Positive SD         : 4        Min Positive DS           : 1
   Max Positive SD         : 21       Max Positive DS           : 28
   Positive SD Number      : 5        Positive DS Number                : 4
   Positive SD Sum         : 52       Positive DS Sum           : 38
   Positive SD Average     : 10       Positive DS Average       : 10
   Positive SD Square Sum  : 754      Positive DS Square Sum    : 460
   Min Negative SD         : 1        Min Negative DS           : 6
   Max Negative SD         : 13       Max Negative DS           : 22
   Negative SD Number      : 4        Negative DS Number                : 5
   Negative SD Sum         : 38       Negative DS Sum           : 52
   Negative SD Average     : 10       Negative DS Average       : 10
   Negative SD Square Sum  : 460      Negative DS Square Sum    : 754

One-way Results:
   Max SD Delay            : 15       Max DS Delay              : 16
   Min SD Delay            : 7        Min DS Delay              : 7
   Number of SD Delays     : 10       Number of DS Delay        s       : 10
   Sum of SD Delays        : 78       Sum of DS Delays          : 85
   Square Sum of SD Delays: 666       Square Sum of DS Delays   : 787


      For UDP Jitter for VoIP SLA, the following parameters are additionally shown:

Voice Scores:
   Max MOS Value           : 4.38     Min MOS Value                           : 4.38
   Max ICPIF Value        : 0        Min ICPIF Value           : 0
```

show ip-sla responder

Syntax

```
show ip-sla responder
```

Description

Show the IP SLA responder details.

show ip-sla responder

```
SLA type         : UDP-echo
Listening Address: 1.1.1.1
Listening Port   : 5555
```

show ip-sla responder statistics

Syntax

```
show ip-sla responder statistics
```

Description

Show the IP SLA responder statistics details.

Parameters

udp-jitter

Show the IP SLA responder statistics for UDP Jitter SLA type.

udp-jitter-voip

Show the IP SLA responder statistics for UDP Jitter VoIP SLA type.

show ip-sla responder statistics

```
IP SLA Responder  : Active
Number of packets received       : 31
Number of error packets received : 0
Number of packets sent           : 0

Recent Sources :
 10.12.80.100 [07:23:49.085 UTC Sun Oct 25 2015] UDP
 10.12.80.100 [07:22:49.003 UTC Sun Oct 25 2015] TCP
 10.12.80.100 [07:20:48.717 UTC Sun Oct 25 2015] TCP
 10.12.80.100 [07:18:48.787 UTC Sun Oct 25 2015] TCP
 10.12.80.100 [07:17:48.871 UTC Sun Oct 25 2015] TCP
```

show tech ip-sla

Syntax

```
show tech ip-sla
```

Description

Display output of a predefined command sequence used by technical support.

show tech ip-sla

```
switch# sh tech ip-sla

ipslaShowTech

 ======== IP SLA show tech BEGIN ============

 GLOBALS:
 Hash Handle:                      1e7bab20
 Struct Mem Handle for hash:       1e7ba2a8
 Struct Mem Handle for SLA ID LL:  1e7c9430
 Struct Mem Handle for FD List:    1e7bd690
 FastLog Handle:                   dfabf5c
 IPSLACtrl task ID:                1068091456
 IPSLA Sender ID:                  1068092544
 IPSLA Listener ID:                1068091840
 Number of enabled SLA's:          1
 SLA ID List Handle:               1ec1ffd4
 FD ID List Handle:                0
 Ring Full Counter:                0

 Details for SLA ID: 1
```

```
SLA ID: 1
Status: Running

SLA mechanism: ICMP-Echo

Destination address: 192.168.1.2
Source address: 192.168.1.1
History bucket size: 25
Payload size: 0
TOS: 0
Schedule:
      Frequency (seconds)       : 60
      Life                      : Forever
      Start Time                : Mon Jun 13 10:42:52 2016
      Next Scheduled Run Time   : Mon Jun 13 10:46:52 2016


Threshold-Monitor is  : Enabled
        Threshold Config     : RTT
        Threshold Type       : Immediate
        Upper Threshold      : 10
        Lower Threshold      : 2
        Action Type          : Log



SLA ID: 1
Status: Running

SLA mechanism: ICMP-Echo

Destination address: 192.168.1.2
Source address: 192.168.1.1
History bucket size: 25
Payload size: 0
TOS: 0
Messages:
       Destination address unreachable        : 0
       Probes skipped awaiting DNS resolution : 0
       DNS resolution failed                  : 0
       No route to target                     : 0
       Internal error                         : 0
       Local interface is down                : 0
       No response from target                : 0
       Successful probes sent                 : 9
       Probe response received                : 9
       Possibly tail dropped                  : 0

Count of Threshold hits:
               RTT              : 0
               packetLoss       : 0


SLA ID: 1

Minimum RTT (ms)         : 1
Maximum RTT (ms)         : 1
Average RTT (ms)         : 1
Total RTT (ms)           : 9
RTT2 (sum of RTT squared): 9

     Start Time                 Status       RTT               Description
```

```
     ----------                    ------       ---                -----------
Tue Jun 14 10:43:12 2016        Passed          1
Mon Jun 13 10:39:05 2016        Passed          1
Mon Jun 13 10:40:05 2016        Passed          1
Mon Jun 13 10:41:05 2016        Passed          1
Mon Jun 13 10:42:05 2016        Passed          1
Mon Jun 13 10:42:52 2016        Passed          1
Mon Jun 13 10:43:52 2016        Passed          1
Mon Jun 13 10:44:52 2016        Passed          1
Mon Jun 13 10:45:52 2016        Passed          1

 ICMP ID hash walk:


 ========== IP SLA show tech END ==============

 ======== IP SLA Server show tech BEGIN ============
Responder not active
IP SLA Responder: Inactive

 ======== IP SLA Server show tech END ============


=== The command has completed successfully. ===
```

clear ip-sla responder statistic

Syntax

`clear ip-sla responder statistics` *`<SLA-TYPE>`* *`<LOCAL-IP-ADDR>`* *`<LOCAL-PORT-NUM>`*`source` *`<SOURCE-IP-ADDR>`*

Description

Clear IP SLA responder statistics for either UDP jitter or VoIP UDP jitter.

Command context

`config`

Parameters

`<SLA-TYPE>`

Specifies the SLA type.

`udp-jitter`

Selects standard UDP jitter.

`udp-jitter-voip`

Selects UDP VOIP jitter.

`<LOCAL-IP-ADDR>`

Specifies the local interface IP address

`<LOCAL-PORT-NUM>`

Specifies the local interface port number. Range: *`1024 to 65535`*.

`<SOURCE-IP-ADDR>`

Specifies the Source IP address.

Example

Clear IP SLA responder statistics for UDP jitter:

```
switch(config)# clear ip-sla responder statistics udp-jitter 1.1.1.1 1100 source
1.1.1.2
```

Interoperability

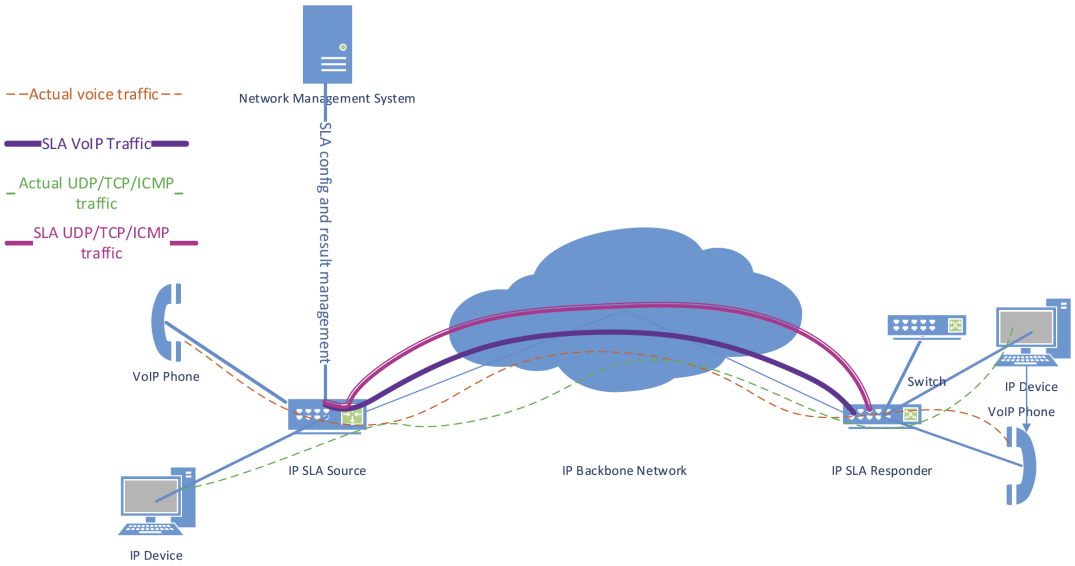
NOTE

Packet loss is expected when H3C TCP-CONNECT source, with a frequency less than or equal to 10 ms, interoperates with TCP-CONNECT responder.

IP SLA UDP Jitter and Jitter for VoIP

Overview

The UDP Jitter and Jitter for VoIP SLA types enable the user to assess the suitability of the network for voice & video related traffic. These SLA's basically calculate parameters like RTT, one way delay, one way positive and negative Jitter etc.



The above diagram shows a typical deployment, where voice & video traffic are exchanged between branch offices of an enterprise over the backbone network. Assessment of the network readiness is always helpful for hosting such services. Parameters like RTT, Jitter and one way delay are a good indicator of network health which assist a network administrator to diagnose latency related issues in the network. VoIP traffic is generally sensitive to delays in the network.

Jitter stands for inter-packet delay variance. If the inter-packet delay increases between successive probe packets, jitter is said to be positive. If the inter-packet delay decreases, jitter is said to be negative. Positive jitter values are undesirable for a network as they indicate increased latencies. A value of 0 jitter is desirable.

Significance of jitter

Consider a media player which plays video streams from a server. Assume that packets take 1 second in flight to reach the media player. This means the moment a user requests a video from the server, the very first packet will arrive after one second and successive packets will be sent immediately (ideally). In real world

scenarios, intermediate node latencies, different return paths for different packets and network congestion can contribute to varying delays. To counter such effects, packets are buffered at the media player. The amount of packet buffering needed can be derived from the jitter values.

NOTE

The above analogy is applicable for other voice & video services and can be a good measure to assess the possibility for hosting a service on a network.

Solution components

IP SLA responder

This device receives IP SLA probe packets from a configured initiator, timestamps the frame at a pre-defined location in the packet upon receipt and sends the same frame back to the initiator.

IP SLA initiator

This device initiates IP SLA probe packets to multiple destinations each with a certain user configurable packet content and periodicity.

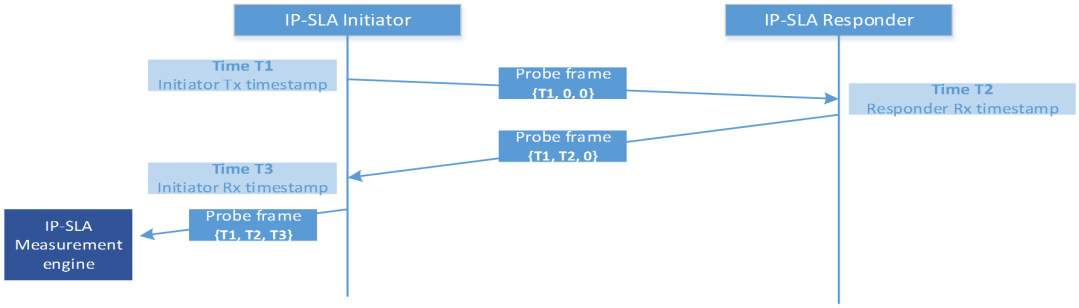
The initiator timestamps the frame at a pre-defined location before sending the frame out to the configured destinations and re-timestamps the frame at a different location once it receives the same back from the responder.

IP SLA measurement engine

This is an application running on the initiator. It processes response frames received from the IP SLA responder and computes one-way delay, jitter and RTT based on the timestamps present in the packet.

This application aggregates this computed information across multiple probe samples and stores this for consumption by an NMS via SNMP or via the device CLI.

It also supports asynchronous user configurable threshold breach notification to an NMS (via SNMP Traps).



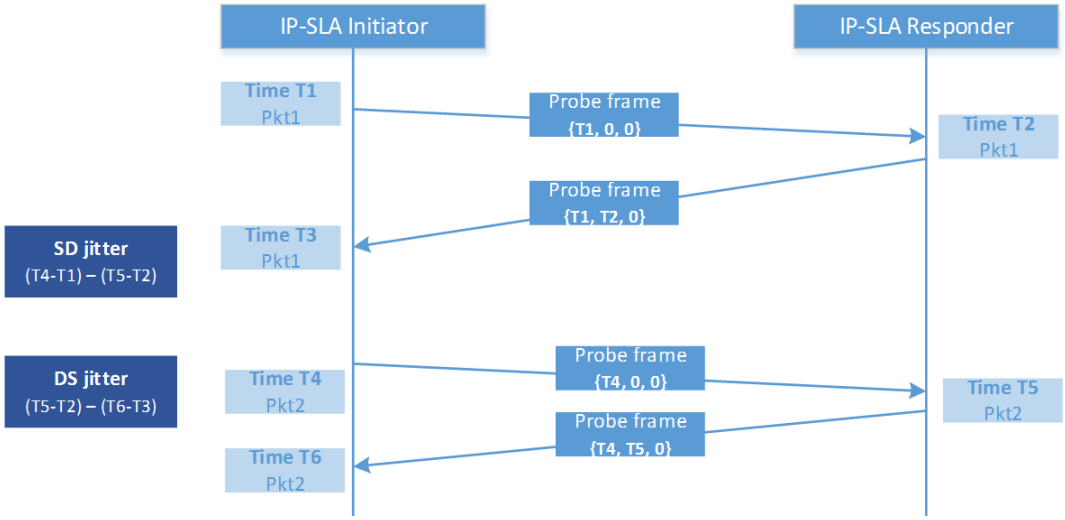
SLA Measurements

The following metrics are measured as part of this IP SLA jitter functionality.

One way jitter

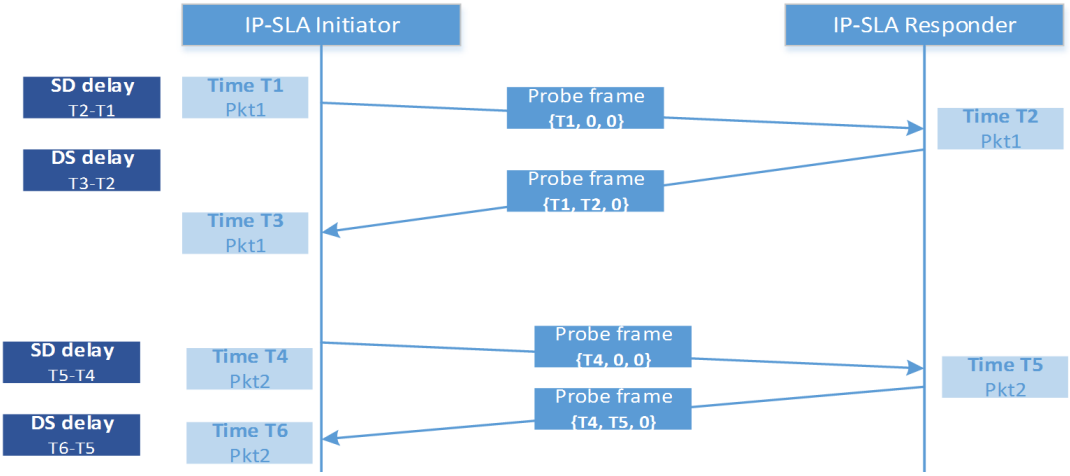
One way jitter is defined as the time difference between inter-packets transmit time and inter-packets arrival time in a given direction. This is measured in both the Initiator to Responder direction (referred to as SD jitter) as well as the Responder to initiator direction (referred to as DS jitter).

Ideally, the jitter in both directions should be 0. A positive value of jitter is bad for VOIP and higher values of jitter will mean poor conversation quality. This is explained in the illustration below:



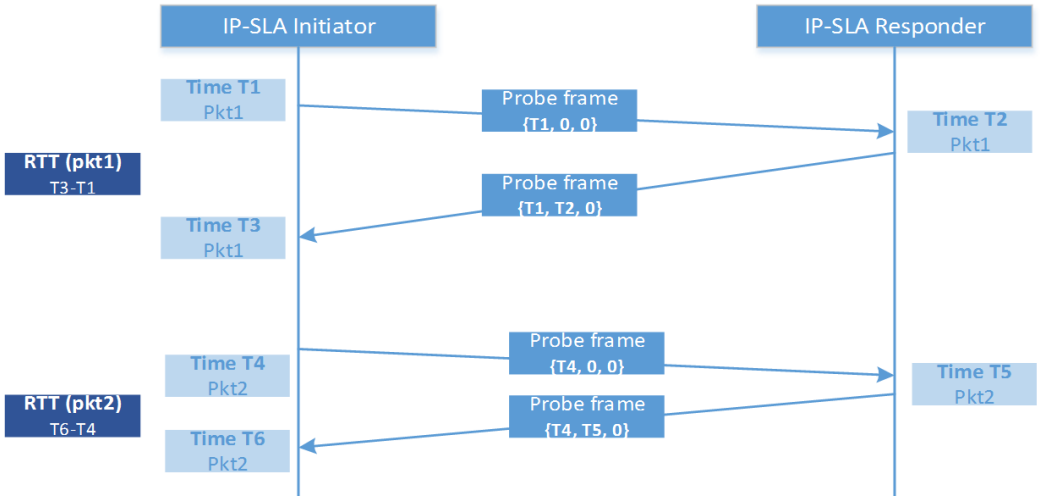
One way delay

One way delay is defined as the time difference between the Initiator transmitting the frame and the Responder receiving the frame. This requires the Initiator and the Responder to be time synchronized with the same clock server. This is explained in the illustration below:



Round trip time

RTT is measured at the initiator on a per packet basis and is as illustrated below:


IP-SLA Initiator
IP-SLA Responder
Time T1
Pkt1
Probe frame
{T1, 0, 0}
Time T2
Pkt1
RTT (pkt1)
T3-T1
Probe frame
{T1, T2, 0}
Time T3
Pkt1
Probe frame
{T4, 0, 0}
Time T4
Pkt2
Time T5
Pkt2
RTT (pkt2)
T6-T4
Probe frame
{T4, T5, 0}
Time T6
Pkt2

Definition of Terms

Term	Definition
DCA	Dynamic Configuration Arbiter
ClearPass	ClearPass Policy Manager
GRE	Generic Routing Encapsulation
SAC	Switch Anchor Controller
S-SAC	Standby Switch Anchor Controller
UAC	User Anchor Controller
Switch Bootstrap	Control plane protocol packets exchange process between a switch and an SAC to register a switch with the configured SAC.
User Bootstrap	Control plane protocol packets exchange process between a switch and a UAC to register a user with the published UAC.
Secondary role	This information is an indication to the controller that it has to enforce additional policies to user traffic based on policy configuration associated with the secondary role.
Reserved VLAN mode	A VLAN is automatically created and reserved for tunnels in this mode.

Overview

Dynamic Segmentation enables Aruba switches to tunnel traffic (all traffic or the traffic of particular clients) to Aruba controllers.

Dynamic Segmentation includes the following:

- User-Based Tunneling tunnels client traffic on the basis of user roles. This ability to dynamically tunnel traffic is powerful, and when used correctly, can help in solving several deployment problems that are prevalent in legacy campus networks. The policies associated with the client can be driven through a RADIUS server, a downloaded role from ClearPass, or by local MAC authentication in the switch. Many devices that require Power over Ethernet (PoE) and network access, such as security cameras, printers, payment card readers, and medical devices, do not have built in security software such as those on desktop or laptop computers. These devices can pose a risk to networks with the lack security on the device. User-Based Tunneling can authenticate these devices using ClearPass, and tunnel the client traffic, utilizing the advanced firewall and policy capabilities in the Aruba Mobility Controller. For providing secure access to IoT devices within the Aruba Intelligent Edge wired network, controller clustering is available in ArubaOS 8.0.0.0. For more

information, see User-Based Tunneling.

- Port-Based Tunneling allows the Aruba switch to tunnel traffic to an Aruba Mobility Controller on a per-port basis. All traffic on a configured switch port is statically tunneled to an Aruba Mobility Controller. For more information, see Port-Based Tunneling.

Tunneling is enabled in the Aruba user role and can be combined with the Downloadable User Role (DUR) feature for dynamic and flexible policy enforcement and segmentation.

Maximum supported user tunnels per switch or stack: 1024 Maximum supported user tunnels per port: 32

Benefits of Dynamic Segmentation

The benefits of dynamic segmentation are:

- Colorless ports / client flexibility
- Client isolation
- Same policy for wired or wireless clients
- With ClearPass, no role preconfiguration is needed.
- Tunnel client traffic over core complexity
- Reduced switch configuration
- Traffic visibility
- Wired guest access
- Simple branch configuration
- Controller supplied client attributes visibility

Use Cases

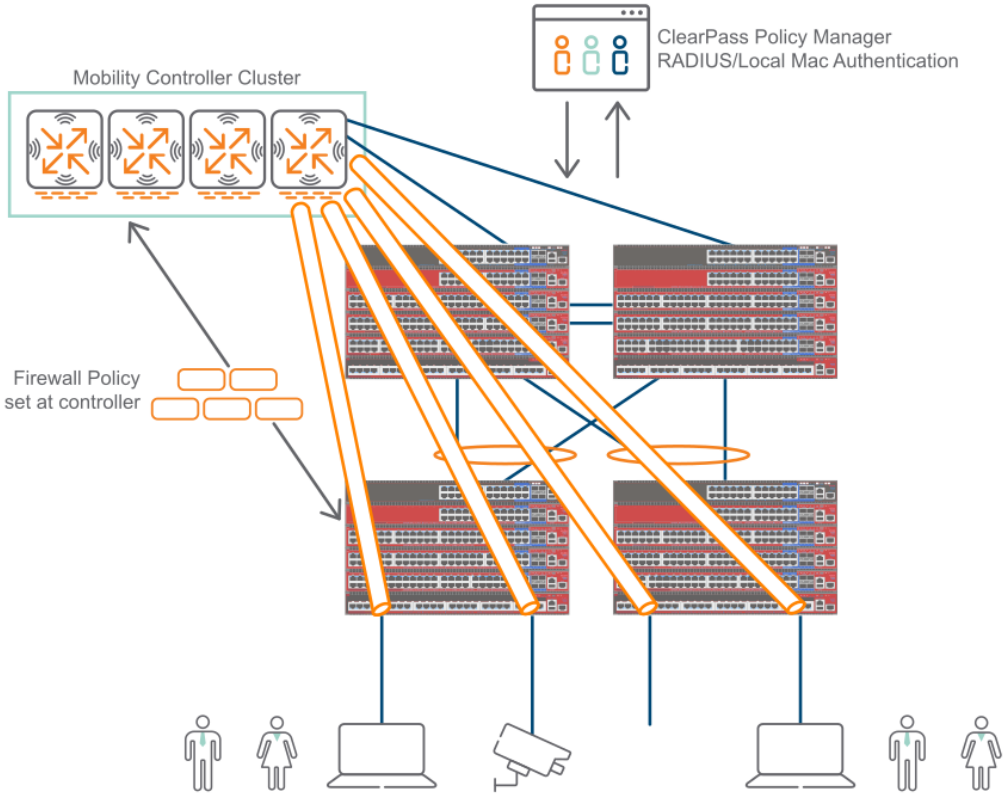
Following are the common use cases for Dynamic Segmentation, apart from the common use case of segmenting traffic based on user role policy:

- Create a wired guest capability.
- Provide a firewall at the Aruba Mobility Controller.

Wired Firewall Access:

To restrict user access, firewall and policies can be implemented for users tunneled to an Aruba Mobility Controller by using the built-in firewall capabilities of the controller.

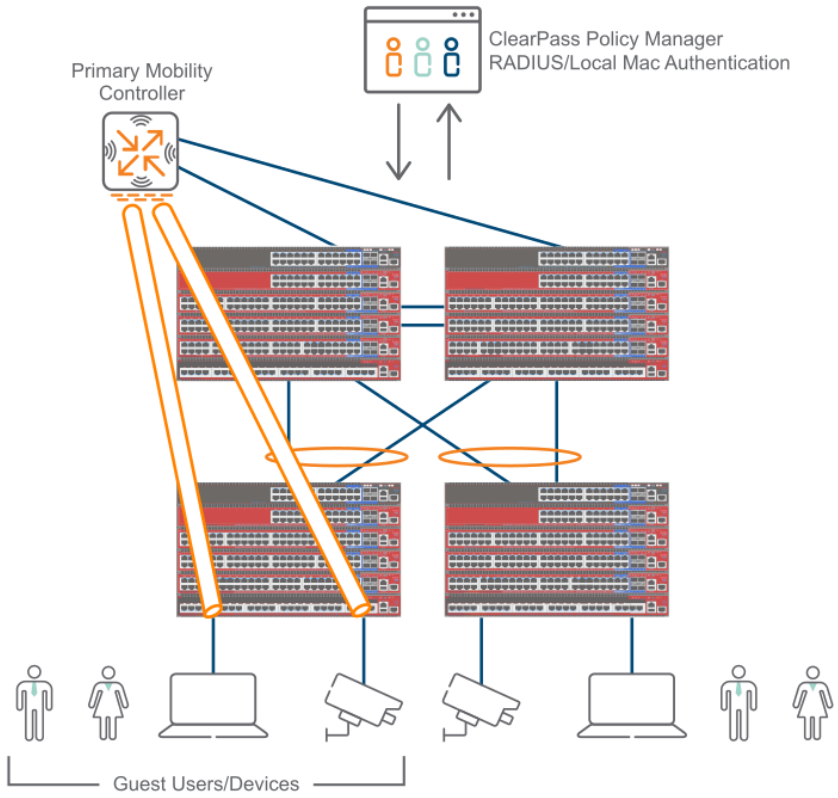
Figure 88 *Wired Firewall Access*



Wired Guest Traffic Segmentation:

The Dynamic Segmentation feature supports segmenting wired guest traffic on the network. This is achieved by creating the secondary role as a guest role on the Aruba Mobility Controller and assigning a specific guest VLAN. Access and firewall policy is then implemented on the controller to isolate guest access to the rest of the campus network.

Figure 89 *Wired Guest Traffic Segmentation*



Users/Devices and Policy Enforcement Recommendations

The following table specifies the enforcement recommendations for different type of users and devices. While it is recommended to tunnel the traffic in some cases, other cases can be met by simply using local forwarding on the switch.

Type	Enforcement	Description
Access Point	Local	Local infrastructure device.
Voice/Video Device	Local	Desk and conference phones, security cameras, and room media systems.
Employee on Managed Device	Local	Users connecting from a healthy and managed device can stay local to the Aruba switch.
Employee on Unmanaged device	Tunnel	Users connecting from an unmanaged or potentially untrusted device can be tunneled.
New/Unknown Device	Tunnel	Tunnel new or unknown devices, potentially untrusted devices used for profiling, potential onboarding, guest registration, and quarantine.
Guest User	Tunnel	Guest users to DMZ guest network.

Type	Enforcement	Description
Contractor	Tunnel	Contractors may need more access than a traditional guest user.
Change in User/Device Posture	Tunnel	User or device goes from a healthy to unhealthy state (OnGuard checks, IntroSpect notification, Ingress Event Engine Notification)

Colorless Ports

Within a campus network with a few thousand switch access ports and numerous intermediate distribution frames (IDFs), network admins must put in effort to assign VLAN IDs to the devices. It is also difficult to maintain switch port to VLAN mapping, and a significant configuration effort to manage thousands of lines of configurations on the switches is required.

With colorless ports, all the switches would have similar configuration with IP, credentials, authentication, VLANs, and uplinks. All access ports need only a few lines of configuration common for all ports. No admin intervention is needed to assign a VLAN to a user, since the user is automatically assigned a reserved VLAN ID.

The benefits of colorless ports are:

- Simplified user experience
- Increased visibility: It is easy to see what is on the network.
- Increased security: The network applies the correct policy to a device.
- Simplified switch configuration. All access ports are configured the same.

For more details on the colorless ports, see User Roles in the *Access Security Guide* for your switch.

Port-Based Tunneling

In a traditional campus network, wireless traffic is encapsulated between the access point and controller using a tunnel. With Port-Based Tunneling on the Aruba switches, a similar implementation is done using the same mechanism with an Aruba Mobility Controller. In essence, a wired port becomes a “wired AP”. Each switch port can then be individually configured to create a single tunnel to the Mobility Controller. However, at the Mobility Controller, each tunneled node port is seen as separate tunnel to provide more granular visibility, as each tunnel has a unique GRE key. By tunneling traffic to the Mobility Controller, in Port-Based Tunneling, authentication and network policies are applied and enforced at the controller-side for tunneled, wired traffic. This simplifies configuration on the switch and centralizes policies at the Mobility Controller. Port-Based Tunneling allows using the same enforcement options for wired and wireless clients. This includes stateful session processing, deep packet inspection, URL filtering, and bandwidth contracts.

The main purpose of Port-Based Tunneling is to use the Mobility Controller as a unified policy enforcement point for traffic from both wired and wireless clients.

If the Mobility Controller is not reached by the Aruba switch, the user can fall back to local switching, which allows the tunneled ports to communicate with the other ports in the same VLAN.

- Port-Based Tunneling is configured on a per-port basis. Traffic to and from ports that is not configured as tunneled is forwarded using the standard layer switching technology.
- An AOS-S switch can be configured with a main and a backup tunnel termination controller called “tunneled-node server”.
- Port-Based Tunneling does not support HA and load balancing over an Aruba Mobility Controller Cluster compared to User-Based Tunneling.

Configuring Port-Based Tunneling

Jumbo frames must be enabled on all devices between the access switch and the controller to support the L2 GRE tunnels.

Follow the steps below to configure port-based tunneling:

Prerequisites

It is recommended to create a specific VLAN for tunneled node operation. The VLAN:

- Must be configured as the only VLAN for tunneled node access ports (untagged)
- Cannot be assigned an IP address – No layer 3 interface
- Must exist on the controller

Procedure

1. Execute the following command to setup the IP address of the Aruba Mobility Controller:
   ```
   switch(config)# tunneled-node-server controller-ip 10.2.10.11
   ```
   Optional steps:
   a. Set up backup controller IP by issuing the following command:
      ```
      switch(config)# tunneled-node-server backup-controller-ip 10.2.10.12
      ```
   b. Set tunneling keepalive timer by issuing the following command. Ensure the time interval between keepalive messages is set to the default value (8):
      ```
      switch(config)# tunneled-node-server keepalive interval
      <1-8> Configure the time interval between two successive keepalive messages
      sent to the
      controller
      ```
2. Execute the following commands to enable port-based tunneling on an interface or a range of interfaces:
   ```
   switch(config)# vlan 200 untagged 1/21-1/24
   exit
   switch(config)#interface 1/21-1/24 tunneled-node-server
   ```
3. Execute the following commands to verify the state of the port-based tunnel(s):
   ```
   switch(config)# show tunneled-node server state
   Tunneled Node Port State
   Active Controller IP Address : 10.2.10.11
   Port State
   ```

```
------ -------------------------
2/23 Complete
```

View the tunnel statistics by issuing the following command:

```
View tunnel statistics
switch(config)# show tunneled-node-server statistics
Tunneled Node Statistics
Port : 2/23
Control Plane Statistics
Bootstrap packets sent : 1
Bootstrap packets received : 1
Bootstrap packets invalid : 0
Tunnel Statistics
Rx Packets : 302
Tx Packets : 0
Rx 5 Minute Weighted Average Rate (Pkts/sec)
: 0 Tx 5 Minute Weighted Average Rate
(Pkts/sec) : 0
Aggregate Statistics
Heartbeat packets sent : 56607
Heartbeat packets received : 56607
Heartbeat packets invalid : 0
Fragmented Packets Dropped (Rx) : 0
Packets to Non-Existent Tunnel : 0
MTU Violation Drop : 0
```

If the `tunneled-node` profile change is applied on any interface or having any on-board users on the interface, the profile change is not allowed. To change the `tunneled-node` profile, follow the below steps:

1. Remove the `tunneled-node-profile` from the interface.
2. Change the profile using `cfg-restore` command and apply the `tunneled-node-profile` on the interface.

Operating notes

- Tunneled node profile can be created using CLI and SNMP.
- The tunneled node profile supports configuring of:
  - Primary controller (both IPv4 and IPv6).
  - Backup controller (both IPv4 and IPv6).
  - Heartbeat keepalive timeout - range 1-40 seconds.
- Only one tunneled node profile can be created.
- The tunneled-node profile can be applied to a physical port only via CLI and SNMP.
- The maximum number of physical ports to which the profile may be applied is:
  - Aruba 5400R Switch Series (non-VSF): 256
  - Aruba 5400R Switch Series (VSF): 512
- High availability (HA) will be supported for the tunneled node related configuration.
- A tunnel, associated with a port, is “up” when the following conditions are met. A tunnel is “down” when either of the conditions are not met.

- Either the primary or backup controller is reachable.
- A boot strap message response is received from the controller.

- Heartbeat between the switch and controller fails when the controller does not respond after five attempts. All tunnels are brought down with a heartbeat failure.
- A tunnel “up or down” status is logged for each tunnel node port in the event log.
- The `show tech` command dumps all user-mode and test-mode command outputs.
- To reach the Aruba controller, the VLAN must have a manual IP configured.
- With the exception of the 802.1x BPDU, the switch consumes all other BPDUs.
- The controller cluster cannot have mix of IPv4 and IPv6 nodes.
- IPv6 addresses are not allowed for both Primary and Backup controllers when in Port-Based Tunnels.

Interaction table

Features enabled with tunneled node:

Feature
Mirrors (MAC, VLAN, port)
PVST/RPVST/STP
DLDP
UDLD
LLDP/CDP
GVRP/MVRP
LACP
Uplink Failure Detection
sFlow
Loop protect
Smartlink
Global QoS (VLAN, port, rate limit)
MAC lockout/lockdown
ACL/Classifiers (ingress/egress)
IGMP/MLD
GMB
Broadcast-limit

Feature
Energy Efficient Ethernet
Flow Control
PoE ■ poe-allocate-by ■ poe-lldp-detect
Rogue MAC detection
LLDP auto provisioning

Restrictions

- Once a tunneled node profile is applied to a port, the controller IP (primary and backup) cannot be changed.
- IP address cannot be assigned to VLANs that contain ports with Port-Based Tunneling configured.
- No support for fragmentation and reassembly for encapsulated frames that result in an MTU violation. Such frames will be dropped.
- Packets from ports configured with Port-Based Tunnels will not be bridged with locally switched ports.

Features that are blocked when Port-Based Tunnels are configured and the scope of the block (either globally, on a port basis or on a VLAN basis):

Feature	Blocked globally/per port/ VLAN with Port- Based Tunneling
IP multicast routing	Global
Openflow	Global
Q-in-Q	Global
Distributed Trunking	Global
Mesh	Global
VXLAN	Global
IP address: manual and dhcp	VLAN
802.1x, mac auth, webauth, LMA, port security	Port
DIPLD (IPv4/IPv6)	Port
DSNOOP (IPv4/IPv6)	VLAN
ARP protect	VLAN
RA guard	Port
Virus throttling	Port

Feature	Blocked globally/per port/ VLAN with Port- Based Tunneling
BYOD	VLAN
Trunk	Profile cannot be applied to a trunk
PBR policies	VLAN
VSF on a Port-Based Tunnel configured port	Port
Source port/Multicast filters	Port
DHCP client/Server/Relay	VLAN

Preventing double tunneling of Aruba Access Points

When an Aruba Access Point (AP) is connected to a port on which Port-Based Tunneling is configured, there are two tunnels from that port to the Controller - one for the AP and another for the tunneled node. To improve performance of APs connected to tunneled node ports, the following configuration parameter under the device profile feature prevents double tunneling.

The parameter decides whether to allow or not, a tunneled node to be configured on the port on which the device-profile is applied. Use the command `switch(config)# device-profile name <device-profile-name> no allow-tunneled-node`.

The default setting of `device-profile` allows tunneled node. Device profile is applied on the port only by reading Organizational Specific TLV in LLDP packets.

Preventing double tunneling using device profile

device-profile name

Syntax

`device-profile name <device-profile-name> no allow-tunneled-node`

Description

Allows or disallows tunneled node when device profile is applied on that port.

Command context

`config`

Parameter

<device-profile-name>

Specifies the name of the device profile to be configured.

Usage

To create a device-profile named test, execute the following command:

`switch(config)# device-profile name test`

To allow tunneled-node by the configured device profile parameter, execute the following command:

`switch(device-profile)# allow-tunneled-node`

Examples

```
switch(config)# device-profile name <device-profile-name>
 switch(device-profile)#
 allow-jumbo-frames    Configure jumbo frame support for the device port.
 allow-tunneled-node   Configure Tunneled Node support for the device port.
 cos                   Configure the Class of Service (CoS) priority for
                       traffic from the device.
 egress-bandwidth      Configure egress maximum bandwidth for the device port.
 ingress-bandwidth     Configure ingress maximum bandwidth for the device
                       port.
 poe-max-power         Configure the maximum PoE power for the device port.
 poe-priority          Configure the PoE priority for the device port.
 poe-allocate-by       Configure the PoE allocation type for the device port.
 speed-duplex          Configure the speed and duplex for the device port.
 tagged-vlan           Configure this port as a tagged member of the specified
                       VLANs.
 untagged-vlan         Configure this port as an untagged member of specified
                       VLAN.
```

Execute `show run` command to display the tunneled mode configuration in an enabled or disabled state:

```
switch(config)# show run
; J9625A Configuration Editor;
; Ver #0f:02.43.18.82.34.61.1c.28.f3.84.9c.63.ff.37.2f:da
hostname "switch"
snmp-server community "public" unrestricted
device-identity name "cpe" lldp oui 33bbcc
device-identity name "cpe" lldp sub-type 1
device-identity name "phone" lldp oui 112233

vlan 1
   name "DEFAULT_VLAN"
   untagged 1-28
   ip address dhcp-bootp
   exit
device-profile name "ram"
   exit
device-profile name "test"
   exit
device-profile type “scs-wan-cpe”
   associate "ram"
   enable
   exit
device-profile type-device "cpe"
   associate "ram"
   enable
   exit
device-profile type-device "phone"
   associate "default-device-profile"
   exit
```

When `allow-tunneled-node` is disabled:

```
switch(config)# show run
; J9625A Configuration Editor;
; Ver #0f:02.43.18.82.34.61.1c.28.f3.84.9c.63.ff.37.2f:da
hostname "switch"
snmp-server community "public" unrestricted
device-identity name "cpe" lldp oui 33bbcc
device-identity name "cpe" lldp sub-type 1
device-identity name "phone" lldp oui 112233

vlan 1
   name "DEFAULT_VLAN"
   untagged 1-28
```

```
   ip address dhcp-bootp
   exit
device-profile name "ram"
   exit
device-profile name "test"
   no allow-tunneled-node
   exit
device-profile type “scs-wan-cpe”
   associate "ram"
   enable
   exit
device-profile type-device "cpe"
   associate "ram"
   enable
   exit
device-profile type-device "phone"
   associate "default-device-profile"
   exit
```

show device-profile config

Syntax

```
show device-profile config
```

Description

Shows the device profile configuration.

Command context

```
config
```

Examples

Use the command `show device-profile config` to display the device profile configuration.

```
switch(config)# show device-profile config

 Device Profile Configuration

 Configuration for device-profile : default-ap-profile
  untagged-vlan      : 1
  tagged-vlan        : None
  ingress-bandwidth  : 100%
  egress-bandwidth   : 100%
  cos                : None
  speed-duplex       : auto
  poe-max-power      : Class/LLDP
  poe-priority       : critical
  allow-jumbo-frames : Disabled
  allow-tunneled-node: Enabled
  poe-allocate-by    : class

 Configuration for device-profile : test
  untagged-vlan      : 1
  tagged-vlan        : None
  ingress-bandwidth  : 100%
  egress-bandwidth   : 100%
  cos                : None
  speed-duplex       : auto
  poe-max-power      : Class/LLDP
  poe-priority       : critical
  allow-jumbo-frames : Disabled
```

```
 allow-tunneled-node: Enabled
 poe-allocate-by    : class


Configuration for device-profile : default-aos-profile
 untagged-vlan      : 1
 tagged-vlan        : None
 ingress-bandwidth  : 100%
 egress-bandwidth   : 100%
 cos                : None
 speed-duplex       : auto
 poe-max-power      : Class/LLDP
 poe-priority       : critical
 allow-jumbo-frames : Disabled
 allow-tunneled-node: Enabled
 poe-allocate-by    : class

Configuration for device-profile : default-scs-profile
 untagged-vlan      : 1
 tagged-vlan        : None
 ingress-bandwidth  : 100%
 egress-bandwidth   : 100%
 cos                : None
 speed-duplex       : auto
 poe-max-power      : Class/LLDP
 poe-priority       : critical
 allow-jumbo-frames : Disabled
 allow-tunneled-node: Enabled
 poe-allocate-by    : class


Configuration for device-profile : default-device-profile
 untagged-vlan      : 1
 tagged-vlan        : None
 ingress-bandwidth  : 100%
 egress-bandwidth   : 100%
 cos                : None
 speed-duplex       : auto
 poe-max-power      : Class/LLDP
 poe-priority       : critical
 allow-jumbo-frames : Disabled
 allow-tunneled-node: Enabled
 poe-allocate-by    : class


Device Profile Association

 Device Type   : aruba-ap
 Profile Name  : default-ap-profile
 Device Status : Disabled

 Device Type   : aruba-switch
 Profile Name  : default-aos-profile
 Device Status : Disabled

 Device Type   : scs-wan-cpe
 Profile Name  : default-scs-profile
 Device Status : Disabled
```

User-Based Tunneling

User-Based Tunneling provides Aruba switches the ability to tunnel specific client traffic to an Aruba controller.

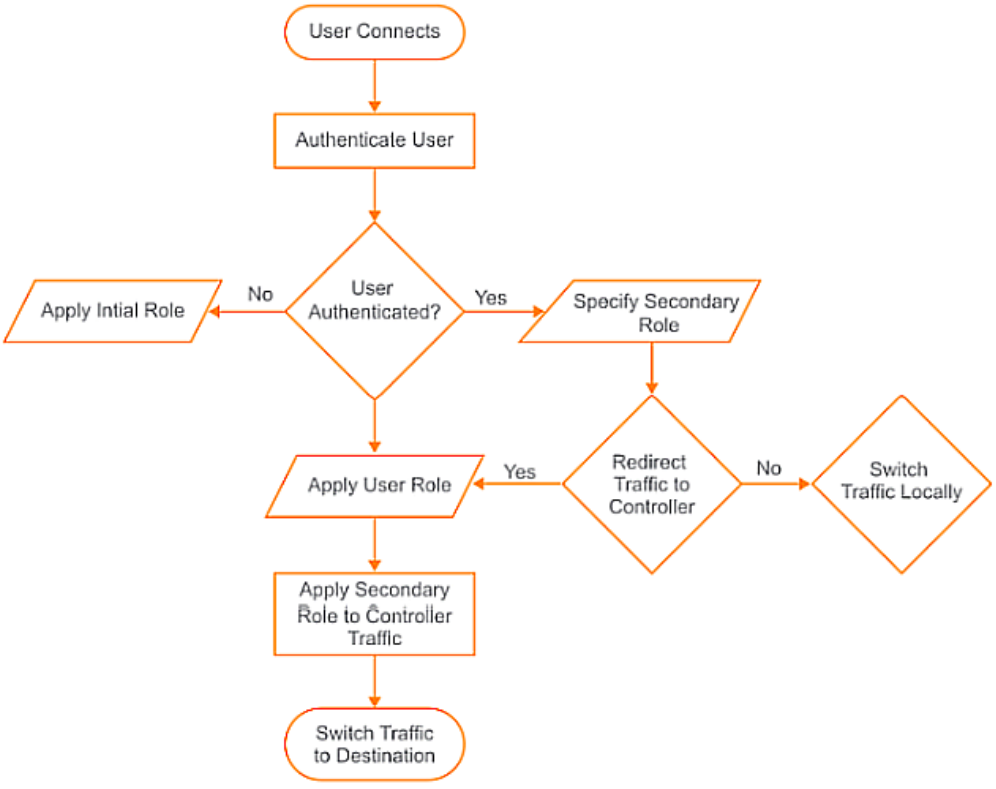
Once User-Based Tunneling is enabled, the Aruba controller provides a centralized security policy, authentication, and access control. The decision to tunnel client traffic is based on the user role. User roles redirect traffic to an Aruba controller when the tunnel status is up. A secondary role, provided by the authentication subsystem, when present in the user role authorizations, notifies the User-Based Tunnel and provides a secondary role. The communication between a User-Based Tunneling switch and the ClearPass is supported only over IPv4.

User-Based Tunneling, combined with ClearPass/LMA policies, is used to indicate if a client's traffic should be tunneled to the controller.

User Authentication Workflow

The flowchart below depicts user authentication workflow for User-Based Tunneling:

1. Authenticate user
2. Apply user role to authenticated user
3. Redirect user traffic to controller
4. Apply secondary user role to user traffic on controller



How it works

The functionality of User-Based Tunneling starts with the tunneled-node server information being discovered on the Aruba switch. User-Based Tunneling module exchanges information with the tunneled-node server to determine its reachability and discover the version details. Once the reachability is confirmed, the user-based tunneling module in the Aruba switch sends a bootstrap message to the tunneled-node server, which replies with an acknowledge message.

Creating a Tunnel

A GRE heartbeat is initiated between the Aruba switch and the managed device creating a tunnel. A GRE heartbeat is exchanged with the managed device, which is the switch anchor controller (SAC). This is the controller-IP in the `tunneled-nodeserver` command. A secondary heartbeat is also established with the standby managed device and acts as a secondary switch anchor controller (s-SAC).

Authenticating the User

As a user connects to a secure port, the Aruba switch sends a request to the RADIUS server (in this case, ClearPass), which authenticates the user and returns a user role attribute to the Aruba switch. Once the attribute containing information on which user role the user will be placed in is received by the Aruba switch, the user role that is configured locally on the Aruba switch or downloaded from the ClearPass.

Aruba User Role

A user role can contain policy, captive portal, and VLAN information. When the user role that is returned from the RADIUS server is applied to the user, the `tunneled-node-server-redirect` command to redirect traffic to a managed device can be included within the user role. When this command is executed and the user-based tunneling feature status is up, the authentication sub system notifies the user-based tunnel node module, providing a secondary role. The secondary role is the user role on the managed device where policy generally exists for tunneled users. This is where the firewall and security will be applied. This secondary-role information is an indication to the managed device that it has to enforce additional policies to the user traffic based on policy configuration associated with the secondary role and then from the tunnel.

The switch establishes user-based tunneling, and applies advanced policies to controllers. Based on the dynamic traffic patten detection, the switch can selectively tunnel voice and data traffic through tagged or untagged VLANs.

Critical Role Support for User-Based Tunneling Clients

When the RADIUS server is not reachable, new clients that cannot be authenticated are moved to the critical role. This new feature enables tunneling traffic of all the devices, connected on that port to the controller using critical role when RADIUS server is not reachable.

On PC behind phone deployments, user-based tunneling with user configured VLAN will be used with separate voice and data VLANs of the critical role.

Tunneling to a Controller Cluster

To ensure high availability, customers can tunnel traffic to a controller cluster instead of just to a standalone controller. If users are tunneled to a controller cluster, the bucket map containing the mapping between a bucket of clients to the active UAC and s-UAC is populated in the controller. A value based on the client MAC address is assigned when a user is redirected to a controller. This value is then used to look up the bucket map and the client device is then anchored to that particular controller node. This secondary role information is an indication to the controller that it has to enforce additional policies to user traffic based on policy configuration associated with the secondary role. After this process, the per user tunneled node module creates a tunnel to this UAC, if not already created, and forward user traffic to that UAC. If a user role does not contain an attribute to redirect traffic to a controller, then the switch will forward the traffic locally.

Once user tunnels are established to the user anchor controllers, a PAPI (Process Application Programming Interface)-based keepalive packet is exchanged with the controllers that have users anchored to them.

Upgrading from earlier images to 16.08 or greater with the same user role configuration is seamless and is supported. After upgrading to 16.08 or later, if Reserved VLAN mode is configured, the VLAN IDs already configured in user roles will not be used for tunneling traffic to the controller.
Downgrading is not allowed when User-Based Tunneling is operating in Reserved VLAN mode. The user cannot downgrade to pre-16.08 image if the user role lacks a VLAN configuration.

Licensing Requirements

A license is required to activate Dynamic Segmentation and if the license is not installed, controllers will not be allowed to form tunnels to Aruba switches and the feature will not be functional. The AP/switch consumes the following license types:

- AP
- PEFNG
- RFP
- WebCC
- MC-VA (for VMC-MD)

The `show license-usage ap` command displays license usage for User-Based Tunnels. Licenses are consumed per switch and User-Based Tunnels will show up alongside APs for license consumption.

```
switch# show ap license-usage

AP Licenses
-----------
Type                      Number
----                      ------
AP Licenses               2048
RF Protect Licenses       2048
PEF Licenses              2048
MM Licenses               2048
Controller License        True
Overall AP License Limit  2048

AP Usage
--------
Type             Count
----             -----
Active CAPs      0
Active RAPs      0
Remote-node APs  0
Active MUX       0
Active PUTN      1
Total APs        1

Remaining AP Capacity
---------------------
Type  Number
----  ------
CAPs  2047
RAPs  2047
```

`show license client-table` output on a Controller Cluster:

```
(cluster1)# show license client-table

Built-in limit: 0
License Client Table
```

```
--------------------
Service Type                                          System Limit  Server Lic.  Used
Lic.  Remaining Lic.  FeatureBit
------------                                          ------------  -----------  -------
--  --------------  ----------
Access Points                                         64            510          2
   62              enabled
Next Generation Policy Enforcement Firewall Module    64            254          2
   62              enabled
RF Protect                                            64            510          2
   62              enabled
Advanced Cryptography                                 4096          512          0
   512             enabled
WebCC                                                 64            0            0
   0               disabled
MM-VA                                                 65            494          3
   62              enabled
MC-VA-RW                                              64            250          0
   64              disabled
MC-VA-EG                                              64            0            0
   0               disabled
MC-VA-IL                                              64            0            0
   0               disabled
MC-VA-JP                                              64            0            0
   0               disabled
MC-VA-US                                              64            0            0
   0               disabled
VIA                                                   4096          0            0
   0               enabled
```

`show license server-table` output on the Mobility Master:

```
(MM1) [mynode]# show license server-table

License Server Table for pool / profile root
-------------------------------------------
Service Type                                          PoolSize  ExpiredLic
ActualPoolSize  UsedLic  RemainingLic  Warnings  FeatureBit
------------                                          --------  ----------  ------------
--  -------  ------------  --------  ----------
Access Points                                         512       0           512
   18       494           None      enabled
Next Generation Policy Enforcement Firewall Module    256       0           256
   18       238           None      enabled
RF Protect                                            512       0           512
   18       494           None      enabled
Advanced Cryptography                                 512       0           512
   0        512           None      enabled
WebCC                                                 0         0           0
   0        0             None      disabled
MM-VA                                                 1000      0           1000
   12       988           None      enabled
MC-VA-RW                                              250       0           250
   0        250           None      enabled
MC-VA-EG                                              50        0           50
   0        50            None      enabled
MC-VA-IL                                              50        0           50
   0        50            None      enabled
MC-VA-JP                                              50        0           50
   0        50            None      enabled
MC-VA-US                                              50        0           50
   0        50            None      enabled
VIA                                                   0         0           0
   0        0             None      enabled
```

```
(MM1) [mynode] #
```

Dependencies

Dynamic Segmentation is supported on the following platforms and firmware versions:

Supported Deployments

- Standalone controller
- Clustered controller

Switch Platform and Firmware Support

- Aruba 3810 Switch Series
- Aruba 2930F Switch Series and Aruba 2930M Switch Series
- Aruba 5400R Switch Series (v3 blades only)
- AOS-S switch 16.04 or later

Controller Firmware Support

- Standalone controller - 7000 Series and 7200 Series running ArubaOS 8.1.0.0 or later
- Clustered controller - 7000 Series and 7200 Series running ArubaOS 8.1.0.0 or later

ClearPass

ClearPass version 6.7.

AirWave

AirWave version 8.2.6.

Even though AirWave 8.2.6 or above will work, AirWave 8.2.8 has additional enhancements to provide visibility to tunnels.

Simplifying User-Based Tunneling with Reserved VLAN

Prior to 16.08, authenticated clients were assigned to the VLANs provided by applied user role profile (configured or downloadable). The User-Based Tunnel would then get established between the switch and controller. Client traffic would be tunneled to the controller, provided the client VLAN imposed by the user role profile was created previously in both switch and controller. Otherwise, User-Based Tunneling functionality would fail.

This created an overhead for network administrators while configuring all possible client VLANs in each access switch and controller, so that the client traffic could be tunneled and segregated properly. Since all client traffic was tunneled to the controller, and controller segregated the traffic based on its configured policy (secondary user role), there was no value added for maintaining multiple VLANs for various categories of clients.

AOS-S switch 16.08 allows creation of a reserved VLAN through which all tunneled traffic is taken to the controller. This simplifies deployment of User-Based Tunneling. A fixed/reserved VLAN is configured under tunneled profile, which is assigned to all tunneled clients and the same VLAN is used while tunneling client traffic to the controller. Thus, to use a reserved VLAN, it is not required to preconfigure VLANs configured under user role in switch, prior to initiating client authentication. When a reserved VLAN is configured, if it is not

already present on the switch, it will be created and traffic from all clients on the switch will go through the reserved VLAN. By adding a single line configuration to tunneled-node command, existing users can migrate to the Reserved VLAN mode without changing any other configuration.

Differences between User-Based Tunnels with and without Reserved VLAN:

User-Based Tunnels without Reserved VLAN	User-Based Tunnels with Reserved VLAN
Tunnel VLANs should be statically configured on all switches.	Tunnel VLANs need not be statically configured on all switches.
User role should have VLAN attribute configured.	User role need not have VLAN attribute configured.
Multicast traffic is replicated on the switch.	Multicast traffic is replicated on the controller.
VLANs need to be synchronized between the switch and the controller.	VLANs need not be synchronized between the switch and the controller.

Operating Notes:

- The reserved VLAN is used exclusively for User-Based Tunneling feature. Deletion of this VLAN is not allowed outside of tunneled profile configuration.
- The VLANs imposed by user role after successful client authentication is ignored, and the reserved VLAN is used for on-boarding the tunneled clients.
- Controller segregates tunneled client traffic based on assigned secondary role and unicasts the multicast/ broadcast traffic to individual clients through UAC tunnel.
- SAC multicast tunnels are no longer used in reserved VLAN mode.
- The reserved VLAN configuration on the controller is optional.
- The default VLAN cannot be configured as a reserved VLAN.
- Migration from Port-Based Tunneling to User-Based Tunneling requires a disable and then, a re-enable of tunneling.
- The user role for tunneled clients will not be allowed to contain untagged and tagged VLAN such as normal clients.

Configuration and show commands

Commands to configure a tunneled node server on the switch

Tunneled node configuration

Commands necessary to configure a tunneled node server for a tunneled node Aruba switch:

- `switch(config)#tunneled-node-server`
- `switch(tunneled-node-server)# controller-ip <IP-ADDR | IPV6-ADDR>`
- Optional: `switch(tunneled-node-server)# backup-controller-ip <IP-ADDR | IPV6-ADDR>`
- Optional: `switch(tunneled-node-server)# keepalive interval <Integer>`
- `switch(tunneled-node-server)# mode role-based reserved-vlan <vlan-id>`
- `switch(tunneled-node-server)# enable`

IPv6 configurations are only available when the switch is operating in role-based mode (User-Based Tunneling).

tunneled-node-server

Syntax

```
tunneled-node-server [controller-ip <IP-ADDR|IPv6-ADDR> | backup-controller-ip <IP-
ADDR|IPv6-ADDR> | [keepalive <TIMEOUT>] | enable | mode role-based {reserved-vlan <VLAN-
ID>} | maintenance-period | | ubt-wol-enable {vlan <VLAN-ID-LIST>}]
no tunneled-node-server [controller-ip <IP-ADDR|IPv6-ADDR> | backup-controller-ip <IP-
ADDR|IPv6-ADDR> | [keepalive <TIMEOUT>] | enable | mode role-based {reserved-vlan <VLAN-
ID>} | maintenance-period | | ubt-wol-enable {vlan <VLAN-ID-LIST>}]
```

Description

Configures tunneled-node server information.

The `no` form of the command removes the tunneled-node server configuration.

Parameters

controller-IP

Configures the controller IP address for the tunneled-node. Both IPv4 and iPv6 are supported.

backup-controller-IP

Configures the backup controller IP address for the tunneled-node. Both IPv4 and IPv6 are supported.

keepalive

Configures the keepalive timeout for the tunneled-node in seconds [1-40]. The default is 8 seconds.

enable

Enters the manager command context.

mode role-based

Specifies the tunneled-node server mode as role based.

mode role-based reserved-vlan

Specifies the VLAN used as tunneled-node server reserved VLAN.

ubt-wol-enable vlan

Enable User-Based Tunneling Wake-on-LAN (WoL) on the specified VLANs.

maintenance-period

Configures maintenance-period for user-based tunnels. The maintenance-period configuration helps to retain the UBT client's authentication session for the configured duration during controller maintenance. The maximum supported timer value is 720 hours (30 days). The default value of 0 is used to disable the maintenance window.

In an event where controller is unreachable during an active maintenance-period, the authenticated clients will be retained in current role and client traffic will be dropped at the ingress port on the switch.

- Once the controller is reachable, client traffic flow is resumed.
- If the controller is not reachable even after configured maintenance-period, the clients will be deaunthenticated.
- User-Based Tunneling (UBT) maintenance will start during cluster migration, when the controller moves from standalone (cluster-disabled) to cluster mode. Maintenance will complete once migration completes.

Examples

```
switch(config)# tunneled-node-server controller-ip 15.255.133.148
```

```
switch(config)# tunneled-node-server backup-controller-ip 15.255.133.148
```

```
switch(config)# tunneled-node-server keepalive 40
```

tunneled-node-server ubt-wol-enable vlan <VLAN-ID-LIST>

Silent devices like Programmable Logic Controller (PLC) devices do not initiate any traffic until they receive a message from the uplink server. Thus, such devices cannot leverage the benefits of colorless ports, which include being authenticated through a RADIUS server and being dynamically placed in a VLAN or being tunneled to a controller.

For non-User-Based Tunneling clients, device VLANs can be manually configured on the respective ports, and the ports should be opened for traffic on egress without authentication with the `controlled-direction in` command.

From AOS-S switch software release 16.10.0017 onwards, for User-Based Tunneling clients, you can update the silent client VLANs with the help of the following command. Once you specify the VLANs and execute the command, the switch will share the VLAN list with the controller. Then the controller will add the shared VLAN list to its multicast tunnel, and the traffic will be allowed from the uplink server to the silent devices. This feature is supported only from Aruba controller version 8.10.0.0 onwards. Also, the `controlled-direction in` command should be configured on all the User-Based Tunneling client ports where the silent clients are connected.

Syntax

```
tunneled-node-server ubt-wol-enable vlan <VLAN-ID-LIST>
no tunneled-node-server ubt-wol-enable vlan <VLAN-ID-LIST>
```

Description

This command enables User-Based Tunneling WoL on the specified VLANs. This configuration will be effective only when User-Based Tunneling is in the `vlan-extend-enable` mode. A maximum of 100 VLANs can be configured.

The `no` form of the command removes the `tunneled-node server ubt-wol-enable vlan` configuration.

- This command is applicable only for User-Based Tunneling in vlan-extend-enable (VLAN-aware) mode. It is not applicable for User-Based Tunneling in vlan-extend-disable (VLAN agnostic) mode or Port-Based Tunneling.
- Silent client VLANs must be pre-configured on the controller and the switch. The VLANs must be configured on the controller before configuring them on the switch.

- When a VLAN is configured on the controller after the VLAN bootstrap process is completed, then the administrator should re-initiate the VLAN bootstrap process from the switch. This can be done by either disabling and enabling the tunneled node when active users are present or removing and configuring the silent VLAN list again on the switch.
- To delete the specified VLANs from the global VLAN context, the VLAN should be removed from the tunneled-node server ubt-wol-enable vlan list using the no tunneled-node-server ubt-wol-enable vlan <VLAN-ID-LIST> command. Also, User-Based Tunneling WoL enabled VLANs can not be deleted when active users are present.

Command Context

`config`

Parameters

VLAN-ID-LIST

Enter the list of VLAN identifiers or one VLAN identifier.

Examples

```
 switch(config)# tunneled-node-server ubt-wol-enable vlan 100

 switch(config)# show running config
 Running configuration:

; JL255A Configuration Editor; Created on release #WC.16.10.0010C
; Ver #14:67.6f.f8.1d.9b.3f.bf.bb.ef.7c.59.fc.6b.fb.9f.fc.ff.ff.37.ef:44
hostname "Aruba-2930F-24G-PoEP-4SFPP"
module 1 type jl255a
tunneled-node-server
controller-ip 10.10.10.10
mode role-based
ubt-wol-enable vlan 100
exit
snmp-server community "public" unrestricted
vlan 1
name "DEFAULT_VLAN"
untagged 1-28
ip address dhcp-bootp
ipv6 enable
ipv6 address dhcp full
exit
vlan 100
name "VLAN100"
no ip address
exit
password manager
```

tunneled-node-server-redirect

Syntax

```
tunneled-node-server-redirect [secondary-role <ROLE-NAME>]

no tunneled-node-server-redirect [secondary-role <ROLE-NAME>]
```

Description

Configures traffic redirect to user-based tunnel. Secondary role is the new user role that will be applied to the tunneled traffic by the controller.

The `no` form of this command stops the traffic re-direction to the controller. Secondary role is the new user role that will be applied to the tunneled traffic by the controller.

Command context

```
user-role
```

Parameters

`secondary-role <ROLE-NAME>`

Specifies the secondary role applied on the user traffic by the controller.

Example

```
switch(config)# aaa authorization user-role name testrole

switch(user-role)#
 tunneled-node-server-redirect
 tunneled-node-server
```

The tunneled-node-server-redirect attribute instructs the switch to redirect all traffic with user-role “testrole” to the controller. The secondary-role “authenticated” specified with the redirect attribute should be configured and present on the controller. In versions 16.07 and earlier, the client VLAN on the switch needs to be present on the Controller. With the Reserved VLAN mode introduced in 16.08, this is not required.

```
class ipv4 "testclass"
     10 match ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
     20 match tcp 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
   exit
policy user "testpolicy"
     10 class ipv4 "testclass" action permit
   exit
aaa authorization user-role name "testrole"
   policy "testpolicy"
   vlan-id 100
   tunneled-node-server-redirect secondary-role "authenticated"
   exit
```

When the `reserved-vlan` option is used, the applied VLAN ID under the user-role "testrole" will not be considered. This is because the traffic will be redirected to the controller using `reserved-vlan`, and not the one configured on the switch.

Show the tunneled-node-server status for all users.

```
switch-PoEP# show tunneled-node-users all

PORT    MAC-ADDRESS     TUNNEL-STATUS   SECONDARY-USERROLE      FAILURE-REASON
1       000ffe-c8ce92   UP              authenticated
5       082e5f-263518   UP              authenticated
```

NOTE

Starting from 16.08, the CLI constraint while configuring `tunneled-node-server-redirect` attribute without configuring VLAN ID has been removed.

IP source interface

Syntax

```
ip source-interface tunneled-node-server [<IP_ADDRESS> | loopback <LOOPBACK_INTERFACE> |
vlan <VLAN_ID>]
```

Description

Defines source IP address or interface for specified protocol.

NOTE

- If interface has multiple addresses, lowest address is used.
- Protocols not configured with a specific address will use the IP address of outbound interface as source.
- If the controller is reachable via two or more VLANs from the switch, then `ip source-interface` for tunneled-node-server should be configured in the switch.

Command context

`config`

Parameters

<IP_ADDRESS>

Specifies the IP address.

<LOOPBACK_INTERFACE>

Specifies a loopback interface.

<VLAN_ID>

Specifies the VLAN ID.

Example

Running configuration:

```
; J9850A Configuration Editor; Created on release #KB.16.05.0000x
; Ver #12:08.1f.fb.7f.bf.bb.ff.7c.59.fc.7b.ff.ff.fc.ff.ff.3f.ef:f4
hostname "switch"
module A type j9989a
module B type j9986a
module C type j9989a
module D type j9986a
module E type j9986a
module F type j9986a
```

```
class ipv4 "testclass"
    10 match ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
    20 match tcp 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
  exit
policy user "testpolicy"
    10 class ipv4 "testclass" action permit
  exit
radius-server host 90.90.90.1
ip routing
ip source-interface tunneled-node-server loopback 1
tunneled-node-server
    controller-ip 21.1.1.2
    mode role-based
  exit
```

Reserved VLAN

Syntax

`tunneled-node-server mode role-based reserved-vlan <VLAN-ID>`

`no tunneled-node-server mode role-based reserved-vlan <VLAN-ID>`

Description

Enable tunneled node server with a reserved VLAN on which all client traffic is sent to the controller.

Example

To configure a tunneled node server in role-based reserved VLAN mode:

```
switch(tunneled-node-server)# mode
port-based        Configure tunneled node server mode as port based.
role-based        Configure tunneled node server mode as role based.

switch(tunneled-node-server)# mode role-based
reserved-vlan  Configure VLAN Mode as No-VLAN, switch without tunneled-node client's
vlan.

switch(tunneled-node-server)# mode role-based reserved-vlan
VLAN-ID                 Configure VLAN to be created and reserved for tunneled-node clients.


switch(tunneled-node-server)# mode role-based reserved-vlan <VLAN-ID>
```

`show tunneled-node-server` output:

```
switch(config)# show tunneled-node-server
 Tunneled Node Server Information
  State                                          : Enabled
  Primary Controller                             : 10.0.0.1
  Backup Controller                              :
  Keepalive Interval (seconds)                   : 8
  Mode                                           : Role-based
  Vlan-Mode                                      : no-vlan/vlan-extend
  Reserved-VLAN                                         : reserved-VID/0

switch(config)# show vlan <reserved-vid>
VLAN ID    Name               | Status           | Voice    | Jumbo
-------------------------------------------------------------------
<VID>      PUTN-ReservedVLAN  | Port-based       | No       | No
```

Show commands

show user-role

Syntax

`show user-role <role-name>`

Description

Displays the user role information for the specified user role name.

Command context

`manager or operator`

Parameters

<role-name>

Specifies the user role name.

Examples

Shows the user role by specific name.

```
switch# show user-role testrole

 User Role Information

   Name                              : testrole
   Type                              : local
   Reauthentication Period (seconds) : 0
   Cached Reauth Period (seconds)    : 0
   Logoff Period (seconds)           : 300
   Untagged VLAN                     : 100
   Tagged VLAN                       :
   Captive Portal Profile            :
   Policy                            :
   Tunnelednode Server Redirect      : Enabled
   Secondary Role Name               : XYZ
   Device Attributes                 : Disabled

switch#
```

show vlan

Syntax

`show vlan <reserved-vid>`

Description

Display the details of reserved VLAN ID.

Command context

`manager`

Parameters

<reserved-vid>

Specifies the reserved VLAN ID.

Examples

```
switch(config)# show vlan <reserved-vid>

Status and Counters - VLAN Information - VLAN <reserved-vid>

VLAN ID : <reserved-vid>
Name    : TUNNELED_NODE_SERVER_RESERVED
Status  : Port-based
Voice   : No
Jumbo   : No
Private VLAN : none
Associated Primary VID    : none
Associated Secondary VIDs : none

Port Information Mode     Unknown VLAN Status
---------------- -------- ------------ ----------------------
```

The user will not be able to delete the reserved VLAN. Reserved VLAN will be automatically removed once the reserved-vlan parameter is removed from tunneled-node configuration.

show tunneled-node-server

Syntax

`show tunneled-node-server [information | statistics <controller> | state <controller>]`

Description

Shows the tunneled-node-server information, statistics, state, or user configured maintenance timer value.

Information for SAC and SSAC Switch Anchor Controller (SAC), Standby Anchor Controller (SSAC) and User Anchor Controller (UAC) is available in the AOS-S switch Controller Guide at https://support.arubanetworks.com/.

Command context

`manager or operator`

Parameters

`information`

Specifies tunneled-node-server information such as alias name of a controller cluster, node-list, and the bucket map information.

`statistics <controller>`

Specifies the data plane statistics with respect to a controller for each port.

`state <controller>`

Specifies the data plane state with respect to a controller.

Example

```
switch(config)# show tunneled-node-server

Tunneled Node Server Information
```

```
  State                          : Enabled
  Primary Controller             : 10.10.10.148
  Backup Controller              : 10.10.10.149
  Keepalive Interval (seconds)   : 1
  Mode                           : Role-based
  Vlan-Mode                      : vlan-extend-enable
  Reserved-Vlan                  :
  Maintenance-period (hours)     : 1
  Wake-on-lan Enabled-vlan       : 100-105,108,110


switch# show tunneled-node-server state

 Local Master Server (LMS) State

 LMS Type     IP Address       State        Capability Role
 Primary   :  10.10.10.148     Complete     Per User   Operational Primary
 Secondary :  10.10.10.149     Complete     Per User   Operational Secondary
 Switch Anchor Controller (SAC) State

               IP Address       Mac Address             State
 SAC         : 10.10.10.148     001a1e-037520           Registered

 User Anchor Controller (UAC) : 10.10.10.148
 User              Port       VLAN       State       Bucket ID
 00000f-000200     1/24       100        Registered  2



switch# show tunneled-node-server statistics

 Tunneled Node Statistics

 Control Plane Statistics

 SAC                  : 10.10.10.148
    Bootstrap Tx      : 1                 Bootstrap Rx         : 1
    Nodelist Rx       : 0                 Nodelist Ackd        : 0
    Bucketmap Rx      : 0                 Bucketmap Ackd       : 0
    Failover Tx       : 0                 Failover Ackd Tx     : 0
    Unbootstrap Tx    : 0                 Unbootstrap Ackd Tx  : 0
    Heartbeat Tx      : 102               Heartbeat Rx         : 102

    UAC               : 10.10.10.148
    Bootstrap Tx      : 1                 Bootstrap Ack        : 1
    Unbootstrap Tx    : 0                 Unbootstrap Ack      : 0
    Keepalive Tx      : 0                 Keepalive Ack        : 0

   Data Plane Statistics

    SAC tunnel Rx                   : 102
    MTU violation Drop              : 0
    Fragmented Packets Dropped (Rx) : 0
    Packets to Non-Existent Tunnel  : 0

    UAC                                    Packets Tx     Packets Rx
    10.10.10.148                           5463693        331

    User Statistics

    UAC                                    User Count
    10.10.10.148                           1
```

When the controller is a standalone:

```
switch(eth-1/24)# show tunneled-node-server information

 SAC Information

  SAC : 10.10.10.148
  Standby-SAC :
UAC List Information

  Cluster Name :
  Cluster Status : Disabled
  Alias Name :
  [ 0] ::    10.10.10.148         0.0.0.0         0.0.0.0         0.0.0.0
  [ 4] ::         0.0.0.0         0.0.0.0         0.0.0.0         0.0.0.0
  [ 8] ::         0.0.0.0         0.0.0.0         0.0.0.0         0.0.0.0


 Bucket Map Information

  Bucket Name :
  Bucket Map Active : [0 .. 255]
  [  0] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [  6] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [ 12] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [ 18] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [ 24] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [ 30] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [ 36] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [ 42] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [ 48] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [ 54] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [ 60] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [ 66] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [ 72] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [ 78] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [ 84] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [ 90] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [ 96] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [102] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [108] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [114] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [120] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [126] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
  [132] :: (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1) (0, -1, 1)
 Maintenance Timer Information

 Status = Not Running, Maintenance time period = 0 hour, Elapsed-time = 0 hour
 VLAN bootstrap information

 ASAC registered vlans = 100-105,108,110
 ASAC Failed vlans     =
 SSAC registered vlans =
 SSAC Failed vlans     =
```

When the controller is a cluster:

```
switch$ show tunneled-node-server information

SAC Information

  SAC : 10.10.10.147
  Standby-SAC : 10.10.10.146

UAC List Information
```

```
  Cluster Name : 3NodeProfile
  Cluster Status : Enabled

  [0] ::    10.10.10.147    10.10.10.146         0.0.0.0         0.0.0.0
  [4] ::         0.0.0.0         0.0.0.0         0.0.0.0         0.0.0.0
  [8] ::         0.0.0.0         0.0.0.0         0.0.0.0         0.0.0.0


Bucket Map Information

  Bucket Name : TUNNELED_NODE_ESSID
  Bucket Map Active : [0 .. 255]
  [  0] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [  6] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [ 12] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [ 18] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [ 24] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [ 30] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [ 36] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [ 42] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [ 48] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [ 54] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [ 60] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [ 66] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [ 72] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [ 78] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [ 84] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [ 90] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [ 96] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [102] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [108] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [114] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [120] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [126] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [132] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [138] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [144] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [150] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [156] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)
  [162] :: (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1) (0, 1, 1) (1, 0, 1)

 Maintenance Timer Information

 Status = Running, Maintenance time period = 1 hour, Elapsed-time = 0 hour
 VLAN bootstrap information

 ASAC registered vlans = 100-105,108,110
 ASAC Failed vlans     =
 SSAC registered vlans = 100-105,108,110
 SSAC Failed vlans     =
```

show tunneled-node-users

Syntax

```
 show tunneled-node-users [all | count | down |  mac <MAC-ADDRESS> |  port <PORT-ADDR> |
up ]
```

Description

Shows the status of a client after configuring and enabling `tunneled-node-server-redirect`.

Command context

manager or operator

Parameters

<ALL>

Specifies all clients and their status.

<COUNT>

Specifies the total number of clients configured to tunnel their traffic to the controller.

<DOWN>

Specifies the clients which are not able to tunnel their traffic.

PORT <PORT-ADDR>

Specifies the port client status.

MAC <MAC-ADDRESS>

Specifies the client status based on the MAC address desired by the user.

<UP>

Displays the client status which are having their tunnels up and running.

Example

```
switch(config)# show tunneled-node-users
 all                  Displays all the clients and their status.
 count                Displays the total number of clients configured to
                      tunnel their traffic to the controller.
 down                 Displays the clients which are not able to tunnel their
                      traffic.
 mac                  Displays the client status based on the MAC address
                      desired by the user.
 port                 Displays the client status of the particular port
                      desired by the user.
 up                   Displays the client status which are having their
                      tunnels up and running
```

```
switch(config)# show tunneled-node-users all

PORT   MAC-ADDRESS  TUNNEL-STATUS   SECONDARY-USERROLE   FAILURE-REASON
123      XYZ123       UP                ROLE NAME1
234      XYZ1234      DOWN              ROLE NAME2       UAC_DOWN
```

```
switch(config)# show tunneled-node-users count

Total number of clients configured with user-based tunneled node: 2
```

```
switch# show port-access clients

Downloaded user roles are preceded by *
 Port Access Client Status

  Port  Client Name   MAC Address       IP Address      User Role         Type  VLAN
  ----- ------------- ----------------- --------------- ----------------- ----- ----
  1/7   2c41387f35b9  2c4138-7f35b9     n/a             Voice_HPE         MAC   171
  1/7   d48564940c46  d48564-940c46     n/a             *DUR_prof2_PUT... MAC   100
  1/16  dur1          001517-857121     n/a             *DUR_prof2_PUT... 8021X 100
  1/17  dur1          d48564-a8afa0     n/a             *DUR_prof2_PUT... 8021X 100
```

```
 3/7   2c41387fe7f8  2c4138-7fe7f8     n/a             Voice_HPE         MAC   171
 3/7   e8393537b4a5  e83935-37b4a5     n/a             *DUR_prof2_PUT... MAC   100
```

```
switch# show port-access clients detailed 1/7

 Port Access Client Status Detail

  Client Base Details :
   Port            : 1/7                  Authentication Type : mac-based
   Client Status   : authenticated        Session Time        : 18972 seconds
   Client Name     : 2c41387f35b9         Session Timeout     : 0 seconds
   MAC Address     : 2c4138-7f35b9
   IP              : n/a

Downloaded user roles are preceded by *
 User Role Information

   Name                             : Voice_HPE
   Type                             :
   Reauthentication Period (seconds) : 0
   Untagged VLAN                    : 171
   Tagged VLANs                     :
   Captive Portal Profile           :
   Policy                           :
   Tunnelednode Server Redirect     : Disabled
   Secondary Role Name              :

  Client Base Details :
   Port            : 1/7                  Authentication Type : mac-based
   Client Status   : authenticated        Session Time        : 18947 seconds
   Client Name     : d48564940c46         Session Timeout     : 0 seconds
   MAC Address     : d48564-940c46
   IP              : n/a

Downloaded user roles are preceded by *
 User Role Information

   Name                             : *DUR_prof2_PUTN-3037-12
   Type                             : downloaded
   Reauthentication Period (seconds) : 0
   Untagged VLAN                    : 100
   Tagged VLANs                     :
   Captive Portal Profile           :
   Policy                           : upol2_DUR_prof2_PUTN-3037-12

Statements for policy "upol2_DUR_prof2_PUTN-3037-12"
policy user "upol2_DUR_prof2_PUTN-3037-12"
     10 class ipv4 "remark2_DUR_prof2_PUTN-3037-12" action rate-limit kbps 1000000
action priority 2 action permit
   exit
Statements for class IPv4 "remark2_DUR_prof2_PUTN-3037-12"
class ipv4 "remark2_DUR_prof2_PUTN-3037-12"
     10 match ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
   exit

   Tunnelednode Server Redirect     : Enabled
   Secondary Role Name              : authenticated
```

Commands to configure VLAN ID in user role

Local user roles allow user-based policy configuration local to an Aruba switch. Within the user role configuration, use the `tunneled-node-server-redirect` command to tunnel traffic to a Mobility Controller. When this command is processed, the tunnel is formed and applied to the secondary role (user role) that exists on the Mobility Controller.

```
switch(user-role)# vlan-id
Usage: no vlan-id <VLAN_ID>

Description: Set the untagged VLAN that users will be assigned to.
```

```
switch(user-role)$ tunneled-node-server-redirect
Usage: no tunneled-node-server-redirect [secondary-role <ROLE_NAME>]

Description: Configures traffic redirect to user-based tunnel. Secondary role is the
new user role that
will be applied to the tunneled traffic by the controller.
```

- The authenticated secondary-role specified with the redirect attribute should be configured and present on the Aruba Mobility Controller.
- VLAN change for a current User-Based Tunneled client should be done by changing a user role with a new untagged VLAN and doing a port bounce (to refresh client IP).

Tunneled Node profile on a Mobility Controller and Cluster

Use the following commands to configure a secondary user role on the Mobility Controller:

```
switch(config)# user-role authenticated
access-list session global-sacl
access-list session apprf-authenticated-sacl
access-list session ra-guard
access-list session allowall
access-list session v6-allowall
```

If the managed device is in a cluster, deploy the following configuration on the Mobility Master:

```
lc-cluster group-profile "hp2node"
controller 10.0.102.6
controller 10.0.102.218
(ArubaMM) [mm] (config) #cd /md/00:1a:1e:02:a4:c0
(ArubaMM) [00:1a:1e:02:a4:c0] (config) #lc-cluster group-membership hp2node
(ArubaMM) [mm] (config) #cd /md/00:1a:1e:02:a6:40
(ArubaMM) [00:1a:1e:02:a6:40] (config) #lc-cluster group-membership hp2node
(ArubaMM) (config) #show configuration node-hierarchy
Default-node is not configured. Autopark is disabled.
Configuration node hierarchy
----------------------------
Config Node Type
----------- ----
/ System
/md System
/md/00:1a:1e:02:a4:c0 Device
/md/00:1a:1e:02:a6:40 Device
/mm System
/mm/mynode System
```

Configure a cluster profile, specify the managed device IP addresses, and map the managed devices to the cluster profile.

```
(ArubaMM) [mynode](config) #show switches
All Switches
------------
IP Address IPv6 Address Name Location Type Model Version Status Configuration State
Config
Sync Time (sec) Config ID
---------- ------------ ---- -------- ---- ----- ------- ------ ------------------ -----
-----
------------ ---------
15.212.178.108 None ArubaMM Building1.floor1 master ArubaMM 8.0.0.0_55647 up UPDATE
SUCCESSFUL
0 0
10.0.102.218 None C2 Building1.floor1 MD Aruba7210 8.0.0.0-hp-interop_0000 up UNK
(00:1a:1e:02:a6:40) N/A N/A
10.0.102.6 None C1 Building1.floor1 MD Aruba7210 8.0.0.0-hp-interop_0000 up UNK
(00:1a:1e:02:a4:c0) N/A N/A
Verify that all managed devices are added and the status is Update Successful.
```

Using User Roles with User-Based Tunneling

User-Based Tunnels can also be used with Local User Roles and any third-party RADIUS server. This requires that the user roles be preconfigured on the switch. For truly colorless and dynamic policy management, Aruba recommends the use of ClearPass to dynamically send policies to both the switch and controller using Downloadable User Roles along with User-Based Tunneling.

- There are two roles required when using Downloadable User Roles with User-Based Tunneling:

  Primary user role: Configured on switch

  Secondary user role: Configured on controller

- Both primary and secondary role can be either statically configured or downloaded from the ClearPass.

This feature is only available for:

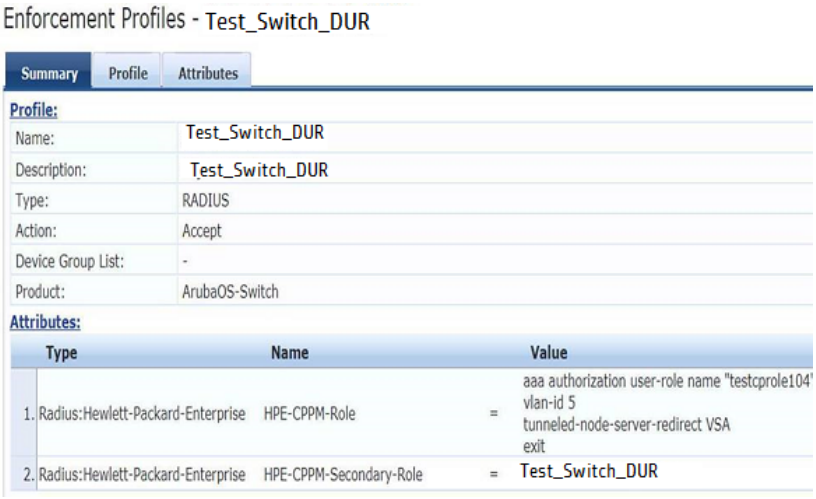
- ClearPass 6.7.0 onward
- Aruba Controller Version 8.3.0 onward
  - To support Downloadable User Roles on controller, a new VSA (`HP-CPPM-Seconday-Role`) is introduced in ClearPass 6.7.0, which contains the secondary user role name.
  - To use the Reserved VLAN mode in 16.08, a minimum version of 8.4 is required on the Controller.

The Aruba switch downloads user policies from ClearPass using downloadable user roles. This makes the ClearPass a centralized point to administer user policy to the access switch and minimize user configuration on the Aruba switch. For downloadable user roles to work appropriately, the signing Certificate Authority (CA) of the ClearPass HTTPS certificate must be added to the Aruba switch and marked as trusted. With AOS-S switch 16.08, there is an automated way to download the CA certificate of ClearPass. Please refer to the *Access Security Guide* on using this feature.

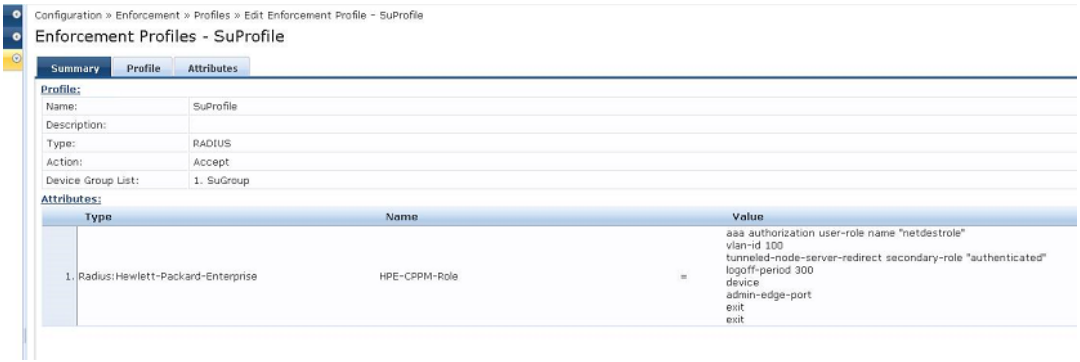
ClearPass Sample Configuration

```
aaa authorization user-role name "<role-name>"
vlan-id <vlan id> tunneled-node-server-redirect VSA
```

When the primary user role is downloaded onto the switch and the secondary user role is downloaded onto the controller:



When the primary user role is downloaded onto the switch and the secondary user role is manually configured on the controller (not sent through VSA):



For more information on user roles, see *Access Security Guide* for your switch.

User-Based Tunneling in v6 networks

Starting with 16.08, User-Based Tunnels are supported in IPv6 environments where all the components forming tunnels are reachable over IPv6. This is important for users who are in the process of migrating from IPv4 to IPv6-only environments. To support those users, User-Based Tunnels will work not only in IPv6-only environments but also hybrid environments where some components run IPv4 while others run IPv6.

The switch, controller, and AirWave can operate in an IPv6-only environment while ClearPass, as of 6.7, still has to be reachable over IPv4 (but supports v4 and v6 clients). Mixed mode is also supported, where one controller can be reachable through v4 and the backup controller can be reachable through IPv6, and the deployment supports clients with dual stacks (v4/v6). Using User-Based Tunnels in a IPv6 network is similar in setup and the configuration and show command covered in earlier sections work for IPv4 as well as IPv6 environments.

PAPI security

Protocol Application Programming Interface (PAPI)

The PAPI Enhanced Security configuration provides protection to Aruba devices, AirWave, and ALE against malicious users sending fake messages that results in security challenges.

Starting from AOS-S switch version 16.02, a minor security enhancement has been made to Protocol Application Programming Interface (PAPI) messages. Protocol Application Programming Interface endpoint authenticates the sender by performing a check of the incoming messages using MD5 (hash). All PAPI endpoints – APs, Controllers, Mobility Access Switches, AirWave, and ALE – must use the same secret key. The switch software currently uses a fixed key to calculate the MD5 digest and cooperate with the controller for PAPI enhanced security.

To use this functionality, the PAPI security profile must be configured on the controller. For more information on the Aruba controller, see the Aruba Networks Controller Configuration Manual.

PAPI configurable secret key

To support enhanced PAPI security, a command is available to configure a MD5 secret key.

papi-security

Syntax

```
switch(config)# papi-security
```

Description

Configure MD5 key for enhanced PAPI security.

Parameters

enhanced-security

The enhanced-security CLI must be enabled in papAruba controller for the connection to be truly secured.

<KEY-STR>

Configure MD5 key for enhanced PAPI security using a key-string parameter.

<KEY-VALUE>

Configure MD5 key for enhanced papi security using a key-value parameter.

Restrictions

- To view the status of the PAPI security, using the `show run` command with the option `include credentials` enabled, the PAPI security key will show in the output as an encrypted form.
- Key length has to be between 10-64.
- By default the enhanced-security is disabled.
- When enhanced-security mode is disabled, any AP can obtain the current shared secret key.
- When enhanced-security mode is enabled, an AP is not updated with the new shared secret key unless the AP knows the previous key and the AP is updated with the new key within one hour of the key creation.
- Key length has to be between 10-64 or the following message will appear:

Minimum key-value length allowed is 10 characters and maximum allowed is 64 characters.

Usage

```
switch(config)# papi-security key-value <KEY-VALUE>switch(config)# no papi-security <KEY-VALUE>
```

papi-security key-value

```
switch(config)# papi-security key-value TestKey12345678
switch(config)# no papi-security key-value

switch(config)# papi-security key-value Test
Minimum key-value length allowed is 10 characters and maximum allowed is 64
characters.
```

show run with encrypted key

```
 switch(config)# show run
Running configuration:
;J9576A Configuration Editor
;Ver #0e:01.f0.92.34.5f.3c.6b.fb.ff.fd.ff.ff.3f.ef:78
;encrypt-cred +NXT3w7ky2IXNXadlJblS/1ZRi/o73Qq28XXcLkSCZq9PU30Kl+KMLMva8rQri5g

 hostname "Switch"
 module 1 type j9576y
 module 2 type j9576x
 encrypt-credentials
 papi-security encrypted-key <"encrypted-key">
 snmp-server community "public" unrestricted
 snmpv3 engineid "00:00:00:0b:00:00:50:65:f3:b4:a6:c0"
 oobm
 ip address dhcp-bootp
 exit

 vlan 1
 name "DEFAULT_VLAN"
 untagged 1-52
 ip address dhcp-bootp
 exit

 activate provision disable
```

show run with include key

```
show run
Running configuration:
; J9576A Configuration Editor
; Ver#0e:01.f0.92.34.5f.3c.6b.fb.ff.fd.ff.ff.3f.ef:78

 hostname "Switch"
 module 1 type j9576y
 module 2 type j9576x
 include-credentials
 papi-security key-value <"key">
 snmp-server community "public" unrestricted
 snmpv3 engineid "00:00:00:0b:00:00:50:65:f3:b4:a6:c0"
 oobm
 ip address dhcp-bootp
 exit

 vlan 1
 name "DEFAULT_VLAN"
 untagged 1-52
 ip address dhcp-bootp
 exit

 activate provision disable
```

Frequently Asked Questions

Following is a list of frequently asked questions and answers relating to per user tunnel node.

In a controller cluster, how does the switch determine which controller to send the user traffic to?

The SAC sends a bucket-map to the switch during the switch bootstrap process. This map is an array of 256 entries with each entry containing the active and standby controller to use. A user's MAC address is hashed into this table to get the controller to tunnel the user traffic to.

When is the heartbeat started to SAC and s-SAC?

Heartbeat is over a GRE tunnel with a specific GRE key (0xDEED). This is initiated with SAC and s-SAC immediately after a switch bootstrap is complete.

What happens when heartbeat to SAC fails?

A heartbeat failure triggers the switch to:

- Remove users anchored to the SAC.
- Fail over to the s-SAC (Example: s-SAC now becomes the new SAC).

What happens when the keepalive to a UAC fails?

The users anchored to the UAC are removed and a message is logged to the same effect in the event log.

Why should jumbo frames be enabled at the switch?

Jumbo frames have to be enabled at the controller uplink VLAN as well as the client VLAN. The GRE tunnel adds an effective 46 bytes to every user packet. The effective tunnel MTU = uplink VLAN MTU -46 bytes for a 1500 MTU, the tunnel MTU gets to be 1454 bytes. This means that a user can send up to only 1,454 bytes of frames. For users to send up to 1500 (default) MTU, jumbo frames need to be enabled.

What happens when a UAC controller goes down?

A node list update is sent by the SAC to the switch to inform that a controller went down. All users anchored to that controller are removed (unbootstrapped). After some time, the controller sends a bucket map update to the switch. The switch then processes the bucket map update and anchors users to the respective controller (standby) as per the bucket map. The users will then be switched over to s-UAC. The s-UAC becomes the new UAC, and is assigned after the bucket map update from SAC.

It is important to verify that the bucket map on switch and controller is the same. Also, it should be verified that users are anchored to the right controller identified in the bucket map on both the switch and controller.

What happens when a SAC controller goes down?

A node list update is sent by s-SAC to switch. Since the node list is received from the s-SAC and not the SAC, the switch considers that SAC is down and initiates a failover to s-SAC. Also, the switch removes all users anchored to SAC. Once s-SAC acknowledges the failover request, the s-SAC becomes the new active SAC. The new Active SAC then sends a node list update and bucket map update. In the node list update, the new s-SAC will be provided. The switch will then bootstrap and initiate a heartbeat with new s-SAC. The switch then processes the bucket map update and anchors users to respective controllers.

It is important to verify that the bucket map on switch and controller is the same. Also, it should be verified that users are anchored to the right controller identified in the bucket map on both the switch and controller.

What happens when the s-SAC controller goes down?

A node list update is sent by the SAC to the switch. The switch stops the heartbeat with the s-SAC which has gone down and removes all users anchored to it. The switch then initiates a bootstrap to a new s-SAC provided in the node list update. Once a bootstrap acknowledgment is received, the switch starts a heartbeat to the new s-SAC. After some time, the SAC will send a bucket map update. The switch then processes the update and anchors users to their respective controllers.

It is important to verify that the bucket map on the switch and controller is the same. Also, it should be verified that users are anchored to the appropriate controller according to the bucket map on both the switch and controller.

What do the states in show tunneled-node-server state mean?

- Registering - Bootstrapping
- Registered - Bootstrapped
- Unregistering – Unbootstrapping

What happens when user-role attributes change?

A rebootstrap is initiated for users applied within that role containing updated role attributes in the bootstrap packet. These users move to registering state. Once an acknowledgment is received from the controller, users then move to registering state. This applies only to VLAN and secondary role changes.

What happens on a client “MAC address move”?

A rebootstrap is initiated for the client. Only after an acknowledgment from the controller is received, the client traffic begins to be tunneled.

What is the recommendation for Per User Tunnel Node client VLAN configuration?

- Tunneled user client VLAN has to be present at the per user tunneled node switch.
- There is no need to specifically add tunneled user ports to this VLAN. Switch AAA takes care of this through MAC-Based VLANs.
- The uplink to the controller port should NOT be part of this VLAN.
- The uplink to the controller VLAN and the tunneled users VLAN cannot be same.

A user is registered at the switch but does not respond to a ping. How do I debug?

- Check that the user roles and VLANs are correctly configured at the switch as well as the controller.
- Check that the IP MTU is set to >= (1500+46) at all the switches in the path from User-Based Tunneling switch to the controller.

There are two parts to the solution, and the part that is failing should be identified.

- To check if the switch is tunneling the traffic, run the `show tunneled-node-server statistics` command to check if the user traffic is being received and transmitted. If the counters do not increment, then the switch configuration needs to be investigated.
- To check if the Mobility Controller is tunneling traffic, run the `show datapath tunnel` to see if the Encaps and Decaps counters increase.

A packet trace of traffic sent from and received at the switch uplink to the controller can also be useful, GRE encapsulated packets are what will be of interest.

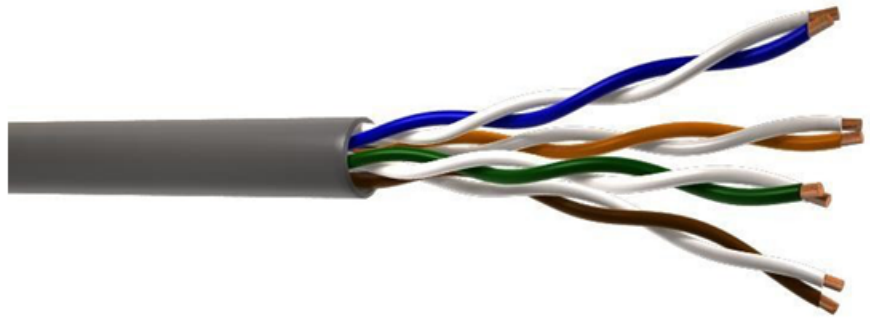
The Time Domain Reflectometry (TDR) or Cable Diagnostics is a port feature supported on some switches running AOS-S switch software. TDR is used to detect cable faults on 100BASE-TX and 1000BASE-T ports.

Virtual cable testing

The Virtual Cable Test (VCT) uses the same command as TDR. It is applicable only for GigT transceivers like copper transceiver (J8177C-ProCurve Gigabit 1000Base-T Mini-GBIC). The VCT test results include distance to the fault, but not the cable length.

Cable diagnostics tests

The TDR (Time-domain reflectometer) cable diagnostic test allows an operator to test Ethernet cables for faults without physically disconnecting from the switch. It helps in troubleshooting connectivity or monitor performance on one or more switch ports.



Cable diagnostic test is categorized as four states. Each of the four twisted pairs is displayed in a standard Ethernet cable:

1. **OK:** The twisted pair is intact and operating normally for the full length of the cable.

   If displayed for all four pairs, the cable must operate normally with no connectivity or any performance issues.

2. **Short:** There is a short between two wires in the same pair.

   A pair that is shorted (example: blue and white) cannot transmit normally, and may cause impaired connectivity or performance for the cable.

3. **Inter-short:** There is short between two or more wires in different pairs.

   If multiple pairs are shorted together (example: brown and green), then there is a significant performance degradation or a total loss of connectivity.

4. **Open:** There is a gap in one or more pairs resulting in a loss of continuity, or no cable is connected to the port.

   It may indicate a damaged or cut cable. A port that has no cable connected is display **Open** for all pairs.

To start a cable diagnostic test, use the following command (in this example, port 1 and 2 are tested):

```
switch# test cable-diagnostics 1-2

This command will cause a loss of link on all tested ports and will take
several seconds per port to complete.  Use the 'show cable-diagnostics'
command to view the results.

Continue (y/n)?  y

After the test is complete, use the following command to view the test results:

switch# show cable-diagnostics

Cable Diagnostic Status - Copper Ports

       MDI    Cable       Cable Length or
  Port Pair   Status      Distance to Fault
  ---- ------ ----------- --------------------
  1    1-2    OK          2m
       3-6    OK          4m
       4-5    OK          2m
       7-8    OK          2m
  2    1-2    Open        0m
       3-6    Open        0m
       4-5    Open        0m
       7-8    Open        0m
```

- Running a cable diagnostic test will result in a brief interruption in connectivity on all tested ports.
- Displayed cable lengths and distances to detected faults are approximate (error margin is ± 10% of cable length).

Syntax

`test cable-diagnostics <PORT-LIST>`

Description

Use the command to test for cable faults.

Parameter

PORT-LIST

Specify copper port as an input port number.

Test cable-diagnostics C21

```
test cable-diagnostics C21

The 'test cable-diagnostics' command will cause a loss of link and will take a few
seconds per interface to complete.
Continue [Y/N]? y
```

```
MDI          Cable    Distance    Pair   Pair         MDI
Port Pair    Status   to Fault    Skew   Polarity     Mode
---------    ------   --------    -----   ------    ------
C21 1-2        Open       0 m      0 ns
    3-6        Open       0 m      0 ns
    4-5        Open       0 m      0 ns
    7-8        Open       1 m      0 ns
```

Test cable-diagnostics 1/1-1/10

```
switch# test cable-diagnostics 1/1-1/10

This command will cause a loss of link on all tested ports and will take
several seconds per port to complete.  Use the 'show cable-diagnostics' command to
view the results.

Continue (y/n)? Y

switch# show cable-diagnostics 1/1-1/10

Cable Diagnostic Status - Copper Ports

       MDI    Cable       Cable Length or
  Port Pair   Status      Distance to Fault
  ---- ------ ----------- --------------------
  1/1  1-2    OK          5m
       3-6    OK          5m
       4-5    OK          7m
       7-8    OK          7m
  1/2  1-2    OK          7m
       3-6    OK          7m
       4-5    OK          7m
       7-8    OK          7m
  1/3  1-2    OK          5m
       3-6    OK          7m
       4-5    OK          5m
       7-8    OK          7m
  1/4  1-2    OK          7m
       3-6    OK          7m
       4-5    OK          7m
       7-8    OK          5m
  1/5  1-2    OK          4m
       3-6    OK          5m
       4-5    OK          5m
       7-8    OK          4m
  1/6  1-2    OK          4m
       3-6    OK          4m
       4-5    OK          4m
       7-8    OK          4m
  1/7  1-2    OK          5m
       3-6    OK          4m
       4-5    OK          5m
       7-8    OK          4m
  1/8  1-2    OK          4m
       3-6    OK          5m
       4-5    OK          4m
       7-8    OK          4m
  1/9  1-2    OK          5m
       3-6    OK          5m
       4-5    OK          5m
       7-8    OK          5m
  1/10 1-2    OK          7m
       3-6    OK          5m
```

```
       4-5    OK          5m
       7-8    OK          5m
```

Good cable tests

```
switch# test cable-diagnostics 51

This command will cause a loss of link on all tested ports and will take
several seconds per port to complete.  Use the 'show cable-diagnostics'
command to view the results.

Continue (y/n)? Y

switch# show cable-diagnostics 51

Cable Diagnostic Status - Transceiver Ports

         MDI    Cable       Distance   Pair    Pair       MDI
  Port   Pair   Status      to Fault   Skew    Polarity   Mode
  ---- ------   ---------   --------   -----   -------   -----
  51     1-2      OK           0 m      8 ns   Normal     MDI
         3-6      OK           0 m      8 ns   Normal
         4-5      OK           0 m      8 ns   Normal     MDIX
         7-8      OK           0 m      0 ns   Normal


switch# test cable-diagnostics 52

This command will cause a loss of link on all tested ports and will take
several seconds per port to complete.  Use the 'show cable-diagnostics'
command to view the results.

Continue (y/n)?  Y

switch# show cable-diagnostics 52

Cable Diagnostic Status - Transceiver Ports

         MDI    Cable       Distance   Pair    Pair       MDI
  Port   Pair   Status      to Fault   Skew    Polarity   Mode
  ---- ------   ---------   --------   -----   -------   -----
  52     1-2      OK           0 m      0 ns   Normal     MDI
         3-6      OK           0 m      0 ns   Normal
         4-5      OK           0 m      0 ns   Normal     MDIX
         7-8      OK           0 m      0 ns   Normal
```

Faulty cable test

```
switch# test cable-diagnostics 51
This command will cause a loss of link on all tested ports and will take
several seconds per port to complete.  Use the 'show cable-diagnostics'
command to view the results.

Continue (y/n)?  y
switch# show cable-diagnostics 51

Cable Diagnostic Status - Transceiver Ports

       MDI    Cable       Distance   Pair   Pair       MDI
  Port Pair   Status      to Fault   Skew   Polarity   Mode
  ---- ------ ----------- ---------- ------ ---------- ------
  51     1-2    OK          0 m        0 ns
         3-6    Short       1 m        0 ns
```

```
        4-5     Short        1 m         0 ns
        7-8     OK           0 m         0 ns


switch# test cable-diagnostics 52

This command will cause a loss of link on all tested ports and will take
several seconds per port to complete.  Use the 'show cable-diagnostics'
command to view the results.

Continue (y/n)?  Y

switch# show cable-diagnostics 52

Cable Diagnostic Status - Transceiver Ports

       MDI     Cable        Distance    Pair    Pair        MDI
  Port Pair    Status       to Fault    Skew    Polarity    Mode
  ---- ------ ------------ ---------- ------ ---------- ------
  52   1-2     Open         0 m         0 ns
       3-6     Open         0 m         0 ns
       4-5     Open         1 m         0 ns
       7-8     Open         0 m         0 ns
```

Error message

Error Message	Cause
The transceiver on port 1/A1 does not support cable diagnostics.	■ Usage of invalid(fiber-SFP+) port ■ The selected range includes an entry for an invalid port.

show cable-diagnostics

Syntax

`show cable-diagnostics<`*`PORT-LIST`*`>`

Description

Use the command to generate results of completed tests on single or multiple ports. For incomplete tests, a warning is displayed.

Parameter

`PORT`

Specify one copper port as an input port number.

clear cable-diagnostics

Syntax

`clear cable-diagnostics`

Description

Use the command to clear the result buffer.

Example

```
switch(config)# clear cable-diagnostics
```

Limitations

TDR has the following limitations:

- TDR length accuracy is ± 5 m
- Does not work on Smart Rate Interfaces with 10GBASE-T and NGBASE-T (2.5G, 5G copper) ports available on:
  - v3 blades
    - J9991A – Aruba 20-port 10/100/1000BASE-T PoE+ / 4-port 1/2.5/5/10GBASE-T PoE+ MACsec v3 zl2 Module
    - J9995A – Aruba 8-port 1/2.5/5/10GBASE-T PoE+ MACsec v3 zl2 Module
  - 3810M (JL076A – Aruba 3810M 40G 8 HPE Smart Rate PoE+ 1-slot Switch)
- Not supported on v2 zl modules
- Valid only on 100BASE-TX and 1000BASE-T ports

List of abbreviated terms

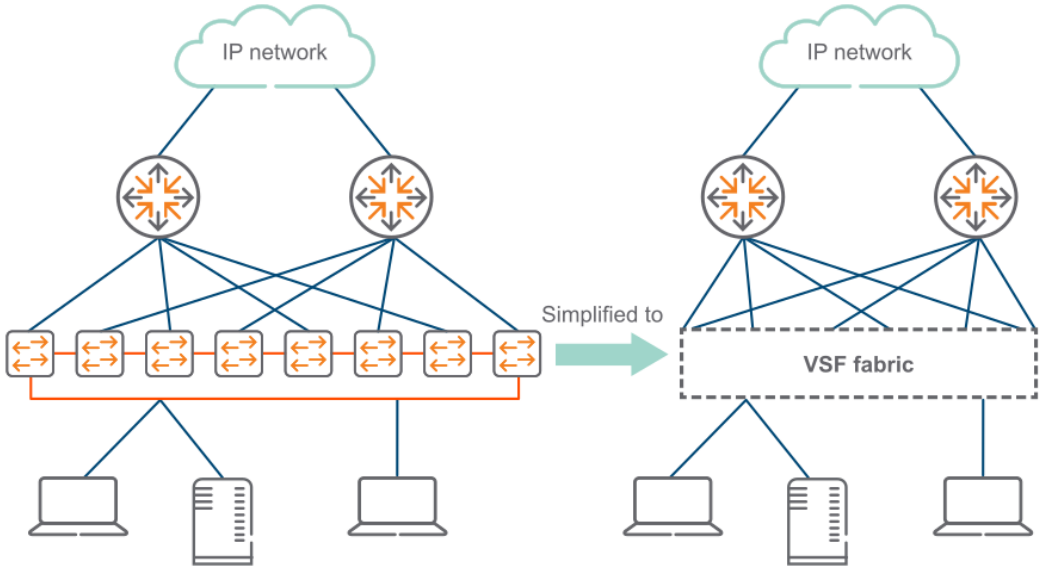
Term	Definition
VSF	Virtual Switch Framework (front plane stacking)
FPS	Front Plane Stacking
BPS	Back Plane Stacking
MM	Management Module
IM	Interface Module
GVRP	GARP VLAN Registration Protocol
GARP	Generic Attribute Registration Protocol
MVRP	Multiple VLAN Registration Protocol

Overview of VSF

Aruba Virtual Switching Framework (VSF) technology virtualizes up to eight physical devices in the same layer into one virtual fabric which provides high availability and scalability. A virtual fabric is therefore multiple physical devices in the same layer that use VSF technology.

VSF allows supported switches connected to each other through normal Ethernet connections (copper or fiber) to behave like a single switch.

Figure 90 *Two devices using VSF technology appearing as a single node to the upper-layer and lower-layer devices*

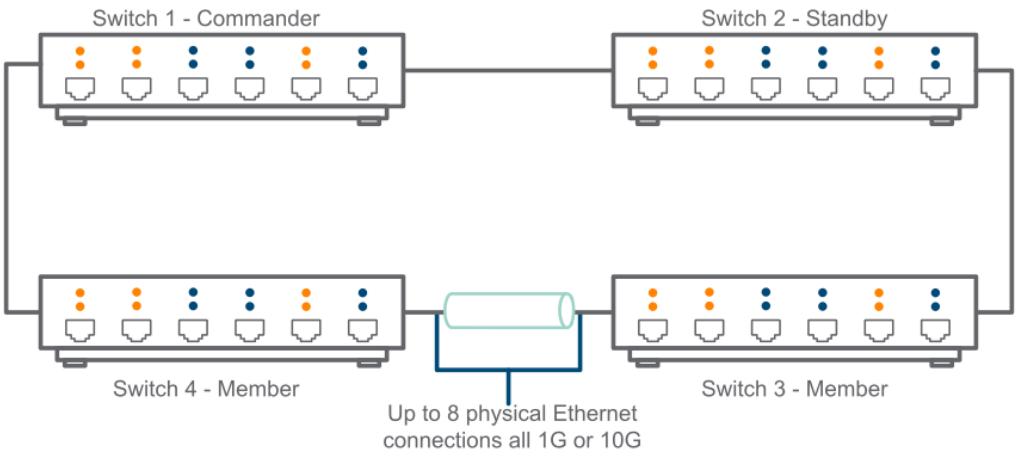


For 16.01, VSF supported a 2-member stack for a pair of 5400R switches with V3 blades, interconnected through standard Ethernet connections with front-plane stacking capability. Interswitch connectivity was restricted to 10G and 40G links. From 16.03 onwards, VSF supported a 4-member stack for 1G and 10G links. In VSF 8-member stack, the same front-plane stacking capability has been extended to 2930F switches. Variants have:

- 1G (copper and SFP) ports and 10G (SFP+) ports.
- PoE+ and non-PoE+ ports.
- None of the variants have an OOBM port.

The VSF feature allows the user to form a stack of up to eight devices of any SKU, including mixing the SKUs in a single stack. The switches in these stacks are interconnected using standard Ethernet connections. These interconnections between member switches are called VSF links. Each VSF link can comprise up to eight individual VSF ports, and traffic between two members will be load-balanced automatically across all the connected ports. Each switch can have two VSF links. The switches behave as a single virtual switch. 2930F supports a maximum of four 10G ports.

Figure 91 *A 4-member VSF stack*



NOTE

The preceding figure applies to a VSF stack having more than four members too.

Benefits of VSF

Simplified topology and easy management

A VSF fabric appears and behaves as one logical switch and is accessible by the network through a single IP address.

NOTE

Spanning tree features are not necessary among VSF members.

1:1 redundancy

One member acts as the commander to manage and control the entire VSF fabric. One of the switches acts as a standby and backs up the commander, and takes over in case of commander failure.

VSF port aggregation

A VSF link can aggregate upto eight VSF ports with the immediate neighboring member. This provides redundancy till failure of seven VSF ports.

Distributed trunking

The Ethernet link aggregation feature can be used to aggregate physical links between the VSF and its upstream or downstream devices across the VSF members. This eliminates the need for spanning tree and also provides load balancing across all ports of the link aggregate.

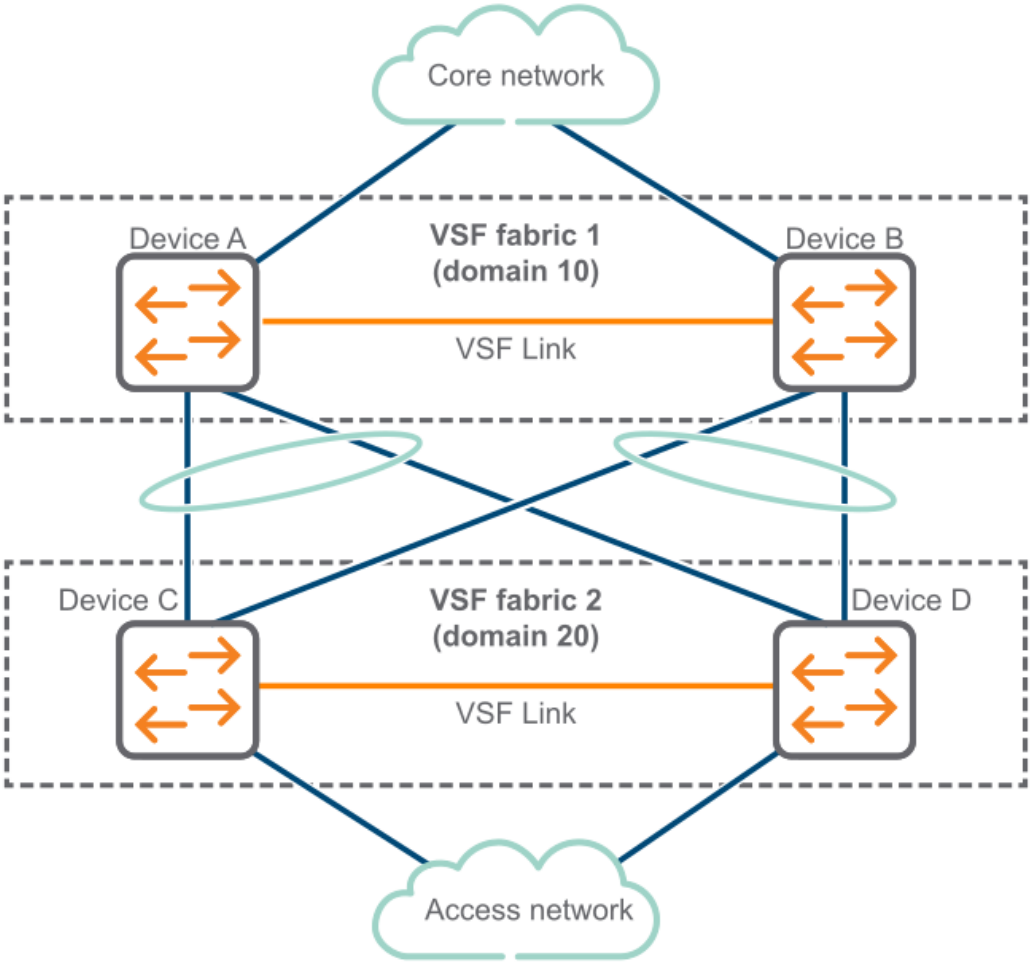
Network scalability

The processing power is equal to the Commander, the forwarding capacity is equal to all the stack members combined.

VSF domain ID

VSF uses VSF domain IDs to uniquely identify VSF fabrics and prevent VSF fabrics from interfering with one another. One VSF fabric forms one VSF domain.

Figure 92 *Two VSF domains*



VSF link

A VSF link is a logical interface that connects VSF member devices. Every VSF-capable device supports a VSF link.

`I-Link<Member ID>_1` is the default VSF link name.

To configure a VSF link, a minimum of one physical interface should be bound to the link. The bound physical interfaces are automatically aggregated to form a VSF link. A VSF link goes down only if all its VSF physical interfaces are down.

Physical VSF ports

VSF ports connect VSF member devices and must be bound to using a VSF link. These VSF ports forward VSF protocol packets and data traffic. Up to eight ports can be bound to a VSF link.

NOTE

Once a port is bound to a VSF link, all existing configuration associated with the port, such as VLAN membership and speed, will be removed.

VSF member ID

VSF fabric uses member IDs to uniquely identify and manage its members. The first part of the interface module number is the Member ID information, which identifies interfaces in a VSF fabric. The device that wins the election and becomes a Commander, will retain its member ID, while the other will automatically be assigned a different unassigned member ID from the pool and reboot.

If the VSF member ID changes when joining a VSF virtual chassis, it will cause a reboot of that member and not the whole VSF virtual chassis.

Interface naming conventions

An interface is named in the following format:

Interface name

<member ID>/<port-index> For example: 1/1, 2/24.

Definition

<member ID >

VSF member ID of the switch. The VSF member ID will be a part of the interface name in a VSF fabric, whether a device has formed a VSF fabric with other devices, or not. A single device is also considered to be a standalone VSF fabric.

<port-index >

Index of the port on the device. Port index depends on the number of ports available on the linecard (or Interface Module).

For example, on VSF, an interface name would take this form:

```
<member ID>/<interface-module><port-index>
```

```
2/4
```

where 2 is the member ID and 4 is the port-index.

VSF member roles

- **Commander**: Control and management plane protocols run on the Commander, which is responsible for managing the forwarding databases, synchronizing them with the Standby and controlling all line cards including that of the Standby.
- **Standby**: Standby is a stateful backup device for the Commander and is ready to take control of the VSF virtual chassis if the Commander device fails. This enables the VSF virtual chassis to continue its operations seamlessly in the event of a failure.
- **Member**: All devices in the stack other than the commander and standby are called member switches. The member switch does not run any networking protocols and has no states. The ports on this switch are directly controlled and programmed by the commander switch. When a standby takes over as commander, one of the member switches is upgraded to standby role.

NOTE

All switches in the VSF stack will have the same software version. During stack formation, switches which do not have the same software version as the commander, will be updated to the commander's software. This will cause a reboot of the updated switch.

Member priority

Member priority determines the possibility of a member device being elected as the Commander. A member with higher priority is more likely to be elected as the Commander. The default priority is 128, but can be between 1 and 255.

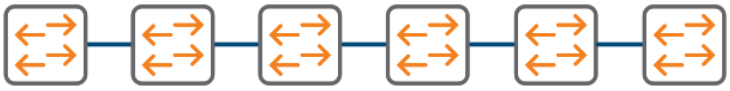
NOTE

Changing the priority does not affect the commander immediately. It will take effect from the next stack reboot, during the commander election.

Supported topologies

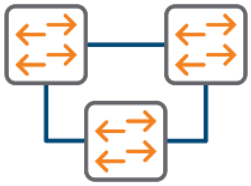
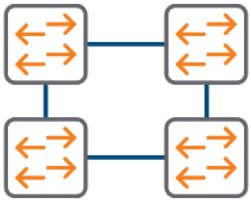
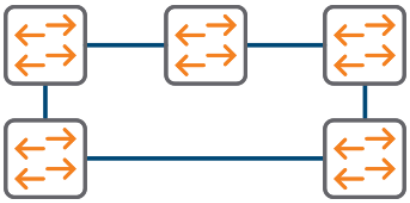
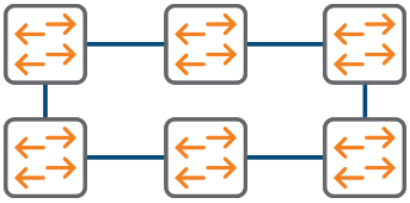
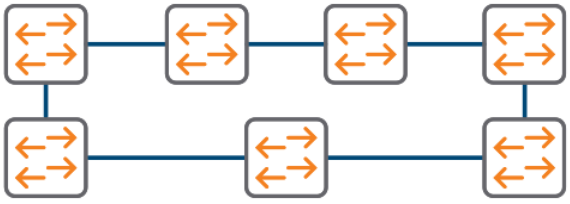
- A VSF fabric can have up to eight members.
- A VSF member can have up to two VSF links.
- A VSF fabric with ring topology is recommended. Loss or failure of one link in this topology will degrade the topology to chain, without losing any VSF members from the stack. Traffic will still continue with minimal loss of in-flight traffic.

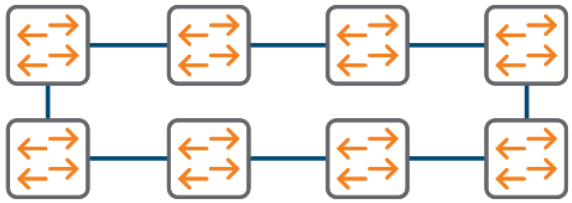
Table 43: *Supported chain topologiies*

Members	Chain topology
1-member (standalone)	
2-member	
3-member	
4-member	
5-member	
6-member	

Members	Chain topology
7-member	
8-member	

Table 44: *Supported ring topologies*

Members	Ring topology
3-member	
4-member	
5-member	
6-member	
7-member	

Members	Ring topology
8-member	

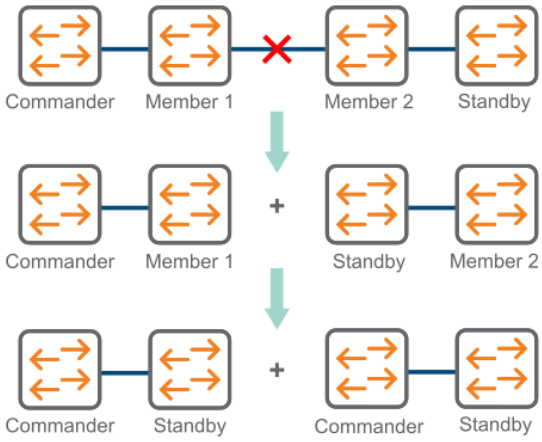
Running-configuration synchronization

VSF uses a strict running-configuration synchronization mechanism. In a VSF fabric, the Commander manages and retains the configuration of all the devices. All other devices obtain and use the running configuration from the Commander.

VSF split

A VSF split can occur due to a VSF link failure where all ports in the VSF link go down or any member is power-cycled or crashes in the chain topology. This failure results in independent VSF fabric fragment each having its own Commander role. It is recommended to configure a Multiple Active Detection (MAD) mechanism to avoid duplicate IP addresses, routing issues and traffic forwarding problems when a VSF split occurs.

Figure 93 *VSF split*

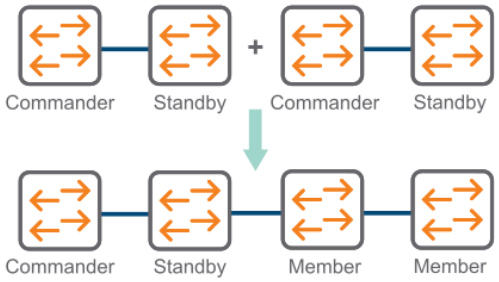


In the preceding figure, after the split, Member 1 will be elected as the new Standby in the previous Commander fragment. Previous Standby will failover and become Commander. Member 2 will be elected as a new standby to that fragment. Once the fragment become inactive, all front plane ports except VSF links will be brought down. A limited set of CLI commands will be available on the inactive fragment.

VSF merge

VSF merge occurs on connecting two different VSF fragments having the same domain-ID through VSF links. One of the VSF fragments reboots to merge with the other fragment and forms one VSF fabric. Devices merge only if they have the same domain ID.

Figure 94 *VSF Merge*



NOTE

Only two fragments can be merged at a time.

VSF commands

Configuration commands

vsf enable

Syntax

`vsf enable domain <DOMAIN-ID>`

Description

Enable VSF on the switch. Allows for switches to be stacked using Ethernet ports.

Parameters

<DOMAIN-ID>

The domain ID can be from 1 to 4294967295.

NOTE

The command `vsf enable` causes the switch to reboot once and form the fabric. Upon reboot, the switch comes up in the "VSF enabled" mode. Port numbers are prefixed with member numbers, such as "1/1". The configuration on the switch becoming Commander will be retained, but any pre-existing configuration on other switches will be over-written. The switch will inherit the same switch software as the member becoming Commander. If the software image of a switch needs to be updated, the switch will reboot twice.

vsf disable

Syntax

`vsf disable`

Description

Disable VSF on the virtual chassis.

Restriction

This command will not be available until VSF is enabled.

vsf member link

Syntax

```
no vsf member <MEMBER-ID> link <LINK-ID> [[ethernet]  <PORT-LIST> | name
 <LINK-NAME> [start-disabled]]
```

Description

Create the VSF links. A set of physical ports between any two members, carrying VSF traffic, is collectively referred to as a VSF link.

Parameters

<MEMBER-ID>

The VSF member-ID for the member command or parameter. Member ID value can be in the range from 1 to 8.

<LINK-ID>

VSF link ID value 1 to 2.

<PORT-LIST>

The port number or a list of ports. Up to eight ports can be assigned into a VSF link.

<LINK-NAME>

The VSF link name. Up to 11 characters are allowed for link name.

Operating Notes

- A VSF link is a logical port dedicated to the internal connection of a VSF virtual device.
- A VSF link is effective only after it is bound to a physical port.
- When an Ethernet port is bound to a VSF link, it carries VSF data traffic and VSF protocol packets.

vsf domain

Syntax

```
vsf domain <DOMAIN-ID>
```

Description

Change a domain ID for the VSF virtual chassis.

Once VSF is enabled and virtual chassis is formed, VSF domain ID can be changed using this command.

Parameters

<DOMAIN-ID>

The VSF virtual chassis domain ID. Domain ID value can be in the range of 1 to 4294967295.

vsf member

Syntax

```
vsf member <MEMBER-ID>
```

Description

Configure VSF member parameters.

Parameters

<MEMBER-ID>

The VSF member-ID for the member command or parameter. Member ID value can be in the range of 1 to 8.

vsf member shutdown

For a switch that physically exists, this command will cause the switch to shut down. `shutdown` is used in preparation to remove the switch from the virtual chassis. The switch will not become a voting member of the virtual chassis again until it is rejoined.

The `shutdown` command cannot be used on the Commander. The `shutdown` command will succeed only if the switch physically exists and is an active member of the virtual chassis.

Syntax

`vsf member <MEMBER-ID> shutdown`

Description

Shut down the VSF virtual chassis member.

Parameters

<MEMBER-ID>

The VSF member-ID for the member command or parameter. Member ID value can be in the range of 1 to 8.

Restriction

Shutdown will not be available until VSF is enabled.

vsf member reboot

Syntax

`boot vsf member <MEMBER-ID>`

Description

Reboot the VSF member and have it rejoin the virtual chassis with the current configuration. If the `boot` option is specified, the switch will come back up with the existing member-ID and rejoin the virtual chassis with the current configuration.

Parameters

<MEMBER-ID>

The VSF member-ID for the member command or parameter. Member ID value can be in the range of 1 to 8.

Restriction

Reboot will not be available until VSF is enabled.

vsf member remove

This command removes the entire configuration for a specified member. After issuing the command, the specified member-ID is available for reuse and may be provisioned or assigned to another device.

If the member physically exists, its configuration will be erased. It will then be powered down by default.

Syntax

```
vsf member <MEMBER-ID> remove
```

Description

Erase the VSF virtual chassis member configuration.

Parameters

<MEMBER-ID>

The VSF member-ID for the member command/ or parameter. Member ID value can be in the range of 1 to 8.

Restriction

Remove will not be available until VSF is enabled.

vsf member remove reboot

Syntax

```
vsf member <MEMBER-ID> remove reboot
```

Description

Removes the entire configuration for a specified member and reboots it. If the member physically exists, its configuration will be erased. If the VSF link is still present, the member reboots and joins the stack through automatic configuration.

Command context

```
config
```

Parameters

<MEMBER-ID>

The VSF member-ID for the member command/ or parameter. Member ID value can be in the range of 1 to 8.

Example

```
switch# config
switch(config)# vsf member 2 remove
reboot          Reboot the specified stack member.
switch(config)# vsf member 2 remove reboot
```

vsf member priority

Syntax

```
vsf member <MEMBER-ID> priority <PRIORITY>
```

Description

Assign a priority to the specified VSF virtual chassis member. The higher the priority, the more likely that the virtual chassis member will become the commander at the next virtual chassis reboot. The default priority value is 128.

Parameters

<MEMBER-ID>

The VSF member-ID for the member command or parameter. Member ID value can be in the range of 1 to 8.

<PRIORITY>

The priority value for VSF member. Priority value can be in the range of 1 to 255.

vsf member type

This CLI command provisions a switch with the member ID and the type defined by the specified J-number for the device. After provisioning the member, the user may perform any configuration on the device ports.

A strict provisioning specifies a MAC address and allows for only one device with the matching J-number and MAC to be configured.

A loose provisioning allows the device with the specified J-number to be configured without a MAC address being specified. This allows any device which matches the J-number to adopt this configuration.

If a provisioned configuration exists with the member ID, the following command is used to change the provisioning from strict and loose and vice versa. It is recommended to configure the member VSF links, in case of strict and loose provisioning. A warning is also displayed while configuring.

```
switch(config)# vsf member 8 type jl264a mac-address e0071b-c6d180
This will save the current configuration. Continue (y/n)?  y

Warning - The link and port should be provisioned for member 8 to
join the VSF stack.

switch(config)# vsf member 8 type jl264a
This will save the current configuration. Continue (y/n)?  y

Warning - The link and port should be provisioned for member 8 to
join the VSF stack.

switch(config)#
```

Syntax

```
vsf member <MEMBER-ID> type <TYPE> [mac <MAC-ADDR>]
```

Description

Configure the family of the VSF member-switch being provisioned. After provisioning, the VSF member-switch can be configured as if it were physically present. When a VSF member-switch matching the provisioned details joins the VSF, it is provided this configuration. A new or missing VSF member can be configured as a provisioned device by using this command.

Parameters

<MEMBER-ID>

The VSF member-ID for the member command/parameter. Member ID value can be in the range of 1 to 8.

<TYPE>

Configure the family of the VSF member-switch being provisioned.

<MAC-ADDR>

Configure the MAC address of the VSF member switch being provisioned.

Restrictions

- If switch N physically exists, the command will fail.
- If switch N is provisioned, the command can be used to change the MAC or type.
- If the J-Number is known to not support stacking, or the J-Number is unknown, the command will fail.
- If the same MAC address is already provisioned or exists on another member ID, the command will fail.

Usage

`vsf member <2> type <J9850A> mac <001122-334455>`

Updates the strict provisioning for VSF VC member 2, and changes the MAC address to 001122-334455.

`vsf member <2> type <J9850A>`

Changes the strict provisioning for VSF VC member 2 to loose provisioning. The configured MAC address is then removed.

`vsf member <2> type <J9850A> mac <00aabb-cceedd>`

Changes loose provisioning for VSF VC member 2 to strict provisioning with MAC address 00aabb-cceedd.

snmp-server enable traps vsf

Syntax

`no snmp-server enable traps vsf`

Description

Enable traps for the VSF functionality.

vsf port-speed

Syntax

`vsf port speed <SPEED>`

Description

Configure the port speed for all VSF ports. Ports that do not support the configured speed can be part of the VSF, but will not be operational. By default, the speed for the VSF is automatically set to the maximum speed of the first link port added. The port speed cannot be set to default if there are ports in the link. Changing the link speed of the VSF ports will trigger a reboot if the entire stack.

Parameters

<SPEED>

The allowed values for port speeds are 1g and 10g.

Usage

`no vsf port speed <SPEED>`

The `no` form of the command cannot be executed if there are ports configured on the link. All the ports in the link have to be unconfigured before setting the speed to default.

Example input

```
switch(config)# vsf port-speed
 1g                    Specify the VSF ports to auto-negotiate at 1 Gbps.
 10g                   Specify the VSF ports to auto-negotiate at 10 Gbps.
```

vsf vlan-mad

Syntax

`vsf vlan-mad <VLAN-ID>`

Description

Configure the VSF Multi-Active Detection (MAD) VLAN. The MAD VLAN is used for stack fragment discovery when there is a stack split. Only one MAD VLAN can be configured.

Parameters

<VLAN-ID>

VLAN identifier or the VLAN name if configured. Vlan ID value can be in the range of 1 to 4096.

Usage

```
no vsf vlan-mad <VLAN-ID>
```

vsf lldp-mad ipv4

Syntax

```
vsf lldp-mad ipv4 <IPV4_ADDR> v2c <COMMUNITY-STR>
no vsf lldp-mad ipv4 <IPV4_ADDR> v2c  <COMMUNITY-STR>
```

Description

Enable LLDP-MAD on the VSF device.

The command `vsf lldp mad` requires a peer switch to be configured as the assist device. LLDP-MAD is applicable only for a two-member VSF stack.

Parameters

<IPV4_ADDR>

The IPv4 address of the MAD (Multi-Active Detection) device.

<COMMUNITY-STR>

The SNMP community string for the MAD (Multi-Active Detection) device.

Usage

```
switch(config)# vsf lldp-mad ipv4
switch(config)# vsf lldp-mad ipv4 <IPv4_ADDR>
switch(config)# vsf lldp-mad ipv4  <MAD-IP-ADDRESS> v2c
switch(config)# vsf lldp-mad ipv4 210.10.0.12 v2c  <COMMUNITY-STR>
```

Show commands

show vsf

Syntax

```
show vsf
```

Description

Shows the list of VSF virtual chassis members that are provisioned.

Restrictions

`show vsf` can be run only after VSF is enabled.

Example output

```
switch# show vsf

 VSF Domain ID    : 123
 MAC Address      : 941882-435589
 VSF Topology     : Ring
 VSF Status       : Active
 Uptime           : 26d 20h 36m
 VSF MAD          : None
 VSF Port Speed   : 10G
 Software Version : WC.16.06.0000x

 Mbr
 ID  MAC Address       Model                                 Pri Status
 --- ----------------- ------------------------------------- --- ---------------
  1  f40343-0796b0     Aruba JL258A 2930F-8G-PoE+-2SFP+ S... 128 Member
 *2  941882-435580     Aruba JL254A 2930F-48G-4SFP+ Switch   128 Member
  3  b05ada-9771c0     Aruba JL256A 2930F-48G-PoE+-4SFP+ ... 128 Standby
  4  b05ada-963120     Aruba JL255A 2930F-24G-PoE+-4SFP+ ... 128 Member
  5  9cdc71-393440     Aruba JL256A 2930F-48G-PoE+-4SFP+ ... 128 Member
  6  b05ada-962180     Aruba JL253A 2930F-24G-4SFP+ Switch   128 Member
  7  b05ada-9631e0     Aruba JL255A 2930F-24G-PoE+-4SFP+ ... 128 Commander
  8  b05ada-96f000     Aruba JL253A 2930F-24G-4SFP+ Switch   128 Member
```

The preceding example shows:

- Topology is ring.
- Member 7 is Commander
- Member 3 is Standby
- Member 1, 2, 4, 5, 6, and 8 are Members

show vsf detail

Syntax

```
show vsf detail
```

Description

This commands shows detailed information related to the current state of the VSF virtual chassis.

Example output

```
switch# show vsf detail

 VSF Domain ID    : 500
 MAC Address      : ecebb8-d0c905
 VSF Topology     : Ring
 VSF Status       : Active
 Uptime           : 1d 8h 25m
 VSF MAD          : VLAN
 VSF Port Speed   : 10G
 Software Version : WC.16.06.0000x

Name             : Aruba-VSF-2930F
Contact          :
Location         :
```

```
Member ID        : 1
MAC Address      : ecebb8-d0c900
Type             : JL558A
Model            : Aruba JL558A 2930F-48G-740W-PoE+-4SFP+ Switch
Priority         : 250
Status           : Commander
ROM Version      : WC.16.01.0004
Serial Number    : CN82K91074
Uptime           : 1d 8h 25m
CPU Utilization  : 0%
Memory - Total   : 343,130,624 bytes
Free             : 221,141,152 bytes
VSF Links -
#1 : Active, Peer member 2
#2 : Active, Peer member 8


Member ID        : 2
MAC Address      : 9cdc71-371d20
Type             : JL253A
Model            : Aruba JL253A 2930F-24G-4SFP+ Switch
Priority         : 128
Status           : Member
ROM Version      : WC.16.01.0006
Serial Number    : CN71HKT0BQ
Uptime           : 0d 17h 26m
CPU Utilization  : 0%
Memory - Total   : 343,130,624 bytes
Free             : 253,175,276 bytes
VSF Links -
#1 : Active, Peer member 3
#2 : Active, Peer member 1


Member ID        : 3
MAC Address      : ecebb8-d0bb00
Type             : JL558A
Model            : Aruba JL558A 2930F-48G-740W-PoE+-4SFP+ Switch
Priority         : 128
Status           : Member
ROM Version      : WC.16.01.0006
Serial Number    : CN82K910C3
Uptime           : 0d 17h 19m
CPU Utilization  : 0%
Memory - Total   : 343,130,624 bytes
Free             : 253,035,252 bytes
VSF Links -
#1 : Active, Peer member 2
#2 : Active, Peer member 4


Member ID        : 4
MAC Address      : b05ada-974800
Type             : JL254A
Model            : Aruba JL254A 2930F-48G-4SFP+ Switch
Priority         : 128
Status           : Member
ROM Version      : WC.16.01.0006
Serial Number    : CN65HKV02Y
Uptime           : 0d 17h 12m
CPU Utilization  : 0%
```

```
Memory - Total   : 343,130,624 bytes
Free             : 253,175,244 bytes
VSF Links -
#1 : Active, Peer member 3
#2 : Active, Peer member 5



Member ID        : 5
MAC Address      : b05ada-962200
Type             : JL255A
Model            : Aruba JL255A 2930F-24G-PoE+-4SFP+ Switch
Priority         : 128
Status           : Member
ROM Version      : WC.16.01.0004
Serial Number    : CN6ZHKW005
Uptime           : 0d 17h 6m
CPU Utilization  : 0%
Memory - Total   : 343,130,624 bytes
Free             : 253,160,108 bytes
VSF Links -
#1 : Active, Peer member 4
#2 : Active, Peer member 6



Member ID        : 6
MAC Address      : 941882-42d320
Type             : JL255A
Model            : Aruba JL255A 2930F-24G-PoE+-4SFP+ Switch
Priority         : 128
Status           : Standby
ROM Version      : WC.16.01.0004
Serial Number    : CN69HKW0ZC
Uptime           : 0d 17h 45m
CPU Utilization  : 0%
Memory - Total   : 343,130,624 bytes
Free             : 240,018,564 bytes
VSF Links -
#1 : Active, Peer member 5
#2 : Active, Peer member 7



Member ID        : 7
MAC Address      : b05ada-975440
Type             : JL256A
Model            : Aruba JL256A 2930F-48G-PoE+-4SFP+ Switch
Priority         : 128
Status           : Member
ROM Version      : WC.16.01.0004
Serial Number    : CN6ZHKX063
Uptime           : 1d 8h 9m
CPU Utilization  : 0%
Memory - Total   : 343,130,624 bytes
VSF Links -
#1 : Active, Peer member 8
#2 : Active, Peer member 6



Member ID        : 8
MAC Address      : e0071b-c6d180
Type             : JL264A
```

```
Model             : Aruba JL264A 2930F-48G-PoE+-4SFP+-TAA Switch
Priority          : 128
Status            : Member
ROM Version       : WC.16.01.0004
Serial Number     : CN66HL501D
Uptime            : 0d 16h 59m
CPU Utilization   : 0%
Memory - Total    : 343,130,624 bytes
Free              : 253,174,992 bytes
VSF Links -
#1 : Active, Peer member 7
#2 : Active, Peer member 1
```

The above example shows:

- Member 1 Link 1 is connected to Member 2 Link 1.
- Member 2 Link 2 is connected to Member 3 Link 1.
- Member 3 Link 2 is connected to Member 4 Link 1.
- Member 4 Link 2 is connected to Member 5 Link 1.
- Member 5 Link 2 is connected to Member 6 Link 1.
- Member 6 Link 2 is connected to Member 8 Link 2.
- Member 7 Link 2 is connected to Member 8 Link 1.
- Member 8 Link 1 is connected to Member 7 Link 2.

show vsf link

Syntax

```
show vsf link
```

Description

Shows the VSF port state of the VSF links for each VSF member.

Example output

```
switch# show vsf link

 VSF Member 1

                   Link     Peer   Peer
 Link Link-Name    State    Member Link
 ---- ---------- -------- ------ ----
 1    I-Link1_1   Up       2      1
 2    I-Link1_2   Down     0      0


 VSF Member 2

                   Link     Peer   Peer
 Link Link-Name    State    Member Link
 ---- ---------- -------- ------ ----
 1    I-Link2_1   Up       1      1
 2    I-Link2_2   Up       3      1


 VSF Member 3
```

```
                  Link     Peer   Peer
Link Link-Name    State    Member Link
---- ---------- -------- ------ ----
1    I-Link3_1    Up       2      2
2    I-Link3_2    Up       4      1


VSF Member 4

                  Link     Peer   Peer
Link Link-Name    State    Member Link
---- ---------- -------- ------ ----
1    I-Link4_1    Up       3      2
2    I-Link4_2    Up       5      1


VSF Member 5

                  Link     Peer   Peer
Link Link-Name    State    Member Link
---- ---------- -------- ------ ----
1    I-Link5_1    Up       4      2
2    I-Link5_2    Up       6      1


VSF Member 6

                  Link     Peer   Peer
Link Link-Name    State    Member Link
---- ---------- -------- ------ ----
1    I-Link6_1    Up       5      2
2    I-Link6_2    Up       8      2


VSF Member 7

                  Link     Peer   Peer
Link Link-Name    State    Member Link
---- ---------- -------- ------ ----
1    I-Link7_1    Down     0      0
2    I-Link7_2    Up       8      1


VSF Member 8

                  Link     Peer   Peer
Link Link-Name    State    Member Link
---- ---------- -------- ------ ----
1    I-Link8_1    Up       7      2
2    I-Link8_2    Up       6      2
```

A VSF port speed which does not match with the global port speed, will be in a down state. The command `show vsf link detail` will display an error message.

show vsf link detail

Syntax

```
show vsf link detail
```

Description

Displays a detailed output of VSF port state and links for each VSF member.

Example output

```
switch# show vsf link detail

 VSF Member: 1     Link: 1

 Port     State
 -------- ------------
 1/9      Up: Connected to port 2/49



 VSF Member: 2     Link: 1

 Port     State
 -------- ------------
 2/49     Up: Connected to port 1/9


 VSF Member: 2     Link: 2

 Port     State
 -------- ------------
 2/51     Up: Connected to port 3/51


 VSF Member: 3     Link: 1

 Port     State
 -------- ------------
 3/51     Up: Connected to port 2/51


 VSF Member: 3     Link: 2

 Port     State
 -------- ------------
 3/49     Up: Connected to port 4/25


 VSF Member: 4     Link: 1

 Port     State
 -------- ------------
 4/25     Up: Connected to port 3/49


 VSF Member: 4     Link: 2

 Port     State
 -------- ------------
 4/27     Up: Connected to port 5/51


 VSF Member: 5     Link: 1

 Port     State
 -------- ------------
 5/51     Up: Connected to port 4/27


 VSF Member: 5     Link: 2
```

```
Port     State
-------- ------------
5/49     Up: Connected to port 6/25


VSF Member: 6     Link: 1

Port     State
-------- ------------
6/25     Up: Connected to port 5/49


VSF Member: 6     Link: 2

Port     State
-------- ------------
6/27     Up: Connected to port 8/27



VSF Member: 7     Link: 2

Port     State
-------- ------------
7/25     Up: Connected to port 8/25


VSF Member: 8     Link: 1

Port     State
-------- ------------
8/25     Up: Connected to port 7/25


VSF Member: 8     Link: 2

Port     State
-------- ------------
8/27     Up: Connected to port 6/27
```

show vsf member

Syntax

`show vsf member <MEMBER ID>`

Parameters

<MEMBER ID>

The VSF member-ID for the member command or parameter. Member ID value can be in the range of 1 to 8.

Example output

```
switch# show vsf member 1

Member ID        : 1
MAC Address      : f40343-f83680
Type             : JL256A
Model            : Aruba JL256A 2930F-48G-PoE+-4SFP+ Switch
Priority         : 255
Status           : Member
```

```
ROM Version      : WC.16.01.0004
Serial Number    : CN76HKX16H
Uptime           : 36d 20h 5m
CPU Utilization  : 0%
Memory - Total   : 343,482,880 bytes
Free             : 253,575,488 bytes
VSF Links -
#1 : Active, Peer member 2
#2 : Active, Peer member 8

switch# show vsf member 2

Member ID        : 2
MAC Address      : 98f2b3-bc4700
Type             : JL254A
Model            : Aruba JL254A 2930F-48G-4SFP+ Switch
Priority         : 255
Status           : Commander
ROM Version      : WC.16.01.0004
Serial Number    : CN77HKV09F
Uptime           : 36d 20h 5m
CPU Utilization  : 24%
Memory - Total   : 343,482,880 bytes
Free             : 224,031,528 bytes
VSF Links -
#1 : Active, Peer member 1
#2 : Active, Peer member 3

switch# show vsf member 3

Member ID        : 3
MAC Address      : f40343-6bff80
Type             : JL255A
Model            : Aruba JL255A 2930F-24G-PoE+-4SFP+ Switch
Priority         : 255
Status           : Member
ROM Version      : WC.16.01.0004
Serial Number    : CN77HKW0FM
Uptime           : 36d 20h 5m
CPU Utilization  : 0%
Memory - Total   : 343,482,880 bytes
Free             : 253,575,664 bytes
VSF Links -
#1 : Active, Peer member 2
#2 : Active, Peer member 4

switch# show vsf member 4

Member ID        : 4
MAC Address      : 98f2b3-bc75c0
Type             : JL254A
Model            : Aruba JL254A 2930F-48G-4SFP+ Switch
Priority         : 255
Status           : Member
ROM Version      : WC.16.01.0004
Serial Number    : CN77HKV06B
Uptime           : 36d 20h 5m
CPU Utilization  : 0%
Memory - Total   : 343,482,880 bytes
Free             : 253,575,816 bytes
VSF Links -
#1 : Active, Peer member 3
#2 : Active, Peer member 5
```

```
switch# show vsf member 5

Member ID        : 5
MAC Address      : 9cdc71-378c00
Type             : JL253A
Model            : Aruba JL253A 2930F-24G-4SFP+ Switch
Priority         : 255
Status           : Member
ROM Version      : WC.16.01.0004
Serial Number    : CN71HKT0BD
Uptime           : 36d 20h 5m
CPU Utilization  : 0%
Memory - Total   : 343,482,880 bytes
Free             : 253,575,816 bytes
VSF Links -
#1 : Active, Peer member 4
#2 : Active, Peer member 6

switch# show vsf member 6

Member ID        : 6
MAC Address      : 941882-429800
Type             : JL258A
Model            : Aruba JL258A 2930F-8G-PoE+-2SFP+ Switch
Priority         : 255
Status           : Standby
ROM Version      : WC.16.01.0004
Serial Number    : CN69HL00F4
Uptime           : 36d 20h 5m
CPU Utilization  : 0%
Memory - Total   : 343,482,880 bytes
Free             : 240,710,660 bytes
VSF Links -
#1 : Active, Peer member 5
#2 : Active, Peer member 7

switch# show vsf member 7

Member ID        : 7
MAC Address      : b05ada-960400
Type             : JL253A
Model            : Aruba JL253A 2930F-24G-4SFP+ Switch
Priority         : 128
Status           : Member
ROM Version      : WC.16.01.0004
Serial Number    : CN65HKT03X
Uptime           : 36d 20h 6m
CPU Utilization  : 0%
Memory - Total   : 343,482,880 bytes
Free             : 253,575,844 bytes
VSF Links -
#1 : Active, Peer member 6
#2 : Active, Peer member 8

switch# show vsf member 8

Member ID        : 8
MAC Address      : b05ada-96d620
Type             : JL255A
Model            : Aruba JL255A 2930F-24G-PoE+-4SFP+ Switch
Priority         : 128
Status           : Member
ROM Version      : WC.16.01.0004
Serial Number    : CN65HKW03D
```

```
Uptime           : 36d 20h 6m
CPU Utilization  : 0%
Memory - Total   : 343,482,880 bytes
Free             : 253,575,660 bytes
VSF Links -
#1 : Active, Peer member 1
#2 : Active, Peer member 7
```

show vsf topology

Syntax

```
show vsf topology
```

Description

This command shows information about VSF virtual chassis member connections.

Example output

```
switch# show vsf topology

 VSF member's interconnection with links:

                   Stby                                                Cmdr
 +---+    +---+    +---+    +---+    +---+    +---+    +---+    +---+
 | 1 |1==1| 2 |2==1| 3 |2==1| 4 |2==1| 5 |2==1| 6 |2==2| 8 |1==2| 7 |
 +---+    +---+    +---+    +---+    +---+    +---+    +---+    +---+
```

- Member ID 1 Link 1 is connected to Member ID 2 Link 1.
- Member ID 2 Link 2 is connected to Member ID 3 Link 1.
- Member ID 3 Link 2 is connected to Member ID 4 Link 1.
- Member ID 4 Link 2 is connected to Member ID 5 Link 1.
- Member ID 5 Link 2 is connected to Member ID 6 Link 1.
- Member ID 6 Link 2 is connected to Member ID 8 Link 2.
- Member ID 8 Link 1 is connected to Member ID 7 Link 2.
- Member ID 3 is current VSF standby.
- Member ID 7 is current VSF commander.

Set the terminal width to 100 for a better alignment of the topology diagram. Default width: 80.

show vsf topology detail

Syntax

```
show vsf topology detail
```

Description

This command displays forwarding path information (unidestination and multidestination flood path information). The unidestination forwarding takes the shortest path in terms of hop counts to reach destination member. The command output provides the egress VSF link used to send traffic along the shortest path

computed. The multidestination path provides the complete flood path taken along the VSF stack for the multidestination traffic ingressing VSF stack or sourced at any VSF member.

Example output

```
switch# show vsf topology detail

 Uni-destination Link Path:

 VSF Member ID  1    2    3    4    5    6    7    8
 -------------- ---- ---- ---- ---- ---- ---- ---- ----
 1              -    1    1    1    1    1    1    1
 2              1    -    2    2    2    2    2    2
 3              1    1    -    2    2    2    2    2
 4              1    1    1    -    2    2    2    2
 5              1    1    1    1    -    2    2    2
 6              1    1    1    1    1    -    2    2
 7              2    2    2    2    2    2    -    2
 8              2    2    2    2    2    2    1    -
```

In the preceding example, the unidestination traffic from Member ID 1 to Member ID 8 egresses through VSF link 1. Member ID 2 to Member ID 8 egresses through VSF link 2. Member ID 3 to Member ID 8 egresses through VSF link 3, and so on.

```
 Multi-destination Path:

 VSF Member ID   Path
 -------------  ------
 1               2-3-4-5-6-8-7
 2               1, 3-4-5-6-8-7
 3               2-1, 4-5-6-8-7
 4               3-2-1, 5-6-8-7
 5               4-3-2-1, 6-8-7
 6               5-4-3-2-1, 8-7
 7               8-6-5-4-3-2-1
 8               7, 6-5-4-3-2-1
```

In the preceding example, the multidestination traffic:

- ingressing at Member ID 1 will be relayed to Member ID 2, Member ID 2 will further relay to Member ID 3, Member ID 3 will further relay to Member ID 4, Member ID 4 to Member ID 5, Member ID 5 to Member ID 6, Member ID 6 to Member ID 8, and Member ID 8 to Member ID 7, which will not relay further. All the receiving Members will consume multidestination traffic before relaying further.
- ingressing or sourced at Member 2 will take two forwarding paths:
  - Relay to Member ID 1. Member ID 1 will consume and not relay further.
  - Relay to Member ID 3 which will further relay to Member ID 4, Member ID 4 to Member ID 5, Member ID 5 to Member ID 6, Member ID 6 to Member ID 8, and Member ID 8 to Member ID 7, which will not relay further

show vsf topology change-history

Syntax

```
show vsf topology <change-history>
```

Description

This command is used to display last 16 topology changes which occurred in the VSF stack and all topology transitions which occurred in recent history, along with details on which specific VSF member or link pair witnessed the state transitions.

Parameters

<change-history>

Show VSF stack topology changes.

Example output

```
Switch# show vsf topology change-history
 Thu Apr  21 00:06:10 2017 : The link between Member 4, Link 2 and Member 3,
 Link 2 went UP

 Thu Apr  21 00:06:10 2017 : The link between Member 3, Link 2 and Member 4,
 Link 2 went UP

 Thu Apr  21 00:06:09 2017 : The link between Member 3, Link 1 and Member 2,
 Link 1 went UP

 Thu Apr  21 00:06:09 2017 : The link between Member 2, Link 1 and Member 3,
 Link 1 went UP

 Thu Apr  21 00:04:07 2017 : The link between Member 2, Link 2 and Member 1,
 Link 2 went UP

 Thu Apr  21 00:04:07 2017 : The link between Member 1, Link 2 and Member 2,
 Link 2 went UP
```

show vsf lldp-mad

Syntax

```
show vsf lldp-mad {parameters|status}
```

Description

Display the VSF LLDP MAD (Multi-Active Detection) information.

Parameters

parameters

Displays the MAD-assist configuration as well as the readiness state.

status

Displays the current state of the MAD probe.

Example output

```
Switch# show vsf lldp-mad parameters

MAD device IP                : 134.1.5.29
    MAD readiness status     : Success | Failure [21:49:45, 9/Jan/2015]
        MAD device MAC       : 08:12:2b:40:44:3a
        Reachable via Vlan   : 10
        Local LAG interface  : TRK5
        MAD-probe portset    : 1, 7, 23
     LAG connectivity        : Full | Partial

Switch# show vsf lldp-mad status
MAD device IP                : 134.1.5.29
    MAD probe portset        : 1, 7, 23
```

```
   VSF split                           : Yes | No
   MAD probe originator                : Yes | No
   Number of probe requests sent       : 3
   Number of probe responses received  : 0
   MAD Active Fragment                 : Yes | No
```

show vsf vlan-mad

Syntax

```
show vsf vlan-mad
```

Description

Shows information for the VSF Multi-Active Detection (MAD) VLAN.

VLAN MAD Connectivity status:

full

All member VLAN MAD ports are connected to the MAD interconnect device.

partial

Atleast one member VLAN MAD port is connected to the MAD interconnect device.

none

None of the member VLAN MAD ports are connected to the MAD interconnect device.

Example output

```
switch# show vsf vlan-mad

Multi-Active Detection VLAN status :

  VLAN ID                      : 200
  VLAN NAME                    : VLAN200
  VLAN MAD Connectivity Status : Full

  Port   Status   Member State
  -----  -------  ---------------
  1/8    Up       Standby
  2/8    Up       Member
  3/8    Up       Member
  4/8    Up       Member
  5/8    Up       Commander
  6/8    Up       Member
  7/8    Up       Member
  8/8    Up       Member
```

If a MAD VLAN is not configured:

```
switch(config)# show vsf vlan-mad
MAD VLAN is not configured
switch(config)#
```

show vsf trunk-designated-forwarder

Syntax

```
show vsf trunk-designated-forwarder member <MEMBER-ID>
```

Description

Show the designated forwarders for each trunk.

Parameters

<MEMBER-ID>

The VSF member-ID for the member command or parameter. Member ID value can be in the range of 1 to 8.

Example

```
Switch# show vsf trunk-designated-forwarder member 1

Trunk Designated Forwarders

  NAME  TYPE  Forwarding Member (Flood) Forwarding Member (Unicast)
  ----- ----- ------------------------- --------------------------
  Trk1  TRK   2                         1, 2
  Trk2  TRK   3                         3, 4
```

show cpu

Syntax

```
show cpu <SECONDS>
```

Description

Show average CPU utilization.

Usage

```
show cpu slot <SLOT-LIST> [<SECONDS>]
```

```
show cpu process [slot <SLOT-LIST>] [refresh <COUNT>]
```

Example output

```
switch(config)# show cpu slot all


VSF slot 1/a:
-------------
42 percent busy, from 300 sec ago
1 sec ave: 37 percent busy
5 sec ave: 36 percent busy
1 min ave: 49 percent busy


VSF slot 2/a:
-------------
1 percent busy, from 300 sec ago
1 sec ave: 2 percent busy
5 sec ave: 1 percent busy
1 min ave: 2 percent busy


VSF slot 3/a:
-------------
1 percent busy, from 300 sec ago
1 sec ave: 1 percent busy
```

```
5 sec ave: 1 percent busy
1 min ave: 1 percent busy


VSF slot 4/a:
-------------
0 percent busy, from 300 sec ago
1 sec ave: 1 percent busy
5 sec ave: 1 percent busy
1 min ave: 1 percent busy


VSF slot 5/a:
-------------
0 percent busy, from 300 sec ago
1 sec ave: 1 percent busy
5 sec ave: 1 percent busy
1 min ave: 1 percent busy


VSF slot 6/a:
-------------
1 percent busy, from 300 sec ago
1 sec ave: 1 percent busy
5 sec ave: 1 percent busy
1 min ave: 1 percent busy


VSF slot 7/a:
-------------
0 percent busy, from 300 sec ago
1 sec ave: 1 percent busy
5 sec ave: 1 percent busy
1 min ave: 1 percent busy


VSF slot 8/a:
-------------
0 percent busy, from 300 sec ago
1 sec ave: 2 percent busy
5 sec ave: 1 percent busy
1 min ave: 1 percent busy
```

show power-over-ethernet

Syntax

`show power-over-ethernet vsf member <MEMBER-ID>`

Description

Show PoE information of specified VSF member.

Parameters

<MEMBER-ID>

The VSF member-ID for the member command or parameter. Member ID value can be in the range of 1 to 8.

Example

For `show power-over-ethernet vsf member 4`:

```
Switch# show power-over-ethernet vsf member 4

 Status and Counters - System Power Status for member 4

 Maximum Power       : 370 W           Operational Status  : On
 Power In Use        : 0 W +/- 6 W     Usage Threshold (%) : 80
```

show system information

Syntax

```
show system information [vsf member <MEMBER-ID>]
```

Description

Show global configured and operational system parameters. If VSF is enabled, this shows the system information for all VSF members.

Parameters

<MEMBER-ID>

The VSF member-ID for the member command or parameter. Member ID value can be in the range from 1 to 8.

Example

```
switch(config)# show system information
 vsf                  Show global configured and operational system parameters
                      of the specified VSF members.

switch(config)# show system information

 Status and Counters - General System Information

  System Name         : Aruba-VSF-2930F
  System Contact      :
  System Location     :
  MAC Age Time (sec)  : 300
  Time Zone           : 0
  Daylight Time Rule  : None

  Software revision   : WC.16.06.0000x
  Base MAC Addr       : f40343-f8368a

 VSF-Member :1

  ROM Version         : WC.16.01.0004
  Up Time             : 35 days
  CPU Util (%)        : 0
  MAC Addr            : f40343-f83680
  Serial Number       : CN76HKX16H
  Memory    - Total   : 343,482,880
              Free    : 253,575,488



 VSF-Member :2

  ROM Version         : WC.16.01.0004
  Up Time             : 35 days
  CPU Util (%)        : 35
  MAC Addr            : 98f2b3-bc4700
  Serial Number       : CN77HKV09F
```

```
 Memory   - Total   : 343,482,880
            Free    : 224,025,392


VSF-Member :3

 ROM Version        : WC.16.01.0004
 Up Time            : 35 days
 CPU Util (%)       : 2
 MAC Addr           : f40343-6bff80
 Serial Number      : CN77HKW0FM
 Memory   - Total   : 343,482,880
            Free    : 253,575,664


VSF-Member :4

 ROM Version        : WC.16.01.0004
 Up Time            : 35 days
 CPU Util (%)       : 0
 MAC Addr           : 98f2b3-bc75c0
 Serial Number      : CN77HKV06B
 Memory   - Total   : 343,482,880
            Free    : 253,575,816


VSF-Member :5

 ROM Version        : WC.16.01.0004
 Up Time            : 35 days
 CPU Util (%)       : 0
 MAC Addr           : 9cdc71-378c00
 Serial Number      : CN71HKT0BD
 Memory   - Total   : 343,482,880
            Free    : 253,575,816


VSF-Member :6

 ROM Version        : WC.16.01.0004
 Up Time            : 35 days
 CPU Util (%)       : 0
 MAC Addr           : 941882-429800
 Serial Number      : CN69HL00F4
 Memory   - Total   : 343,482,880
            Free    : 240,710,660


VSF-Member :7

 ROM Version        : WC.16.01.0004
 Up Time            : 35 days
 CPU Util (%)       : 0
 MAC Addr           : b05ada-960400
 Serial Number      : CN65HKT03X
 Memory   - Total   : 343,482,880
            Free    : 253,575,844
```

```
 VSF-Member :8

  ROM Version        : WC.16.01.0004
  Up Time            : 35 days
  CPU Util (%)       : 0
  MAC Addr           : b05ada-96d620
  Serial Number      : CN65HKW03D
  Memory   - Total   : 343,482,880
             Free    : 253,575,660
```

show system information vsf member

Syntax

`show system information vsf member <MEMBER-ID>`

Description

Show global configured and operational system parameters of the specified VSF members.

Parameters

<MEMBER-ID>

The VSF member-ID for the member command or parameter. Member ID value can be in the range of 1 to 8.

Example output

```
switch# show system information vsf member 1

Status and Counters - General System Information

  System Name        : Aruba-VSF-2930F
  System Contact     :
  System Location    :
  MAC Age Time (sec) : 300
  Time Zone          : 0
  Daylight Time Rule : None

  Software revision  : WC.16.06.0000x
  Base MAC Addr      : f40343-f8368a



VSF-Member :1

  ROM Version        : WC.16.01.0004
  Up Time            : 36 days
  CPU Util (%)       : 0
  MAC Addr           : f40343-f83680
  Serial Number      : CN76HKX16H
  Memory   - Total   : 343,482,880
             Free    : 253,575,488

switch# show system information vsf member 2

Status and Counters - General System Information

  System Name        : Aruba-VSF-2930F
  System Contact     :
  System Location    :
  MAC Age Time (sec) : 300
```

```
  Time Zone          : 0
  Daylight Time Rule : None

  Software revision  : WC.16.06.0000x
  Base MAC Addr      : f40343-f8368a



VSF-Member :2

  ROM Version        : WC.16.01.0004
  Up Time            : 36 days
  CPU Util (%)       : 10
  MAC Addr           : 98f2b3-bc4700
  Serial Number      : CN77HKV09F
  Memory   - Total   : 343,482,880
             Free    : 224,022,468

switch# show system information vsf member 3

Status and Counters - General System Information

  System Name        : Aruba-VSF-2930F
  System Contact     :
  System Location    :
  MAC Age Time (sec) : 300
  Time Zone          : 0
  Daylight Time Rule : None

  Software revision  : WC.16.06.0000x
  Base MAC Addr      : f40343-f8368a



VSF-Member :3

  ROM Version        : WC.16.01.0004
  Up Time            : 36 days
  CPU Util (%)       : 0
  MAC Addr           : f40343-6bff80
  Serial Number      : CN77HKW0FM
  Memory   - Total   : 343,482,880
             Free    : 253,575,664

switch# show system information vsf member 4

Status and Counters - General System Information

  System Name        : Aruba-VSF-2930F
  System Contact     :
  System Location    :
  MAC Age Time (sec) : 300
  Time Zone          : 0
  Daylight Time Rule : None

  Software revision  : WC.16.06.0000x
  Base MAC Addr      : f40343-f8368a



VSF-Member :4

  ROM Version        : WC.16.01.0004
  Up Time            : 36 days
```

```
  CPU Util (%)       : 0
  MAC Addr           : 98f2b3-bc75c0
  Serial Number      : CN77HKV06B
  Memory   - Total   : 343,482,880
             Free    : 253,575,816

switch# show system information vsf member 5

Status and Counters - General System Information

  System Name        : Aruba-VSF-2930F
  System Contact     :
  System Location    :
  MAC Age Time (sec) : 300
  Time Zone          : 0
  Daylight Time Rule : None

  Software revision  : WC.16.06.0000x
  Base MAC Addr      : f40343-f8368a



VSF-Member :5

  ROM Version        : WC.16.01.0004
  Up Time            : 36 days
  CPU Util (%)       : 0
  MAC Addr           : 9cdc71-378c00
  Serial Number      : CN71HKT0BD
  Memory   - Total   : 343,482,880
             Free    : 253,575,816

switch# show system information vsf member 6

Status and Counters - General System Information

  System Name        : Aruba-VSF-2930F
  System Contact     :
  System Location    :
  MAC Age Time (sec) : 300
  Time Zone          : 0
  Daylight Time Rule : None

  Software revision  : WC.16.06.0000x
  Base MAC Addr      : f40343-f8368a



VSF-Member :6

  ROM Version        : WC.16.01.0004
  Up Time            : 36 days
  CPU Util (%)       : 0
  MAC Addr           : 941882-429800
  Serial Number      : CN69HL00F4
  Memory   - Total   : 343,482,880
             Free    : 240,710,660

switch# show system information vsf member 7

Status and Counters - General System Information

  System Name        : Aruba-VSF-2930F
  System Contact     :
```

```
  System Location    :
  MAC Age Time (sec) : 300
  Time Zone          : 0
  Daylight Time Rule : None

  Software revision  : WC.16.06.0000x
  Base MAC Addr      : f40343-f8368a



VSF-Member :7

  ROM Version        : WC.16.01.0004
  Up Time            : 36 days
  CPU Util (%)       : 0
  MAC Addr           : b05ada-960400
  Serial Number      : CN65HKT03X
  Memory   - Total   : 343,482,880
             Free    : 253,575,844

switch# show system information vsf member 8

Status and Counters - General System Information

  System Name        : Aruba-VSF-2930F
  System Contact     :
  System Location    :
  MAC Age Time (sec) : 300
  Time Zone          : 0
  Daylight Time Rule : None

  Software revision  : WC.16.06.0000x
  Base MAC Addr      : f40343-f8368a



VSF-Member :8

  ROM Version        : WC.16.01.0004
  Up Time            : 36 days
  CPU Util (%)       : 0
  MAC Addr           : b05ada-96d620
  Serial Number      : CN65HKW03D
  Memory   - Total   : 343,482,880
             Free    : 253,575,660
```

show system fans

Syntax

`show system fans [vsf member <MEMBER-ID>]`

Description

Show system fan status. If VSF is enabled, this shows the system fan status for all VSF members.

Parameters

<MEMBER-ID>

The VSF member-ID for the member command parameter. Member ID value can be in the range of 1 to 8.

Example output

```
Aruba-VSF-2930F# show system fans

Fan Information

VSF-Member  1

  Num   | State       | Failures | Location
--------+-------------+----------+----------

0 / 0 Fans in Failure State
0 / 0 Fans have been in Failure State

VSF-Member  2

  Num   | State       | Failures | Location
--------+-------------+----------+----------
Sys-1   | Fan OK      |   0      | Chassis

0 / 1 Fans in Failure State
0 / 1 Fans have been in Failure State

VSF-Member  3

  Num   | State       | Failures | Location
--------+-------------+----------+----------
Sys-1   | Fan OK      |   0      | Chassis
Sys-2   | Fan OK      |   0      | Chassis
Sys-3   | Fan OK      |   0      | Chassis

0 / 3 Fans in Failure State
0 / 3 Fans have been in Failure State

VSF-Member  4

  Num   | State       | Failures | Location
--------+-------------+----------+----------
Sys-1   | Fan OK      |   0      | Chassis
Sys-2   | Fan OK      |   0      | Chassis

0 / 2 Fans in Failure State
0 / 2 Fans have been in Failure State

VSF-Member  5

  Num   | State       | Failures | Location
--------+-------------+----------+----------
Sys-1   | Fan OK      |   0      | Chassis
Sys-2   | Fan OK      |   0      | Chassis
Sys-3   | Fan OK      |   0      | Chassis

0 / 3 Fans in Failure State
0 / 3 Fans have been in Failure State

VSF-Member  6

  Num   | State       | Failures | Location
--------+-------------+----------+----------
Sys-1   | Fan OK      |   0      | Chassis

0 / 1 Fans in Failure State
0 / 1 Fans have been in Failure State

VSF-Member  7
```

```
  Num   | State       | Failures | Location
-------+-------------+----------+----------
Sys-1   | Fan OK      |   0      | Chassis
Sys-2   | Fan OK      |   0      | Chassis

0 / 2 Fans in Failure State
0 / 2 Fans have been in Failure State

VSF-Member  8

  Num   | State       | Failures | Location
-------+-------------+----------+----------
Sys-1   | Fan OK      |   0      | Chassis

0 / 1 Fans in Failure State
0 / 1 Fans have been in Failure State
```

show system chassislocate

Syntax

```
show system chassislocate
```

Description

Displays the current status of the `chassislocate` settings.

Display locator LED status

```
Locator LED Status
          Current    Time
Member    State      Remaining  Configuration
------    -------    ---------  -------------
1         blink      00:27:05   blink 30 at startup
2         on         01:05:27
3         off
```

show system power-supply

Syntax

```
show system power-supply [detailed | fahrenheit]
```

Description

Shows power supply information in either full detail or full detail in Fahrenheit only. Default temperature is displayed in degrees Celsius.

Command context

```
manager and operator
```

Parameters

`detailed`

Shows detailed switch power supply sensor information.

`fahrenheit`

Shows detailed switch power supply sensor information with temperatures in degrees Fahrenheit.

Usage

- The `show system power-supply detailed` command shows detailed information for the local power supplies only.
- The `show system power-supply detailed` command shows detailed information for power supplies in the `powered` state only.

Examples

Use of the command `show system power-supply` shows the power supply status for all active switches.

```
Switch# show system power-supply

Power Supply Status:

 PS#    Model      Serial          State          AC/DC  + V    Wattage
 ---- --------- ------------ ----------------- -------------- ---------
   1   J9828A    IN30G4D009   Powered           AC 120V/240V      700
   2   J9828A    IN30G4D00C   Powered           AC 120V/240V      700
   3                          Not Present       -- ---------        0
   4   J9830A    IN43G4G05H   Powered           AC 120V/240V     2750

   3 /  4 supply bays delivering power.
   Total power: 4150 W
```

Use of the command `show system power-supply detailed` shows the power supply status in detail for all active switches.

```
Switch# show system power-supply detailed

 Status and Counters - Power Supply Detailed Information

  PS# Model   Serial      State        Status
  --- ------- ----------- ------------ -------------------------------------
  1   J9828A  IN30G4D009  Powered      AC Power Consumption : 44 Watts
                                       AC MAIN Voltage      : 209 Volts
                                       Power Supplied       : 31 Watts
                                       Power Capacity       : 700 Watts
                                       Inlet Temp (C/F)     : 27.0C/80.6F
                                       Internal Temp (C/F)  : 30.5C/86.0F
                                       Fan 1 Speed          : 1600 RPM (47%)
                                       Fan 2 Speed          : 1600 RPM (47%)

  2   J9828A  IN30G4D00C  Powered      AC Power Consumption : 46 Watts
                                       AC MAIN Voltage      : 209 Volts
                                       Power Supplied       : 21 Watts
                                       Power Capacity       : 700 Watts
                                       Inlet Temp (C/F)     : 27.7C/80.6F
                                       Internal Temp (C/F)  : 32.5C/89.6F
                                       Fan 1 Speed          : 1600 RPM (47%)
                                       Fan 2 Speed          : 1600 RPM (47%)

  3                       Not Present

  4   J9830A  IN43G4G05H  Powered      AC Power Consumption : 90 Watts
                                       AC MAIN/AUX Voltage  : 210/118 Volts
                                       Power Supplied       : 16 Watts
                                       Power Capacity       : 2750 Watts
                                       Inlet Temp (C/F)     : 30.9C/86.0F
                                       Internal Temp (C/F)  : 65.6C/149.0F
                                       Fan 1 Speed          : 2000 RPM (37%)
```

```
                                        Fan 2 Speed          : 1950 RPM (36%)



   3 /  4 supply bays delivering power.
   Currently supplying 68 W / 4150 W total power.
```

Use of the command `show system power-supply fahrenheit` shows the power supply status in Fahrenheit for all active switches.

```
Switch# show system power-supply detailed fahrenheit
Power Supply Status:
 Mem PS# Model   Serial      State        Status
 --- --- ------- ----------- ------------ -----------------------------------
 1   1   J9830A  IN5BGZ81KZ  Powered      Power Consumption   : 95 Watts
                                          AC MAIN/AUX Voltage : 118/208 Volts
                                          Inlet/Internal Temp : 85.6F/87.7F
                                          Fan 1 Speed (util)  : 1650RPM (20%)
                                          Fan 2 Speed (util)  : 1600RPM (19%)

 1   2   J9829A  IN5BGZ81KX  Powered      Power Consumption   : 51 Watts
                                          AC Input Voltage    : 208 Volts
                                          Inlet/Internal Temp : 85.6F/87.7F
                                          Fan 1 Speed (util)  : 1650RPM (20%)
                                          Fan 2 Speed (util)  : 1600RPM (19%)

 1   3   J9828A  IN5BGZ81KY  Powered      Power Consumption   : 43 Watts
                                          AC Input Voltage    : 119 Volts
                                          Inlet/Internal Temp : 85.6F/87.7F
                                          Fan 1 Speed (util)  : 1650RPM (20%)
                                          Fan 2 Speed (util)  : 1600RPM (19%)

 1   4                       Not Present

 2   1   J9830A  IN5BGZ81KZ  Powered      Power Consumption   : 95 Watts
                                          AC MAIN/AUX Voltage : 118/208 Volts
                                          Inlet/Internal Temp : 85.6F/87.7F
                                          Fan 1 Speed (util)  : 1650RPM (20%)
                                          Fan 2 Speed (util)  : 1600RPM (19%)

 2   2   J9829A  IN5BGZ81KX  Powered      Power Consumption   : 51 Watts
                                          AC Input Voltage    : 208 Volts
                                          Inlet/Internal Temp : 85.6F/87.7F
                                          Fan 1 Speed (util)  : 1650RPM (20%)
                                          Fan 2 Speed (util)  : 1600RPM (19%)

 2   3   J9828A  IN5BGZ81KY  Powered      Power Consumption   : 43 Watts
                                          AC Input Voltage    : 119 Volts
                                          Inlet/Internal Temp : 85.6F/87.7F
                                          Fan 1 Speed (util)  : 1650RPM (20%)
                                          Fan 2 Speed (util)  : 1600RPM (19%)
 2   4                       Not Present
-------------------------------------------------------------------------------
   6 / 8 supply bays delivering power.
   Total Input Power: 378 Watts
```

Use of the command `show system power-supply detailed` shows the power supply status all active switches including a nonpowered J9830A PSU.

```
switch# show system power-supply detailed

 Status and Counters - Power Supply Detailed Information

  PS# Model   Serial      State        Status
```

```
--- ------- ----------- ------------ -------------------------------------
1   J9828A  IN30G4D009  Powered      AC Power Consumption : 44 Watts
                                     AC MAIN Voltage      : 209 Volts
                                     Power Supplied       : 31 Watts
                                     Power Capacity       : 700 Watts
                                     Inlet Temp (C/F)     : 27.0C/80.6F
                                     Internal Temp (C/F)  : 30.5C/86.0F
                                     Fan 1 Speed          : 1600 RPM
                                     Fan 2 Speed          : 1600 RPM

2   J9828A  IN30G4D00C  Powered      AC Power Consumption : 46 Watts
                                     AC MAIN Voltage      : 209 Volts
                                     Power Supplied       : 21 Watts
                                     Power Capacity       : 700 Watts
                                     Inlet Temp (C/F)     : 27.7C/80.6F
                                     Internal Temp (C/F)  : 32.5C/89.6F
                                     Fan 1 Speed          : 1600 RPM
                                     Fan 2 Speed          : 1600 RPM

3                       Not Present

4   J9830A  IN43G4G05H  Aux Not Powered


 2 /  4 supply bays delivering power.
Currently supplying 68 W / 4150 W total power.
```

Use of the command `show system power-supply` shows the power supply status all active switches with power supply #2 showing permanent failure.

```
switch# show system power-supply

Power Supply Status:

 PS#    Model      Serial          State          AC/DC  + V    Wattage
 ---- --------- ------------ ----------------- -------------- ---------
   1                         Not Present       -- ---------        0
   2   J9829A    IN30G4D00C  Permanent Failure  AC 120V/240V     1100
   3   J9829A    IN30G4D00D  Powered           -- ---------       1100
   4   J9829A    IN43G4G05H  Powered           AC 120V/240V      1100

   3 /  4 supply bays delivering power.
   Total power: 3300 W
```

Table 45: *Field key for output of show system power-supply detailed*

Field	Description
AC Power Consumption	Actual power consumed from AC input
AC MAIN/AUX Voltage	Actual voltage measured on AC Input: ■ Two voltages are displayed for PS#4, as the J9830A includes two AC input IEC connectors. ■ Most power-supplies contain a single AC Input IEC connector and are labeled MAIN.
Power Supplied	Actual voltage being supplied from the power-supply to the switch for general power and PoE.
Power Capacity	The maximum power that the power-supply can provide to the switch.

Field	Description
Inlet Temp (C/F)	The thermal sensor at the inlet of the power-supply - shown in both Celsius and Fahrenheit
Internal Temp (C/F)	The thermal sensor internal to the power-supply (will vary depending upon the model) - shown in both Celsius and Fahrenheit. **NOTE:** There is no "Output Temperature Sensor" on either the 5400R or 3810M switches.
Fan Speed	Shows the current fan speed in RPM and the percent of total fan speed utilization. For PSUs that contain more than one fan, a separate line will be included for each.
Currently Supplying	A summary of the total power being supplied and the total capacity (same summary as seen on the command `show system power-supply`).

show uptime

Syntax

`show uptime [vsf member <MEMBER-ID>]`

Description

Display the elapsed time since the last boot of the specified member.

Parameters

<MEMBER-ID>

The VSF member-ID for the member command or parameter. Member ID value can be in the range of 1 to 8.

Example output

```
switch(config)# show uptime
 VSF Virtual Chassis
 35d 19h 45m

 VSF Member 1
 35d 19h 45m

 VSF Member 2
 35d 19h 45m

 VSF Member 3
 35d 19h 45m

 VSF Member 4
 35d 19h 45m

 VSF Member 5
 35d 19h 45m

 VSF Member 6
 35d 19h 45m

 VSF Member 7
 35d 19h 45m

 VSF Member 8
 35d 19h 45m
```

Support commands

copy core-dump

Copy core-dump from the specified VSF member. User can copy available core-dump file from interface module or management module.

Syntax

```
copy core-dump vsf member <MEMBER-ID><SLOT-ID> | mm-active sftp | tftp | usb | xmodem
<HOST-NAME-STR> | <IP-ADDR> | <IPV6-ADDR><FILENAME-STR>
```

Description

The VSF member-ID for the member command or parameter. Member ID value can be in the range from 1 to 8.

Parameters

<MEMBER-ID>

Specify the VSF member.

<SLOT-ID>

Copy interface module core-dump file.

copy fdr-log

Copy FDR (Flight data recorder) logs. User can either copy from management module or interface module or both.

Syntax

```
copy fdr-log vsf member <MEMBER-ID> all | mm-active sftp | tftp | usb | xmodem <HOST-
NAME-STR> | <IP-ADDR> | <IPV6-ADDR><FILENAME-STR>
```

Description

Copy FDR logs from the switch to an SFTP/TFTP server, USB, or xmodem terminal.

Parameters

<MEMBER-ID>

The VSF member-ID for the member command or parameter. Member ID value can be in the range from 1 to 8.

copy crash-log

Syntax

```
copy crash-log vsf member <MEMBER-ID> | <SLOT-ID-RANGE> | mm | sftp | tftp | usb | xmodem
sftp | tftp | usb | xmodem <HOST-NAME-STR> | <IP-ADDR> | <IPV6-ADDR><FILENAME-STR>
```

Description

Copy the switch log file.

Parameters

<MEMBER-ID>

The VSF member-ID for the member command or parameter. Member ID value can be in the range from 1 to 8.

<SLOT-ID-RANGE>

Enter the single slot identifier.

copy crash-data

Copy the crash data file of the switch.

Syntax

```
copy crash-data vsf member <MEMBER-ID><SLOT-ID-RANGE> | mm | sftp | tftp | usb | xmodem
sftp | tftp | usb | xmodem <HOST-NAME-STR> | <IP-ADDR> | <IPV6-ADDR><FILENAME-STR>
```

Description

Copy the switch crash data file.

Parameters

<MEMBER-ID>

The VSF member-ID for the member command or parameter. Member ID value can be in the range from 1 to 8.

<SLOT-ID-RANGE>

Enter the single slot identifier.

show boot-history

Syntax

```
show boot-history [vsf member <MEMBER-ID>]
```

Description

Display the system boot log for VSF.

Parameters

<MEMBER-ID>

The VSF member-ID for the member command or parameter. Member ID value can be in the range from 1 to 8.

core-dump

Enable/disable core-dump for the specified member. User can enable/disable core-dump for interface modules or management module.

Syntax

```
core-dump interfaces | management-module | vsf | tftp-server member <MEMBER-ID>
interfaces | management-module
```

Description

Enable/disable core-dump on the management module or the interface module.

Parameters

interfaces

Enable/disable core dump on all the interfaces.

management-module

Enable/disable core-dump on the management module.

tftp-server

Address of the auto TFTP server to which the files will be uploaded.

<MEMBER-ID>

The VSF member-ID for the member command or parameter. Member ID value can be in the range from 1 to 8.

erase fdr-log vsf

Erase FDR log from the specified member.

Syntax

```
erase fdr-log [vsf member <MEMBER-ID>][slot | mm-active]
```

Description

Erase the FDR log files.

Parameters

<MEMBER-ID>

The VSF member-ID for the member command or parameter. Member ID value can be in the range from 1 to 8.

copy crash-files

Syntax

```
copy crash-files vsf member <MEMBER-ID> [<SLOT-ID-RANGE> | mm-active sftp | tftp | usb |
xmodem] <HOST-NAME-STR> | <IP-ADDR> | <IPV6-ADDR><FILENAME-STR>
```

Description

Copy the switch crash files from the specific VSF member

Parameters

mm-active

Copy active management module crash files.

<MEMBER-ID>

The VSF member-ID for the member command or parameter. Member ID value can be in the range from 1 to 8.

<SLOT-ID-RANGE>

Enter single slot identifier.

Usage

```
switch(config)# copy crash-files vsf member
switch(config)# copy crash-files vsf member 1
```

VSF configuration

There are two methods to configure VSF for a switch:

- Manual configuration. See Manual configuration of a VSF on page 648.
- Automatic configuration. See Automatic configuration of a VSF fabric on page 654.

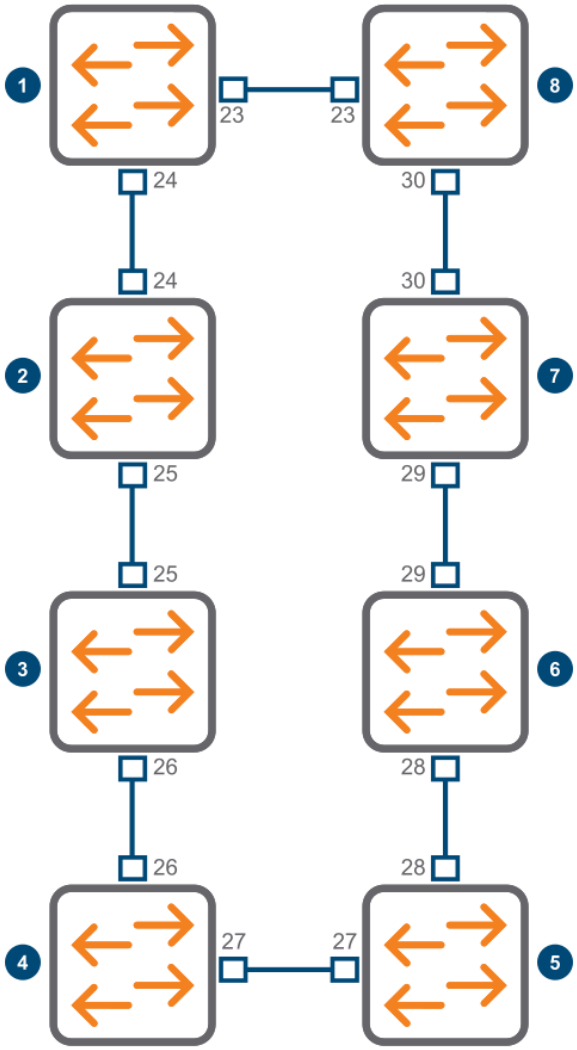
Manual configuration of a VSF

Prerequisites

Manual configuration of a VSF requires the user to individually configure every switch in the stack, and enable VSF on each switch independently. This process provides the best control for the user to configure VSF member number, priority, and VSF links.

It is recommended to have a software version greater than or equal to 16.06.XXXX on all switches, to form a stack of size greater than four members.

Figure 95 *An eight-member ring setup*



Procedure

1. To form an eight-member ring setup as shown, do not make the connections initially.

   The ports on each switch are Ethernet ports, and connecting as described will create a network loop. The ports are connected only after each device is fully configured.

2. Log in to the first device, numbered 1. This is configured as VSF stack member 1.

a. At the prompt, enter the following commands:

```
switch# configure
switch(config)# vsf member 1 priority 200
switch(config)# vsf member 1 link 1 24
All configuration on this port has been removed and port is placed in VSF
mode.
switch(config)# vsf member 1 link 2 23
All configuration on this port has been removed and port is placed in VSF
mode.
To enable VSF, the REST interface will be disabled.
This will save the current configuration and reboot the switch.
Continue (y/n)? y
```

b. The above sequence of commands will configure the switch as member 1, with priority 200. Since this switch has the highest priority configured, it becomes the Commander. The ports 23 and 24 are configured on VSF links 2 and 1 respectively.

3. Log in to the second device, numbered 2. It is configured as VSF member 2.

a. Physically connect member 2 with member 1 over the configured VSF ports, and execute the following commands.

```
switch# configure
switch(config)# vsf member 2 priority 150
switch(config)# vsf member 2 link 1 25
All configuration on this port has been removed and port is placed in VSF
mode.
switch(config)# vsf member 2 link 1 24
All configuration on this port has been removed and port is placed in VSF
mode.
To enable VSF, the REST interface will be disabled.
This will save the current configuration and reboot the switch.
Continue (y/n)? y
```

b. The preceding sequence of commands will configure the member 2 with priority 150.

4. Log in to the third and fourth devices (configured as members 3 and 4 respectively).

a. Physically connect member 3 with member 2. Enter the following commands on device 3:

```
switch# configure
switch(config)# vsf member 3 priority 100
switch(config)# vsf member 3 link 1 26
All configuration on this port has been removed and port is placed in VSF
mode.
switch(config)# vsf member 3 link 2 25
All configuration on this port has been removed and port is placed in VSF
mode.
To enable VSF, the REST interface will be disabled.
This will save the current configuration and reboot the switch.
Continue (y/n)? y
```

b. Physically connect member 4 with member 3. Enter the following commands on device 4:

```
switch# configure
switch(config)# vsf member 4 priority 100
switch(config)# vsf member 4 link 1 27
All configuration on this port has been removed and port is placed in VSF
mode.
```

```
switch(config)# vsf member 4 link 2 26
All configuration on this port has been removed and port is placed in VSF
mode.
To enable VSF, the REST interface will be disabled.
This will save the current configuration and reboot the switch.
Continue (y/n)? y
```

5. Log in to the fifth and sixth devices (configured as members 5 and 6 respectively).
   a. Physically connect member 5 with member 4. Enter the following commands on device 5:

```
switch# configure
switch(config)# vsf member 5 priority 100
switch(config)# vsf member 5 link 1 28
All configuration on this port has been removed and port is placed in VSF
mode.
switch(config)# vsf member 5 link 2 27
All configuration on this port has been removed and port is placed in VSF
mode.
To enable VSF, the REST interface will be disabled.
This will save the current configuration and reboot the switch.
Continue (y/n)? y
```

   b. Physically connect member 6 with member 5. Enter the following commands on device 6:

```
switch# configure
switch(config)# vsf member 6 priority 100
switch(config)# vsf member 6 link 1 29
All configuration on this port has been removed and port is placed in VSF
mode.
switch(config)# vsf member 6 link 2 28
All configuration on this port has been removed and port is placed in VSF
mode.
To enable VSF, the REST interface will be disabled.
This will save the current configuration and reboot the switch.
Continue (y/n)? y
```

6. Log in to the seventh and eighth devices (configured as members 7 and 8 respectively).
   a. Physically connect member 7 with member 6. Enter the following commands on device 7:

```
switch# configure
switch(config)# vsf member 7 priority 100
switch(config)# vsf member 7 link 1 30
All configuration on this port has been removed and port is placed in VSF
mode.
switch(config)# vsf member 7 link 2 29
All configuration on this port has been removed and port is placed in VSF
mode.
To enable VSF, the REST interface will be disabled.
This will save the current configuration and reboot the switch.
Continue (y/n)? y
```

   b. Physically connect member 8 with one link to member 1 and another to member 7. Enter the following commands on device 8:

```
switch# configure
switch(config)# vsf member 8 priority 100
switch(config)# vsf member 8 link 1 23
All configuration on this port has been removed and port is placed in VSF
```

```
mode.
switch(config)# vsf member 8 link 2 30
All configuration on this port has been removed and port is placed in VSF
mode.
To enable VSF, the REST interface will be disabled.
This will save the current configuration and reboot the switch.
Continue (y/n)? y
```

The remaining six members have priority set to 100. All the eight switches will be configured to use the same domain ID: 5472, which will make a single stack.

7. Connect the switches together as shown. Enable VSF on each of the eight switches by executing the `vsf enable domain 5472` command. Multiple reboots of the switches may occur since the switch roles change when connected together. To prevent this, the user can power off all switches, connect the cables, and power on together. The stack will form directly.
8. The final VSF stack configuration after the stack formation will be:

```
switch# show vsf
VSF Domain ID    : 5472
MAC Address      : b05ada-961103
VSF Topology     : Ring
VSF Status       : Active
Uptime           : 0d 2h 26m
VSF MAD          : None
VSF Port Speed   : 1G
Software Version : WC.16.03.0000x



Mbr
ID  MAC Address   Model                                  Pri Status
--- ------------ ---------------------------------------- --- ----------
  1  b05ada-961100 Aruba JL253A 2930F-24G-4SFP+ Switch    200 Commander
 *2  b05ada-9721c0 Aruba JL260A 2930F-48G-4SFP Switch     150 Standby
  3  b05ada-972200 Aruba JL254A 2930F-48G-4SFP+ Switch    100 Member
  4  b05ada-96f080 Aruba JL259A 2930F-24G-4SFP Switch     100 Member
  5  9cdc71-393440 Aruba JL253A 2930F-24G-4SFP+ Switch    100 Member
  6  b05ada-962180 Aruba JL260A 2930F-48G-4SFP Switch     100 Member
  7  b05ada-9631e0 Aruba JL254A 2930F-48G-4SFP+ Switch    100 Member
  8  b05ada-96f000 Aruba JL259A 2930F-24G-4SFP Switch     100 Member
```

It indicates an eight-member VSF stack, with domain ID 5472. The stack topology is a ring, and the stack interconnect ports are of 1G speed. The user is connected to the console of member 2.

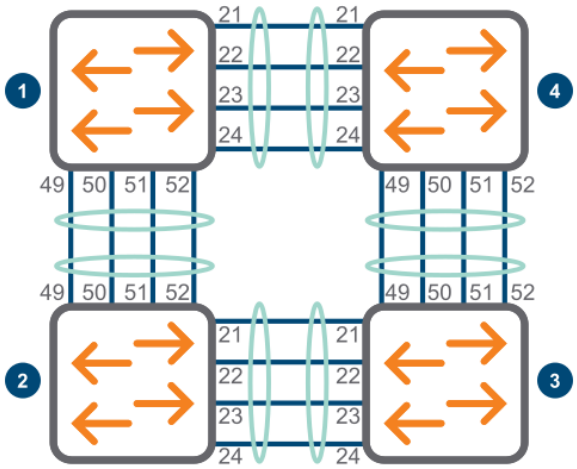
The user can alternatively add a port to a VSF link keeping it in disabled state using `vsf member 1 link 1 24 start-disabled` command. It is helpful when the user wants to keep the VSF ports disabled, make the connections, and then enable them back. However, VSF ports on each member have to be individually enabled for the stack formation.

Manual configuration with multiple ports bundled in a VSF link

In manual configuration of a switch with multiple ports bundled in a VSF link, up to eight VSF ports can be aggregated in a single VSF link. This creates a load-balanced aggregate VSF connection with redundancy.

This method is applicable for a VSF stack having more than four members too.

Figure 96 *Manual configuration with multiple ports bundled in a VSF link*



Procedure

1. Log in to the first device. This will be configured as VSF member 1. At the prompt, enter the following commands:

```
switch# configure
switch(config)# vsf member 1 priority 200
switch(config)# vsf member 1 link 1 49-52
All configuration on this port has been removed and port is placed in VSF mode.
switch(config)# vsf member 1 link 2 21-24
All configuration on this port has been removed and port is placed in VSF mode.
switch(config)# vsf enable domain 5472
To enable VSF, the REST interface will be disabled.
This will save the current configuration and reboot the switch.
Continue (y/n)? y
```

   The above sequence of commands will configure the switch as member 1, which will boot as the Commander with priority 200.

```
switch# show vsf

VSF Domain ID    : 5472
MAC Address      : b05ada-961103
VSF Topology     : No Stack Formed
VSF Status       : Active
Uptime           : 0d 3h 22m
VSF MAD          : None
VSF Port Speed   : 1G
Software Version : WC.16.03.0000x

Mbr
ID  MAC Address   Model                                  Pri Status
--- ------------ -------------------------------------- --- ---------------
*1  b05ada-961100 Aruba JL253A 2930F-24G-4SFP+ Switch    200 Commander
```

2. Log in to the second device. This will be configured as VSF member 2. At the prompt, enter the following commands:

```
switch# configure
switch(config)# vsf member 2 priority 150
switch(config)# vsf member 2 link 1 49-52
All configuration on this port has been removed and port is placed in VSF mode.
switch(config)# vsf member 2 link 2 21-24
All configuration on this port has been removed and port is placed in VSF mode.
switch(config)# vsf enable domain 5472
To enable VSF, the REST interface will be disabled.
This will save the current configuration and reboot the switch.
Continue (y/n)? y
```

The above sequence of commands will configure switch 2 as the Standby, with a priority of 150. Connect links of switch 1 and switch 2 after executing the `vsf enable domain` command. A 2-member stack will be formed.

```
switch# show vsf

VSF Domain ID    : 5472
MAC Address      : b05ada-961103
VSF Topology     : Chain
VSF Status       : Active
Uptime           : 0d 3h 22m
VSF MAD          : None
VSF Port Speed   : 1G
Software Version : WC.16.03.0000x

Mbr
ID  MAC Address   Model                                  Pri Status
--- ------------- -------------------------------------- --- ---------------
*1  b05ada-961100 Aruba JL253A 2930F-24G-4SFP+ Switch    200 Commander
 2  b05ada-9721c0 Aruba JL260A 2930F-48G-4SFP Switch     150 Standby
```

3. Log in to the third and fourth devices. These will be configured as members 3 and 4 respectively. Enter the following commands on device 3:

```
switch# configure
switch(config)# vsf member 3 priority 100
switch(config)# vsf member 3 link 1 21-24
All configuration on this port has been removed and port is placed in VSF mode.
switch(config)# vsf member 3 link 2 49-52
All configuration on this port has been removed and port is placed in VSF mode.
switch(config)# vsf enable domain 5472
To enable VSF, the REST interface will be disabled.
This will save the current configuration and reboot the switch.
Continue (y/n)? y
```

The above sequence of commands will configure switch 3 as a Member, with a priority 100. Connect the links of switch 2 and switch 3 after executing the `vsf enable domain` command. A 3-member stack will be formed.

```
switch# show vsf

VSF Domain ID    : 5472
MAC Address      : b05ada-961103
VSF Topology     : Chain
VSF Status       : Active
Uptime           : 0d 3h 22m
VSF MAD          : None
VSF Port Speed   : 1G
Software Version : WC.16.03.0000x
```

```
Mbr
ID  MAC Address   Model                                  Pri Status
--- ------------- -------------------------------------- --- ---------------
*1  b05ada-961100 Aruba JL253A 2930F-24G-4SFP+ Switch    200 Commander
 2  b05ada-9721c0 Aruba JL260A 2930F-48G-4SFP Switch     150 Standby
 3  b05ada-972200 Aruba JL254A 2930F-48G-4SFP+ Switch    100 Member
```

Enter the following commands on device 4:

```
switch# configure
switch(config)# vsf member 4 priority 100
switch(config)# vsf member 4 link 1 49-52
All configuration on this port has been removed and port is placed in VSF mode.
switch(config)# vsf member 4 link 2 21-24
All configuration on this port has been removed and port is placed in VSF mode.
switch(config)# vsf enable domain 5472
To enable VSF, the REST interface will be disabled.
This will save the current configuration and reboot the switch.
Continue (y/n)? y
```

The above sequence of commands will configure switch 4 as a Member, with a priority 100. Connect links between switch 3 and switch 4, and switch 4 and switch 1, after executing the `vsf enable domain` command on switch 4. A 4-member stack will now be formed with four ports bundled in a single VSF link.

```
switch# show vsf

VSF Domain ID    : 5472
MAC Address      : b05ada-961103
VSF Topology     : Ring
VSF Status       : Active
Uptime           : 0d 3h 22m
VSF MAD          : None
VSF Port Speed   : 1G
Software Version : WC.16.03.0000x

Mbr
ID  MAC Address   Model                                  Pri Status
--- ------------- -------------------------------------- --- ---------------
*1  b05ada-961100 Aruba JL253A 2930F-24G-4SFP+ Switch    200 Commander
 2  b05ada-9721c0 Aruba JL260A 2930F-48G-4SFP Switch     150 Standby
 3  b05ada-972200 Aruba JL254A 2930F-48G-4SFP+ Switch    100 Member
 4  b05ada-96f080 Aruba JL259A 2930F-24G-4SFP Switch     100 Member
```

4. The `show vsf link` command will display an output of VSF port state and links for each VSF member.

Automatic configuration of a VSF fabric

Automatic configuration of a VSF is simpler than the manual configuration, as it only requires the user to log in and configure one switch. The other switches automatically get their configurations from the first switch, but only if the switches are in factory default state. Automatic configuration is not supported on switches that have been previously deployed, or have had any configuration change made to them, over either CLI, web, or SNMP. A switch may be restored to factory default state by using the CLI command `erase startup-configuration` command.

The following configuration methods can be applied to a stack having more than four members too.

Automatic configuration of a VSF can be configured using two methods:

- without provisioning
- with provisioning
  - Chassis type, called loose provisioning
  - Chassis type and MAC-address, called strict provisioning

Without provisioning:

1. Do not connect the ports initially. Since the ports are Ethernet ports, connecting them in a ring topology can cause loops. Note down the J-number & MAC address of each switch. The J-number is available on the front panel of the switch while the MAC address is available on the back panel of the switch.
2. Connect to the console of the member intended to be the commander (member 1 in this example). To enable VSF on the member, execute the following commands:

```
switch# configure
switch(config)# vsf member 1 priority 200
switch(config)# vsf member 1 link 1 22
All configuration on this port has been removed and port is placed in VSF mode.
switch(config)# vsf member 1 link 2 23
All configuration on this port has been removed and port is placed in VSF mode.
switch(config)# vsf enable domain 3144
To enable VSF, the REST interface will be disabled.
This will save the current configuration and reboot the switch.
Continue (y/n)? y
```

   The preceding sequence of commands will configure the switch as member 1, with priority 200. The ports 22 and 23 are configured on VSF links 1 and 2 respectively. VSF is now enabled. The domain must be specified while enabling VSF.

3. Upon reboot, the switch is a one-member stack. Execute the `show vsf` command:

```
switch# show vsf

VSF Domain ID    : 3144
MAC Address      : b05ada-961103
VSF Topology     : No Stack Formed
VSF Status       : Active
Uptime           : 0d 3h 22m
VSF MAD          : None
VSF Port Speed   : 1G
Software Version : WC.16.03.0000x

Mbr
ID  MAC Address   Model                                  Pri Status
--- ------------ ---------------------------------------- --- ---------------
*1  b05ada-961100 Aruba JL253A 2930F-24G-4SFP+ Switch    200 Commander
```

4. Physically connect the switch with default configuration to the configured VSF links on member 1. The new switch will automatically reboot to join the stack as the Standby.

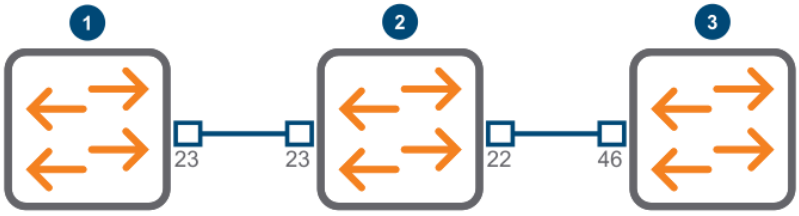
```
switch# show vsf

VSF Domain ID    : 3144
MAC Address      : b05ada-961103
VSF Topology     : Chain
VSF Status       : Active
Uptime           : 0d 3h 22m
VSF MAD          : None
VSF Port Speed   : 1G
```

```
Software Version : WC.16.03.0000x

Mbr
ID  MAC Address   Model                                  Pri Status
--- ------------- -------------------------------------- --- ---------------
*1  b05ada-961100 Aruba JL253A 2930F-24G-4SFP+ Switch    200 Commander
 2  b05ada-9721c0 Aruba JL260A 2930F-48G-4SFP Switch     150 Standby
```

5. Configure link 2 of the newly joined member and connect switch 3 with default configuration, to the link 2 of member 2 (Standby). The new member will automatically reboot and join the stack as member 3.

```
switch# show vsf

VSF Domain ID    : 3144
MAC Address      : b05ada-961103
VSF Topology     : Chain
VSF Status       : Active
Uptime           : 0d 3h 22m
VSF MAD          : None
VSF Port Speed   : 1G
Software Version : WC.16.03.0000x

Mbr
ID  MAC Address   Model                                  Pri Status
--- ------------- -------------------------------------- --- ---------------
*1  b05ada-961100 Aruba JL253A 2930F-24G-4SFP+ Switch    200 Commander
 2  b05ada-9721c0 Aruba JL260A 2930F-48G-4SFP Switch     150 Standby
 3  b05ada-972200 Aruba JL254A 2930F-48G-4SFP+ Switch    128 Member
```

6. All switches can be now interconnected and powered on.



With provisioning:

1. Do not connect the ports initially. Since the ports are Ethernet ports, connecting them in a ring topology can cause loops. Note down the J-number & MAC address of each switch. The J-number is available on the front panel of the switch while the MAC address is available on the back panel of the switch.
2. Connect to the console of the member intended to be the commander (member 1 in this example). To enable VSF on the member, execute the following commands:

```
switch# configure
switch(config)# vsf member 1 priority 200
switch(config)# vsf member 1 link 1 22
All configuration on this port has been removed and port is placed in VSF mode.
switch(config)# vsf member 1 link 2 23
All configuration on this port has been removed and port is placed in VSF mode.
switch(config)# vsf enable domain 3144
To enable VSF, the REST interface will be disabled.
This will save the current configuration and reboot the switch.
Continue (y/n)? y
```

The preceding sequence of commands will configure the switch as member 1, with priority 200. The ports 22 and 23 are configured on VSF links 1 and 2 respectively. VSF is now enabled. The domain must be specified while enabling VSF.

3. Upon reboot, the switch is a one-member stack. Execute the `show vsf` command:

```
switch# show vsf

VSF Domain ID    : 3144
MAC Address      : b05ada-961103
VSF Topology     : No Stack Formed
VSF Status       : Active
Uptime           : 0d 3h 22m
VSF MAD          : None
VSF Port Speed   : 1G
Software Version : WC.16.03.0000x

Mbr
ID  MAC Address   Model                                  Pri Status
--- ------------- -------------------------------------- --- ---------------
*1  b05ada-961100 Aruba JL253A 2930F-24G-4SFP+ Switch    200 Commander
```

4. Provision the configuration for each of the other switches. Provisioning allows the user to specify the type of each switch in the stack. Once provisioned, the user can make configuration changes on ports of the switch. When the switch joins the stack, it will automatically get any configuration made. Provision member 2:

```
switch# configure
switch(config)# vsf member 2 type JL260A mac-address b05ada-9721c0
This will save the current configuration. Continue (y/n)?  y

Warning - The link and port should be provisioned for member 2 to
join the VSF stack.

switch(config)# vsf member 2 priority 150
switch(config)# vsf member 2 link 1 2/22
All configuration on this port has been removed and port is placed in VSF mode.
switch(config)# vsf member 2 link 2 2/23
All configuration on this port has been removed and port is placed in VSF mode.
switch(config)#
```

The member number, switch type, and MAC address are specified first. Once this command is executed, the ports of the switch are now available to be configured, as 2/1, 2/2 and so on. The links of member 2 are also provisioned, using ports 2/22 and 2/23 on links 1 & 2 respectively. The provisioned switch also shows up in the stack configuration:

```
switch# show vsf

VSF Domain ID    : 3144
MAC Address      : b05ada-961103
VSF Topology     : No Stack Formed
VSF Status       : Active
Uptime           : 0d 3h 22m
VSF MAD          : None
VSF Port Speed   : 1G
Software Version : WC.16.03.0000x

Mbr
ID  MAC Address   Model                                  Pri Status
--- ------------- -------------------------------------- --- ---------------
```

```
*1  b05ada-961100 Aruba JL253A 2930F-24G-4SFP+ Switch    200 Commander
 2  b05ada-9721c0 Aruba JL260A 2930F-48G-4SFP Switch     150 Provisioned
```

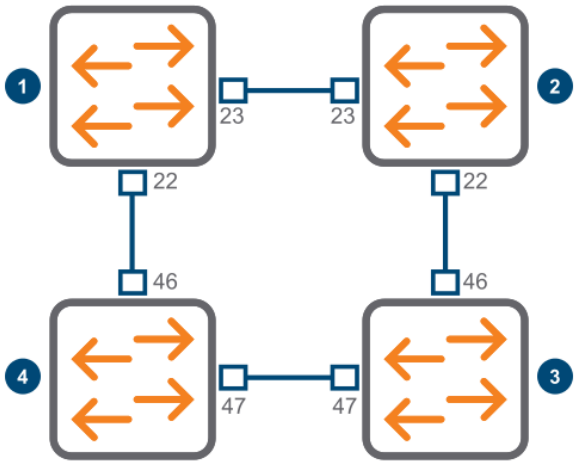
5. The same procedure is repeated to provision switches 3 & 4 too. To continue configuring and provisioning switches 3 & 4, enter the following commands on the console:

```
switch(config)# vsf member 3 type JL254A mac-address b05ada-972200
This will save the current configuration. Continue (y/n)?  y

Warning - The link and port should be provisioned for member 3 to
join the VSF stack.

switch(config)# vsf member 3 link 1 3/46
All configuration on this port has been removed and port is placed in VSF mode.
switch(config)# vsf member 3 link 2 3/47
All configuration on this port has been removed and port is placed in VSF mode.
switch(config)# vsf member 4 type JL259A mac-address b05ada-96f080
This will save the current configuration. Continue (y/n)?  y

Warning - The link and port should be provisioned for member 4 to
join the VSF stack.

switch(config)# vsf member 4 link 1 4/46
All configuration on this port has been removed and port is placed in VSF mode.
switch(config)# vsf member 4 link 2 4/47
All configuration on this port has been removed and port is placed in VSF mode.
```

The provisioned switch also shows up in the stack configuration:

```
switch# show vsf

VSF Domain ID    : 3144
MAC Address      : b05ada-961103
VSF Topology     : No Stack Formed
VSF Status       : Active
Uptime           : 0d 3h 22m
VSF MAD          : None
VSF Port Speed   : 1G
Software Version : WC.16.03.0000x

Mbr
ID  MAC Address   Model                                  Pri Status
--- ------------- -------------------------------------- --- ---------------
*1  b05ada-961100 Aruba JL253A 2930F-24G-4SFP+ Switch    200 Commander
 2  b05ada-9721c0 Aruba JL260A 2930F-48G-4SFP Switch     150 Provisioned
 3  b05ada-972200 Aruba JL254A 2930F-48G-4SFP+ Switch    128 Provisioned
 4  b05ada-96f080 Aruba JL259A 2930F-24G-4SFP Switch     128 Provisioned
```

6. All switches can be now interconnected and powered on. Connect all the switches as shown:



Procedure

1. After the connections have been made, power on switch 2 and 4. These switches will boot up normally as a standalone switch with the default configuration.
2. The VSF enabled switch will push down the VSF configuration information to the other switches over the VSF link ports.
3. Since switches 2 and 4 are the directly connected switches, they will receive their configuration first, and reboot. This procedure takes between 30 seconds to 1 minute.
4. Once switches 2 & 4 have joined the stack, power on switch 3.
5. VSF configuration will be pushed to switch 3. It will reboot last, and join the stack. The final stack configuration will now include all switches.

```
switch# show vsf

VSF Domain ID    : 3144
MAC Address      : b05ada-961103
VSF Topology     : Ring
VSF Status       : Active
Uptime           : 0d 3h 22m
VSF MAD          : None
VSF Port Speed   : 1G
Software Version : WC.16.03.0000x

Mbr
ID  MAC Address   Model                                  Pri Status
--- ------------- -------------------------------------- --- ---------------
*1  b05ada-961100 Aruba JL253A 2930F-24G-4SFP+ Switch    200 Commander
 2  b05ada-9721c0 Aruba JL260A 2930F-48G-4SFP Switch     150 Standby
 3  b05ada-972200 Aruba JL254A 2930F-48G-4SFP+ Switch    128 Member
 4  b05ada-96f080 Aruba JL259A 2930F-24G-4SFP Switch     128 Member
```

In this scenario, specifying the MAC address of each provisioned switch is optional. If the MAC address is not specified, the switch is termed a loose-provisioned switch. When the commander configures a switch connected on a VSF link port, it will find the first provisioned switch which matches the J-number, and push the configuration to the connected switch.

Port speed

The 2930 switches support only one port speed across all VSF ports in the stack. This port speed is configurable, and is initially set automatically to the highest speed capable by the first VSF port that is configured.

Users can add ports of any speed to a VSF link. Only ports which match the configured VSF port speed will link up in the VSF stack. Ports which do not match the VSF port speed will be in an error state, stating port speed mismatch. This new feature allows users to migrate a stack based on 1G interconnects to a stack based on 10G interconnects, and vice-versa, without having to reform the VSF stack from the beginning. The migration procedure from 1G interconnects to 10G interconnects is:

In a stack with 1G interconnects, the user simply adds the 10G ports to each link. These ports should also be physically interconnected, but they will not link up. Once all the configuration is complete and the interconnections are made, the user changes the port speed using the command `vsf port-speed 10g`. This triggers a reboot of the stack, and once the stack is reformed, it uses the configured 10G ports while the 1G ports will be in error state. The 1G ports can now be disconnected and unconfigured.

In the case of transceiver ports, the speed is determined by the bay type. An SFP+ bay, if configured, will set port speed to 10G. If an SFP transceiver is inserted into the bay, it will not link up and be in error state.

VSF port LED front panel

On enabling the VSF link ports, the LED flashes solid orange state in the front panel. The user can recognize and connect the VSF link ports. Solid orange LED state indicates:

- Port is reserved.
- Port is reserved but disabled.
- Post is reserved and not linked up. The port LED starts showing activity by flashing green when it links up to the partner port, and successfully forms the VSF stack.

Selecting **Usr** in the front panel displays stack member information. For example:

- Port1 LED indicates status of Stack Member 1.
- Port2 LED indicates status of Stack Member 2.

Table 46: *Mode LED states and indication*

LED States	Indication
Slow flash green	Stack member number of the displaying chassis
Fast flash green	Stack member number of the commander chassis.
On orange	Stack member is faulty or in a booting condition.
Off	Stack member does not exist in the stack.

VSF port LEDs

Table 47: *VSF port LEDs*

Global Status LED	Mode LED Usr	Port LED	Diagnostic tips
Solid green	Solid green	Solid orange	See LED 1 and LED 2 display solid green color, whereas, LED 3 displays solid orange on page 661
Slow flash orange	Solid green	Slow flash green-MemberFast flash green-CommanderSolid green-Member with good stacking connectionSlow flash orange-Member with poor stacking connection	See LED 1 displays slow flash orange, LED 2 displays solid green, whereas, LED 3 displays different colors on page 661
Slow flash orange	Solid green	Slow flash green-MemberFast flash green-CommanderSlow flash orange-Member in another fragment	See LED 1 displays slow flash orange and LED 2 displays solid green color, whereas, LED 3 displays different colors on page 662
Solid green	Solid green	Slow flash green-MemberFast flash green-Commander	See LED 1 and LED 2 display solid green, whereas, LED 3 displays different colors on page 663
Solid green	Solid green	Slow flash green-MemberFast flash green-Commander	See LED 1 and LED 2 display solid green, whereas, LED 3 displays different colors on page 663

Diagnostic tips for stacking error

LED 1 and LED 2 display solid green color, whereas, LED 3 displays solid orange

Symptom

LED 1 and LED 2 display solid green color, whereas, LED 3 is off. [1]

[1] LED 1 is Global Status LED, LED 2 is Mode LED Usr, and LED 3 is Port LED.

Cause

Stacking is disabled on the switch. The member is unreachable or booting.

Action

1. Connect a console cable to the switch and establish a console session.
2. Enter `vsf enable domain <ID>` from the CLI config context.
3. Recheck the switch LEDs:

   Stacking port LED is back to solid green. Port LED in user mode is green.

LED 1 displays slow flash orange, LED 2 displays solid green, whereas, LED 3 displays different colors

Symptom

LED 1 displays slow flash orange and LED 2 displays solid green. LED 3 displays slow flash green, fast flash green, slow flash orange, or solid green.[1]

[1] LED 1 is Global Status LED, LED 2 is Mode LED Usr, and LED 3 is Port LED.

Solution 1

Cause

The interface cable is connected to the VSF port on which the link LED is blinking.

Action

1. Make sure that the stacking cable is fully connected at both ends of the link.
2. If an equipment failure has occurred, see the LEDs on the device at the other end of the connection.

Solution 2

Cause

A stacking link failure has occurred on a link that was functioning:

- The switch at the other end of the VSF port cable has been powered off.
- The stacking feature is disabled on the switch at the other end of the VSF port cable.
- The cable is faulty.

Action

1. If this error occurred on an operational stack, it could result in changes to the stack configuration. This can include election of a new stack commander and possibly a new standby. Ensure that the correct set of supported cabling is used for installed transceivers or RJ45 fixed port.
2. See the Stack Management chapter in the 2930F *Advance Traffic Management Guide* for more information. Contact your Hewlett Packard Enterprise authorized network reseller, or use the electronic support services from Hewlett Packard Enterprise to get assistance. See www.hpe.com/support/hpesc.

LED 1 displays slow flash orange and LED 2 displays solid green color, whereas, LED 3 displays different colors

Symptom

LED 1 displays slow flash orange and LED 2 displays solid green color. LED 3 displays slow flash green, fast flash green, or slow flash orange.[1]

[1] LED 1 is Global Status LED, LED 2 is Mode LED Usr, and LED 3 is Port LED.

Cause

A stack link failure has occurred in a chain topology and multiple stack fragments have been created. Each fragment will elect a Commander, so there will be multiple switches with the Cmd LED on.

Action

1. Repair the cause of the stack link failure.
2. Reconnect the switches in their original topology so that the switches can reform the original stack.

LED 1 and LED 2 display solid green, whereas, LED 3 displays different colors

Symptom

LED 1 and LED 2 display solid green, whereas, LED 3 displays slow flash green and fast flash green.[1]

[1] LED 1 is Global Status LED, LED 2 is Mode LED Usr, and LED 3 is Port LED.

Cause

Merging two stacks that have different stack IDs which were not previously part of the same stack.

Action

1. Select one of the stacks as the one to retain.
2. Erase the stacking configuration for each switch in the other stack by issuing `stacking factory-reset` at the config level. The startup configuration for each switch is erased, including the stacking configuration.
3. Add the switches to the stack as described in the Stack Management chapter of the *Advanced Traffic Management Guide for AOS-S Switch K/KA/KB.16.01*.

Locating LED behavior in stacking system

Table 48: *Locating LED behavious in stacking system*

Switch LED	State	Meaning
Locator(blue) Standalone commander ChassisLocate On | Off | Blink	On-Blinking-Off	The Locator LED is used to identify a specific switch in the network equipment installation. The LED can be set to Solid or Blink, and for a specified number of minutes (1-1440). Default: 30 minutes. Use `chassislocate` command to control this LED.
Locator in 4 member stack Locating specific stacking Member Chassis Locate Member <No> On | Off | Blink	On-Blinking-Off	Locator LED is used to locate specific stacking member in stacking.
Locator in 4 member stack Global command to locate all the members in stack. ChassisLocate On | Off | Blink	On-Blinking-Off	Locator LED is used to locate specific stacking member in stacking.

Switch LED	State	Meaning
Locator behavior in various member states	Standby rebooting in the middle of locate LED duration.	After bootup, standby indicates Locator, if it was indicating before reboot.
	Member rebooting in the middle of locate LED duration.	After bootup, member indicates Locator, if it was indicating before reboot.
	Member removed in the middle of locate LED duration.	After member is removed, it boots up as standalone member and does not indicate Locator LED.
	Stack split and merge	Locate LED indication is restored once merged back into stack.

Unsupported XCVR behavior

When unsupported transceiver is installed or hotswapped on the VSF reserved port, it flashes slow orange, indicating that the transceiver has failed validation

Port or Link LED behavior

When VSF is reserved, it flashes solid orange, indicating port state as reserved, but moves on to flash green, showing activity when linked up successfully.

Mode LED set to PoE on VSF enabled Port

PoE is disabled by default on VSF port, hence it indicates slow flash orange on VSF port when POE mode LED is selected.

VSF restrictions

- VSF is mutually exclusive with distributed trunking, mesh, and Q-in-Q.
- VSF port restrictions:
  - Must be 10Gbps/1Gbps.
  - A VSF link can only comprise ports with the same speed; either all 10G or all 1G. A VSF port speed which does not match with the global port speed, will be in a down state. The command `show vsf link detail` will display an error message.
  - Maximum eight ports can be configured on one VSF link.
  - VSF ports must be directly connected and there should be no transit devices between members.
- In a VSF virtual chassis, flow-control is not supported between ports on different chassis across VSF links.
- A VSF stack downgrade is not allowed if we try to downgrade a 2930 VSF stack having a stack size greater than four members, to an image lesser than 16.06.
- For switches running software versions lesser than 16.06, it is recommended to first upgrade to 16.06 for supporting a stack having more than four members.

- VSF merge between a fragment running a software version 16.06 and a fragment running an image lesser than 16.06 is not recommended.
- A power outage or cable connection failures can split a stack with greater than four members, into more than two fragments (for example, 1-2-3-4, 5-6, and 7-8). To restore the stack to its previous state after addressing the issues, ensure that not more than two fragments are merged at a time. For example, merge 1-2-3-4 with 5-6, followed by merging 1-2-3-4-5-6 with 7-8.

VSF Use Cases

Use Case 1: Multiple Active Detection

What is MAD?

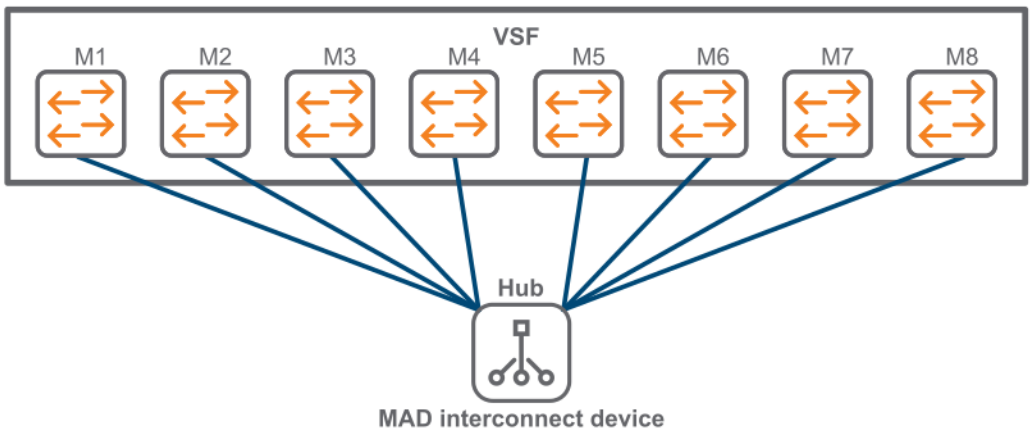
Multiple Active Detection (MAD) is a protection mechanism against the fallout of a VSF stack split. A stack split occurs when there is a connectivity failure between the two stack switches. The simplest protection against connectivity failure is to have multiple redundant ports in the VSF link.

The two switches operate in a split-brain scenario. Both split fragments cannot talk to each other and are forwarding traffic, but:

- they have the same MAC address,
- they have the same IP addresses on all VLANs, and
- depending on the deployment, they are likely to be connected to same uplink/downlink switches though a link-aggregation.

A MAD protocol must be enabled to prevent network-wide issues that a stack split can cause. MAD protocols attempt to detect the presence of the other stack fragment. If detected, the goal of MAD is to keep only one stack fragment up. The other stack fragment is brought down (all switch ports are disabled). This prevents issues caused by duplicate IP addresses and/or duplicate MAC address.

Figure 97 *MAD interconnect device*



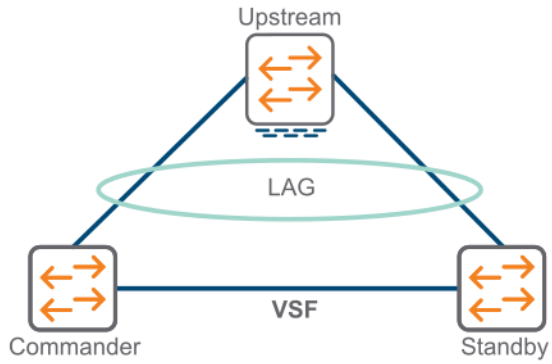
NOTE

Once a MAD decision has been accepted and the active member is determined, the member remains in the current state until the VSF fabric has been repaired.

LLDP MAD

LLDP-MAD is used to detect multiple-active VSF fragments. This protocol is not supported for more than 2-member stacking switches. When a VSF fabric existing between an active and a standby member fails, LLDP-MAD determines whether multiple active topology is in place. If LLDP-MAD is configured and a VSF split occurs, one of the VSF members will become inactive, which disables the non-VSF frontplane ports. This ensures that only one of the members will be actively forwarding traffic.

Figure 98 *LLDP-MAD*



MAD readiness check

The MAD assist device must be connected over a LACP trunk interface to the VSF device. Once you configure the IP address of a MAD assist device, the VSF switch will perform a MAD readiness check to determine: If the above three conditions are not met, MAD will fail to detect dual active fragments during a VSF split. This error will create a log message.

- If the MAD assist device is reachable.
- If a trunk interface is used to reach the device.
- If the trunk state is up.

The MAD readiness check is repeated periodically. If MAD-probe parameters have changed, an appropriate message will be logged.

VLAN MAD

MAD VLAN can be used for management. Switches which support VSF and do not have OOBM ports, use front-plane ports to detect active stack fragments upon split. One port from each member of the stack should be part of a MAD VLAN and it should be connected to MAD interconnect device in the same network. MAD VLAN can be used for the purpose of management like telnet and SSH. The front-plane ports of switches which support only VSF will be part of one VLAN called MAD VLAN.

Limitations of VLAN MAD

- Any other protocol which may alter the functionality of VLAN MAD should not be enabled on VLAN MAD.
- Proper functionality of VLAN MAD cannot be ensured when there is more than one failure.
- Only one port per member can be assigned to the VLAN MAD.
- A source port filter cannot be configured on a port that is a member of the VLAN MAD.
- VLAN MAD cannot be configured on a VLAN that has source port filter enabled member ports.
- Trunk ports cannot be assigned to the VLAN MAD.

- The default VLAN cannot also be the VLAN MAD.
- GVRP cannot be configured on VLAN MAD member ports. Use the interface level `unknown-vlans` command to disable GVRP in ports.
- MVRP cannot be enabled on VLAN MAD member ports.
- VLAN MAD cannot be configured when multicast filter is enabled for MAC address 0x00, 0x12, 0x79, 0x4a, 0xd5, and 0x82.
- LACP enabled port cannot be part of the MAD VLAN.
- BPDU filtering cannot be disabled on MAD VLAN ports.

Use Case 2: Replacing a switch in a stack

A stack maintains the MAC address of all member switches in its configuration. This is to enable the stack to reform quickly upon reboot. In the event a failed switch needs to be replaced in the stack, the replacement switch will be considered as a new switch joining the stack, and will be assigned an unused member and a default configuration.

```
Switch# show vsf
VSF Domain ID    : 164423
MAC Address      : b05ada-96f043
VSF Topology     : Chain
VSF Status       : Fragment Active
Uptime           : 0d 10h 30m
VSF MAD          : None
VSF Port Speed   : 1G
Software Version : WC.16.03.0003

Mbr
ID  MAC Address       Model                                  Pri Status
--- ----------------- -------------------------------------- --- --------------
  1  b05ada-962160     Aruba JL253A 2930F-24G-4SFP+ Switch    128 Missing
 *2  b05ada-96f040     Aruba JL253A 2930F-24G-4SFP+ Switch    250 Commander
  3  b05ada-973680     Aruba JL262A 2930F-48G-PoE+-4SFP Sw... 250 Standby
  4  b05ada-963860     Aruba JL261A 2930F-24G-PoE+-4SFP Sw... 128 Member
```

In the above stack, member 1 has failed, and needs to be replaced. A replacement switch with the same model number (JL253A) will not take on the role of the switch it replaced, because the MAC address of the replacement switch will be different from the switch that it replaces.

To enable the configuration to assimilate the replacement switch as member 1 in the stack, the MAC address needs to be cleared. Use the CLI command `vsf member 1 type JL253A`. This will retain all configuration made on member 1 and remove only the MAC address. After the command is executed, the output of `show vsf` will be as follows:

```
VSF Domain ID    : 164423
MAC Address      : b05ada-96f043
VSF Topology     : Chain
VSF Status       : Fragment Active
Uptime           : 0d 10h 34m
VSF MAD          : None
VSF Port Speed   : 1G
Software Version : WC.16.03.0003

Mbr
ID  MAC Address       Model                                  Pri Status
--- ----------------- -------------------------------------- --- --------------
  1                    Aruba JL253A 2930F-24G-4SFP+ Switch    128 Provisioned
```

```
*2  b05ada-96f040     Aruba JL253A 2930F-24G-4SFP+ Switch    250 Commander
 3  b05ada-973680     Aruba JL262A 2930F-48G-PoE+-4SFP Sw... 250 Standby
 4  b05ada-963860     Aruba JL261A 2930F-24G-PoE+-4SFP Sw... 128 Member
```

Subsequently, any switch model under JL253A, which is connected to the stack, will be assigned member 1 configuration and role.

Use Case 3: Changing VSF link speed

The sequence to change the VSF link speed is as follows:

Prerequisites

VSF requires that all ports in all VSF links in the VSF stack must be of the same speed. VSF supports two port speeds, 1G and 10G, and up to 8 ports can be added to a VSF link. There is no default port speed defined. When a VSF link is first configured, the global port speed is automatically set to the interface speed of the port on the link.

- There is no restriction on the ports which can be added to a VSF link. Ports which do not match the global port speed can be added to a VSF link, but only ports matching the configured global port speed will be up.
- On a running VSF stack, the current applicable port speed is shown as part of the `show vsf` command output.

```
switch(config)# show vsf
VSF Domain ID      : 164423
MAC Address        : b05ada-9694e3
VSF Topology       : Chain
VSF Status         : Active
Uptime             : 0d 5h 37m
VSF MAD            : None
VSF Port Speed     : 1G
Software Version   : WC.16.03.0003
```

Procedure

1. Add ports of the desired link speed to each link of the stack. Once this is done, the `show vsf link detail` output would be similar to:

```
VSF Member: 1     Link: 1

Port     State
-------- ---------------------------
1/1      Up   : Connected to port 4/1
1/25     Error: Port speed mismatch

VSF Member: 1     Link: 2

Port     State
-------- ---------------------------
1/2      Up   : Connected to port 2/2
1/26     Error: Port speed mismatch


VSF Member: 2     Link: 1

Port     State
-------- ---------------------------
2/1      Up   : Connected to port 3/1
2/25     Error: Port speed mismatch
```

2. Connect the ports of the new speed (1/25, 1/26, etc.). Since the ports are kept disabled, it is safe to make the connections at this point. The link will not come up. All links must have ports of both speeds, otherwise the link will fail to come up when the port speed is changed.
3. Execute the command indicating the target speed: `vsf port speed <1G/10G>`. This will trigger a reboot of the whole stack. On reboot, the stack will form using the ports which match the new VSF port speed. Ports which do not match will be kept disabled. The output of `show vsf link detail` after the reboot would be as follows:

```
VSF Member: 1     Link: 1

Port     State
-------- -------------------------
1/1      Error: Port speed mismatch
1/25     Up   : Connected to 4/25

VSF Member: 1     Link: 2

Port     State
-------- -------------------------
1/2      Error: Port speed mismatch
1/26     Up   : Connected to 2/26


VSF Member: 2     Link: 1

Port     State
-------- -------------------------
2/1      Error: Port speed mismatch
2/25     Up   : Connected to 3/25
```

4. Disconnect the unused ports (1/1, 1/2 etc.). This is a safety measure to avoid accidentally creating a network loop when executing the next step.
5. Unconfigure the unused ports from the VSF link, using the command `no vsf member 1 link 1 1/1` etc. Once this step is completed, the output of `show vsf link detail` would be as follows:

```
VSF Member: 1     Link: 1

Port     State
-------- --------------------
1/25     Up: Connected to 4/25

VSF Member: 1     Link: 2

Port     State
-------- --------------------
1/26     Up: Connected to 2/26


VSF Member: 2     Link: 1

Port     State
-------- --------------------
2/25     Up: Connected to 3/25
```

The ports which have been removed from VSF links can now be used as regular Ethernet ports.

Use Case 4: Adding a switch to a stack

The automatic configuration mode only works with a newly unboxed switch, or a switch which has been reset to factory default configuration using the CLI command `erase startup-configuration`. Now, connecting the switch in between the two end switches of the chain will trigger an automatic configuration download to the switch, after which it will join the stack.

In manual configuration mode, the switch to be added has to be configured to join the stack. This involves the following steps:

Prerequisites

A functional running stack can be scaled up by adding a switch to increase capacity. There will be minimal disruption of switching function during this operation. This process is similar to the VSF deployment, and can be done in either Manual or Automatic configuration mode.

The maximum number of members in a VSF stack is 8.

- The first step is to convert running stack to chain, if it is in ring topology. To increase the stack size, add a new switch to the stack, and then convert it back to a ring.
- This involves disconnecting a VSF link between two stack members. Switching functions will continue, with possible loss of some in-flight traffic.

Procedure

1. Configure new switch links, which will be connected to the two end switches of the chain.
2. Enable VSF on new switch with the same Domain ID as the stack. This will cause the switch to reboot.
3. Connect the cables to the end switches of the stack, and the stack will be formed.

   There could again be some possible loss of some in-flight traffic as a ring topology forms from the chain topology.

Use Case 5: Stack split and merge

- Upon a merge, the inactive fragment will reboot and always join the stack.
- In an equal stack split, the fragment with the commander will always be active.
- In an unequal stack split, the fragment with higher number of members will always be active.

Any topology change to an active fragment which is in a partial state will result in an undesirable behavior.

Overview

To simplify the deployment of mobility and IoT devices, Aruba switches have a mechanism to automatically detect devices based on their LLDP signatures and apply configuration to the port to which they are connected. This reduces the time needed to add, move, or change devices on the network and also eliminates potential misconfigurations on the port.

Device Profiles allow an administrator to create configuration containers for different classes of devices and associate them with certain device types. The configuration containers are stored as part of the config, but do not come into effect until a device with the right LLDP signature is connected to a port on that switch. Device profiles allow network administrators to apply port settings automatically, eliminating configuration mistakes as well as reducing the time taken to connect wired devices.

Organization-specific TLVs and subtypes that come as part of LLDP messages are used to detect and apply profiles to devices. A maximum of 16 devices can be detected and defined using Device Profiles. The following sections talk about the operational steps that need to be followed to add Mobility and IoT devices as well as features such as Rogue AP detection that can be used for mobile-first deployments with Aruba APs.

Auto configuring Aruba APs

The auto device detection and configuration detects a directly connected Aruba AP dynamically and applies predefined configurations to ports on which the Aruba AP is detected.

You can create port configuration profiles, associate them to a device type, and enable or disable a device type. One of the device types supported is `aruba-ap` and it is used to identify all the Aruba APs.

When a configured device type is connected on a port, the system automatically applies the corresponding port profile. Connected devices are identified using LLDP. When the LLDP information on the port ages out, the device profile is removed.

By default, the device profile feature is disabled. When you enable the device profile support for a device type, if no other device profile is mapped to the device type, the default device profile `default-ap-profile` is associated with the device type. You can modify the AP default device profile configuration but you cannot delete it. The `default-ap-profile` command supports only the AP device type.

Only APs which are connected directly will be detected.

Associating a device with a profile

To associate an Aruba access point (AP) device-type to a user-defined profile, use the context `Switch (device-aruba-ap)#`. All Aruba access points use the identifier **aruba-ap**.

The `no` form of the command removes the device type association and disables the feature for the device type.

The feature is disabled by default.

device-profile name

Syntax

```
device-profile name <PROFILE-NAME> [untagged-vlan <VLAN-ID>|tagged-vlan <VLAN-LIST>|cos
<COS-VALUE>|ingress-bandwidth <Percentage>|egress-bandwidth <Percentage> |{poe-priority
{critical | high | low}speed-duplex {auto |auto-10 | auto-100 | ...}|poe-max-power
<Watts>|allow-jumbo-frames |poe-allocate-by {usage | class}]
no device-profile name <PROFILE-NAME> [untagged-vlan <VLAN-ID> |tagged-vlan <VLAN-LIST> |
cos <COS-VALUE> |ingress-bandwidth <Percentage> |egress-bandwidth <Percentage> |{poe-
priority {critical | high | low} |speed-duplex {auto |auto-10 | auto-100 | ...} |poe-max-
power <Watts> |allow-jumbo-frames |poe-allocate-by {usage | class}]
```

Description

This command is used to create a user-defined profile. A profile is a named collection of port settings applied as a group. You can modify the default profile, `default-ap-profile`, but you cannot delete it. You can create four additional profiles.

The `no` form of the command removes the user-defined profiles.

The `default-ap-profile` has the following values:

- `untagged-vlan`: 1
- `tagged-vlan`: None
- `ingress-bandwidth`: 100
- `egress-bandwidth`: 100
- `cos`: 0
- `speed-duplex`: auto
- `poe-max-power`: class/LLDP
- `poe-priority`: critical
- `allow-jumbo-frames`: Disabled
- `poe-allocate-by`: class

You can modify these parameters. For example, you can execute `no untagged-vlan` to create a device profile with tagged only ports.

Parameters

`name`

Specifies the name of the profile to be configured. The profile names can be at most 32 characters long.

`cos`

The Class of Service (CoS) priority for traffic from the device.

`untagged-vlan`

The port is an untagged member of specified VLAN.

`tagged-vlan`

The port is a tagged member of the specified VLANs.

`allow-tunneled node`

Configuration to allow Tunneled Node when device profile is applied on port.

ingress-bandwidth

The ingress maximum bandwidth for the device port.

egress-bandwidth

The egress maximum bandwidth for the device port.

poe-priority

The PoE priority for the device port.

speed-duplex

The speed and duplex for the device port.

poe-max-power

The maximum PoE power for the device port. The value is set based on PD Class detection and/or LLDP negotiation. `poe-max-power` will have class appropriate value depending on the class of your AP. (Example: class4 = 25.5W, class 3=13W, class2=6.49W, class1=3.84W, class0=13W)

poe-allocate-by

Configuration of the PoE allocation type for the device port. This value can be `usage` or `class`. The default value is `class`.

Use PoE allocation type as `usage` with caution, as it might lead to a state where sufficient power is not delivered to connected devices, when the power requirement gradually increases.

Restrictions

- You can modify the configuration parameters of the default profile, `default-ap-profile`, but you cannot delete it or change its name.
- The profile configuration is only applicable to access points.

device-profile type

From within the configure context:

Syntax

```
device-profile type <DEVICE> [associate <PROFILE-NAME> | enable | disable ]
```

Description

This command specifies an approved device type in order to configure and attach a profile to it. The profile's configuration is applied to any port where a device of this type is connected.

Approved device types

aruba-ap

Aruba access point device.

arubaos-switch

AOS-S switch

Parameters

From within the **device-aruba-ap** context

associate *<PROFILE-NAME>*

Associated the specified device type by profile name.

enable

Enables the automatic profile association.

disable

Disables the automatic profile association.

Usage

```
no device-profile type <DEVICE> [associate <PROFILE-NAME> |enable | disable
```

The device types supported are `aruba-ap` and `arubaos-switch`.

device-profile type device-name

Syntax

```
device-profile type [aruba-ap | aruba-switch | scs-wan-cpe |
device-name <DEVICE-NAME> associate <PROFILE-NAME> | enable | disable]

no device-profile type [aruba-ap | aruba-switch | scs-wan-cpe |
device-name <DEVICE-NAME> associate <PROFILE-NAME> | enable | disable]
```

Description

Associates the device profile with the type of device by identity.

The `no` form of this command removes the device profile from the device type.

Command context

```
config
```

Parameters

`associate <PROFILE-NAME>`

Selects the profile name associated with the device-type.

`enable`

Selects the profile of the device being enabled.

`disable`

Selects the profile of the device being disabled.

Usage

- The command `device-profile type aruba-ap enable` enables profile for Aruba-AP.
- Device Name is defined the same as Device Identity.

show device-profile

Within the configure context:

Syntax

```
show device-profile
```

Description

Show device profile configuration and status.

config

Show the device profile configuration details for a single, or all, profiles.

status

Show currently applied device profiles.

Usage

```
show device-profile config <PROFILE-NAME>
show device-profile status
```

show device-profile config

```
Switch# Show device-profile config
Device Profile Configuration

  Configuration for device-profile : default-ap-profile
  untagged-vlan      : 1
  tagged-vlan        : None
  ingress-bandwidth  : 100%
  egress-bandwidth   : 100%
  cos                : None
  speed-duplex       : auto
  poe-max-power      : Class/LLDP
  poe-priority       : critical
  allow-jumbo-frames : Disabled
  allow-tunneled-node: Enabled
  poe-allocate-by    : class
```

show device-profile config profile1

```
Switch(device-profile)# show device-p config test

 Device Profile Configuration

 Configuration for device-profile : profile1
  untagged-vlan      : 1
  tagged-vlan        : None
  ingress-bandwidth  : 100%
  egress-bandwidth   : 100%
  cos                : None
  speed-duplex       : auto
  poe-max-power      : Class/LLDP
  poe-priority       : critical
  allow-jumbo-frames : Disabled
  allow-tunneled-node: Enabled
  poe-allocate-by    : class
```

show command device-profile status

Syntax

```
show device-profile [config | status]
```

Description

Displays the device-profile configuration or device-profile status.

Parameters

config

Show device profile configuration details for a single profile or all profiles.

status

Show currently applied device profiles status.

show device-profile status

```
Switch# show device-profile status

 Device Profile Status
  Port          Device Type      Applied Device Profile
  ----          -----------      ----------------------
  5             aruba-ap         profile1
  10            aruba-ap         profile1
```

show device-profile config

Syntax

```
show device-profile config
```

Description

Shows the device profile configuration.

Command context

```
config
```

Examples

Use the command `show device-profile config` to display the device profile configuration.

```
switch(config)# show device-profile config

 Device Profile Configuration

 Configuration for device-profile : default-ap-profile
  untagged-vlan      : 1
  tagged-vlan        : None
  ingress-bandwidth  : 100%
  egress-bandwidth   : 100%
  cos                : None
  speed-duplex       : auto
  poe-max-power      : Class/LLDP
  poe-priority       : critical
  allow-jumbo-frames : Disabled
  allow-tunneled-node: Enabled
  poe-allocate-by    : class

 Configuration for device-profile : test
  untagged-vlan      : 1
  tagged-vlan        : None
  ingress-bandwidth  : 100%
  egress-bandwidth   : 100%
  cos                : None
  speed-duplex       : auto
  poe-max-power      : Class/LLDP
  poe-priority       : critical
  allow-jumbo-frames : Disabled
  allow-tunneled-node: Enabled
  poe-allocate-by    : class
```

```
Configuration for device-profile : default-aos-profile
 untagged-vlan      : 1
 tagged-vlan        : None
 ingress-bandwidth  : 100%
 egress-bandwidth   : 100%
 cos                : None
 speed-duplex       : auto
 poe-max-power      : Class/LLDP
 poe-priority       : critical
 allow-jumbo-frames : Disabled
 allow-tunneled-node: Enabled
 poe-allocate-by    : class

Configuration for device-profile : default-scs-profile
 untagged-vlan      : 1
 tagged-vlan        : None
 ingress-bandwidth  : 100%
 egress-bandwidth   : 100%
 cos                : None
 speed-duplex       : auto
 poe-max-power      : Class/LLDP
 poe-priority       : critical
 allow-jumbo-frames : Disabled
 allow-tunneled-node: Enabled
 poe-allocate-by    : class


Configuration for device-profile : default-device-profile
 untagged-vlan      : 1
 tagged-vlan        : None
 ingress-bandwidth  : 100%
 egress-bandwidth   : 100%
 cos                : None
 speed-duplex       : auto
 poe-max-power      : Class/LLDP
 poe-priority       : critical
 allow-jumbo-frames : Disabled
 allow-tunneled-node: Enabled
 poe-allocate-by    : class


Device Profile Association

 Device Type   : aruba-ap
 Profile Name  : default-ap-profile
 Device Status : Disabled

 Device Type   : aruba-switch
 Profile Name  : default-aos-profile
 Device Status : Disabled

 Device Type   : scs-wan-cpe
 Profile Name  : default-scs-profile
 Device Status : Disabled
```

show device-profile status

Syntax

```
show device-profile status
```

Description

Shows the profile status of the device.

Command context

`config`

Example

Use the `show decive-profile status` command to view status.

```
switch(confg)# show device-profile status
Port     Device-type          Applied device profile
 -------- -------------------- ----------------------
 A1             <device-name>           abc
```

Default AP Profile

Creates a user-defined profile.

The profile name is a valid character string with the maximum permissible length of 32. The default profile is named `default-ap-profile` and cannot be modified.

The default configuration parameters may be modified using the command `device-<PROFILE NAME> default-ap-profile`. Up to four different profiles may be configured.

The `no` command removes the user-defined profiles.

allow-jumbo-frames

Syntax

`allow-jumbo-frames`

Description

Configure jumbo frame support for the device port. Jumbo frames are not enabled by default.

Auto configuring IoT Devices

Wired IoT devices can also be automatically configured using device profiles. Since the market for IoT devices is vast, with several hundred manufacturers and thousands of devices, instead of hardcoding the LLDP signatures, Aruba switches provide a way for an administrator to create a device type for the IoT devices in their deployment. By associating the custom device type that they create with a device profile, users can leverage the power profiles not only for Aruba devices but also for other manufacturers. The requirement for automatic detection of IoT devices is that they should support LLDP.

Creating a device identity and associating a device type

Procedure

1. Create a device identity using the command:

   ```
   switch# device-identiy name <DEVICE-NAME>
   ```

2. Aruba switches detect devices automatically using LLDP. Configure one of the following TLV values in LLDP packet to identify a device:
   - OUI (Type 127): The Organizationally Unique Identifier (OUI) is a 24-bit globally unique assigned number used to identify LLDP device. The default OUI 000000 indicates that device-identity will not use LLDP to identify device.

```
switch(config)# device-identity name <DEVICE-NAME> lldp oui <MAC-OUI> sub-type
<SUBTYPE>
```

- System Name (Type 5): The system name field is an alpha-numeric string that indicates the assigned name of the system. The maximum supported length is 128 characters.

```
switch(config)# device-identity name <DEVICE-NAME> lldp sys-name <SYSTEM-NAME>
```

- System Description (Type 6): The system description field is an alpha-numeric string that is a textual description of the network entity. The maximum supported length is 128 characters.

```
switch(config)# device-identity name <DEVICE-NAME> lldp sys-desc <SYSTEM-
DESCRIPTION>
```

Examples:

To add new device on switch:

```
switch(config)# device-identity name ArubaOUI lldp oui 000b86 sub-type 2
```

To remove device from switch:

```
switch(config)# no device-identity name ArubaOUI
```

To configure system name on switch:

```
switch(config)# device-identity name ArubaName lldp sys-name Aruba
```

To configure system description on switch:

```
switch(config)# device-identity name ArubaDesc lldp sys-desc "Aruba Cloud
Managed Device"
```

The order of precedence of TLV used to detect a device is as follows:

- Hardcoded Aruba OUI
- System Name (type 5)
- System Description (type 6)
- MAC OUI (type 127)

A case-insensitive substring match is carried out on the received LLDP TLV value for system name and description to identify a device. One or more device identities can be associated with a single device profile.

Configuring a TLV value to a device identity will overwrite the previous value.

3. Show device identity configuration:

```
switch(config)# show device-identity lldp

Device Identity Configuration

 Index  Device name            Oui        Subtype
 ------ ---------------------- ---------- -------
 1      ArubaOUI               000b86     2

Configuration With System Name and System Description TLV

 Index        : 2
```

```
Device Name  : ArubaName
TLV Type     : System Name
TLV Value    : Aruba

Index        : 3
Device Name  : ArubaDesc
TLV Type     : System Description
TLV Value    : Aruba Cloud Managed Device
```

The maximum devices that can be configured using `device-identity` are 16. The maximum devices that can be associated using `device-profile` are 19. The maximum profiles that can be created using `device-profile` are 17.

show device-identity

Syntax

```
show device-identity
```

Description

Specify name of the device to be discovered.

Example

```
device-identity name avayaPhone lldp oui 00096e sub-type 1

switch(device-profile)# show device-identity

 Device Identity Configuration

 Index  Device name            Protocol
 ------ ---------------------- --------------
 1      avayaPhone             LLDP
 2      aruba                  LLDP
 3      wireless               LLDP

switch(device-profile)# show device-identity  lldp

 Device Identity Configuration

 Index  Device name            Oui        Subtype
 ------ ---------------------- ---------- -------
 1      avayaPhone             00096e     1

 Configuration With System Name and System Description TLV

 Index        : 2
 Device Name  : Aruba2
 TLV Type     : System Description
 TLV Value    : Cloud

 Index        : 3
 Device Name  : Aruba1-Device
 TLV Type     : System Name
 TLV Value    : Aruba1
```

device-profile type-device associate

From within the configure context:

Syntax

```
device-profile type-device <DEVICE_NAME> [associate <PROFILE-NAME> | enable | disable ]
```

Description

Specify device name defined in device-identity in order to configure and attach a profile to it. Device identity uses discovery protocol like LLDP to identify device. LLDP makes use of OUI and sub type of organizational specific TLV type 127 to detect device.

Approved device types

aruba-ap

Aruba access point device.

arubaos-switch

AOS-S switch

Parameters

<DEVICE_NAME>

Defines in device-identity.

associate ***<PROFILE-NAME>***

Associated the specified device type by profile name.

enable

Enables the automatic profile association.

disable

Disables the automatic profile association.

Usage

Use the following command to configure a device:
`device-identity name <DEVICE_NAME> lldp oui <OUI> subtype <SUBTYPE>.`

Example

```
device-p device-type avayaPhone associate avaya
```

The device types supported are `aruba-ap` and `arubaos-switch`.

show device-profile config

Syntax

```
show device-profile config
```

Description

Shows the device profile configuration.

Command context

```
config
```

Examples

Use the command `show device-profile config` to display the device profile configuration.

```
switch(device-profile)# show device-p con avaya

 Device Profile Configuration

 Configuration for device-profile : avaya
  untagged-vlan      : 1
  tagged-vlan        : None
  ingress-bandwidth  : 100%
  egress-bandwidth   : 100%
  cos                : None
  speed-duplex       : auto
  poe-max-power      : Class/LLDP
  poe-priority       : critical
  allow-jumbo-frames : Disabled
  allow-tunneled-node: Enabled
  poe-allocate-by    : class
```

show device-profile status

Syntax

```
show device-profile [config | status]
```

Description

Displays the device-profile configuration or device-profile status.

Parameters

config

Show device profile configuration details for a single profile or all profiles.

status

Show currently applied device profiles status.

show device-profile status

```
Switch# show device-profile status

Device Profile Status

              Port     Device-type          Applied device profile
              -------- -------------------- --------------------------
              A2        avayaPhone          avaya
```

Support for Aruba device types

The following Aruba device types are supported:

- Aruba-AP
- AOS-S switch
- Any device that can be defined using LLDP OUI and subtype in the switch

Isolating Rogue APs

One of the important features to turn on in a mobile-first deployment is the ability of the switches to detect and quarantine rogue access points. Administrators would like to prevent unauthorized access to their networks

and a rogue AP can open up the network to unwanted users and traffic.

The Rogue AP Isolation feature detects and blocks any unauthorized APs in the network. You can either log or block the rogue device. If the action requested is to log the rogue device, the MAC address of the rogue device is logged in the system logs (RMON). If the action is to block the rogue device, the traffic to and from the MAC address of the rogue device is blocked. The MAC is also logged in the system log.

When an Aruba AP detects a rogue AP on the network, it sends out the MAC address of the AP as well as the MAC of the clients connected to the AP to the switch using the AOS-S switch proprietary LLDP TLV protocol. The switch then adds a rule in its hardware table to block all the traffic originating from the rogue AP's MAC address.

The `rogue-ap-isolation` command configures the rogue AP isolation for the switch and gives the option to enable or disable the rogue AP isolation feature. The `rogue-ap-isolation action` command gives you the ability to block the traffic to or from the rogue device or log the MAC of the rogue device. When the action is set to block, the rogue MAC is logged as well. By default, the action is set to block.

The `rogue-ap-isolation whitelist` command lets you add devices detected as possible rogue APs to the whitelist. A maximum of 128 MAC addresses are supported for the whitelist.

The `clear rogue-aps` command clears the detected rogue AP device MAC address.

Using the Rogue AP Isolation feature

1. Check the feature state:

```
switch# show rogue-ap-isolation

 Rogue AP Isolation

  Rogue AP Status : Disabled
  Rogue AP Action : Block

  Rogue MAC Address Neighbour MAC Address
  ----------------- --------------------
```

2. Enable the feature:

```
switch# rogue-ap-isolation enable
switch# show rogue-ap-isolation

 Rogue AP Isolation

  Rogue AP Status : Enabled
  Rogue AP Action : Block

  Rogue MAC Address Neighbour MAC Address
  ----------------- --------------------
```

3. Change the action type from block to log:

```
switch# rogue-ap-isolation action log
switch# show rogue-ap-isolation

 Rogue AP Isolation

  Rogue AP Status : Enabled
  Rogue AP Action : Log
```

```
 Rogue MAC Address Neighbour MAC Address
 ----------------- --------------------
```

4. List the current whitelist entries:

```
switch# show rogue-ap-isolation whitelist

Rogue AP Whitelist Configuration

 Rogue AP MAC
 ------------------
```

5. Add a new whitelist entry:

```
switch# rogue-ap-isolation whitelist 005056-00326a
switch# show rogue-ap-isolation whitelist

Rogue AP Whitelist Configuration

 Rogue AP MAC
 ------------------
 00:50:56:00:32:6a
```

rogue-ap-isolation

syntax

```
rogue-ap-isolation {enable | disable}
```

Description

Configures the rogue AP isolation for the switch.

Parameters

`enable`

Enables the rogue AP isolation.

`disable`

Disables the rogue AP isolation.

rogue-ap-isolation action

syntax

```
rogue-ap-isolation action {log | block}
```

Description

Configures the action to take for the rogue AP packets. This function is disabled by default.

Parameters

`action`

Configure the action to take for rogue AP packets. By default, the rogue AP packets are blocked.

`log`

Logs traffic to or from any rogue access points.

block

Blocks and logs traffic to or from any rogue access points.

rogue-ap-isolation whitelist

syntax

```
no rogue-ap-isolation whitelist <MAC-ADDRESS>
```

Description

Configures the rogue AP Whitelist MAC addresses for the switch. Use this command to add to the whitelist the MAC addresses of approved access points or MAC addresses of clients connected to the rogue access points. These approved access points will not be added to the rogue AP list even if they are reported as rogue devices.

Parameters

MAC-ADDRESS

Specifies the MAC address of the device to be moved from the rogue AP list to the whitelist.

no

Removes the MAC address individually by specifying the MAC.

Restrictions

You can add a maximum of 128 MAC addresses to the whitelist.

clear rogue-ap-isolation

syntax

```
clear rogue-ap-isolation { <MAC-ADDRESS> | all }
```

Description

Removes the MAC addresses from the rogue AP list.

Parameters

MAC-ADDRESS

Specifies the MAC address of the device to be moved from the rogue AP list.

all

Clears all MAC addresses from the rogue AP list.

Restrictions

The MAC addresses cleared using this option will be added back to the rogue list under the following cases:

1. The LLDP administrator status of the port on which the AP that reported the MAC is disabled and enabled back.
2. The data that is in the rogue AP TLV sent from the AP that informed the rogue MAC has changed.
3. To permanently ignore a MAC from being detected as rogue, add it to the whitelist.

Feature Interactions

L3 MAC

The Rogue AP isolation feature will not block a MAC configured as an IP receive MAC address on a VLAN interface. This event will be logged in RMON if such MACs are detected as rogue.

Conversely, any MAC already blocked by Rogue AP isolation will not be allowed to be configured as an IP receive MAC address of a VLAN interface.

For example:

```
switch# vlan 1 ip-recv-mac-address 247703-3effbb
Cannot add an entry for the MAC address 247703-3effbb because it is already
blocked by rogue-ap-isolation.
```

Limitations

- You can add a maximum of 128 MAC addresses to the whitelist.
- When a MAC is already authorized by any of the port security features such as LMA, WMA, or 802.1X, the MAC is logged but you cannot block it using the `rogue-ap-isolation` feature. A RMON event is logged to notify the user.
- When a MAC is already configured as an IP received MAC of a VLAN interface, the MAC is logged but you cannot block it by using the `rogue-ap-isolation` feature. A RMON event is logged to notify the user.
- When a MAC is already locked out via lockout-mac or locked down using the `static-mac` configuration, the MAC is logged but you cannot block it using the `rogue-ap-isolation` feature. A RMON event is logged to notify the user.
- The number of rogue MACs supported on a switch is a function of the value of `max-vlans` at boot time. Since the resources are shared with the `lockout-mac` feature, the scale is dependent on how many lockout addresses have been configured on the switch using the `lockout-mac` feature. The following table lists the scale when there are no lockout addresses configured on the switch:

Max VLAN	Supported MACs
0 < VLAN <= 8	200
8 < VLAN <= 16	100
16 < VLAN <= 256	64
256 < VLAN <= 1024	16
1024 < VLAN <= 2048	8
2048 < VLAN <= 4094	4

The switch will create an RMON log entry and the rogue MAC will be ignored when the limit is reached.

If the `max-vlans` value is changed to a different value, the scale of rogue MACs supported will not change until the next reboot.

Troubleshooting

Switch does not detect the rogue AP TLVs

Symptom

The switch does not detect the rogue AP TLVs that could be sent from the neighboring device.

Cause

The LLDP administrator status of a port is moved from `txOnly` to `tx_rx` or `rx_only` within 120 seconds of the previous state change to `txOnly`.

Action

1. Wait for 120 seconds before moving from the state `txOnly` to the state `tx_rx` or `rx_only`.
2. Move the administrator status to `disable` and then back to `tx_rx` or `rx_only`.

Show commands

Use the following show commands to view the various configurations and status.

Command	Description
`show rogue-ap-isolation`	Shows the following information: ■ The status of the feature: enabled or disabled. ■ The current action type for the rogue MACs detected. ■ The list of MAC addresses detected as rogue and the MAC address of the AP that reported them.
`show rogue-ap-isolation whitelist`	Shows the rogue AP whitelist configuration.

Requirements

Only APs directly connected to the switch will be detected.

Limitations

- Only one device type is supported, `aruba-ap`, and it is used to identify all the Aruba APs.
- You can modify the configuration parameters of the default profile, `default-ap-profile`, but you cannot delete it or change its name.
- If the port was part of any protocol VLANs prior to the device profile application, those VLANs will not be removed while applying the device profile.
- The egress-bandwidth is only supported for devices running on:
  - Aruba 2930F Switch Series
  - Aruba 2930M Switch Series
- Enabling jumbo frame support in a profile affects other ports with different profiles. When a profile has

jumbo frames enabled and is applied to any port, all other ports that are members of any VLAN listed in the profile will also have jumbo frame support.

Feature Interactions

Profile Manager and 802.1X

Profile Manager interoperates with RADIUS when it is working in the client mode. When a port is blocked due to 802.1X authentication failure, the LLDP packets cannot come in on that port. Therefore, the Aruba AP cannot be detected and the device profile cannot be applied. When the port gets authenticated, the LLDP packets comes in, the AP is detected, and the device profile is applied.

You must ensure that the RADIUS server will not supply additional configuration such as VLAN or CoS during the 802.1X authentication as they will conflict with the configuration applied by the Profile Manager. If the RADIUS server supplies any such configurations to a port, the device profile will not be applied on such ports.

Profile Manager and LMA/WMA/MAC-AUTH

If either LMA, WMA, or MAC-AUTH is enabled on an interface, all the MAC addresses reaching the port must be authenticated. If LMA, WMA, or MAC-AUTH is configured on an interface, the user can have more granular control and does not need the device profile configuration. Therefore, the device profile will not be applied on such interface.

Profile manager and Private VLANs

When the device profile is applied, a check is performed to verify if the VLAN addition violates any PVLAN requirements. The following PVLAN related checks are done before applying the VLANs configured in the device profile to an interface:

- A port can be a member of only one VLAN from a given PVLAN instance.
- A promiscuous port cannot be a member of a secondary VLAN.

MAC lockout and lockdown

The Rogue AP isolation feature uses the MAC lockout feature to block MACs in hardware. Therefore, any MAC blocked with the Rogue AP isolation feature cannot be added with the `lockout-mac` or `static-mac` command if the action type is set to `block`.

For example:

```
switch# lockout-mac 247703-7a8950
Cannot add the entry for the MAC address 247703-7a8950 because it is already
blocked by rogue-ap-isolation.
```

```
switch# static-mac 247703-7a8950 vlan 1 interface 1
Cannot add the entry for the MAC address 247703-7a8950 because it is already
blocked by rogue-ap-isolation.
```

Similarly, any MAC that was added with the `lockout-mac` or `static-mac` command and that is being detected as rogue will be logged, but not blocked in hardware as it already is set to block. If the MAC is removed from `lockout-mac` or `static-mac` but is still in the rogue device list, it will be blocked back in hardware if the action type is `block`.

LMA/WMA/802.1X/Port-Security

Any configuration using LMA, WMA, 802.1X, or Port-Security will not be blocked if the Rogue AP isolation feature is enabled. All these features act only when a packet with the said MAC is received on a port.

If `rogue-ap-isolation` blocks a MAC before it is configured to be authorized, packets from such MACs will be dropped until one of the following happens:

- Rogue action is changed to LOG.
- Rogue-AP isolation feature is disabled.
- The MAC is not detected as rogue anymore.
- LLDP is disabled on the port (or globally).

Once a MAC has been authorized by one of these features, it will not be blocked by Rogue AP isolation. A RMON will be logged to indicate the failure to block.

The Rogue AP module will retry to block any such MACs periodically. In the event of the MAC no longer being authorized, Rogue AP isolation will block the MAC again. No RMON is logged to indicate this event.

Troubleshooting

Dynamic configuration not displayed when using “show running-config”

Symptom

The `show running-config` command does not display the dynamic configuration applied through the device profile.

Cause

The `show running-config` command shows only the permanent user configuration and parameters configured through device profile.

Action

Use the specific `show device-profile` command to display the parameters dynamically configured through the device profile.

The show run command displays non-numerical value for untagged-vlan

Symptom

The `show run` command displays one of the following values for `untagged-vlan`:

- `no untagged-vlan`
- `untagged-vlan : None`

Cause

The `no device-profile` or the `no rogue-ap-isolation whitelist` command is executed to configure `untagged-vlan` to `0`.

Action

No action is required.

Show commands

Use the following show commands to view the various configurations and status.

Command	Description
`show device-profile`	Shows the device profile configuration and status.
`show device-profile config`	Shows the device profile configuration details for a single profile or all profiles.
`show device-profile status`	Shows currently applied device profiles.
`show run`	Shows the running configuration.

The OOBM port is available only on the 2930M Switch Series.

OOBM concepts

Management communications with a managed switch can be:

- In band—through the networked data ports of the switch
- Out of band—through a dedicated management port (or ports) separate from the data ports

Out-of-band ports have typically been serial console ports using DB-9 or specially wired 8-pin modular (RJ-style) connectors. Some recent switches have added networked OOBM ports.

OOBM operates on a "management plane" that is separate from the "data plane" used by data traffic on the switch and by in-band management traffic. That separation means that OOBM can continue to function even during periods of traffic congestion, equipment malfunction, or attacks on the network. In addition, it can provide improved switch security: a properly configured switch can limit management access to the management port only, preventing malicious attempts to gain access via the data ports.

Network OOBM typically occurs on a management network that connects multiple switches. It has the added advantage that it can be done from a central location and does not require an individual physical cable from the management station to each switch's console port.

Table 49: *Switch management ports*

	In band	Out of band	
	Networked	Directly connected	Networked
Management interface	Command line (CLI), menu, Web	Command line (CLI), menu	Command line (CLI), menu
Communication plane	Data plane	Management plane	Management plane
Connection port	Any data port	Dedicated serial or USB console port	Dedicated networked management port
Connector type	Usually RJ-45; also CX4, SFP, SFP+, and XFP	DB9 serial, serial-wired 8-pin RJ	RJ-45

	In band	Out of band	
	Networked	Directly connected	Networked
Advantages	Allows centralized management	Not affected by events on data network, shows boot sequence	Not affected by events on data network, allows centralized management, allows improved security
Disadvantages	Can be affected by events on data network; does not show boot sequence	Requires direct connection to console port (can be done via networked terminal server)	Does not show boot sequence

OOBM and switch applications

The table below shows the switch applications that are supported on the OOBM interface as well as on the data interfaces. In this list, some applications are client-only, some are server-only, and some are both.

Application	Inbound OOBM (server)	Outbound OOBM (client)	Inbound data plane (server)	Outbound data plane (client)
Telnet	yes	yes	yes	yes
SSH	yes		yes	[1]
SNMP	yes	yes	yes	yes
TFTP	yes	yes	yes	yes
HTTP	yes	[1]	yes	[1]
SNTP	[1]	yes	[1]	yes
TIMEP	[1]	yes	[1]	yes
RADIUS	[1]	yes	[1]	yes
TACACS	[1]	yes	[1]	yes
DNS	[1]	yes	[1]	yes
Syslog	[1]	yes	[1]	yes
Ping	yes	yes	yes[2]	yes
Traceroute	yes[2]	yes	yes[2]	yes

For applications that have servers, `oobm/data/both` options have been added to listen mode. There is now a `listen` keyword in the CLI commands to allow selection of those options. Default **value** is `both` for all servers.

[1]N/A = not applicable

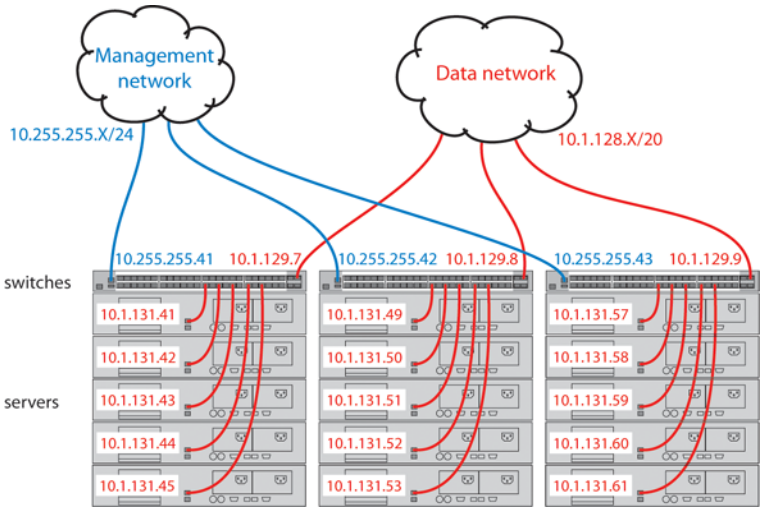
[2]***=Ping and Traceroute do not have explicit servers. Ping and Traceroute responses are sent by the host stack.

Example

In a typical data center installation, top-of-rack switches connect servers to the data network, while the management ports of those switches connect to a physically and logically separate management network. This allows network administrators to manage the switches even if operation on the data network is disrupted.

In Figure 99: Network OOBM in a data center, the switches face the hot aisle of the data center, allowing easy connection to the network ports on the backs of the servers.

Figure 99 *Network OOBM in a data center*



For even more control, the serial console ports of the switches can be connected to the management network through a serial console server (essentially, a networked serial switch), allowing the network administrators to view the CLI activity of each switch at boot time and to control the switches through the console ports (as well as through the management ports.)

OOBM Configuration

OOBM configuration commands can be issued from the global configuration context (config) or from a specific OOBM configuration context (oobm.)

Entering the OOBM configuration context from the general configuration context

Syntax

`oobm`

Enters the OOBM context from the general configuration context.

Example

```
switch(config)# oobm
Switch (oobm)#
```

Enabling and disabling OOBM

From the OOBM context:

Syntax

`enable disable`

From the general configuration context:

Syntax

`oobm enable oobm disable`

Enables or disables networked OOBM on the switch.

OOBM is not compatible with either a management VLAN or stacking. If you attempt to enable OOBM when a management VLAN is enabled or when stacking is enabled, the command will be rejected and you will receive an error message.

If an OOBM IP address exists and you disable OOBM, the OOBM IP address configuration is maintained. If you enable OOBM and there is a pre-existing OOBM IP address, it will be reinstated.

Network OOBM is enabled by default.

Examples

```
Switch (oobm)# enable
Switch (oobm)# disable
switch(config)# oobm enable
switch(config)# oobm disable
```

Enabling and disabling the OOBM port

The OOBM `interface` command enables or disables the OOBM interface (that is, the OOBM port, as opposed to the OOBM function.)

From the OOBM context:

Syntax

`interface [enable | disable]`

From the general configuration context:

Syntax

`oobm interface [enable | disable]`

Enables or disables the networked OOBM interface (port.)

Examples

```
Switch (oobm)# interface enable
switch(config)# oobm interface disable
```

Setting the OOBM port speed

The OOBM port operates at 10 Mbps or 100 Mbps, half or full duplex. These can be set explicitly or they can be automatically negotiated using the `auto` setting.

From the OOBM context:

Syntax

```
interface speed-duplex [10-half | 10-full | 100-half | 100-full | auto]
```

From the general configuration context:

Syntax

```
oobm interface speed-duplex [10-half | 10-full | 100-half | 100-full | auto]
```

Enables or disables the networked OOBM interface (port.) Available settings are:

`10-half`	10 Mbps, half-duplex
`10-full`	10-Mbps, full-duplex
`100-half`	100-Mbps, half-duplex
`100-full`	100-Mbps, full-duplex
`auto`	auto negotiate for speed and duplex

Example

```
Switch (oobm)# interface speed-duplex auto
```

Configuring an OOBM IPv4 address

Configuring an IPv4 address for the OOBM interface is similar to VLAN IP address configuration, but it is accomplished within the OOBM context.

From the OOBM context:

Syntax

```
no ip address [dhcp-bootp | ip-address/mask-length]
```

From the general configuration context:

Syntax

```
no oobm ip address [dhcp-bootp | ip-address/mask-length]
```

Configures an IPv4 address for the switch's OOBM interface.

You can configure an IPv4 address even when global OOBM is disabled; that address will become effective when OOBM is enabled.

Example

```
Switch (oobm)# ip address 10.1.1.17/24
```

Configuring an OOBM IPv4 default gateway

Configuring an IPv4 default gateway for the OOBM interface is similar to VLAN default gateway configuration, but it is accomplished within the OOBM context.

From the OOBM context:

Syntax

`no ip default-gateway ip-address`

From the general configuration context:

Syntax

`no oobm ip default-gateway ip-address`

Configures an IPv4 default gateway for the switch's OOBM interface.

Example

```
Switch (oobm)# ip default-gateway 10.1.1.1
```

Configuring an IPv6 default gateway for OOBM devices

An OOBM interface is used for managing devices from remote sites. OOBM devices must be given a default gateway responsible to maintain a network connection when these devices are placed in an IPv6 network enabled with RA suppression.

To configure and enable an IPv6 default gateway for OOBM interfaces, use the `oobm ipv6 default-gateway` command.

oobm ipv6 default-gateway

Syntax

`oobm ipv6 default-gateway <IPV6-ADDR>`

`no oobm ipv6 default-gateway`

Description

Configures the IPv6 default gateway address for OOBM interfaces.

The *no* form of the command deletes the default gateway. It is imparative that an IPv6 address is specified when the *no* form of the command is used.

Command context

`config`

Parameters

<IPV6-ADDR>

Specifies the IPv6 address when configuring the OOBM for a specific gateway.

Example

```
switch(config)# oobm ipv6 default-gateway 1001::1/64
```

oobm member ipv6 default-gateway

Syntax

`oobm member <MEMBER-ID> ipv6 default-gateway <IPV6-ADDR>no oobm member <MEMBER-ID> ipv6 default-gateway`

Description

Configures the IPv6 default gateway address for an OOBM member using their unique identifier and the IPv6 address of the default gateway.

When *no* proceeds the command, the default gateway address is deleted.

Command context

`config`

Parameters

<MEMBER-ID>

Specifies the unique member-id which allows the OOBM device access to the IPv6 default-gateway.

<IPV6-ADDR>

Specifies the IPv6 address of the default gateway for a member OOBM interface.

Example

Configuring and deleting the OOBM member from a specific IPv6 gateway.

```
switch(config)# oobm member 1 ipv6 default-gateway 1001::1

switch(config)# no oobm member 1 ipv6 default-gateway
```

IPv6 default router preferences

The command `ipv6 nd ra router-preference {high | medium | low}` provides an extension to the Neighbor Discovery Router Advertisement messages for communicating default router preferences from routers to hosts. The extension improves the ability of hosts to pick the appropriate router for an off-link destination. In network topologies, where the host has multiple routers on its Default Router list, the choice of router for an off-link destination is critical for making the communication more efficient. For example, one router may provide much better performance than another for a destination while choosing a wrong router may result in failure to communicate.

ipv6 nd ra router-preference

Syntax

```
ipv6 nd ra router-preference {low | medium | high}
no ipv6 nd ra router-preference
```

Description

Sets the router-preference configuration for communicating default router preferences from routers to hosts. Improves the ability of hosts to pick the appropriate router for an off-link destination by providing options at the operator level which set the router preference value as low, medium, or high. Depending on the router preference value set, the host receives the value as part of the IPv6 neighbor discovery router advertisement and chooses the best router for communication.

The `no` form of this command removes the router-preference configuration.

Command context

`vlan`

Parameters

`low`

Specifies the router-preference value to low.

medium

Specifies the router-preference value to medium. Medium is the default router-preference value.

high

Specifies the router-preference value to high.

Usage

- When VRRP is configured, RA messages for Virtual IP are sent with configured router-preference values.
- This command complies with RFC 4191.

Example

Default router-preferences.

```
switch(vlan-1)# ipv6 nd ra router-preference
 low                    Set the Default Router Preference to low.
 medium                 Set the Default Router Preference to medium (default).
 high                   Set the Default Router Preference to high.

switch(vlan-1)# ipv6 nd ra router-preference high
```

OOBM show commands

The `show` commands for OOBM are similar to the analogous commands for the data plane. Note that you must always include the `oobm` parameter to see the information for the OOBM interface, regardless of the context. For instance, even from the OOBM context, the `show ip` command displays the IP configuration for the data plane; to see the IP configuration of the OOBM interface, you need to use `show oobm ip`.

Showing the global OOBM and OOBM port configuration

Syntax

`show oobm`

Summarizes OOBM configuration information. This command displays the global OOBM configuration (enabled or disabled), the OOBM interface status (up or down), and the port status (enabled/disabled, duplex, and speed.)

You can issue this command from any context

Example

```
Switch# show oobm

Global Configuration
  OOBM Enabled   : Yes
  OOBM Port Type  : 10/100TX
  OOBM Interface Status : Up
  OOBM Port   : Enabled
  OOBM Port Speed  : Auto
```

Showing OOBM IP configuration

Syntax

`show oobm ip`

Summarizes the IP configuration of the OOBM interface. This command displays the status of IPv4 (enabled/disabled), the IPv4 default gateway, and the IPv4 address configured for the interface.

You can issue this command from any context.

Example

```
Switch# show oobm ip
```

Showing OOBM ARP information

Syntax

```
show oobm arp
```

Summarizes the ARP table entries for the OOBM interface.

You can issue this command from any context.

Example

```
Switch# show oobm arp
```

show oobm ipv6

Syntax

```
show oobm ipv6
```

Description

Shows the IPv6 service status for OOBM interfaces.

Command context

```
operator
```

Example

Shows the IPv6 service status for OOBM interfaces.

```
switch# show oobm ipv6

Internet (IPv6) Service for OOBM Interface


  IPv6 Status    : Enabled
  IPv6 Default Gateway : 1000::2

                                                                Address   Intf
 Member IP Config  IP Address/Prefix Length                     Status    Status
 ------ ---------- ---------------------------------------- --------- ------
 Global manual     1000::1/64                                           Up
 Global autoconfig fe80::42a8:f0ff:fe9e:901/64                          Up
```

show oobm ipv6 (for stacked switches)

Syntax

```
show oobm ipv6
```

Description

Shows the OOBM IPv6 interface for a stacked switch.

Command context

operator

Example

Shows the OOBM IPv6 interface for a stacked switch.

```
stack-switch# show oobm ipv6

 Internet (IPv6) Service for OOBM Interface


  IPv6 Status    : Enabled
  IPv6 Default Gateway : 3000::2

                                                                Address   Intf
 Member IP Config  IP Address/Prefix Length                     Status    Status
 ------ ---------- ---------------------------------------- --------- ------
 Global manual     3000::1/64                                   Active    Down
 Global autoconfig fe80::42a8:f0ff:fe9b:a581/64                 Active    Down
 1      manual     1000::1/64                                   Active    Down
 2      manual     2000::1/64                                   Active    Up
```

show oobm ipv6 member (for stacked switches)

Syntax

show oobm ipv6 member *<MEMBER-ID>*

Description

Shows the OOBM IPv6 service detail for a specific member.

Command context

operator

Example

Shows the OOBM IPv6 service detail for a specific member.

```
stack-switch# show oobm ipv6 member 2

 Internet (IPv6) Service for OOBM Interface


  IPv6 Status    : Enabled
  IPv6 Default Gateway : 1000::1

                                                                Address   Intf
 Member IP Config  IP Address/Prefix Length                     Status    Status
 ------ ---------- ---------------------------------------- --------- ------
 2      manual     1000::2/64                                   Active    Up
```

show oobm ip detail (for stacked switches)

Syntax

```
show oobm ip detail
```

Description

Shows the OOBM IP detail for a stacked switch.

Command context

```
operator
```

Example

Show the OOBM IP detail for a stacked switch.

```
stack-switch# show oobm ip detail

 Internet (IP) Service for OOBM Interface

Global Configuration

  IPv4 Status    : Enabled
  IPv6 Status    : Enabled

  IPv4 Default Gateway : 3.3.3.1
  IPv6 Default Gateway : 3000::1

 Origin     | IP Address/Prefix Length                    Status
 ---------- + ------------------------------------------- -----------
 manual     | 3.3.3.2/24                                  preferred
 manual     | 3000::2/64                                  preferred
 autoconfig | fe80::42a8:f0ff:fe9b:a581/64                preferred


Member 1

  IPv4 Status    : Enabled
  IPv6 Status    : Enabled

  IPv4 Default Gateway : 2.2.2.1
  IPv6 Default Gateway : 2000::1

 Origin     | IP Address/Prefix Length                    Status
 ---------- + ------------------------------------------- -----------
 manual     | 2.2.2.2/24                                  preferred
 manual     | 2000::2/64                                  preferred


Member 2

  IPv4 Status    : Enabled
  IPv6 Status    : Enabled

  IPv4 Default Gateway : 1.1.1.1
  IPv6 Default Gateway : 1000::1

 Origin     | IP Address/Prefix Length                    Status
 ---------- + ------------------------------------------- -----------
 manual     | 1.1.1.2/24                                  preferred
 manual     | 1000::2/64                                  preferred
```

Application server commands

Application servers (as described in OOBM and server applications in OOBM concepts on page 691 have added a `listen` keyword with `oobm|data|both` options to specify which interfaces are active.

Default value is `both` for all servers.

Syntax

```
telnet-server [listen {oobm | data | both}]
```

Syntax

```
ip ssh [listen {oobm | data | both}]
```

Syntax

```
snmp-server [listen {oobm | data | both}]
```

Syntax

```
tftp server [listen {oobm | data | both}]
```

Syntax

```
web-management [listen {oobm | data | both}]
```

In all cases, `show running-config` displays the server configurations.

Use the `no` form of the command to prevent the server from running on either interface.

Examples

Telnet: `no telnet-server`

SSH: `no ip ssh …`

SNMP: `no snmp-server …`

TFTP: `no tftp server`

HTTP: `no web-management …`

The `show servers` command shows the listen mode of the servers:

```
Switch# show servers
Server listen mode

Server   Listen mode
-----------------------------
Telnet         | both
Ssh          | both
Tftp         | both
Web-management | both
Snmp         | both
```

Application client commands

CLI commands for client applications have added the `oobm` keyword to allow you to specify that the outgoing request be issued from the OOBM interface. If you do not specify the `oobm` keyword, the request will be issued from the appropriate in-band data interface. Command syntax is:

Telnet:

```
telnet ip-address [oobm]
```

TFTP:

```
copy tftp ... ip-address filename... [oobm]
```

SNTP:

```
no sntp server priority priority ip-address [oobm] [version]
```

TIMEP:

```
no ip timep [dhcp | manual ip-address | [oobm]]
```

RADIUS:

```
no radius-server host ip-address [oobm]
```

TACACS+:

```
no tacacs-server host ip-address [oobm]
```

DNS:

```
no ip dns server-address priority priority ip-address [oobm]
```

Syslog:

```
no logging ip-address [[control-descr] | [oobm]]
```

Ping:

```
ping [...] [source [ip-address | vlan-id | oobm]]
```

Traceroute:

```
traceroute [...][source [ip-address|vlan-id|oobm]]
```

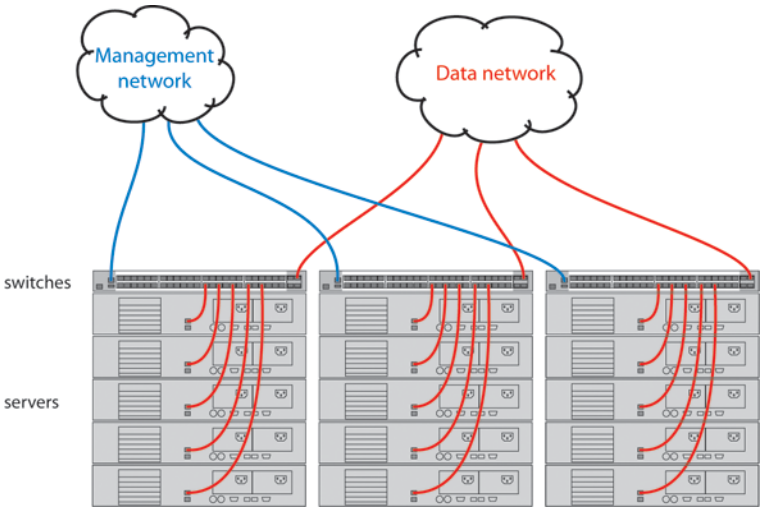
Management and Configuration Guide

Example

Figure 100: Example data center shows setup and use of network OOBM using the commands described above.

Assume that the figure below describes how you want to set up your data center.

Figure 100 *Example data center*



Assume that you are configuring the switch in the left-hand rack to communicate on both the data and management networks. You might do the following:

- Configure an IP address on the data network.
- Verify that out-of-band management is enabled. (It is enabled by default.)
- Configure an IP address on the management network.
- Verify that the switch can communicate on both networks.

The CLI commands that follow would accomplish those tasks. (The first time through the process you might easily make the omission shown near the end of the example.)

```
Switch 41# config
Switch 41(config)# vlan 1
Switch 41(vlan-1)# ip address 10.1.129.7/20        Set up IP address on data network.
Switch 41(vlan-1)# end                                  Exit back to manager context.
Switch 41# show oobm                               Look at default OOBM configuration.

Global Configuration
  OOBM Enabled   : Yes
  OOBM Port Type  : 10/100TX
  OOBM Interface Status : Up                                Defaults look appropriate.
  OOBM Port   : Enabled
  OOBM Port Speed  : Auto

Switch 41# config
Switch 41(config)# oobm                                      Go to OOBM context and
Switch 41(oobm)# ip address 10.255.255.41/24                     add IP address and
Switch 41(oobm)# ip default-gateway 10.255.255.1                    default gateway.
Switch 41(oobm)# end                                       Exit back to manager context.
Switch 41# ping 10.1.131.44              Ping server in this rack (on data network.)
10.1.131.44 is alive, time = 19 ms
Switch 41# ping 10.1.131.51                              Ping server in adjacent rack.
10.1.131.51 is alive, time = 15 ms
Switch 41# ping 10.255.255.42                            Ping switch in adjacent rack.
The destination address is unreachable.        Oops! It's on the management network.
Switch 41# ping source oobm 10.255.255.42             Go through the management port
10.255.255.42 is alive, time = 2 ms                              and it works fine.
Switch 41#
```

Networking Websites

Aruba Support Portal

asp.arubanetworks.com

Aruba Software and Documentation

asp.arubanetworks.com/downloads

Aruba Security Advisories

www.arubanetworks.com/support-services/security-bulletins

Hewlett Packard Enterprise Networking Information Library

www.hpe.com/networking/resourcefinder

Hewlett Packard Enterprise Networking Software

www.hpe.com/networking/software

Hewlett Packard Enterprise Networking website

www.hpe.com/info/networking

Hewlett Packard Enterprise My Networking website

www.hpe.com/networking/support

Hewlett Packard Enterprise My Networking Portal

www.hpe.com/networking/mynetworking

Hewlett Packard Enterprise Networking Warranty

www.hpe.com/networking/warranty

General websites

Hewlett Packard Enterprise Information Library

www.hpe.com/info/EIL

For additional websites, see Support and other resources.

Accessing Aruba Support

Aruba Support Services	https://www.arubanetworks.com/support-services/
Aruba Support Portal	https://asp.arubanetworks.com/
North America telephone	1-800-943-4526 (US & Canada Toll-Free Number) +1-408-754-1200 (Primary - Toll Number) +1-650-385-6582 (Backup - Toll Number - Use only when all other numbers are not working)
International telephone	https://www.arubanetworks.com/support-services/contactsupport/

Be sure to collect the following information before contacting Support:

- Technical support registration number (if applicable)
- Product name, model or version, and serial number
- Operating system name and version
- Firmware version
- Error messages
- Product-specific reports and logs
- Add-on products or components
- Third-party products or components

Other useful sites

Other websites that can be used to find information:

Airheads social forums and Knowledge Base	https://community.arubanetworks.com/
Software licensing	https://lms.arubanetworks.com/
End-of-Life information	https://www.arubanetworks.com/support-services/end-of-life/
Aruba software and documentation	https://asp.arubanetworks.com/downloads

Accessing updates

To download product updates:

Aruba Support Portal

https://asp.arubanetworks.com/downloads

If you are unable to find your product in the Aruba Support Portal, you may need to search My Networking, where older networking products can be found:

My Networking

https://www.hpe.com/networking/support

To view and update your entitlements, and to link your contracts and warranties with your profile, go to the Hewlett Packard Enterprise Support Center More Information on Access to Support Materials page:

https://support.hpe.com/portal/site/hpsc/aae/home/

Access to some updates might require product entitlement when accessed through the Hewlett Packard Enterprise Support Center. You must have an HPE Passport set up with relevant entitlements.

Some software products provide a mechanism for accessing software updates through the product interface. Review your product documentation to identify the recommended software update method.

To subscribe to eNewsletters and alerts:

https://www.hpe.com/support/e-updates

Warranty information

To view warranty information for your product, go to https://www.arubanetworks.com/supportservices/product-warranties/.

Regulatory information

To view the regulatory information for your product, view the *Safety and Compliance Information for Server, Storage, Power, Networking, and Rack Products*, available at www.hpe.com/support/Safety-Compliance-EnterpriseProducts

Additional regulatory information

Aruba is committed to providing our customers with information about the chemical substances in our products as needed to comply with legal requirements, environmental data (company programs, product recycling, energy efficiency), and safety information and compliance data, (RoHS and WEEE). For more information, see https://www.arubanetworks.com/company/about-us/environmental-citizenship/.

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Overview

Link Aggregation Control Protocol-Multi-Active Detection (LACP-MAD) is a detection mechanism deployed by HPE Comware switches to recover from a breakup of the Intelligent Resilient Framework (IRF) stack due to link or other failure.

LACP-MAD is implemented by sending extended LACP data units (LACPDUs) with a type length value (TLV) that conveys the active ID of an IRF device. The active ID is identical to the member ID of the master and is thus unique to the device. When LACP MAD detection is enabled, the members exchange their active IDs by sending extended LACPDUs.

- When the IRF device operates normally, the active IDs in the extended LACPDUs sent by all members are the same, indicating that there is no multiactive collision.
- When there is a breakup in the IRF chassis, the active IDs in the extended LACPDUs sent by the members in different IRF devices are different, indicating that there are multiactive collisions.

LACP-MAD passthrough helps IRF-capable devices detect multiaccess and take corrective action. These devices do not initiate transmission of LACP-MAD frames or participate in any MAD decision-making process. These devices forward LACP-MAD TLVs received on one interface to the other interfaces on the trunk. LACP-MAD passthrough can be enabled for 24 LACP trunks. By default, LACP-MAD passthrough is disabled.

This Appendix is applicable only if the customer is using a hybrid deployment of Comware and AOS-S switches.

LACP-MAD Passthrough commands

interface lacp

Syntax

```
no interface <PORT-LIST> lacp [mad-passthrough [enable|disable]|active|passive|key <KEY>]
```

Description

Defines whether LACP is enabled on a port, and whether it is in active or passive mode when enabled. When LACP is enabled and active, the port sends LACP packets and listens to them. When LACP is enabled and passive, the port sends LACP packets only if it is spoken to.

When LACP is disabled, the port ignores LACP packets. If the command is issued without a mode parameter, 'active' is assumed. During dynamic link aggregation using LACP, ports with the same key are aggregated as a single trunk. MAD passthrough applies only to trunks and not to physical ports.

Parameters

mad-passthrough

Applies only to trunks and not to physical ports.

enable

Allows the port to send LACP packets.

disable

When LACP is disabled, the port ignores LACP packets.

active

When LACP is enabled and active, the port sends LACP packets and listens to them. Defaults to active.

passive

When LACP is enabled and passive, the port sends LACP packets only if it is spoken to.

key *<KEY>*

During dynamic link aggregation using LACP, ports with the same key are aggregated as a single trunk.

show lacp

Syntax

```
show lacp [counters [<PORT-LIST>] | local [<PORT-LIST>] |peer [<PORT-LIST>] |
distributed | mad-passthrough [counters [<PORT-LIST>]]]
```

Description

Show LACP-MAD passthrough configuration on LACP trunks, or show LACP-MAD passthough counters on ports.

Parameters

counters

Display the various counters related to LACP ports.

local

Display the various local information related to LACP ports.

peer

Display the LACP peer port information.

distributed

Show distributed LACP information.

mad-passthrough

Display the various counters related to LACP MAD passthrough ports.

Usage

```
show lacp mad-passthrough counters [<PORT-LIST>]
```

clear lacp statistics

Syntax

```
clear lacp statistics
```

Description

Clear all LACP statistics including MAD passthrough counters. Resets LACP packets sent and received on all ports.

Introduction

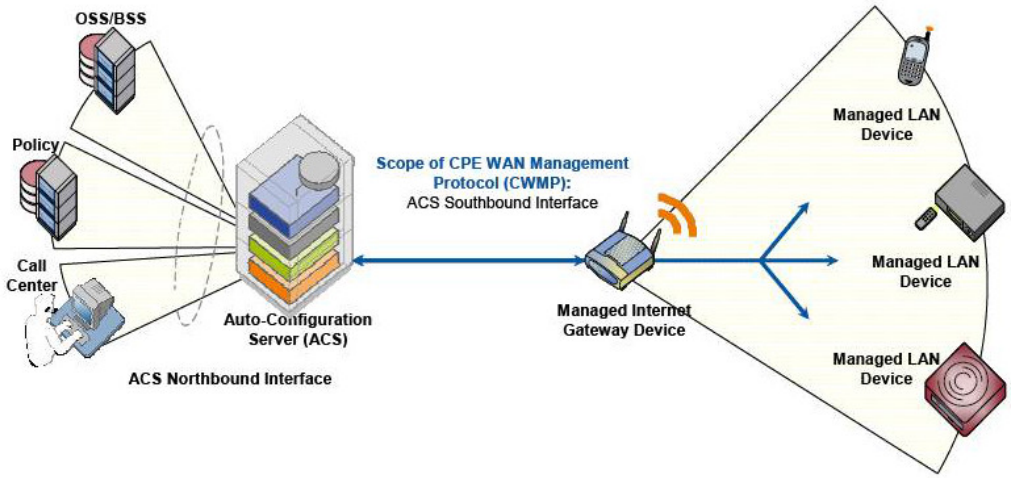
TR-069 is a technical specification created by the **Broadband Forum**. The TR-069 protocol specifies client and serve requirements to manage devices across the Internet by using a client server architecture to provide communicatio between the CPE (Customer Premises Equipment) and the ACS (Auto Configuration Server). A protocol helps to manage complex networks where many devices such as modems, routers, gateways, VoIP phones and mobile tablets compete for resources. TR-069 defines the CPE WAN Management Protocol (CWMP) protocol necessary to remotely manage end-user devices. ACS provides automatic configuration for these devices.

NOTE

CWMP is automatically enabled. To conserve resources, reconfigure this setting using the `cwmp disable` command.

TR-069 defines an auto-configuration architecture which provides the following primary capabilities:

- Auto-configuration and dynamic service provisioning
- Software/firmware image management
- Status and performance monitoring
- Diagnostics
- Bidirectional SOAP/HTTP based protocol



Advantages of TR-069

- TR-069 can manage devices with dynamic IP addresses.

  TR-069 use Organization Unique ID (OUI) and serial number rather than IP to identify a device.

- TR-069 can manage devices in a private network.

  The HPE ACS BIMS (an iMC module) uses HTTP to communicate with the device, and the session is initiated by the device, so BIMS can pass through NAT to manage the device.

- TR-069 is secure.

  TR-069 can use HTTPS to communicate with or transfer files to/from the device; it is more secure than TFTP, FTP or Telnet.

- TR-069 is suitable for WAN management across internet.

- TR-069 is suitable for zero-touch configuration.

  The zero-configuration mechanism is defined in the TR-069 specification.

- TR-069 is suitable for large-scale device management.

  TR-069 support distributed architecture. The ACS can be distributed to multiple servers, each ACS can manage part of devices.

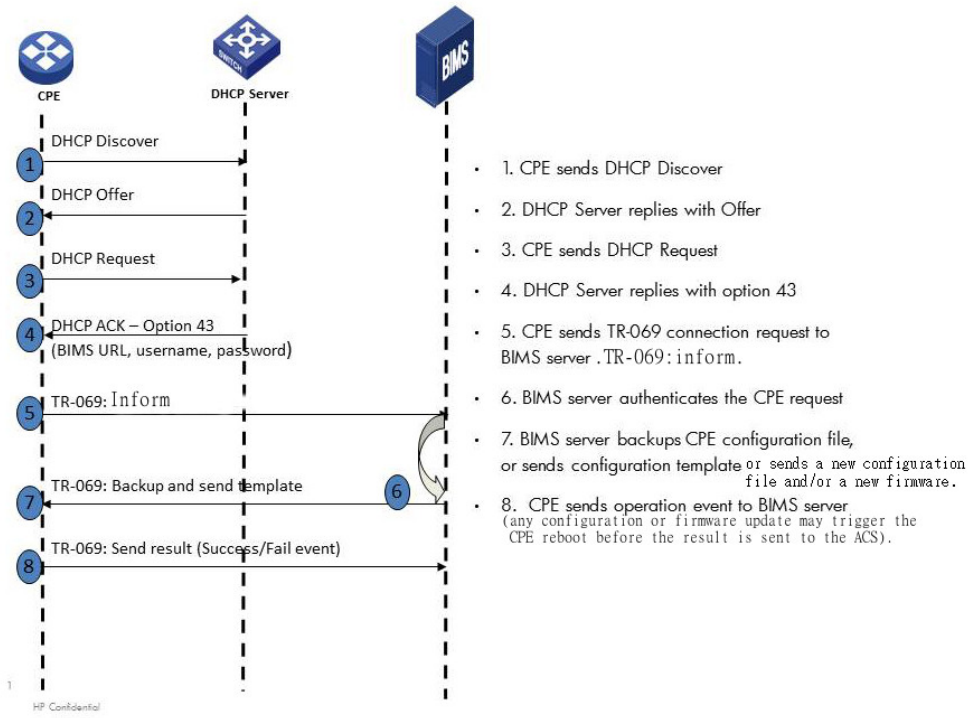
Zero-touch configuration process

Auto configuration or “zero-touch” deployment is a recurring customer requirement, especially for remote-office deployments. New devices introduced inside a private network require management tools be co-located to configure them or update firmware, or require manual intervention to do configuration. TR-069 allows managing devices that reside in a private network via HTTP(S), enabling a new set of deployment and management models today, not possible using SNMP.

The client side, when configured, will contact the server at a predefined URL, using HTTP or HTTPS as protocol. After authentication, the ACS is able to perform the following basic operations:

- Update CPE Configuration.
- Update CPE TR-069 parameters.
- Update CPE firmware.
- Reboot CPE (backup, startup, and running configurations)
- Run CPE ping diagnostics.
- Reset CPE to factory default.
- Get periodic Status (several parameters can be retrieved depending on what is supported).

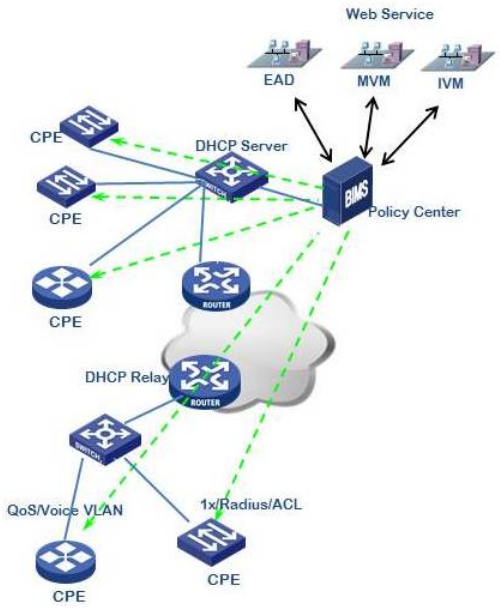
Since TR-069 uses HTTP, it can be used across a WAN. If the CPE can reach the URL, it can be managed. TR-069 is mostly a push protocol where the client periodically sends information without server requests. This allows for greater scalability over traditional SNMP based tools, which are also bounded to work within the LAN, while TR-069 can offer management to remote offices.



Zero-touch configuration for Campus networks

In this example, the following steps to configure CPEs for a Campus Network environment.

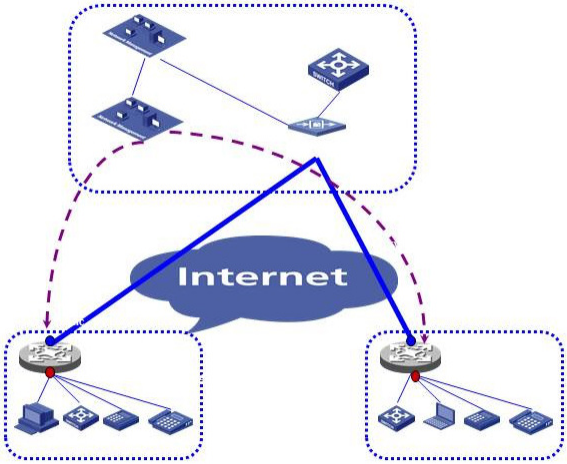
1. Pre-configuration for all CPEs in BIMS.
2. CPEs get BIMS parameters from DHCP server.
3. CPEs initiate a connection to BIMS, then BIMS deploys the pre-configuration to CPEs.



Zero-touch configuration for Branch networks

In this example, the following steps to configure CPEs for a Branch network environment.

1. Create the basic configuration for your spoke device manually, using the username/password from ISP and BIMS URL.
2. The IPSec VPN configuration is generated by IVM and deployed by BIMS.
3. The IPSec VPN tunnel is automatically created.
4. The device in the branch private network can DHCP relay to HQ to continue the zero touch configuration.



Zero-touch configuration setup and execution

1. DHCP configuration
2. BIMS configuration
3. Execution

CLI commands

Configuration setup

Within the configure mode:

Syntax

```
cwmp
```

acs

Configure Auto Configuration Server (ACS) access.

cpe

Configure Customer Premises Equipment (CPE) access.

disable

Disable the CPE WAN Management Protocol.

CWMP is automatically enabled. To conserve resources, reconfigure this setting using the `cwmp disable` command.

enable

Enable the CPE WAN Management Protocol.

Syntax

```
no cwmp
```

acs

Configure Auto Configuration Server (ACS) access.

cpe

Configure Customer Premises Equipment (CPE) access.

enable

Enable the CPE WAN Management Protocol.

ACS password configuration

Syntax

```
cwmp acs
```

password

Configure the password used for authentication when the switch connects to the ACS.

url

Configure the URL of the ACS.

username

Configure the username used for authentication when the switch connects to the ACS.

When encrypt-credentials is off

Syntax

```
cwmp acs password
```

plaintext

Configure the password used for authentication when the switch connects to the ACS.

When encrypt-credentials is on

Syntax

```
cwmp acs password
```

encrypted-key

An encrypted password generated with the `encrypt-credentials` command.

plaintext

Configure the password used for authentication when the switch connects to the ACS.

Encrypt-credential on

```
cwmp acs password encrypted-key
```

ASCII-STR

Enter an ASCII string (maximum length: 384 characters).

Plaintext password

```
cwmp acs password plaintext
```

PASSWORD-STR

A plaintext password used for ACS authentication (maximum length: 256 characters).

ACS URL configuration

Syntax

```
cwmp acs url
```

URL-STR

The URL of the ACS (maximum length: 256 characters).

ACS username configuration

Syntax

```
cwmp acs username
```

USERNAME-STR

A username for ACS authentication (maximum length: 256 characters).

CPE configuration

Syntax

```
cwmp cpe
```

password

Configure the password used for authentication when the ACS connects to the switch.

username

Configure the username used for authentication when the ACS connects to the switch.

CPE password configuration

When encrypt-credentials is on

Syntax

```
cwmp cpe password
```

encrypted-key

An encrypted password generated with the 'encrypt-credentials' command.

plaintext

Configure the password used for authentication when the ACS connects to the switch.

Syntax

```
cwmp cpe password encrypted-key
```

ASCII-STR

Enter an ASCII string (maximum length: 384 characters).

When encrypt-credentials is off

Syntax

```
cwmp cpe [password]
```

plaintext

Configure the password used for authentication when the ACS connects to the switch.

Syntax

```
cwmp cpe
```

PASSWORD-STR

A plaintext password used for ACS authentication (maximum length: 256 characters).

CPE username configuration

Syntax

```
cwmp cpe [username]
```

USERNAME-STR

A username for ACS authentication (maximum length: 256 characters).

Enable/disable CWMP

Syntax

```
cwmp [enable|disable]
```

Setting the default flash for boot

You can set which flash image to boot from as the default image on boot by using this command:

Syntax

```
boot set-default flash [primary | secondary]
```

Sets the flash image to boot from on the next boot.

`primary`	Boots the primary flash image.
`secondary`	Boots the secondary flash image.

Example

Figure 101: boot set-default command defaulting to secondary flash shows an example of the output when the command is used to set the boot default to secondary flash.

Figure 101 `boot set-default` *command defaulting to secondary flash*

```
Switch(config)# show flash
Image           Size(Bytes)   Date   Version
-----           -----------  -------- -------------------
Primary Image   : 7463821   11/05/09 K.15.01.0001
Secondary Image : 7463821   11/05/09 K.15.01.0001

Boot Rom Version: K.15.07
Default Boot    : Primary


Switch(config)# boot set-default flash secondary
This command changes the location of the default boot. This
command will change the default flash image to boot from
secondary. Hereafter, 'reload' and 'boot' commands will boot
from secondary. Do you want to continue [y/n]? y

Switch(config)# show flash
Image           Size(Bytes)   Date   Version
-----           -----------  -------- -------------------
Primary Image   : 7463821   03/05/09 K.15.01.0001
Secondary Image : 7463821   03/05/09 K.15.01.0001

Boot Rom Version: K.15.07
Default Boot    : Secondary
```

Booting the active management module from the current default flash

Syntax

```
reload [after <[[DD:]HH:]MM> | at <HH:MM[:SS]> [<MM/DD[/[YY]YY]>]] [system]
no reload [after <[[DD:]HH:]MM> | at <HH:MM[:SS]> [<MM/DD[/[YY]YY]>]] [system]
```

The no form of this command removes any pending reboot requests.

Description

Use the `reload` command to perform the following:

- Boot (warm boot) the active management module from the current default flash (You can change the default flash with the `boot set-default` command. See Setting the default flash for boot.)Switchover occurs if redundancy is enabled and the standby management module is in standby mode. If redundancy is disabled or the standby management module is not present, the `reload` command boots the system.
- Use the `reload` command with `system`parameter to schedule the reboot the entire chassis or stack.

The `reload` command is a "warm" reboot; it skips the Power on Self Test routine.

If the `running config` file is different from the stored config file, you are prompted to save the config file. The `reload at/after` versions of this command do not display a prompt to save configuration file changes: the changes are lost on the scheduled reload.

Parameters

`after <[[DD:]HH:]MM>`

Schedules the reload of an entire switch, chassis, or stack in <DD> days, <HH> hours, <MM> minutes.

`at <HH:MM[:SS]> [<MM/DD[/[YY]YY]>]`

Schedules the reload of an entire switch, chassis, or stack at <HH> hours, <MM> minutes, <SS> seconds <MM> month, <DD> day, <[YY]YY> year.

`system`

Performs a warm reboot of the entire chassis or stack at a specified time.

Example

Figure 102 `reload` *command with redundancy enabled*

```
Switch(config)# reload
This command will cause a switchover to the other management module
which may not be running the same software image and configurations.
Do you want to continue [y/n]? y


(Boots….)


Switch(config)# show redundancy

Settings
--------
Mgmt Redundancy : Nonstop Switching Enabled
Rapid Switchover Stale Timer : 0

Statistics
----------
Failovers     : 1
Last Failover : Mon April 30 09:10:11 2009

Slot Module Description                        Status   SW Version   Boot Image
---- ----------------------------------------- -------- ------------ ----------
MM1  Switch J9092A Management Module 8200zl    Active   K.15.01.0001 Primary
MM2  Switch J9092A Management Module 8200zl    Standby  K.15.01.0001 Primary
```

`reload after` command with `system` parameter

Use the following command to schedule reload for a stack.

```
Switch (config)# reload after 88:11:59 system
Reload of the entire stack is scheduled in 88 days, 11 hours, 58 minutes
This command will reboot the entire stack at the scheduled time.
Continue (y/n)? y
Warning! Any change in configuration may be lost during the scheduled reboot.
Please remember to save the changes before the scheduled reboot happens.
```

Use the following show command to view the configured reload options.

```
Switch (config)# show reload after
Reload of the entire stack is scheduled in 88 days, 11 hours, 58 minutes
```

`reload at` command with `system` parameter

Use the following command to schedule reload for a stack.

```
Switch (config)# reload at 12:00:00 06/15/2020 system
Reload of the entire stack is scheduled at 12:00:00 06/15/2020
(in 27 days, 7 hours, 35 minutes)
This command will reboot the entire stack at the scheduled time.
Continue (y/n)? y
Warning! Any change in configuration may be lost during the scheduled reboot.
Please remember to save the changes before the scheduled reboot happens.
```

Use the following show command to view the configured reload options.

```
Switch (config)# show reload at
Reload of the entire stack is scheduled for 12:00:00 06/15/2020
(in 27 days, 7 hours, 35 minutes)
```

boot command

In redundant management systems, the `boot` or `boot active` command causes a switchover to the standby management module as long as the standby module is in standby mode. This message displays:

```
This management module will now reboot and will become the
standby module! You will need to use the other management
module's console interface. Do you want to continue [y/n]?
```

If you select **y**, switchover is initiated by the standby management module, which becomes the active management module after boot completes.

If the standby module is not in standby mode (for example, it is in failed mode or offline mode), switchover to the standby module does not occur. The system is rebooted and this message displays:

```
The other management module is not in standby mode and this
command will not cause a switchover, but will reboot the
system, do you want to continue [y/n]?
```

If the other management module is not present in the switch, the system simply reboots.

The `boot` command has these options.

Command	Action
`boot cr`	Reboots the active management module from the flash image that is specified for the default boot. This can be changed with the `boot set-default flash` command. You can select which image to boot from during the boot process itself. (See Figure 103: The management module rebooting, showing boot profiles to select.) The switch will switchover to the standby management module. **NOTE:** This is changed from always booting from primary flash. You are prompted with a message, which indicates the flash being booted from.
`boot active`	Boots the active management module. The switch starts to boot from the default flash image. You can select which image to boot from during the boot process itself. (See Figure 103: The management module rebooting, showing boot profiles to select.) The switch will switchover to the standby management module. If a second management module is not present in the switch, the system is rebooted.
`boot standby`	Boots the standby management module. The switch does not switchover. If the standby module is not present, this message displays: "The other management module is not present."
`boot system [flash [primary | secondary]]`	Boots both the active and standby management modules. You can specify the flash image to boot from.
`boot set-default flash {primary | secondary}`	Sets the default flash for the next boot to primary or secondary. You see this message:"This command changes the location of the default boot. This command will change the default flash image to boot from flash chosen>. Hereafter, 'reload' and 'boot' commands will boot from flash chosen>. Do you want to continue [y/n]?"

You can select a **boot profile** during the reboot process, as shown in boot command . If you make no selection, the boot defaults to the image displayed as the default choice (shown in parentheses.)

Figure 103 *The management module rebooting, showing boot profiles to select*

```
Boot Profiles:

0. Monitor ROM Console
1. Primary Software Image
2. Secondary Software Image

Select profile(primary): 2

Booting Secondary Software Image...
```

An example of the `boot` command with the **default flash** set to **secondary** is shown in Figure 104: Showing boot command with default flash set to secondary.

Figure 104 *Showing boot command with default flash set to secondary*

```
Switch(config)# boot set-default flash secondary
This command changes the location of the default boot. This command will
change the default flash image to boot from secondary image. Hereafter,
'reload' and 'boot' commands will boot from secondary image. Do you want
to continue [y/n]? y
Switch(config)# show flash

Image           Size(Bytes)    Date   Version
-----           -----------  -------- --------------------
Primary Image   : 7476770    11/01/09 K.15.01.0001
Secondary Image : 7476770    11/01/09 K.15.01.0001

Boot Rom Version: K.15.07
Default Boot    : Secondary

Switch(config)# boot

This management module will now reboot from secondary and will become
the standby module! You will need to use the other management module's
console interface. Do you want to continue [y/n]?
```

For a given reboot, the switch automatically reboots from the `startup-config` file assigned to the flash (primary or secondary) being used for the current reboot. The `startup-default` command can be used to set a boot configuration policy. This means that both the flash image and one of the three configuration files can be specified as the default boot policy.

Boot and reload commands with OSPFv2 or OSPFv3 enabled

It is now possible to gracefully shut down OSPFv2 or OSPFv3 routing on switches without losing packets that are in transit. OSPF neighbors are informed that the router should not be used for forwarding traffic, which allows for maintenance on the switch without interrupting traffic in the network. There is no effect on the saved switch configuration

Prior to a switch shutdown, the CLI/SNMP `reload` command or the CLI `boot` command is executed to initiate the sending of OSPF "empty Hello list" messages on the interfaces that are part of the OSPF routing configuration. After a small delay (approximately 2 seconds) that allows the messages to be transmitted on all applicable interfaces the `boot` or `reload` command continues.

Modules operating in nonstop mode

When a switch is in standalone mode and OSPF routing is enabled, the "empty Hello list" is transmitted whenever the `boot` or `reload` command is executed.

When the switch is operating in nonstop switching mode (redundant), and a single module is being reloaded or booted, the standby module notifies neighboring switches of the management module failover. If the failover fails, the "empty Hello list" is transmitted before the switch is rebooted.

When a switch is operating with multiple management modules in warm standby mode, the "empty Hello list" is sent when a `reload` or `boot` command is executed. The standby management module sends out OSPF Hello packets after becoming the active management module.

Additional commands affected by redundant management

The other existing commands operate with redundant management as shown below.

Command	Action
`auto-tftp`	If a new image is downloaded using `auto-tftp`, the active management module downloads the new software version to both the active and standby modules. Rebooting after the `auto-tftp` completes reboots the entire system.
`banner`	The banner will not been seen on the standby module, only the active module.
`chassislocate`	If the management module performs a switchover, the LED does not remain lit.
`clear`	The `clear crypto` command causes public keys to be deleted from both modules when the second module is in standby mode.
`console`	Console settings, such as mode, flow-control, and baud-rate, are the same on both management modules. There cannot be individual settings for each management module.
`copy`	Files are automatically sync'd from the active management module to the standby management module.When no parameter is specified with the `copy crash-data` or `copy crash-log` command, files from all modules (management and interface) are concatenated. **NOTE:** If redundancy is disabled or the standby module failed selftest, the `copy` command affects only the active management module.
`copy core-dump [mm | standby | flash | xmodem | usb` *`filename`*`]`	The `copy core-dump standby flash` command copies the standby management module's coredump to the active management module's flash. The destination file is fixed as dumpM1.cor or dumpM2.cor, depending on which module is the standby management module.The

Command	Action
	`copy core-dump [mm | standby | flash | xmodem | usb <filename>]` command copies the core file of the active management module or the standby management module to a USB flash drive or to an xmodem host.
`core-dump management-module`	Enables or disables a core dump on a management module.
`crypto`	Authentication files for ssh or the https server are copied to the standby management module. The `clear crypto` command deletes the public keys from both modules when the second module is in standby mode.
`erase flash`	Erases the software version on the active and standby modules. If redundancy has been disabled, or if the standby module has not passed selftest, the flash is not erased on the standby module.
`erase config`	Erases the config file on the active and standby modules. If redundancy has been disabled, or if the standby module has not passed selftest, the config file is not erased on the standby module.
`erase startup-config`	Affects both modules if the second module is in standby mode. If redundancy has been disabled, or if the standby module has not passed selftest, the `startup-config` file is not erased on the standby module.
`fastboot`	When fastboot is enabled, this information is saved to the standby management module when the config files are sync'd. The fastboot value is used during the next boot on both modules.
`front-panel-securityfactory-resetpassword-clearpassword-recovery`	This command and its options affect only the active management module.
`kill`	Does not affect the console on the standby module.
`log`	Log messages from a formerly active management module are available on the current active management module after a switchover.
`password (set` or `clear)`	Affects only the active management module until a switchover occurs, at which time it affects the new active module.

Command	Action
`startup-default`	Affects both modules. The config file is immediately sent to the standby module and also becomes the default on that module when the next boot occurs.
`update`	Affects only the active module. The standby may become the active module when the updated active module is booted.
`write`	A `write memory` updates the config file in flash on the active module. The file is then sync'd to the standby module.

Show commands

CWMP configuration and status query

Syntax

```
show cwmp
```

configuration

Show current CWMP configuration.

status

Show current CWMP status.

When CWMP is enabled

Syntax

```
show cwmp configuration
```

CWMP configuration

```
CWMP Configuration
CWMP Status           : Enabled
ACS URL               : http://16.93.62.32:9090
ACS Username          : bims
Inform Enable Status  : Enabled
Inform Interval       : 60
Inform Time           : 2014-04-08T06:00:00
Reconnection Timeout  : 30
```

CWMP status

```
CWMP Status
CWMP Status               : Enabled
ACS URL                   : http://16.93.62.32:9090
ACS URL Origin            : Config
ACS Username              : bims
Connection Status         : Disconnected
Data Transfer Status      : None
```

```
Last ACS Connection Time : Wed Apr  9 16:56:00 2014
Time to Next Connection  : 00:00:36
```

When CWMP is disabled

Syntax

```
show cwmp status
```

CWMP status

```
CWMP Status
CWMP Status              : Disabled
```

CWMP configuration

```
show cwmp configuration
CWMP Configuration
CWMP Status          : Disabled
```

Event logging

The TR-069 client offers some tools to diagnose problems:

- System logging
- Status/control commands

System logging

The CPE implements the following system log notification codes and sample messages:

- RMON_TR69_INFORM_COMPLETE
  - INFORM to http://15.29.20.50:9090/ from (IP address not set yet) completed with error.
  - INFORM to http://15.29.20.50:9090/ from 10.0.10.212 completed with error.
  - INFORM to http://15.29.20.50:9090/ from 10.0.10.212 completed successfully.
- RMON_TR69_AUTH_FAILED
  - Authentication on ACS http://15.29.20.50:9090/ failed.
- RMON_TR69_CONN_FAILED
  - Connection attempts with ACS http://15.29.20.50:9090/ from 10.0.10.212 failed.

To avoid flooding the system log on frequent attempts to connect with the ACS, the following criteria are used with both successful and failed attempts:

1. The very first event is always logged.
2. Any change from success to failure or vice versa is always logged.
3. Repeat success or failure events are logged only once every five minutes.

The HTTP file transfer component supports these system log notification codes and sample messages:

- RMON_HTTP_XFER_COMPLETE
  - I 11/19/13 08:06:13 04185 http: Download of http://10.0.11.240:9876/path to DestinationFile completed successfully.
  - I 11/19/13 08:06:13 04185 http: Upload of SourceFile to http://10.0.11.240:9876/path completed successfully.
- RMON_HTTP_CONN_FAILED
  - W 11/19/13 08:06:13 04186 http: Connection to http://10.0.11.240:9876/path failed.
- RMON_HTTP_TIMED_OUT
  - W 11/19/13 08:06:13 04192 http: Download of http://10.0.11.240:9876/path to DestinationFile timed out.
  - W 02/20/14 00:32:17 04192 http: Upload of SourceFile to http://10.0.11.240:9876/path timed out.
- RMON_HTTP_NO_SPACE

  W 11/19/13 08:06:13 04189 http: Upload of SourceFile to http://10.0.11.240:9876/path canceled because of insufficient memory.
- RMON_HTTP_REQ_FAILED
  - W 11/19/13 08:06:13 04190 http: Upload of SourceFile tohttp://10.0.11.240:9876/path failed (errno13).
  - W 11/19/13 08:06:13 04190 http: Upload of SourceFile to http://10.0.11.240:9876/path failed (errno 1).
  - W 11/19/13 08:06:13 04190 http: Download of http://10.0.11.240:9876/path to DestinationFile failed (errno 13).
  - W 11/19/13 08:06:13 04190 http: Download of http://10.0.11.240:9876/path to DestinationFile failed (errno 1).
  - W 11/19/13 08:06:13 04190 http: Download of http://10.0.11.240:9876/path to DestinationFile failed (errno 17).
- RMON_HTTP_WRONG_FILE
  - W 11/19/13 08:06:13 04191 http: Download canceled because file http://10.0.11.240:9876/path is malformed or incompatible.
  - W 11/19/13 08:06:13 04191 http: Download canceled because file http://10.0.11.240:9876/path is malformed or incompatible.
- RMON_HTTP_FILE_NOT_FOUND
  - W 11/19/13 08:06:13 04200 http: Upload of SourceFile to http://10.0.11.240:9876/path canceled because of inexistent file.

Status/control commands

The following commands help assess the general state of TR-069 and control the source of the ACS configuration record:

Table 50: *Status/control commands*

Command	Result

`show cwmp status`	`CWMP is Enabled  ACS URL : https://16.93.62.32:9443`
	`ACS URL is set by : Config`
	`ACS Username : bims`
	`Connection status : Disconnected`
	`Data transfer status : None`
	`Time of last successful connection : Thu Feb 20 01:16:59 2014`
	`Interval upon to next connection : Null`

`show cwmp configuration`	`CWMP is Enabled  ACS URL : https://16.93.62.32:9443`
	`ACS Username : bims`
	`Inform Enable Status : Disabled`
	`Inform Interval : 3559`
	`Inform Time :`
	`Reconnection times : 30`

`no dhcp tr69-acs-url`	Prevents using any ACS information from DHCP

Configuration backup and restore without reboot

The configuration backup and restore without reboot supports the following features:

Interface Access (Telnet, Console/Serial, web)	Port Shutdown with Broadcast Storm
Access Control Lists (ACLs)	Source-Port Filters
AAA Authentication	TACACS+ Authentication
CoS (Class of Service)	Time Protocols (TimeP, SNTP)
Network Management Applications (SNMP)	Uni-directional Link Detection (UDLD)
Port Configuration	Virus Throttling (Connection-Rate Filtering)
Port Security	Web-based Authentication
Port-Based Access Control (802.1X)	Backplane stacking
Quality of Service (QoS)	Job Scheduler
Spanning Tree (STP, RSTP, MSTP, RPVST+)	Authorized IP Managers
VLANs	Authorized Manager List (Web, SSH, TFTP)
802.1Q VLAN Tagging	Auto MDIX Configuration
802.1X Port-Based Priority	DHCP Configuration
802.1X Multiple Authenticated Clients Per Port	Flow Control (802.3x)
IGMP	Friendly Port Names
LACP/Trunk	Guaranteed Minimum Bandwidth (GMB)
MAC Lockdown	IP Addressing
MAC-based Authentication	IP Routing
MAC Lockout	Jumbo Packets
LMA	LLDP
Multicast Filtering	LLDP-MED
Power over Ethernet (PoE and PoE+)	Loop Protection
Protocol Filters	MAC Address Management
RADIUS Authentication and Accounting	Management VLAN

RADIUS-Based Configuration	Passwords and Password Clear Protection/include-credentials
Encrypted-password	QoS: Strict-Priority Queuing
Port Monitoring	QoS: Turn on/off VLAN Precedence
Port Status	QoS: Egress Queue Rate-limiting
Rate-Limiting	CDP
Syslog	System Parameters (hostname, Banner)
System Information	Front-panel-security
Telnet Access	DLDP
Traffic/Security Filters	OOBM
VLAN Mirroring (1 static VLAN)/Port mirroring	Switch interconnect
Voice VLAN	Airwave Controller IP configuration
Web Authentication RADIUS Support	Aruba Central integration
Web UI	Captive portal commands
Log IP address of an ACL match	Consolidated Client View
access-list logtimer	IPsec for Zero Touch Provisioning
UFD: Uplink Failure Detection	Local User roles
Wake-on-LAN for a Specific VLAN	Port QoS Trust Mode
WebUI Inactivity Timer	Per-port Tunneled node
Control Plane Protection	Zero-touch provisioning - DHCP, Activate
Egress ACLs	ClearPass support
Device profile - switch auto configuration	HTTP redirection/Captive portal
Device profile: Auto configuration with Aruba AP detection	Device profile: LLDP Authentication Bypass with AP
Tunneled Node enhancement: fallback to switching	RADIUS Port Speed VSA
Rogue AP isolation	Dynamic ARP Protection
DHCP Option 82	Dynamic IP Lockdown
DHCP snooping	Eavesdrop Protection
Distributed Trunking	GVRP
RMON 1,2,3,9	Private VLANs

SavePower Features	IP SLA
sFlow	sys-debug acl
VxLAN	MAC Based VLANs (MBV)
Smartlink	RBAC: Role Based Access Control
Fault Finder extended to cover Flapping Transceiver Mitigation	RADIUS Service Tracking
Fault Finder (Per Port Enable)	sys-debug destination
SNMP Trap Throttling	Protocol VLANS

Limitations

Switch configuration restore without reboot feature does not support the following scenarios:

- Removing a physically present member through `cfg-restore` command.
- Flex-module provisioning or removal on standalone or a stack.
- Module provisioning or removal on standalone or a stack.
- Adding a VLAN when the VLAN limit is already reached by having dynamic VLANs. Due to timing issues, ports or dynamic VLANs take some time to become offline or be removed, even after applying a removal command. In such a case, restore commands fail as normal CLI commands.
- The maximum number of backup configuration files has been increased from three to five. When the firmware is downgraded to lower versions, the `show config files` command displays the details to only three configuration files.
- Restore is allowed based on the available system resource factors.

Blocking of configuration from other sessions

All `write` operations are not allowed from other sessions (CLI/WebUI/SNMP/REST, and so on) during a configuration restoration process. Only `read` operation is allowed. Attempts to use `write` operation results in the `Configuration restore is in progress, configuration changes are temporarily disabled` error. The following `show` commands are blocked during a configuration restoration process:

- `show-tech`
- `show config`
- `show running-config`
- `show startup-config`

Smart Rate is a new technology designed to enable higher port link speeds on legacy cabling where an Ethernet RJ45 port type can link at 1Gbps, 2.5Gbps, 5Gbps, or 10Gbps.

When situations occur where a network link establishes at a lower than expected speed (or not at all) due to marginal or bad cabling, the Smart Rate port technology allows administrators to triage cabling issues and determine root causes of lower than expected performance.

Smart Rate Technology is available on the following products:

- Switch 5400R v3 zl2 modules (J9991A, J9995A)
- Switch 5400R chassis switch bundles (JL002A)

Show Smart Rate port

Syntax

`show interface` *`PORT-LIST`* `smartrate`

Displays port diagnostics on a Smart Rate port.

Unlinked Smart Rate port

```
show interface C5 smartrate

Status and Counters - Smart Rate information for Port C5

Model         : 0x03a1
Chip         : 0xb4b3
Firmware (major)      : 0x0002
Firmware (minor)      : 0x0003
Firmware (candidate)     : 0x0005
Firmware (provision)     : 0x0001

      Chan1   Chan2   Chan3   Chan4 (in db)
Current SNR  9.000000  6.700000  3.500000  9.200000
Minimum SNR  9.000000  6.700000  3.500000  9.200000

CRC8 errors:     0
LDPC errors:     0
LDPC 1 iteration:    27620089
LDPC 2 iterations:    954117
LDPC 3 iterations:    0
LDPC 4 iterations:    0
LDPC 5 iterations:    0
LDPC 6 iterations:    0
LDPC 7 iterations:    0
LDPC 8 iterations:    0

23  Number of fast retrains requested by Local Device.
32  Number of fast retrains requested by Link Partner.
150 Accumulated time (ms) spent in fast retrain since last AN.
9  Number of RFI Training Link Recovery Events since last AN.
3  Number of Link Recover Events since last AN.
```

```
Established link speed       : 5000Mbps
Number of attempts to establish link   : 5
Uptime since link was last established (ms) : 5099

Local port advertised speeds

1000Mbps 2500Mbps  5000Mbps  10Gbps
 No   Yes   Yes   No

Link partner speed capability

1000Mbps  2500Mbps  5000Mbps  10Gbps
 Yes   Yes   Yes   No

Link Partner matching vendor: Yes
```

Smart Rate port that is linked at 1Gbps

```
show interface C5 smartrate

Status and Counters - Smart Rate information for Port C5

Model         : 0x03a1
Chip          : 0xb4b3
Firmware (major)     : 0x0002
Firmware (minor)     : 0x0003
Firmware (candidate)    : 0x0005
Firmware (provision)    : 0x0001

Established link speed         :1000Mbps
Number of attempts to establish link    :5
Uptime since link was last established (ms)  : 5099

Local port advertised speeds

1000Mbps  2500Mbps  5000Mbps  10Gbps
 No     No     No     No

Link partner speed capability

1000Mbps  2500Mbps  5000Mbps  10Gbps
 Yes    Yes    Yes    Yes

Link Partner matching vendor: Yes
```

Rate-Limiting – GMB features when Fast-Connect SmartRate ports are configured

When Rate-Limiting or Guaranteed Minimum Bandwidths are configured for 5Gbps ports, the granularity of percentage-based rates for the 5Gbps speed is in steps of 2%. For example, a 1% rate-limit for a 5Gbps port will function as a 2% limit while a 5% limit will function as a 6% limit.

The Guaranteed Minimum Bandwith profiles will show the same behavior. For example on an 8-queue system, the actual default servicing profile will be 2%, 4%, 30%, 10%, 10%, 10%, 16%, and 20%. The CLI and SNMP values for these ports will show what the customer configured, but the actual hardware results will be in steps of 2%.

This limitation only applies to 5Gbps ports. Ports running at 2.5Gbps have the same 1% granularity as all previously-offered port speeds.

Error messages

- On ports that do not support the respective speed-duplex option, the command will fail with an error message similar to the following:

  Value `auto-10` is not applicable to port E1.
- The following speed-duplex options are not available on switch platforms that do not have Smart Rate ports.
  - auto-2500
  - auto-5000
  - auto-2500-5000

Speed-duplex

Syntax

`interface` *`PORT-LIST`* `speed-duplex`

Parameters

auto	Auto-negotiate link parameters.
auto-100	100 Mbps only, auto-negotiate link parameters.
auto-1000	1000 Mbps only, auto-negotiate link parameters.
auto-2500	2500 Mbps only, auto-negotiate link parameters.
auto-5000	5000 Mbps only, auto-negotiate link parameters.
auto-2500-5000	2500 or 5000 Mbps only, auto-negotiate link parameters.
auto-10g	10 Gbps only, auto-negotiate link parameters.

Limitations on 5Gbps ports

For 5Gbps ports, when the customer has Rate-Limiting or Guaranteed Minimum Bandwidths configured, the granularity of percentage-based rates for the 5Gbps speed is in steps of 2%. For example a 1% rate-limit for a 5Gbps port will function as a 2% limit, a 5% limit will function as a 6% limit. The Guaranteed Minimum Bandwith profiles will show the same behavior. On an 8-queue system, the actual default servicing profile will be 2% 4% 30% 10% 10% 10% 16% 20%. The CLI and SNMP values for these ports will show what the customer configured, but the actual hardware results will be in steps of 2%.

This limitation only applies to the 5Gbps ports. Ports running at 2.5Gbps have a 1% granularity in port speeds.

Error messages

- On ports that do not support the respective speed-duplex option, the command will fail with an error message similar to the following:

  Value `auto-10` is not applicable to port E1.

- The following speed-duplex options are not available on switch platforms that do not have Smart Rate ports.
  - auto-2500
  - auto-5000
  - auto-2500-5000

100 Mbps Support on Smart Rate ports

Overview

Smart Rate ports are designed to link devices at 1 Gbps, 2.5 Gbps, 5 Gbps, and 10 Gbps. Older devices such as legacy printers can run at maximum speed of 100 Mbps. To address this issue, the speed duplex auto-100 enhancement is introduced on Smart-Rate ports. Depending on the device model, Smart Rate ports can operate on 100Mbps speed.

If MACsec is configured on a port, we cannot configure speed duplex as auto-100 for that particular port, and conversely.

100Mbps is supported on auto speed duplex mode by default.

100 Mbps support on Smart Rate ports is available for 5400R, 3810M and 2930M.

interface speed-duplex auto-100

Syntax

`interface` **<PORT>** `speed-duplex auto-100`

Description

Configures speed option to support Auto-100 on Smart Rate ports.

Command context

`config`

Parameter

PORT

Specify a port number.

Example

```
switch(config)#interface A1 speed-duplex auto-100
switch(config)#show interface brief
 Status and Counters - Port Status

                          | Intrusion                          MDI  Flow Bcast
  Port          Type      | Alert     Enabled Status Mode       Mode Ctrl Limit
  ------------ ---------- + --------- ------- ------ ---------- ---- ---- -----
  A1            10GbE-T   | No        Yes     Up     100FDx     MDI  off  0
  A2            10GbE-T   | No        Yes     Up     100FDx     Auto off  0
  A3            10GbE-T   | No        Yes     Down   10GigFD    Auto off  0
  A4            10GbE-T   | No        Yes     Down   10GigFD    Auto off  0
```

show interfaces smartrate

Syntax

`show interfaces <PORT-LIST> smartrate`

Description

Displays Smart Rate diagnostic information.

Parameter

PORT-LIST

Specify a port number or a list of ports.

Examples

```
switch(config)#show interfaces A1 smartrate

 Status and Counters - Smart Rate information for Port A1

  Model                    : 0x03a1
  Chip                     : 0xb582
  Firmware                 : 3.3.e
  Provisioning             : 0x0002

  Established link speed                 : 100BASE-T
  Number of attempts to establish link   : 1
  Uptime since link was established      : 30 seconds

  Local Port advertised capabilities
  100MBT   | 1.0GBT   | 2.5G NBT | 5.0G NBT | 2.5GBT | 5.0GBT | 10GBT
   Yes     |  No      |   No     |   No     |  No    |  No    |  No

  Link Partner advertised capabilities
  100MBT   | 1.0GBT   | 2.5G NBT | 5.0G NBT | 2.5GBT | 5.0GBT | 10GBT
   Yes     |  Yes     |   Yes    |   Yes    |  No    |  No    | Yes
```

```
switch(config)#  show interface A2 smartrate

 Status and Counters - Smart Rate information for Port A2

  Model                    : 0x03a1
  Chip                     : 0xb582
  Firmware                 : 3.3.e
  Provisioning             : 0x0002

  Established link speed                 : 100BASE-T
  Number of attempts to establish link   : 1
  Uptime since link was established      : 30 seconds

  Local Port advertised capabilities
  100MBT   | 1.0GBT   | 2.5G NBT | 5.0G NBT | 2.5GBT | 5.0GBT | 10GBT
   Yes     |  Yes     |   Yes    |   Yes    |  Yes   |  Yes   |  Yes

  Link Partner advertised capabilities
  100MBT   | 1.0GBT   | 2.5G NBT | 5.0G NBT | 2.5GBT | 5.0GBT | 10GBT
   Yes     |  No      |   No     |   No     |  No    |  No    |  N0
```

show interface config

Syntax

```
show interface config
```

Description

Displays port settings.

Example

```
switch#(config) show interface config
 Port Settings

  Port  Type        | Enabled Mode          Flow Ctrl MDI
  ----- ----------- + ------- ------------ --------- ----
  A1    10GbE-T     | Yes     Auto-100     Disable   Auto
  A2    10GbE-T     | Yes     Auto         Disable   Auto
  A3    10GbE-T     | Yes     Auto         Disable   Auto
  A4    10GbE-T     | Yes     Auto         Disable   Auto
```

show running-config

Syntax

```
show running-config
```

Description

The Smart Rate port auto-100 is part of the `show running-config` output.

Example

```
switch(config)#show running-config
Running configuration:

; JL320A Configuration Editor; Created on release #WC.16.06.0000x
; Ver #13:03.f8.1c.9b.3f.bf.bb.ef.7c.59.fc.6b.fb.9f.fc.ff.ff.37.ef:49

module 1 type jl320a
flexible-module A type JL081A
interface A1
   speed-duplex auto-100
   exit
```

Downgrade with CLI reboot command

Procedure

1. If the Smart Rate port speed configuration is `auto-100`, `boot system flash primary` command will prompt user to change the `auto-100` to other configuration.

   ```
   switch# boot system flash primary
   This will reboot the system from the primary image.

   Continue (y/n)? y
   ```

2. To proceed, select **y**.

```
Firmware downgrade is not allowed when smartrate port is configured with
auto-100. Please change the speed-duplex to other configuration.
```

3. To reject, select **n**.

Downgrade without CLI reboot command (power cycle)

Procedure

1. **Reboot** with `auto-100` mode configuration on Smart Rate port, the following events occur:
   a. The speed duplex status is shown blank when you execute the **show interface brief** command.
   b. The port status is displayed as down.
2. Save the configuration and again **reboot**. The preconfigured auto-100 restores the Smart Rate port to auto mode, thus restoring its functionality.

Overview

TCP is a symmetric protocol, allowing data to be sent at any time in any direction, and therefore timestamp echoing may occur in any direction. As defined in RFC 1323, TCP timestamps are an extension to the original TCP stack, that was introduced to identify and reject old duplicate packets (PAWS) and to improve round-trip-time measurement. The timestamp echo reply is sent in any Acknowledgment (ACK) or data segment.

Randomize TCP Timestamp

By default, the TCP timestamps will not be randomized. Using a scanner or other tool, an attacker can observe the TCP timestamp and determine the system uptime to gain information about the operational state of the system. Also, sequential TCP timestamp exposes the system to the following vulnerabilities.

- Determining whether the switches are patched against a specific vulnerability because updating software requires a reboot.
- Identifying the switches that are behind a Network Address Translation (NAT) or a load balancer, and this may allow the attacker to get conclusions about the load balancing configuration.
- Determining with certainty whether the attack is successful or the attack is blocked by any Intrusion Prevention System (IPS).

To avoid such risks, the following command is introduced to randomize TCP timestamp offsets per connection.

Syntax

```
ip tcp randomize-timestamp
no ip tcp randomize-timestamp
```

Description

This command enables TCP timestamp randomization. Once the command is issued, all the newly established TCP sessions will use random offset along with the timestamp. The TCP sessions established before enabling the `ip tcp randomize-timestamp` configuration will continue with TCP timestamp without random offset.

The following message will be displayed when the `ip tcp randomize-timestamp` command is issued.

```
Enabling or disabling timestamp randomization will be applied only to the new TCP
sessions.
```

The `no` form of the command disables TCP timestamp randomization.

The TCP timestamp randomization is applied in the following cases:

- When the switch is acting as a server
- When the switch is acting as a client

Command Context

config

Example

```
 switch(config)# ip tcp randomize-timestamp

 switch(config)# show running config
 Running configuration:

; JL323A Configuration Editor; Created on release #WC.16.10.0008B
; Ver #14:67.6f.f8.1d.9b.3f.bf.bb.ef.7c.59.fc.6b.fb.9f.fc.ff.ff.37.ef:44

hostname "Aruba-2930M-40G-8SR-PoEP"
module 1 type jl323a
ip tcp randomize-timestamp
snmp-server community "public"
oobm
ip address dhcp-bootp
ipv6 enable
ipv6 address dhcp full
exit
vlan 1
name "DEFAULT_VLAN"
untagged 1-48
ip address dhcp-bootp
ipv6 enable
ipv6 address dhcp full
exit
password manager
```

Appendix F
Glossary

Acronym	Definition
ACL	Access Control List
AMP	AirWave Management Platform
AP	Access Point
BYOD	Bring Your Own Device
BPS	Backplane Stacking
CoA	Change of Authorization
CLI	Command Line Interface
DHCP	Dynamic Host Configuration Protocol
DoS	Denial-of-Service
EWA	Enhanced Web Authentication
IP	Internet Protocol
HA	High Availability
HMAC-SHA1	Hash-based Message Authentication Code used with the SHA-1 cryptographic hash function.
HTTP	Hypertext Transfer Protocol
HTTPS	Secure Hypertext Transfer Protocol
ID	Identifier
IP	Internet Protocol
L3	The third, or routing, layer of the open systems interconnection (OSI) model. The network layer routes data to different LANs and Wide Area Networks (WANs) based on network addresses.
LAN	Local Area Network
MAC	Media Access Control
MAFR	MAC Authentication Failure Redirect
MAS	Management Interface Specification

Acronym	Definition
NMS	Network Management System
PVOS	AOS-S switch Operating System
RADIUS	Remote Authentication Dial In User Service
SNMP	Simple Network Management Protocol
VLAN	Virtual Local Area Network
VSA	Vendor Specific Attribute
VSF	Virtual Switching Framework
ZTP	Zero Touch Provisioning