IBM Storage Networking

Data Center Network Manager Configuration Guide

SC27-9285-00

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Before you use the information in this publication, be sure to read the general information under “Notices” on page 137.

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Read this first

Summary of changes

This is the first edition of the IBM® Storage Networking Data Center Network Manager Configuration Guide.

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For support information for this product and other SAN products, see the following Web site:http://www.ibm.com/servers/storage/support/san

For detailed information about the Fibre Channel standards, see the Fibre Channel Industry Association (FCIA) Web site at: www.fibrechannel.org/

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The following list includes the major accessibility features in this product:

- Light emitting diodes (LEDs) that flash at different rates, to represent the same information as the colors of the LEDs
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Keyboard navigation

This product does not have an attached or integrated keyboard. Any keyboard navigation is provided through the management software and GUI.

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About this document

This document is intended for use by systems administrators and technicians experienced with networking, Fibre Channel, and storage area network (SAN) technologies. It describes general configuration tasks for the Data Center Network Manger (DCNM), a management system for the IBM Unified Fabric. Throughout this document, the product is referred to as the *Data Center Network Manager (DCNM)*, or the *Web Client*.

IBM and Cisco product matrix

The product matrix provides a cross-reference between the comparable IBM and Cisco product models.

When you use any of the Cisco documents, such as the Fabric Configuration Guide, you will notice that the model numbers reflect the corresponding Cisco products. "IBM and Cisco product matrix" provides a product matrix to correlate the Cisco products and models to the IBM product names and machine types and model numbers. Products withdrawn from marketing are not listed.

Table 1. Cisco and IBM product and model number matrix

Cisco product name	IBM product name	IBM machine type and model number
913T Fabric Switch	SAN32C-6	8977 Model T32
9250i Multiservice Switch	SAN50C-R	8977 Model R50
9706 Multilayer Director	SAN192C-6	8978 Model E04
9710 Multilayer Director	SAN384C-6	8978 Model E08
9718 Multilayer Director	SAN768C-6	8978 Model E16

Product documentation

The following documents contain information related to this product:

- *IBM SAN32C-6 Installation, Service and User Guide*, SC27-9275-00
- *IBM SAN50C-R Installation, Service and User Guide*, SC27-9274-00
- *IBM SAN192C6, 384C-6, 768C-6 Installation, Service and User Guide*, SC27-9276-00

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Chapter 1. Introducing the Data Center Network Manager

The Data Center Network Manager (DCNM) is a management system for the IBM Unified Fabric. It enables you to provision, monitor, and troubleshoot the data center network infrastructure. It provides visibility and control of the unified data center. DCNM provides a comprehensive feature set that meets the routing, switching, and storage administration needs of data centers. DCNM streamlines the provisioning for the unified fabric and monitors the SAN and LAN components, providing a high level of visibility and control through a single web based management console for IBM Storage Networking SAN c-type Family switches and director products. During the DCNM installation, you can choose install applications related to Unified Fabric only for Unified Fabric-mode installations.

DCNM is a thin unified Web Client that includes DCNM SAN as an installation option. All Cisco DCNM Web Client and Cisco DCNM for SAN product documentation is now published to the Data Center Network Manager listing page on Cisco.com:

http://www.cisco.com/en/US/products/ps9369/tsd_products_support_configure.html.

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Chapter 2. DCNM user roles

This chapter contains following sections:

- "DCNM credentials"
- "DCNM users"
- DCNM roles
- "Roles from the DCNM perspective"

DCNM credentials

DCNM has two sets of credentials:

- Device credentials which are used to discover and manage devices.
- DCNM credentials which allow access to the DCNM server.

This document describes about DCNM credentials and how user roles are mapped to specific set of DCNM server operations.

DCNM users

DCNM user-based access allows the administrator to control the access to the IBM DCNM server by using the DCNM client (Web Client or LAN client). The user access is secured by a password.

Note: DCNM does not allow you to reset the password using adduser script. You must logon to DCNM Web UI to reset the password. The adduser script is used only to add a new DCNM user on the existing DCNM setup.

Roles from the DCNM perspective

The DCNM perspective defines the operations that a user can perform on the DCNM client by controlling the menu and tool bar items. Different perspectives define different sets of operations. For example, the Admin perspective allows all the operations by showing all the menu and tool bar items where as Operator perspective allows limited set of operation by hiding Admin and Config Menu items.

Each DCNM user role is mapped to a particular DCNM perspective, which allows limited access to server features. DCNM clients support following four perspectives.

- Admin perspective
- Server admin perspective
- SME perspective
- Operator perspective

The following table matches each DCNM role to a client perspective

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Table 2. DCNM roles and perspectives mapping table

Role	Perspective
global-admin	Admin Perspective
network-admin	
san-admin	
san-network-admin	
lan-network-admin (Web Client)	
server-admin	Server admin perspective
sme-admin	SME perspective
sme-sgt-admin	
sme-kmc-admin	
sme-recovery	
network-operator	Operator perspective
lan-network-admin (SAN Thick Client)	

.

Admin perspective

You can access the admin perspective from the DCNM web client and SAN client only, if you are assigned the role of global-admin, network-admin, san-admin, san-network-admin, or lan-network-admin.

Web client admin perspective

Web client admin perspective has full control of the DCNM server and can access all the features. Via the access to the Admin menu items, the users also has full control of DCNM authentication settings.

SAN Thick Client admin perspective

SAN thick client admin perspective has full control of the DCNM server and can access all the features. All the top-level menu items are accessible.

Server Admin Perspective

Server admin perspective can be accessed via web client and SAN thick client only by the users who are assigned the role of server-admin.

Web client server admin perspective

Web client server admin perspective has access to all the web client features. Via the access to the Admin menu items, the users also has full control of DCNM authentication settings.

SAN Thick Client server admin perspective

The configuration capabilities of a server admin role are limited to FlexAttach and relevant data. The server admin can pre-configure SAN for new servers, move a server to another port on the same NPV device or another NPV device and replace a failed server onto the same port without involving the SAN administrator. The server admin cannot manage Fabric Manager users or connected clients. The menu

items that are not related to server management, Zone or Performance, for example) are not accessible. SAN thick client server admin perspective has no access to the Discover button, Fabrics and License Files tabs. The server admin is not able to manage Fabric Manager users or connected clients in SAN thick client.

SME perspective

Storage Media Encryption (SME) perspective is designed for sme-admin, sme-sgt-admin, sme-kmc-admin and sme-recovery role-based users. It can be categorized to five different SME admin perspectives according to the following roles.

- Web Client SME Admin Perspective
- SME Storage Perspective
- SME Key Management Perspective
- SME Recovery Perspective
- SAN Thick Client SME Perspective

Web Client SME Admin Perspective

Web client sme admin perspective is designed to sme-admin role users who have no access to Admin and Config menu items in the Web client and cannot use features under those menu items. On the other hand, the SME provision features are accessible.

SME Storage Perspective

SME storage perspective is designed to the sme-stg-admin role users. sme-stg-admin role users have same perspective as sme-admin role except you cannot manage the key management features.

SME Key Management Perspective

SME key management perspective is designed to the sme-kmc-admin role users. sme-kmc-admin role users have same perspective as sme-admin role except that you cannot perform SME configurations.

SME Recovery Perspective

SME recovery perspective is designed to the sme-recovery role users for master key recovery. sme-recovery role users have same perspective as sme-admin role except that you cannot perform the storage and key management features.

SAN Thick Client SME Perspective

SAN thick client SME perspective has no access to the Discover button, Fabrics and License Files tabs. All the SME related perspective are not able to manage Fabric Manager users or connected clients, as well as operator perspective.

Operator Perspective

Operator perspective is designed for network-operator and lan-network-admin role users, and lan-network-admin role only has SAN thick client operator perspective.

Web Client Operator Perspective

Web client operator perspective has no access to Admin and Config menu items and the features under those menu items cannot be used. All the other features can be used.

SAN Thick Client Operator Perspective

SAN thick client operator perspective has no access to the Discover button, Fabrics and License Files tabs, and is not able to manage Fabric Manager users or connected clients.

Chapter 3. Device Pack for DCNM

This topic provides the following information:

- "Supported devices"
- "Installing the device pack"

Supported devices

The following table shows the Hardware supported by this device pack.

IBM product name	**IBM machine type and model number**
SAN32C-6	8977 Model T32
SAN50C-R	8977 Model R50
SAN192C-6	8978 Model E04
SAN384C-6	8978 Model E08
SAN768C-6	8978 Model E16
Cisco products	**Machine type and model number**
Cisco MDS 9132T Fabric Switch	9711 Model T32
Cisco MDS 9718 Multilayer Director	9710 Model E16
Cisco MDS 9396S Multilayer Fabric Switch	9711 Model S96
Cisco MDS 9706 Multilayer Director	9710 Model E06
Cisco MDS 9148S Multilayer Fabric Switch	9711 Model S48
Cisco MDS 9250i Multilayer Fabric Switch	9710 Model E01
Cisco MDS 9710 Multilayer Director	9710 Model E08
Withdrawn from marketing, Supported	
Cisco MDS 9148 Fabric Switch	2417 Model C48
Cisco MDS 9124 Fabric Switch	2417 Model C24
Cisco MDS 9222i Multilayer Fabric Switch	2054 Model E01
Cisco MDS 9124 Fabric Switch	2053 Model 424
Cisco MDS 9506 Multilayer Director	2054 Model E04
Cisco MDS 9509 Multilayer Director	2054 Model E07
Cisco MDS 9513 Multilayer Director	2054 Model E11
Cisco MDS 9513 Multilayer Director	2062 Model E11
Cisco MDS 9513 Multilayer Director	2062 Model D04
Cisco MDS 9509 Multilayer Director	2062 Model D07

Installing the device pack

About this task

Perform the following steps to install the device pack with DCNM.

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Procedure

1. Navigate to *www.cisco.com/go/dcnm*, and download the latest device pack. For example, dcnm-device-pack.10.4.2.DP.1.zip.
2. Copy the zip file to the DCNM machine.
3. Stop the DCNM applications by using the appropriate command.
   - For DCNM in Standalone and Federation modes, use the command, *appmgr stop dcnm* .
   - For DCNM in Native HA mode, on the Active Node, use the following script (that is located under the /root folder): *Stop_DCNM_Servers*.
   - For DCNM in Linux Standalone and Federation modes, use the following command: *stopSANServer.sh*.
   - For DCNM in Windows Standalone and Federation modes, use the *stopSanService.bat* command.
4. Navigate to the location where you saved the device pack, and extract the files.
5. Execute the patch file by using the following command:

   Note: You must provide the entire path to the Device Pack location to execute this command. The installation may fail otherwise.

   ./patch.sh < patchname_with_path >

   For example,

   ```
   /usr/local/cisco/dcm/fm/bin/patch.sh /root/dcnm-device-pack.10.4.2.DP.1.zip
   ```

   The patch installation process begins after you issue the command.

   Note: For Federation and Native-HA setup with Cisco DCNM, ensure that the device pack is installed on both primary and secondary devices.
6. After the patch installation is complete, restart DCNM applications using the appropriate command.
   - For DCNM in Standalone and Federation modes, use the *appmgr start dcnm* command.
   - For DCNM in Native HA mode, on the Active Node, use the following script (that is located under the /root folder): *Start_DCNM_Servers*.
   - For DCNM in Linux Standalone and Federation modes, use the *startSANServer.sh* command.
   - For DCNM in Windows Standalone and Federation modes, use the *startSanService.bat* command.

Chapter 4. DCNM Web Client

Using the DCNM Web Client, you can monitor the IBM Storage Networking SAN c-type family switch events, performance and inventory, and perform minor administrative tasks.

The default user credentials to access DCNM, Release 11.1.x are as configured during the deployment of the installers.

DCNM Web Client provides the following features:

- "Navigating the DCNM Web Client"
- "DCNM Web search engine" on page 10
- "Scope menu"
- "Admin menu" on page 10
- "Table and filtering navigation" on page 10
- "Printing" on page 10
- "Exporting to a file" on page 10
- Viewing monitor information

Navigating the DCNM Web Client

The Data Center Network Manager (DCNM) is a management system for the a Unified Fabric. It enables you to provision, monitor, and troubleshoot the data center network infrastructure. It provides visibility and control of the unified data center. DCNM provides a comprehensive feature set that meets the routing, switching, and storage administration needs of data centers. DCNM streamlines the provisioning for the unified fabric and monitors the SAN and LAN components. DCNM provides a high level of visibility and control through a single web based management console for IBM Storage Networking SAN c-type Family switches. During the DCNM installation, you can choose to install applications related to Unified Fabric only for Unified Fabric-mode installations.

The DCNM Web Client has standardized certain navigation conventions.

- "Scope menu"
- "Admin menu" on page 10
- "Table and filtering navigation" on page 10
- "Printing" on page 10
- "Exporting to a file" on page 10
- "Sorting columns" on page 10

Scope menu

The drop-down list called Scope applies to all pages except the Administration and Configure pages. You can use the scope menu to filter network information by the following criteria.

- Data Center
- Default_LAN
- Default_SAN

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- Individual Fabric Various other custom scopes created by the users.

The features accessible from the tabs are limited to the areas that you choose in the filter tree.

Admin menu

You can use the admin menu to do the following tasks.

DCNM SAN
Launch the SAN Client.

DCNM DM
Launch the Device Manager Client which is part of the SAN option.

Change Password
Changes the password for the current logged in user.

Help Content
Pops out the online help of the current page.

About Display the information about Data Center Network Manager.

Logout
Logout from the DCNM Web Client.

Table and filtering navigation

Some tables can be filtered and include a filter option to view subsets of the information. Either choose the filter menu or click **Filter**. An editable row at the top of the table appears. Enter values into the table cells and click **Return** to display matching rows.

Printing

Click Print to view the table in a printer-friendly format. You can then print the page from the browser.

Exporting to a file

An Export icon is in the upper right corner of some tables or top right corner of the window. Click this icon to export the data to Microsoft Excel.

Sorting columns

Not all columns are sortable but you can click a sortable column head to sort the information for that column.

DCNM Web search engine

The search engine uses the following search criteria to help you locate records.

- Search by name.
- Search by IP Address.
- Search by WWN.
- Search by Alias.
- Search by MAC Address.

- Search by serial number.

Using the DCNM search engine

About this task

Navigate to the Main window to start a search engine session.

Procedure

1. Click the **Search** box on the top right corner of the main window. The search text box appears.
2. Use the drop-down to search by the following categories.
   - Name
   - IP address
   - WWN
   - Alias
   - MAC address
   - Serial number
3. Enter the value based on the search option and click the arrow to begin the search. The search results are displayed in a new window.

Downloading DCNM-SAN Client

About this task

You must use the DCNM Web Client to launch the DCNM-SAN client.

Procedure

1. On the top right of the DCNM Web Client home screen, click the settings icon next to the login user. Select DCNM-SAN option.
2. If you have the latest Java version installed, a Warning message is displayed. Click **Run** with the latest version button.
3. Enter the user credentials to log on to DCNM-SAN client. The request for user credentials appears only the first time you launch the DCNM-SAN Client.

Downloading the device manager client

About this task

You must use the DCNM Web Client to Install Cisco Device Manager client.

Note: Device Manager Client is part of the SAN option.

Procedure

1. On the top right of the DCNM Web Client home screen, click the settings icon next to the login user. Select DCNM DM option. If you have the latest Java version installed, a Warning message is displayed.
2. DCNM Device Manager supports JRE versions 1.6 and 1.7. Follow the instructions in the Device Manager installer wizard to proceed with the installation.

3. Once the installation is complete, enter the user credentials to log on to the Device Manager client.

Viewing dashboard information

The DCNM Web Client dashboard gives you the following types of comprehensive information.

Summary
You can view the summary dashboard which displays the overall functioning of all the devices connected. It gives you daily statistics of the connected devices. The summary also includes panels to simplify the management of LAN and SAN clients.

Network
You can view the information on switches including status and license, as well as detailed switch dashboard information for a specific switch.

Storage
You can view details about the storage device along with its events and topology.

Compute
You can view the details and events for a particular Host along with its events and topology.

Note: Compute is available only with SAN installations.

For more information about the Dashboard tab, refer to the Web Client Online Help.

Viewing topology information

Topology is a first class menu item in this release with the intention that it is fully functional for providing detailed access to configuration as well as monitoring functionality. The DCNM topology consolidates functionality in the existing Fabric topology as well as the current Dashboard topology into a new fully featured topology which includes the following features in a single view.

- Optional display of Vinci Balls or device icons.
- Display of Multi-link, Port-channels, VPCs.
- Display of Inter-fabric links.
- VDC and Pod Groupings.
- Device-Scope, Fabric and Datacenter drill-down.
- Automatic VPC Peer and FEX Groupings.
- Ability to select devices and take action consistent with other areas of the product.

For more information about Topology, refer to the Web Client Online Help.

Viewing inventory information

You can use the global Scope pane to view the inventory and the performance for both SAN and LAN switches . You can select LAN, SAN, or both to view the inventory information. You can also export and print the inventory information. In this tab, you can find the discovered LAN switches, SAN switches, Storage devices and Virtual Machine Manager. You can also add a new discovery LAN or SAN switch as well.

For more information about Inventory tab, refer to the Web Client Online Help.

Viewing monitor information

You can get the performance statistics of CPU, Memory, Traffic, others, accounting and events information. You can also view performance information about SAN and LAN. You can create customized reports based on historical performance, events, and inventory information gathered in this tab. You can create aggregate reports with summary and detailed views. You can also view previously saved reports.

For more information about Monitor tab, refer to the Web Client Online Help.

Viewing configure information

Allow user to view and configure Zoning, Device Alias, Port Monitoring and Device Credentials.

For more information about Configure tab, refer to the Web Client Online Help.

Creating a local certificate

You can view and configure DCNM servers, DCNM users, performance setup and event setup.

For more information about Administration tab, refer to the Web Client Online Help.

Using DCNM web client with SSL

The DCNM Web Client uses HTTPs. If you want to install SSL certificates and use the DCNM Web Client over HTTPs (using TCP port 443 or another custom port), you need a certificate for each external IP address that accepts secure connections. You can purchase these certificates from a well-known Certificate Authority (CA).

To enable SSL, you must set up the keystore to use either a self-signed certificate or a certificate from a trusted third-party company such as VeriSign.

The following topics provide information about:

- Creating a Local Certificate.
- Creating a Certificate Request.

Creating a local certificate

About this task

Use the following command to set up a keystore to use a self-signed certificate (local certificate).

Procedure

1. From the command line, enter the following command on windows:

   ```
   %JAVA_HOME%/bin/keytool -genkey -alias tomcat -keyalg RSA -keystore
   "C:\Program Files\Cisco Systems\dcm\jboss-as-7.2.0.Final\standalone\configuration\fmserver.jks"
   ```

2. Enter your name, organization, state, and country. Enter change it when prompted for a keystore password. If you prefer to use your own password, do not forget to change the keystorepass attribute in the server.xml file. When prompted for a key password, press Enter or use the same password as the keystore password.

   Note:

   You can now follow the steps in the next section for modifying DCNM Web Client to use SSL.

   To obtain a certificate from the Certificate Authority of your choice, you must create a Certificate Signing Request (CSR). The CSR is used by the certificate authority to create a certificate that identifies your website as secure.

Creating a certificate request

About this task

Procedure

1. Create a local certificate (as described in the previous section).

   Note: You must enter the domain of your website in the fields First and Last name in order to create a working certificate.

2. Use the following command to create the CSR.

   ```
   keytool -certreq -keyalg RSA -alias tomcat -file certreq.csr -keystore
   "C:\Program Files\Cisco Systems\dcm\jboss-as-7.2.0.Final\standalone\configuration\fmserver.jks"
   ```

   Now you have a file called certreq.csr. The file is encoded in PEM format. You can submit it to the certificate authority. You can find instructions for submitting the file on the Certificate Authority website.

   After you have your certificate, you can import it into your local keystore. You must first import a Chain Certificate or Root Certificate into your keystore. You can then import your certificate.

3. Download a Chain Certificate from the Certificate Authority where you obtained the certificate.
   - For Verisign.com commercial certificates, go to this URL. http://www.verisign.com/support/install/intermediate.html
   - For Verisign.com trial certificates, go to this URL. http://www.verisign.com/support/verisign-intermediate-ca/Trial_Secure_Server_Root/index.html
   - For Trustcenter.de, go to this URL. http://www.trustcenter.de/certservices/cacerts/en/en.htm#server

- For Thawte.com, go to this URL. http://www.thawte.com/certs/trustmap.html

4. Import the Chain Certificate into your keystore by entering the command.

```
keytool -import -alias root -keystore
" C:\Program Files\Cisco Systems\dcm\jboss-as-7.2.0.Final\standalone\configuration\
fmserver.jks" -trustcacerts -file filename_of_the_chain_certificate
```

5. Import the new certificate in X509 format by entering the following command.

```
keytool -import -alias tomcat -keystore
" C:\Program Files\Cisco Systems\dcm\jboss-as-7.2.0.Final\standalone\configuration\
fmserver.jks" -trustcacerts -file your_certificate_filename
```

Chapter 5. Media Control

This chapter describes the Media Controller and Programmable Media Network (PMN) AMQP notification in the DCNM. This chapter contains the following sections.

Overview

The IP fabric for media solution helps transition from an SDI router to an IP-based infrastructure. In an IP-based infrastructure, a single cable has the capacity to carry multiple bidirectional traffic flows and can support different flow sizes without requiring changes to the physical infrastructure.

The IP fabric for media solution consists of a flexible spine and leaf architecture or a single modular switch topology. The solution uses Cisco Nexus 9000 Series switches in conjunction with the Cisco non-blocking multicast (NBM) algorithm (an intelligent traffic management algorithm) and with or without the Data Center Network Manager (DCNM) Media Controller. Using open APIs, the DCNM Media Controller can integrate with various broadcast controllers. The solution provides a highly reliable (zero drop multicast), highly visible, highly secure, and highly available network.

For information about Cisco's IP fabric for media solution, see the Cisco Nexus 9000 Series NX-OS IP Fabric for Media Solution Guide, Releases 7.0(3)I4(5), 7.0(3)I6(1), and 7.0(3)F2(1) at the following URLhttp://www.cisco.com/c/en/us/td/docs/switches/datacenter/nexus9000/sw/7-x/ip_fabric_for_media/solution/guide_703i45/b_Cisco_Nexus_9000_Series_IP_Fabric_for_Media_Solution_Guide_703I45.html

For information about the media controller functionality in the DCNM Web Client, see the DCNM Web Client Online Help at the following URL. http://www.cisco.com/c/en/us/td/docs/switches/datacenter/sw/DCNM_OLH/Web_Client/b_DCNM_web_client_olh/Media_Controller.html

For information about the PMN APIs, see the Cisco DCNM API reference guide at the following URL. https://developer.cisco.com/site/data-center-network-manager/

PMN AMQP Notification in DCNM

DCNM uses the Advanced Message Queuing Protocol (AMQP), which is an open standard protocol to exchange messages with other entities. It generates real-time AMQP notification for various operations. The message contains routing key, properties, and payload sections. The consumer of the message can use the routing

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key to quickly filter the required messages. The properties section provides additional information about the message such as message priority, delivery mode, content type, content encoding, and header. The payload is the actual notification content.

Notification body

The DCNM notification payload contains necessary information about the event. The following table shows the event categories that DCNM generates.

Table 3. Event categories

Category	Operation
Host	Create/update/delete/import.
Host Policy	Create/update/delete/import, association with Host, dissociation from the Host, host policy (ACL) deployment status.
Flow	Create/delete/migration. Insufficient bandwidth of interface, HTTP error during config deployment to the switch, flow stitch status.
Flow Policy	Create/delete/update/import.
Flow Alias	Create/delete/update/import.
Switch	Switch reload, switch interface status update, line card status update, failed flow update,

Sample notification

Host Creation
Host created with name: Host-2.1.1.3 by admin

Host Policy Creation
Host Policy with policy name LabVideoPolicy successfully created by admin

Flow Migration
Successful Migration:NodeDown: 4130(93180YC-68) is down [broken node 4130(93180YC-68) triggers flow 225.3.2.1 with sender:13080/6580 removal]

Switch Reload
Switch with IP:192.0.2.1 has recovered from a reload and is up now

Note: In the upcoming DCNM release, the PMN notification body will be changed to JSON format and the routing key will consist of event type, operation status and so on for notification filtering. Some information. The keys used in REST APIs will be added to notification body to simplify the integration of external application.

Chapter 6. Configuring DCNM Native High Availability

This chapter describes the DCNM Native High Availability (HA) configuration and troubleshooting and includes the following information.

DCNM HA overview

DCNM Native HA provides a high availability solution for the DCNM. It consists of two DCNM nodes in which one node assumes the role of the active node and the other node assumes the role of the standby node.

The native HA is supported on Linux platform with ISO and OVA installation. For standalone installation, we will not support native HA as there might be missing Linux packages which are required for native HA. Native HA is also not supported on Windows platform.

By default, DCNM is bundled with an embedded database engine PostgreSQL. The DCNM native HA is achieved by two DCNM's running as Active / Warm Standby, with their embedded databases synchronized in real time. So, if the active DCNM is down, the standby will take over with the same database data and resume the operation.

DCNM native HA installation

For detailed DCNM native HA setup process, please refer to Cisco DCNM Installation Guide, Release 10.0(x).

DCNM License Usage and Limitations

The DCNM license is tied to host Mac Address. In DCNM native HA setup, there are two hosts with different Mac addresses.

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In DCNM native HA, only primary DCNM (node 1) is allowed to load license, the secondary (node 2) can only apply the licenses. This is similar to DCNM Federation where DCNM with Id 0 could load licenses, all others can only apply the licenses.

Note: DCNM recommends having licenses on one instance and a spare matching license on the second instance.

Native HA failover and split-brain

DCNM failover can be manually triggered, or if the standby DCNM detects that the active DCNM is not responsive, the standby takes and acts as active. In DCNM native HA, the VIP(s) are always associated with active host. When failover occurs, the active host disassociates the VIP(s) and shuts down the DCNM process. The standby then associates the VIP(s) with the host, changes the database from stream replication mode to normal mode, and starts up the DCNM process.

Split-Brain syndrome occurs when the communication on enhanced fabric interface between two HA peers is lost. As the result, both hosts act as Active. When the communication resumes, both hosts negotiate and eventually one becomes active, and the other goes to standby.

Disk File Replication

In addition to database real-time synchronization between two DCNM HA peers, there are also a number of disk files that need to be replicated (including the POAP templates, performance data (RRD files), and so forth.

Replacing HA hosts

About this task

If you need to replace an HA host machine, use the following procedures.

Note: The IP addresses or VIPs are assumed not to be changed. Hosts that having "Deployed role: Standby" can only be replaced.

Procedure

1. Stop the DCNM on the standby host (no IP change).
2. Stop the DCNM on the active host (no IP change).
3. Backup the Standby DCNM.
4. Make a local copy of the ha-properties file from `/root/packaged-files/properties/` path.
5. On the new host, configure the IP addresses on eth0 and eth1to be identical to the old host being replaced.
6. If the host is a virtual machine, configure the mac address to be identical to the old host, so there will be no need to get new licenses for the new host.
7. On the new host which will join the HA setup, run the HA setup script, just like in the normal HA setup procedure.
8. Restart the DCNM on the active host, then restart the DCNM on the standby host.

DCNM native HA with scaled up test

Different HA scale limits have been mentioned under DCNM 11.1.x release. Please refer to Cisco DCNM Release Notes, Release 11.1.x for scale requirement and scale limits.

AAA configuration

For AAA configuration, you need to install DCNM native HA with local user credentials. Once the installation is done, please log into the DCNM web client and go to **Administrator > Management Users > Remote AAA** and select the required authentication mode.

Note: When doing remote AAA authentication, DCNM is sending out request using its own eth0 IP rather than VIP. Therefore, on the AAA server, we need to put two entries for DCNM IP, one for active DCNM, the other for standby IP, but not VIP.

Troubleshooting the DCNM Native HA

When the DCNM native HA setup is in an uncertain situation, stop both hosts and resolve the problem. Start only one host and ensure that it is fully functional, and the device data is correct before you bring up the second host as standby.

Note: Throughout this troubleshooting procedure, dcnm1 is considered as the Active host and dcnm2 is considered for Secondary host.

This contains the following sections:

- Recovering DCNM when both hosts are powered down
- Recovering from Split-Brain syndrome
- Checking the DCNM Native HA Status
- Verifying if the Active and Standby Hosts are Operational
- Verifying HA Database Synchronization
- Resolving HA Status Failure condition
- Bringing up Database on Standby Host

Recovering DCNM when both hosts are Powered Down

About this task

Perform the following tasks to troubleshoot the DCNM Native HA setup when both the hosts are powered down.

Procedure

1. Power on dcnm1.
2. Wait for all the applications to be operational. and then use the `appmgr status all` command to check the status of the applications.

   ```
   dcnm1# appmgr status all
   ```
3. Logon to DCNM. Verify if it is fully functional. Check if the device data is correct.

- If successful in logging on to DCNM, power on dcnm2 as Secondary host. Terminate the troubleshooting procedure.
- If the host fails to bring up all the applications, or if the device data is incorrect, use the `appmgr stop all` command to stop the process. Wait for all the applications to stop.

4. Power on dcnm2, and wait for all the applications to be operational.
5. Use the `appmgr status all` command to check the status of the applications.

   ```
   dcnm2# appmgr status all
   ```

6. Logon to DCNM. Verify if it is fully functional. Check if the device data is correct.
   - If success, power on dcnm1 as Secondary host. Terminate the troubleshooting procedure.
   - If dcnm2 fails to bring up all the applications, or if the device data is incorrect, use the `appmgr stop all` command to stop the process.
7. Restore both hosts from backup.

Recovering from Split-Brain syndrome

About this task

To recover from the Split-brain Syndrome, you need to resolve the communication problem between the two hosts which causes the problem. Perform the following tasks to accomplish this.

Procedure

1. Use the `appmgr stop all` command, to stop the applications on both the Active and Standby DCNM hosts.

   ```
   dcnm1# appmgr status all
   dcnm#2 appmgr status all
   ```

2. Ping the peer host eth1 IP address from both hosts and make sure it is reachable.
3. Start all the applications on dcnm1. Wait for all the applications to be operational. Use the `appmgr status all` command to check the status of the applications.

   ```
   dcnm1# appmgr status all

   '
   ```

4. Logon to dcnm1 and verify if it is fully functional and if all the data is correct.
   - If all the data is correct, proceed to Step 6.
   - If data loss is seen, proceed to Step 5.
5. Use the `appmgr stop all` command, to stop the applications.

   ```
   dcnm1# appmgr stop all
   ```

6. Start all the applications on dcnm2. Wait for all the applications to be operational. Use the `appmgr status all` command to check the status of the applications.

   ```
   dcnm2# appmgr status all
   ```

7. Logon to DCNM. Verify if it is fully functional. Check if the device data is correct.
   - If successful, power on dcnm1 as Secondary host. Terminate the troubleshooting procedure.

- If data loss is seen on dcnm2, use the `appmgr stop all` command, to stop all the applications.

  ```
  dcnm2# appmgr stop all
  ```

8. Restore both hosts from backup.

Checking DCNM Native HA Status

About this task

Perform the following tasks to determine the status of the DCNM Native HA.

Procedure

1. Login into Cisco DCNM Web Client.
2. Navigate to **Web Client > Administration > Native HA**.
3. Check for HA Status.

   The following list shows the various statuses of the Native HA with a description for each.

   OK Implies that the Native HA is operational. Both the hosts on the Native HA are synchronized.

   Stopped
   Implies that the Standby host is not operational and the database is not synchronized.

   Failed
   Implies that the Active host is unable to synchronize with the Standby host. Check the log files for more information. The log file is located at: `/usr/local/cisco/dcm/fm/logs/fms_ha.log`

   Not Ready
   Implies that the Standby host is not setup or not configured.

   .

Verifying if the Active and Standby Hosts are Operational

About this task

Perform the following tasks to determine if the hosts are operational.

Procedure

1. Use the `appmgr show ha-role` command to check the current HA role on the host.

   ```
   dcnm1# show ha-role

   Active
   dcnm2# show ha-role

   Standby
   ```

2. Check the VIP, using the `ip address` command. On the Active host, both eth0 and eth1 must have two IP addresses configured, with VIP assigned as the secondary IP address. On the standby host, there is only one IP address for both eth0 and eth1 interfaces.
3. Check the DCNM java process by use of the `ps -ef | grep java` command.

```
dcnm1# ps -ef | grep java
```

The results must show one Java process, appended with standalone-san.xml.

```
 dcnm2# ps -ef | grep java
```

There should no be any Java process, appended with standalone-san.xml.

4. Check the heartbeat of the DCNM hosts.

```
dcnm1# /etc/init.d/heartbeat status

heartbeat OK
dcnm2# /etc/init.d/heartbeat status

heartbeat OK
```

5. Check if the database engine PostgreSQL is operational.

```
dcnm1# /etc/init.d/postgresql-9.4 status

server is running ......
dcnm2# /etc/init.d/postgresql-9.4 status

server is running ......
```

6. Check the HA cluster information.

```
dcnm1# cl_status listnodes
dcnm2# cl_status listnodes
```

The two hostnames of the HA cluster are displayed.

7. Check the HA heartbeat status.

```
dcnm1# cl_status nodestatus <hostname>
dcnm2# cl_status nodestatus <hostname>
```

If this command returns `active`, the heartbeat on the host is OK. If the command returns `dead`, the heartbeat on the host is not running or not recognized.

Verifying HA database synchronization

About this task

When running DCNM Native HA, both the host databases must be operational, one host as Active and the other host as Standby. Any changes made in the Active database must synchronize with the Standby database in real time.

Procedure

To verify if the database is synchronizing, use the `ps -ef | grep post` command.

```
dcnm1# ps -ef | grep post

postgres: wal sender process postgres 172.23.244.222(40826) streaming
0/9A846C04
dcnm2# ps -ef | grep post

postgres: wal receiver process streaming 0/9A84E00
```

Resolving HA status failure condition

About this task

Perform the following to resolve if the HA status check results in failure.

Step 5 , page 6-7.

Procedure

1. Logon to the DCNM Web UI.
2. Navigate to **Administration > Native HA** and click the Test icon. Check if there are errors. Click **Detailed Logs** for more information.
3. Check log file at the following location. `/usr/local/cisco/dcm/fm/logs/fms_ha.log` There should be some log messages indicating why the HA status is Failed.
4. Verify if Standby host is operational. for more information., See Verifying if the Active and Standby Hosts are Operational, Check is any applications are not operational. Generally, the HA status shows Failed due to Standby database being down or rejected connection. If the connection to standby database is rejected, the HA status shows as Failed. Check the file located at:`/usr/local/cisco/dcm/db/data/pg_hba.conf`

   The configuration file must contain entries for all IP addresses listed on active host ip address. If not, contact Technical Support for further assistance.
5. If Standby database is completely down, see Bringing up Database on Standby Host.

Bringing up the database on standby host

About this task

Normally, the database must be running on both the Active or Standby host, regardless of DCNM being operational or stopped. However, the database could be down mostly because of the initial database synchronization failure.

Perform the following to bring up the database on the Standby host.

Procedure

1. Start the Standby database, using the `/etc/init.d/postgresql-9.4 start` command. If the return value is `PostgreSQL 9.4 started successfully`, the Standby database is OK. The HA status shows `OK` within a few minutes. If the database is not started successfully, the database files may be corrupted. This condition occurs due to initial synchronization failure. In such a condition, navigate to the located at: `/usr/local/cisco/dcm/db/replication`
2. Check for the file `pgsql-standby-backup.tgz`. If the file exists, perform the following substeps to restore database files, and start database again.
   a. Enter the `ps -ef | grep post` command and ensure that the Postgres process is not running.
   b. If the Postgres process is running, use the `kill <pid>` command to stop it.
   c. Use the following commands to remove all the database files.

   ```
   cd /usr/local/cisco/dcm/db
   rm -rf data/*
   ```

d. Restore the database files from the backup by using `tar xzf replication/pgsql-standby-backup.tgz data` command.
e. Check if the database has started successfully.

Chapter 7. DCNM-SAN Overview

This chapter provides an overview of the basic DCNM-SAN components and includes the following sections:

DCNM-SAN Server

The DCNM-SAN Server is a platform for advanced Storage Networking products monitoring, troubleshooting, and configuration capabilities. DCNM-SAN Server provides centralized Storage Networking products management services and performance monitoring. SNMP operations are used to efficiently collect fabric information. The DCNM-SAN software, including the server components, requires about 60 MB of hard disk space on your workstation. The DCNM-SAN Server runs on Windows 2000, Windows 2003, Windows 2008, Windows XP, Windows 7, Solaris 9 and 10, and Red Hat Enterprise Linux AS Release 5.

Each computer configured as a DCNM-SAN Server can monitor multiple Fibre Channel SAN fabrics. Up to 16 clients (by default) can connect to a single DCNM-SAN Server concurrently. The DCNM-SAN Clients can also connect directly to IBM Storage Networking SAN c-type Family switch in fabrics that are not monitored by a DCNM-SAN Server, which ensures that you can manage any of your IBM Storage Networking SAN c-type Family switches and directors from a single console.

DCNM-SAN Client

The DCNM-SAN Client is a Java and SNMP-based network fabric and device management tool with a GUI that displays real-time views of your network fabric, including SAN type c-type Family of switches. and third-party switches, hosts, and storage devices.

DCNM-SAN Client provides Fibre Channel troubleshooting tools, in addition to complete configuration and status monitoring capabilities for IBM Storage Networking SAN c-type Family switches. You can use these health and configuration analysis tools on the IBM Storage Networking SAN c-type Family switches to perform Fibre Channel ping and traceroute.

Fabric Manager Release 4.1(1b) and later releases provide a multilevel security system by adding a server admin role that allows access to limited features. The configuration capabilities of a server admin is limited to configuring FlexAttach

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and relevant data. Advanced mode option is available only for network administrators and provides all of the DCNM-SAN features, including security, IVR, iSCSI, and FICON.

Device Manager

Device Manager provides a graphical representation of a IBM Storage Networking SAN c-type Family switch and directors, along with the installed switching modules, the supervisor modules, the status of each port within each module, the power supplies, and the fan assemblies.

The tables in the DCNM-SAN Information pane basically correspond to the dialog boxes that appear in Device Manager. However, while DCNM-SAN tables show values for one or more switches, a Device Manager dialog box shows values for a single switch. Device Manager also provides more detailed information for verifying or troubleshooting device-specific configuration than DCNM-SAN.

Device Manager provides two views: Device View and Summary View. Use Summary View to monitor interfaces on the switch. Use Device View to perform switch-level configurations including the following configurations:

- Configuring virtual Fibre Channel interfaces
- Configuring Fibre Channel over Ethernet (FCoE) features
- Configuring zones for multiple VSANs
- Managing ports, PortChannels, and trunking
- Managing SNMPv3 security access to switches
- Managing CLI security access to the switch
- Managing alarms, events, and notifications
- Saving and copying configuration files and software image
- Viewing hardware configuration
- Viewing chassis, module, port status, and statistics

DCNM Web Client

With DCNM Web Client you can monitor SAN c-type switch events, performance, and inventory from a remote location using a web browser.

Performance Manager Summary reports—The Performance Manager summary report provides a high-level view of your network performance. These reports list the average and peak throughput and provides hot-links to additional performance graphs and tables with additional statistics. Both tabular and graphical reports are available for all interconnections monitored by Performance Manager.

Performance Manager drill-down reports—Performance Manager can analyze daily, weekly, monthly and yearly trends. You can also view the results for specific time intervals using the interactive zooming functionality. These reports are only available if you create a collection using Performance Manager and start the collector.

Zero maintenance database for statistics storage—No maintenance is required to maintain Performance Manager's round-robin database, because its size does not increase over time. At prescribed intervals the oldest samples are averaged

(rolled-up) and saved. A full two days of raw samples are saved for maximum resolution. Gradually the resolution is reduced as groups of the oldest samples are rolled up together.

Performance Manager

The primary purpose of DCNM-SAN is to manage the network. A key management capability is network performance monitoring. Performance Manager, which is part of DCNM server, gathers network device statistics historically and provides this information graphically using a web browser. Performance Manager presents recent statistics in detail and older statistics in summary. Performance Manager also integrates with external tools such as a Traffic Analyzer.

Performance Manager has three operational stages.

- Definition—The Flow Wizard sets up flows in the switches.
- Collection—The Web Server Performance Collection screen collects information on desired fabrics.
- Presentation—Generates web pages to present the collected data through DCNM-SAN Web Server.

Performance Manager can collect statistics for ISLs, hosts, storage elements, and configured flows. Flows are defined based on a host-to-storage (or storage-to-host) link. Performance Manager gathers statistics from across the fabric based on collection configuration files. These files determine which SAN elements and SAN links Performance Manager gathers statistics for. Based on this configuration, Performance Manager communicates with the appropriate devices (switches, hosts, or storage elements) and collects the appropriate information at fixed five-minute intervals.

Authentication in DCNM-SAN Client

Administrators launch DCNM-SAN Client and select the seed switch that is used to discover the fabric. The user name and password are passed to DCNM-SAN Server and are used to authenticate to the seed switch. If this user name and password are not a recognized SNMP user name and password, either DCNM-SAN Client or DCNM-SAN Server opens a CLI session to the switch (SSH or Telnet) and retries the user name and password pair. If the user name and password are recognized by the switch in either the local switch authentication database or through a remote AAA server, then the switch creates a temporary SNMP user name that is used by DCNM-SAN Client and DCNM-SAN Server.

Traffic Analyzer

The Traffic Analyzer provides real-time analysis of SPAN traffic or analysis of captured traffic through a Web browser user interface. Traffic encapsulated by one or more Port Analyzer Adapter products can be analyzed concurrently with a single workstation running Traffic Analyzer, which is based on ntop, a public domain software enhanced for Fibre Channel traffic analysis.

The Traffic Analyzer monitors round-trip response times, SCSI I/Os per second, SCSI read or traffic throughput and frame counts, SCSI session status, and management task information. Additional statistics are also available on Fibre Channel frame sizes and network management protocols.

Network Monitoring

DCNM-SAN provides extensive SAN discovery, topology mapping, and information viewing capabilities. DCNM-SAN collects information on the fabric topology through SNMP queries to the switches connected to it. DCNM-SAN recreates a fabric topology, presents it in a customizable map, and provides inventory and configuration information in multiple viewing options such as fabric view, device view, summary view, and operation view.

Once DCNM-SAN is invoked, a SAN discovery process begins. Using information polled from a seed IBM Storage Networking SAN c-type Family switch, including Name Server registrations, Fibre Channel Generic Services (FC-GS), Fabric Shortest Path First (FSPF), and SCSI-3, DCNM-SAN automatically discovers all devices and interconnects on one or more fabrics. All available switches, host bus adapters (HBAs), and storage devices are discovered. The IBM Storage Networking SAN c-type Family switches use Fabric-Device Management Interface (FMDI) to retrieve the HBA model, serial number and firmware version, and host operating-system type and version discovery without host agents. DCNM-SAN gathers this information through SNMP queries to each switch. The device information discovered includes device names, software revision levels, vendor, ISLs, PortChannels, and VSANs.

Performance Monitoring

DCNM-SAN and Device Manager provide multiple tools for monitoring the performance of the overall fabric, SAN elements, and SAN links. These tools provide real-time statistics as well as historical performance monitoring.

Real-time performance statistics are a useful tool in dynamic troubleshooting and fault isolation within the fabric. Real-time statistics gather data on parts of the fabric in user-configurable intervals and display these results in DCNM-SAN and Device Manager.

Device Manager provides an easy tool for monitoring ports on the IBM Storage Networking SAN c-type Family switches. This tool gathers statistics at a configurable interval and displays the results in tables or charts. These statistics show the performance of the selected port in real-time and can be used for performance monitoring and troubleshooting. For a selected port, you can monitor any of a number of statistics including traffic in and out, errors, class 2 traffic, and FICON data. You can set the polling interval from ten seconds to one hour, and display the results based on a number of selectable options including absolute value, value per second, and minimum or maximum value per second.

Chapter 8. Configuring the DCNM-SAN Server

This chapter describes the DCNM-SAN Server, which is a platform for advanced switch monitoring, troubleshooting, and configuration capabilities. No additional software needs to be installed. The server capabilities are an integral part of the DCNM-SAN software.

This chapter contains the following sections.

Information About the DCNM-SAN Server

Install DCNM-SAN Server on a computer that you want to provide centralized MDS management services and performance monitoring. SNMP operations are used to efficiently collect fabric information. The DCNM-SAN software, including the server components, requires about 60 MB of hard disk space on your workstation. DCNM-SAN Server runs on Windows 2000, Windows 2003, Windows XP, Solaris 9 and 10, and Red Hat Enterprise Linux AS Release 5.

Each computer configured as a DCNM-SAN Server can monitor multiple Fibre Channel SAN fabrics. Up to 16 clients (by default) can connect to a single DCNM-SAN Server concurrently. The DCNM-SAN Clients can also connect directly to an MDS switch in fabrics that are not monitored by a DCNM-SAN Server, which ensures you can manage any of your MDS devices from a single console.

DCNM-SAN Server Features

The DCNM-SAN Server has the following features:

• Multiple fabric management— DCNM-SAN Server monitors multiple physical fabrics under the same user interface. This facilitates managing redundant fabrics. A licensed DCNM-SAN Server maintains up-to-date discovery information on all configured fabrics so device status and interconnections are immediately available when you open the DCNM-SAN Client.

• Continuous health monitoring—MDS health is monitored continuously, so any events that occurred since the last time you opened the DCNM-SAN Client are captured.

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• Roaming user profiles—The licensed DCNM-SAN Server uses the roaming user profile feature to store your preferences and topology map layouts on the server, so that your user interface will be consistent regardless of what computer you use to manage your storage networks.

Note You must have the same release of DCNM-SAN Client and DCNM-SAN Server.

Note You will not be able to manage a SAN fabric if the DCNM-SAN Server is going through a IP NAT firewall to access the SAN fabric. All the IP addresses that are discovered in a SAN fabric must be directly reachable by the DCNM-SAN Server.

Licensing Requirements For DCNM-SAN Server

When you first install DCNM-SAN, the basic unlicensed version of DCNM-SAN Server is installed with it. You get a 30-day trial license with the product. However, trial versions of the licensed features such as Performance Manager, remote client support, and continuously monitored fabrics are available. To enable the trial version of a feature, you run the feature as you would if you had purchased the license. You see a dialog box explaining that this is a demo version of the feature and that it is enabled for a limited time.

To get the licensed version after 30 days, you need to buy and install the DCNM-SAN Server package. You need to get either a switch based FM_SERVER_PKG license file and install it on your switches, or you need to get DCNM server based license files and add them to your server. Please go to **Administration > Licenses** on the DCNM Web Client, or go to the license files tab of the DCNM-SAN Client control panel to find the license files. You can assign the licenses to the switches through either the **Administration > Licenses** window on the DCNM Web Client or the license assignment tab of the DCNM-SAN Client control panel.

Installing and Configuring DCNM-SAN Server

About this task

Note: Prior to running DCNM-SAN Server, you should create a special DCNM-SAN administrative user on each switch in the fabric or on a remote AAA server. Use this user to discover your fabric topology.

Procedure

1. Prior to running the DCNM-SAN Server, create a special DCNM-SAN administrative user on each switch in the fabric or on a remote AAA server. Use this user to discover your fabric topology.
2. Log in to DCNM-SAN.
3. Set the DCNM-SAN Server to continuously monitor the fabric.
4. Repeat Step 2 through Step 3 for each fabric that you want to manage through DCNM-SAN Server.
5. Install DCNM-SAN Web Server. See Verifying Performance Manager Collections
6. Verify Performance Manager is collecting data. See Verifying Performance Manager Collections

Installing DCNM-SAN Server

About this task

When you first install DCNM, the basic version of the DCNM-SAN Server (unlicensed) is installed with it. After you click the DCNM-SAN icon, a dialog box opens and you can enter the IP address of a computer running the DCNM-SAN Server component. If you do not see the DCNM-SAN Server IP address text box, click Options to expand the list of configuration options. If the server component is running on your local machine, leave local host in that field. If you try to run DCNM-SAN without specifying a valid server, you are prompted to start the DCNM-SAN Server locally.

DCNM supports the following options that you can choose during installation. Based on the option you select, the application will be installed in one of the following modes.

- DCNM Web Client
- DCNM SAN + LAN Client

To download the software from cisco.com, go to the following website: https://software.cisco.com/download/home/281722751/type/282088134/release/11.0%25281%2529

For detailed DCNM installation steps, please refer to DCNM Installation Guide, Release 10.0(x).

Data Migration in DCNM-SAN Server

The database migration should be limited to the existing database. Data collision can occur when you merge the data between the several databases.

When you upgrade a non federation mode database to a federation mode database for the first time, the cluster sequence table is filled with the values larger than the corresponding ones in the sequence table and conforming to the cluster sequence number format for that server ID.

Verifying performance manager collections

Once Performance Manager collections have been running for five or more minutes, you can verify that the collections are gathering data by choosing **Performance Manager > Reports** in DCNM-SAN. You see the first few data points gathered in the graphs and tables.

Managing a DCNM-SAN Server Fabric

You can continuously manage a DCNM-SAN Server fabric, whether or not a client has that fabric open. A continuously managed fabric is automatically reloaded and managed by DCNM-SAN Server whenever the server starts.

Selecting a Fabric to Manage Continuously

Procedure

1. Choose **Server > Admin**. The Control Panel dialog box with the Fabrics tab opens.

   Note: The Fabrics tab is only accessible to network administrators.

   Note: You can preconfigure a user name and password to manage fabrics. In this instance, you should use a local switch account, not a TACACS+ server.
2. Choose one of the following Admin options.
   - Manage Continuously—The fabric is automatically managed when the DCNM-SAN Server starts and continues to be managed until this option is changed to Unmanage.
   - Manage—The fabric is managed by the DCNM-SAN Server until there are no instances of DCNM-SAN viewing the fabric.
   - Unmanage—The DCNM-SAN Server stops managing this fabric.
3. Click Apply.

   Note: If you are collecting data on these fabrics using Performance Manager, you should now configure flows and define the data collections.

DCNM-SAN Server Properties File

The DCNM-SAN Server properties file (MDS 9000\server.properties) contains a list of properties that determine how the DCNM-SAN Server will function. You can edit this file with a text editor, or you can set the properties through the DCNM-SAN Web Services GUI, under the Admin tab.

Note: You can optionally encrypt the password in the server.properties and the AAA.properties files.

The server properties file contains these nine general sections:

- GENERAL—Contains the general settings for the server.
- SNMP SPECIFIC—Contains the settings for SNMP requests, responses, and traps.
- SNMP PROXY SERVER SPECIFIC—Contains the settings for SNMP proxy server configuration and TCP port designation.
- GLOBAL FABRIC—Contains the settings for fabrics, such as discovery and loading.
- CLIENT SESSION—Contains the settings for DCNM-SAN Clients that can log into the server.
- EVENTS—Contains the settings for syslog messages.
- PERFORMANCE CHART—Contains the settings for defining the end time to generate a Performance Manager chart.
- EMC CALL HOME—Contains the settings for the forwarding of traps as XML data using e-mail, according to EMC specifications.
- EVENT FORWARD SETUP—Contains the settings for forwarding events logged by DCNM-SAN Server through e-mail.
- SNMP Specific

  - snmp.preferTCP—If this option is set to true, TCP is the default protocol for Cisco DCNM-SAN Server to communicate with switches. By default, this setting is true. For those switches that do not have TCP enabled, Cisco DCNM-SAN Server uses UDP. The advantage of this setting is the ability to designate one TCP session for each SNMP user on a switch. It also helps to reduce timeouts and increase scalability.

    Note: If you set this option to false, the same choice must be set in DCNM-SAN. The default value of snmp.preferTCP for DCNM-SAN is true.
- Performance Chart
  - pmchart.currenttime—Specifies the end time to generate a Performance Manager chart. This should only be used for debugging purposes.
- EMC Call Home
  - server.callhome.enable—Enables or disables EMC Call Home. By default, it is disabled.
  - server.callhome.location—Specifies the Location parameter.
  - server.callhome.fromEmail—Specifies the From Email list.
  - server.callhome.recipientEmail—Specifies the recipientEmail list.
  - server.callhome.smtphost—Specifies the SMTP host address for outbound e-mail.
  - server.callhome.xmlDir—Specifies the path to store the XML message files.
  - server.callhome.connectType—Specifies the method to use to remotely connect to the server.
  - server.callhome.accessType—Specifies the method to use to establish remote communication with the server.
  - server.callhome.version—Specifies the version number of the connection type.
  - server.callhome.routerIp—Specifies the public IP address of the RSC router.
- Event Forwarding
  - server.forward.event.enable—Enables or disables event forwarding.
  - server.forward.email.fromAddress—Specifies the From Email list.
  - server.forward.email.mailCC—Specifies the CC Email list.
  - server.forward.email.mailBCC—Specifies the BCC Email list.
  - server.forward.email.smtphost—Specifies the SMTP host address for outbound e-mail.
- Deactivation
  - deactivate.confirm=deactivate—Specific Request for User to type a String for deactivation.

Note: In a federated server environment, you should not change Cisco DCNM-SAN Server properties by modifying server.properties file. You must modify the server.properties using web client menu **Admin > Configure > Preferences**.

Modifying DCNM-SAN Server

You can modify certain DCNM-SAN Server settings without stopping and starting the server.

- Changing the DCNM-SAN Server Username and Password
- Changing the DCNM-SAN Server Username and Password

- Changing the DCNM-SAN Server Fabric Discovery Username and Password
- Changing the Polling Period and Fabric Rediscovery Time
- Changing the IP Address of the DCNM-SAN and DCNM-SMIS WINDOWS Server
- Changing the IP Address of the DCNM-SAN for Federated Windows Setup
- Changing the IP Address of the DCNM-SAN and DCNM-SMIS LINUX Server
- Using Device Aliases or FC Aliases

Changing the DCNM-SAN Server Username and Password

About this task

You can modify the username or password used to access a fabric from DCNM-SAN Client without restarting the DCNM-SAN Server.

Procedure

1. Choose **Server > Admin**. The Control Panel dialog box with the Fabrics tab opens.
2. Set the Name or Password for each fabric that you are monitoring with DCNM-SAN Server.
3. Click Apply to save these changes.

Changing the DCNM-SAN Server Fabric Discovery Username and Password

About this task

Complete the following tasks to change the Username and password for the DCNM-SAN server fabric discovery.

Procedure

1. Click **Server > Admin** in DCNM-SAN. The Control Panel dialog box with the Fabrics tab opens.
2. Click the fabrics that have updated user name and password information.
3. From the Admin listbox, select **Unmanage** and then click **Apply**.
4. Enter the appropriate user name and password and then click **Apply**.

   For more information, see "Performance manager authentication" on page 45.

Changing the Polling Period and Fabric Rediscovery Time

About this task

The DCNM-SAN Server periodically polls the monitored fabrics and periodically rediscovers the full fabric at a default interval of five cycles. You can modify these settings from DCNM-SAN Client without restarting the DCNM-SAN Server.

Procedure

1. Choose **Server > Admin**. The Control Panel dialog box with the Fabrics tab opens.

2. For each fabric that you are monitoring with the DCNM-SAN Server, set the Polling Interval to determine how frequently the DCNM-SAN Server polls the fabric elements for status and statistics.
3. For each fabric that you are monitoring with the DCNM-SAN Server, set the Rediscover Cycles to determine how often the DCNM-SAN Server rediscovers the full fabric.
4. Click **Apply** to save these changes.

Changing the IP Address of the DCNM-SAN & DCNM-SMIS Windows Server

About this task

Complete the following tasks to change the IP address of a DCNM-SAN and DCNM-SMIS Server.

Procedure

1. Stop the DCNM-SAN and DCNM-SMIS Servers.
2. Replace the old IP Address with the new IP Address in the following files:
   - $INSTALLDIR\jboss-as-7.2.0.Final\bin\service\sanservice.bat
   - $INSTALLDIR\jboss-as-7.2.0.Final\standalone\configuration\standalone-san.xml(Including DB url)
   - $INSTALLDIR\fm\conf\server.properties
3. Enter the following command to assign a new IP address.

   ```
   run $INSTALLDIR\fm\bin\PLMapping.bat -p newipaddress 0
   ```

   Assume $INSTALLDIR is the top directory of DCNM installation. The above command is for single server instance, where 0 is the server ID.
4. Change the old IP Address with the new IP Address in the file `$INSTALLDIR\fm\conf\smis.properties`
5. Start the DCNM-SAN and DCNM-SMIS Servers.

Changing the IP Address of the DCNM-SAN for Federated Windows Setup

To change the IP address of the DCNM-SAN for federated Windows OS, complete both of the following tasks.

- Changing the IP address of primary server.
- Changing the IP address of secondary server.

Changing the IP address of primary server

About this task

Complete the following steps to change the IP address of the primary server.

Procedure

1. Stop the DCNM-SAN and DCNM-SMIS Servers.
2. Replace the old IP Address with the new IP Address in the following file.

   ```
   $INSTALLDIR\jboss-as-7.2.0.Final\bin\service\sanservice.bat
   ```
3. Replace the old IP Address with the new IP Address in the following file.

`$INSTALLDIR\jboss-as-7.2.0.Final\standalone\configuration\standalone-san.xml`

4. Change the old IP Address with the new IP Address in the file.
   `$INSTALLDIR\fm\conf\server.properties`

   Note: If the DB is installed locally (URL points to LocalHost), you do not need to change the DB URL in the standalone-san.xml, server.properties.
5. Enter the following command to assign a new IP address:
   `run $INSTALLDIR\fm\bin\PLMapping.bat -p newipaddress 0`
   Assume $INSTALLDIR is the top directory of DCNM installation. The above command is for primary server instance, where 0 is the server ID.
6. Change the old IP Address with the new IP address in the file:
   `$INSTALLDIR\fm\conf\smis.properties`
7. Start the DCNM-SAN and DCNM-SMIS Servers.

Changing the IP address of secondary server

About this task

Complete the following steps to change the IP address of the secondary server.

Procedure

1. Stop the DCNM-SAN and DCNM-SMIS Servers.
2. Replace the old IP Address with the new IP Address in the file:
   `$INSTALLDIR\jboss-as-7.2.0.Final\bin\service\sanservice.bat`
3. Replace the old IP Address with the new IP Address in the file:
   `$INSTALLDIR\jboss-as-7.2.0.Final\standalone\configuration\standalone-san.xml`
4. Replace the old IP Address with the new IP Address in the file:
   `$INSTALLDIR\fm\conf\server.properties`
5. If you changed the IP address in primary server, change the DB URL in the following files:
   - standalone-san.xml
   - server.properties
   - postgresql.cfg.xml\ oracle.cfg.xml

   Note: The file `postgresql.cfg.xml\ oracle.cfg.xml` can be found under `$INSTALLDIR\jboss-as-7.2.0.Final\standalone\ conf\` directory.
6. To assign a new IP address, enter the following command.
   `run $INSTALLDIR\fm\bin\PLMapping.bat -p newipaddress 1 .`
   Assume $INSTALLDIR is the top directory of DCNM installation. In the above command, 1 is the server ID.

   Note: To obtain the server ID, run
   `$INSTALLDIR\fm\bin\PLMapping.bat -show.`
7. Replace the old IP Address with the new IP Address in the file:
   `$INSTALLDIR\fm\conf\smis.properties`
8. Start the DCNM-SAN and DCNM-SMIS Servers.

Changing the IP Address of the DCNM-SAN and DCNM-SMIS LINUX Server

About this task

To change the IP address of a DCNM-SAN and DCNM-SMIS Server, follow these steps:

Procedure

1. Stop the DCNM-SAN and DCNM-SMIS Servers.
2. Replace the old IP Address with the new IP Address in the following files.
   - $INSTALLDIR/jboss-as-7.2.0.Final/bin/service.sanservice.bat
   - $INSTALLDIR/jboss-as-7.2.0.Final/standalone/configuration/standalone-san.xml (Including DB url)
   - $INSTALLDIR/fm/conf/server.properties
3. Enter the following command to assign a new IP address.

   ```
   run $INSTALLDIR/fm/bin/PLMapping.sh -p newipaddress 0
   ```

   Assume $INSTALLDIR is the top directory of DCNM installation. The above command is for single server instance, where 0 is the server ID.
4. Replace the old IP Address with the new IP Address in the file

   ```
   $INSTALLDIR/fm/conf/smis.properties
   ```

   Note: If this is a DCNM virtual appliance (OVA/ISO) deployed without any Fabric enhancements, update the property DCNM_IP_ADDRESS in the file `/root/packaged-files/properties/installer.properties` with the new IP Address.
5. Start the DCNM-SAN and DCNM-SMIS Servers.

Using Device Aliases or FC Aliases

About this task

You can change whether DCNM-SAN uses FC aliases or global device aliases from DCNM-SAN Client without restarting DCNM-SAN Server.

Procedure

1. Choose **Server > Admin**. You see the Control Panel dialog box with the Fabrics tab open.
2. For each fabric that you are monitoring with DCNM-SAN Server, check or uncheck the FC Alias check box.

   If you check the FC Alias checkbox, DCNM-SAN uses FC Alias from DCNM-SAN Client. If you uncheck the FC Alias checkbox, DCNM-SAN use global device alias from DCNM-SAN Client.
3. Click **Apply** to save these changes.

Configuring Security Manager

The security at Fabric Manager Server level control access to different features of the Fabric Manager. The existing security controls in the Fabric Manager allows a user to continue even after many unsuccessful login attempts. With the new security manager, the Fabric Manager will perform a lock-out for the specific user

after a specified number of unsuccessful login attempts. System administrators will be able to generate a report of login attempts.

To see the number of failed login attempts, in the Fabric Manager Control Panel, click **Local FM Users**. You see the control panel.

Server Federation

The Server Federation is a distributed system that includes a collection of intercommunicated servers or computers that is utilized as a single, unified computing resource. With DCNM-SAN Server Federation, you can communicate with multiple servers together in order to provide scalability and easy manageability of data and programs running within the federation. The core of server federation includes several functional units such as DCNM-SAN Server, embedded web servers, database and DCNM-SAN Client that accesses the servers.

The DCNM-SAN Server in the federation uses the same database to store and retrieve data. The database is shared among different servers to share common information. A DCNM-SAN Client or DCNM-SAN Web Client can open fabrics from the DCNM-SAN Server using the mapping table. A fabric can be moved from one logical server to another. A logical server also can be moved from one physical machine to another machine.

Restrictions

- You cannot upgrade more than one DCNM-SAN Server in an existing federation. If you choose to do so, you may not be able to migrate the Performance Manager statistics and other information on that server.
- You may be required to synchronize the time on all the DCNM-SAN Servers in a federated server environment.

Mapping Fabric ID to Server ID

About this task

The IP address of the physical server is mapped to the server ID during the installation of the DCNM-SAN Server. Whenever the IP address of the physical server is changed, you need to use the PLMapping script to map the new IP address to the server ID of the DCNM-SAN Server. Whenever the you open or discover a fabric, the fabric ID is mapped to the server ID . You can move a fabric to a different server ID using the control panel.

Procedure

1. Choose **Server > Admin**. The **Control Panel** opens.
2. Select the fabric that you want to move to a different server and then click **Move**. The **Move Fabric** dialog box opens and the fabrics that you selected appear in the **Fabrics to Move** list box.
3. From the **Move To Server** drop-down list, select the server you want to move the fabric to and click **Move**.

Opening the Fabric on a Different Server

About this task

Procedure

1. Choose **Server > Admin**. The **Control Panel** opens.
2. Click **Discover**. The **Discover New Fabric** dialog box opens.
3. In the **Seed Switch** list box, enter the IP Address of the seed switch.
4. In the **User Name** field, enter the username.
5. In the **password** field, enter the password.
6. From the **Auth-Privacy** drop-down list, choose the privacy protocol you want to apply.
7. To open the selected fabric in a different server, select the **server ID** from the **Server** drop-down list.
8. Click **Discover**.

   Note: You may receive an error message when you discover a fabric in a federation while another DCNM-SAN Server is joining the federation. You can discover the fabric on after the installation or upgradation is complete.

Viewing the Sessions in a Federation

About this task

Procedure

1. Choose **Server > Admin**.
2. Click the **Connected Clients** tab. The Control Panel appears.

Viewing the Servers in a Federation

Procedure

1. Choose **Server > Admin**.
2. Click the **Servers** tab. The Control Panel appears.

Discovering devices managed by SVI

About this task

Note

Procedure

1. Log on to the DCNM Web Client.
2. Select **Admin>Server Properties**.
3. Scroll down to the **GENERAL->DATA SOURCE FABRIC** section.
4. Set the **fabric.managementIpOverwrite** property to **false**.
5. Click **Apply**.
6. Restart the DCNM service.

   Note: If you experience technical issues using DCNM, you must restart the database service manually.

7. Delete any previously discovered switch that incorrectly shows the mgmt0 IP address.
8. Retry the discovery.

   Note: Each SVI switch must be discovered separately.

Additional References

- Server Federation is a licensed feature. For more information on DCNM-SAN Server Licensing, see Cisco MDS 9000 Family NX-OS Licensing Guide.
- For more information on deploying DCNM-SAN Server in a federation, see Cisco Fabric Manager Server Federation Deployment Guide.

Chapter 9. Configuring Authentication in the DCNM-SAN

This chapter describes the interdependent software components in the DCNM-SAN that communicate with the switches, authentication steps and the best practices for setting up your fabric and components for authentication.

This chapter contains the following sections:

- "Information about DCNM-SAN authentication"
- Best Practices for Discovering a Fabric
- Performance Manager Authentication
- DCNM-SAN Web Client Authentication

Information about DCNM-SAN authentication

DCNM-SAN contains multiple components that interact to manage a fabric, including:

- DCNM-SAN Client
- DCNM-SAN Server
- Performance Manager
- Interconnected fabric of IBM Storage Networking SAN c-type Family switches and storage devices
- AAA server (optional)

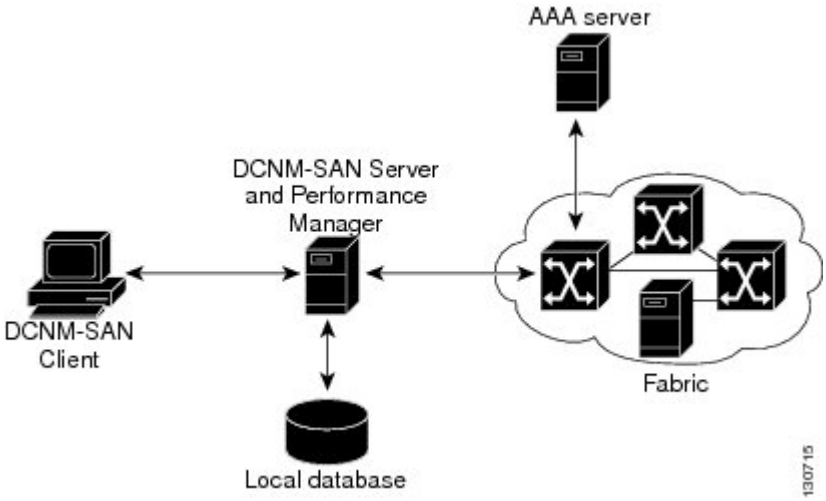

Figure 1. DCNM-SAN Authentication Example

Administrators launch DCNM-SAN Client and select the seed switch that is used to discover the fabric. The user name and password used are passed to DCNM-SAN Server and used to authenticate to the seed switch. If this user name and password are not a recognized SNMP user name and password, either DCNM-SAN Client or DCNM-SAN Server opens a CLI session to the switch (SSH or Telnet) and retries the user name and password pair. If the user name and password are recognized by the switch in either the local switch authentication

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database or through a remote AAA server, then the switch creates a temporary SNMP user name that is used by DCNM-SAN Client and server.

Note: You may encounter a delay in authentication if you use a remote AAA server to authenticate DCNM-SAN or Device Manager.

Note: You must allow CLI sessions to pass through any firewall that exists between DCNM-SAN Client and DCNM-SAN Server.

Note: We recommend that you use the same password for the SNMPv3 user name authentication and privacy passwords as well as the matching CLI user name and password.

Best practices for discovering a fabric

The DCNM-SAN Server monitors multiple physical fabrics under the same user interface. This facilitates managing redundant fabrics. A licensed DCNM-SAN Server maintains up-to-date discovery information on all configured fabrics so device status and interconnections are immediately available when you launch DCNM-SAN Client.

CAUTION: If the DCNM-SAN Server's CPU usage exceeds 50 percent, it is recommended that you switch to a higher CPU-class system.

We recommend that you use these best practices for discovering your network and setting up Performance Manager. This ensures that the DCNM-SAN Server has a complete view of the fabric. Subsequent DCNM-SAN Client sessions can filter this complete view based on the privileges of the client logging in. For example, if you have multiple VSANs in your fabric and you create users that are limited to a subset of these VSANs, you want to initiate a fabric discovery through DCNM-SAN Server using a network administrator or network operator role so that DCNM-SAN Server has a view of all the VSANs in the fabric. When a VSAN-limited user launches the DCNM-SAN Client, that user sees only the VSANs they are allowed to manage.

Note: DCNM-SAN Server should always monitor fabrics using a local switch account, do not use a AAA (RADIUS or TACACS+) server. You can use a AAA user account to log into the clients to provision fabric services.

Note: Even when remote AAA server authentication is enabled on the switch, use the local switch account that is not defined in the remote AAA server for fabric discovery. In other words, when a user is not found in the remote AAA server, then local switch user authentication will be allowed by the switch for SNMPv3 clients like DCNM.

Setting up discovery for a fabric

About this task

Procedure

1. Create a special DCNM-SAN administrative user name in each switch on your fabric with network administrator or network operator roles. Or, create a special DCNM-SAN administrative user name in your AAA server and set every switch in your fabric to use this AAA server for authentication.

2. Verify that the roles used by this DCNM-SAN administrative user name are the same on all switches in the fabric and that this role has access to all VSANs.
3. Launch DCNM-SAN Client using the DCNM-SAN administrative user. This step ensures that your fabric discovery includes all VSANs.
4. Set DCNM-SAN Server to continuously monitor the fabric.
5. Repeat Step 4 for each fabric that you want to manage through the DCNM-SAN Server.

Performance manager authentication

About this task

Performance Manager uses the user name and password information stored in the DCNM-SAN Server database. If this information changes on the switches in your fabric while Performance Manager is running, you need to update the DCNM-SAN Server database and restart Performance Manager. Updating the DCNM-SAN Server database requires removing the fabric from DCNM-SAN Server and rediscovering the fabric.

Procedure

1. Click **Server > Admin** in DCNM-SAN. The **Control Panel** dialog box with the Fabrics tab opens.
2. Click the fabrics that have updated user name and password information.
3. From the **Admin listbox**, choose **Unmanage** and then click **Apply**.
4. Enter the appropriate user name and password and then click **Apply**.
5. From the **Admin listbox**, choose **Manage** and then click **Apply**.
6. To rediscover the fabric, click the **Open** tab and check the box(es) next to the fabric(s) you want to open in the **Select** column.
7. Click **Open** to rediscover the fabric. The DCNM-SAN Server updates its user name and password information.
8. Repeat Step 3 through Step 7 for any fabric that you need to rediscover.
9. Choose **Performance > Collector > Restart** to restart **Performance Manager** and use the new user name and password.

DCNM-SAN Web Client authentication

About this task

DCNM-SAN Web Server does not communicate directly with any switches in the fabric. DCNM-SAN Web Server uses its own user name and password combination that is either stored locally or stored remotely on an AAA server.

We recommend that you use a RADIUS or TACACS+ server to authenticate users in DCNM-SAN Web Server.

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Using a RADIUS server to launch the DCNM-SAN Web Client

Procedure

1. Launch the DCNM-SAN Web Client.

2. Choose **Admin > Management Users > Remote AAA** to update the authentication used by the DCNM-SAN Web Client.
3. Set the authentication mode attribute to radius.
4. Set the RADIUS server name, shared secret, authentication method, and ports used for up to three RADIUS servers.
5. Click **Modify** to save this information.

Using a TACAS+ server to launch the DCNM-SAN Web Client

Procedure

1. Launch the DCNM-SAN Web Client.
2. Choose **Admin > Management Users > Remote AAA** to update the authentication used by the DCNM-SAN Web Client.
3. Set the authentication mode attribute to tacas.
4. Set the RADIUS server name, shared secret, authentication method, and ports used for up to three RADIUS servers.
5. Click **Modify** to save this information.

Note: DCNM-SAN does not support SecureID because it is not compatible with SNMP authentication. DCNM-SAN uses the same login credentials for all the switches in a fabric. Since SecureID cannot be used more than once for authentication, DCNM-SAN will not be able to establish a connection to the second switch using a SecureID.

Chapter 10. Configuring DCNM-SAN Client

This chapter describes about the DCNM-SAN Client, which is a java-based GUI application that provides access to the DCNM-SAN applications from a remote workstation.

This chapter contains the following sections:

Information About DCNM-SAN Client

The DCNM-SAN is a Java and SNMP-based network fabric and device management tool with a GUI that displays real-time views of your network fabric, and switches, IBM Storage Networking SAN c-type Family and third-party switches, hosts, and storage devices.

In addition to complete configuration and status monitoring capabilities for IBM Storage Networking SAN c-type Family switches, DCNM-SAN Client provides Fibre Channel troubleshooting tools. You can use these health and configuration analysis tools on the IBM Storage Networking SAN c-type Family switches to perform Fibre Channel ping and traceroute.

DCNM-SAN Release 4.1(1b) and later provides multilevel security system by adding a server admin role that allows access to limited features. The configuration capabilities of a server admin is limited to FlexAttach and relevant data.

Note: You must use the same release of DCNM-SAN Client and DCNM-SAN Server.

DCNM-SAN Advanced Mode

Advanced mode is enabled by default and provides the full suite of DCNM-SAN features, including security, IVR, iSCSI, and FICON. To simplify the user interface, from the list box in the upper right corner of the DCNM-SAN Client, choose Simple. In simple mode, you can access basic IBM Storage Networking SAN c-type Family features such as VSANs, zoning, and configuring interfaces. Advanced mode option is not available for server admin role.

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DCNM-SAN Client Quick Tour: Server Admin Perspective

DCNM-SAN provides a multilevel security system by adding a server admin role that allows access only to limited features. The configuration capabilities of a server admin role is limited to FlexAttach and relevant data. The server admin can pre-configure SAN for new servers, move a server to another port on the same NPV device or another NPV device and replace a failed server onto the same port without involving the SAN administrator. The server role admin will not be able to manage DCNM-SAN users or connected clients.

DCNM-SAN provides an improved user interface by including movable and dockable panes to let users arrange the Physical Attributes pane, Logical Domains pane, Fabric pane and Information pane according to requirements, making it easier to manage the workflow. The dockable panes are also called as dockable frames. A dockable frame can be standalone (floating), minimized or maximized. The logical, physical, information and the fabric panes can be can be collapsed and expanded as needed. These panes can also be docked at either the right side left side or to the bottom of the workspace.

DCNM-SAN Main Window

This section describes the DCNM-SAN Client interface that is specific to server admin users as shown in Figure 2 on page 49.

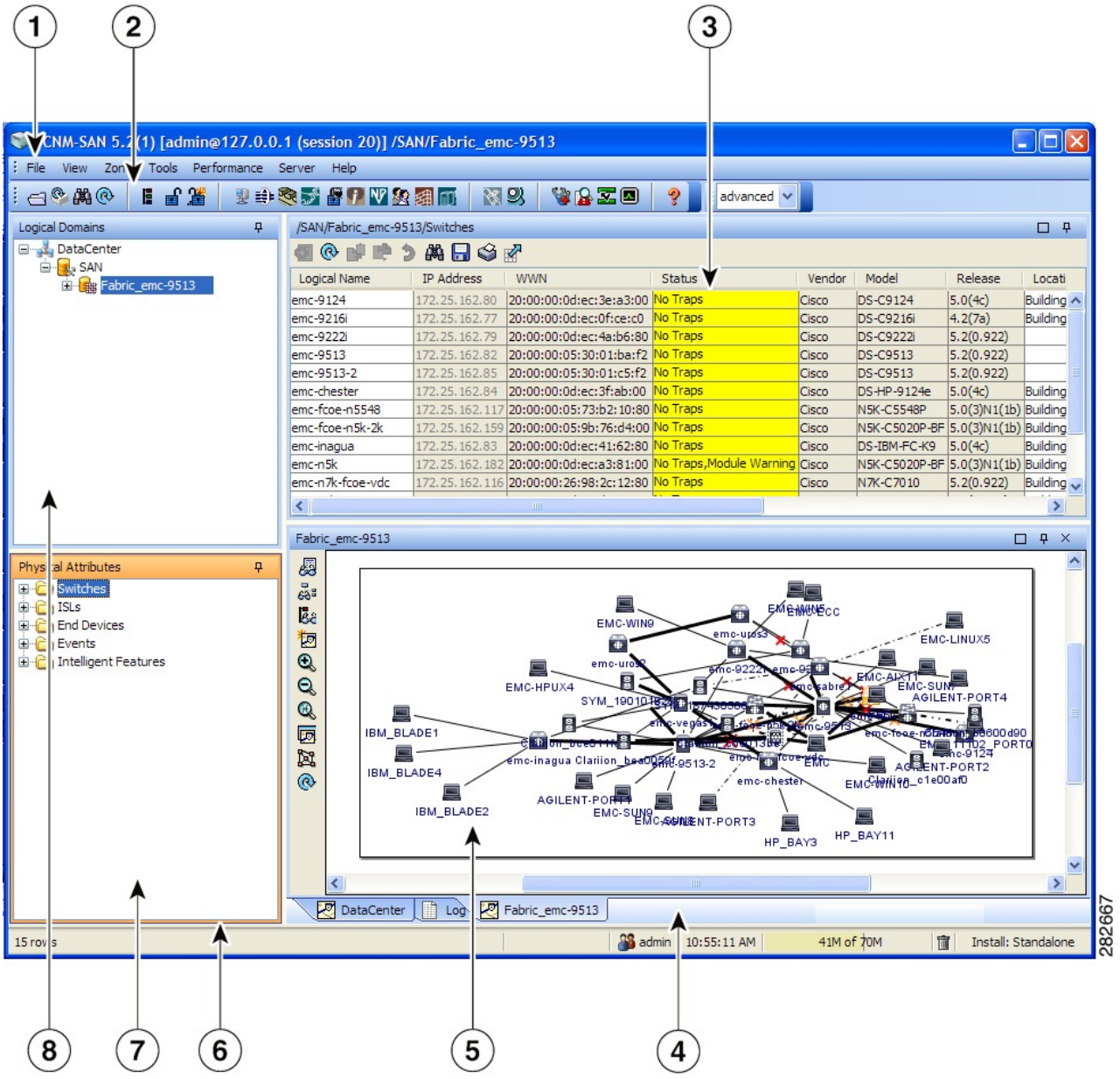

Figure 2. DCNM-SAN Main Window: Server Admin Perspective

1. Menu bar - Provides access to options that are organized by menus.
2. Toolbar - Provides icons for direct access to the most commonly used options on the File, Tools, and Help menus.
3. Information pane - Displays information about whatever option is selected in the menu tree.
4. Status Bar (right side) - Shows the last entry displayed by the discovery process and the possible error message.
5. Fabric pane - Displays a map of the network fabric, including switches, hosts, and storage. It also provides tabs for displaying log and event data.
6. Status Bar (left side) - Shows short-term transient messages, such as the number of rows displayed in a table.

7. Physical Attributes pane - Displays a tree of available configuration tasks depending on the fabric, VSAN, or zone selected previously. Lists the switches in the logical selection.
8. Logical Domains pane - Displays a tree of configured SAN, fabrics and user-defined groups.

Note: You can resize each pane by dragging the boundaries between each region or by clicking the **Minimize** or **Maximize** controls.

Menu Bar

The menu bar at the top of the DCNM-SAN main window provides options for managing and for controlling the display of information on the Fabric pane. Server admin will not have all the options that are available for SAN admin. The menu bar provides the following menus:

File Opens a new fabric, rediscovers the current fabric, locates switches, sets preferences, prints the map.

View Changes the appearance of the map (these options are duplicated on the Fabric pane toolbar).

Tools Manages the Server and configuration using the FlexAttach virtual pWWN feature.

Help Displays online help topics for specific dialog boxes in the Information pane.

Tool Bar

The DCNM-SAN main toolbar (specific to server admin) provides icons for accessing the most commonly used menu bar options as shown in Table 4.

Table 4. DCNM-SAN Client Main Toolbar

Icon	Description
	Opens switch fabric.
	Rediscovers current fabric.
	Finds in the map.
	Shows online help.

Logical Domains Pane

Use the Logical Domains pane to view fabrics and to access user-defined groups. You can expand the groups to see different user-defined groups. The non-editable groups created for each core switch contains their NPV switches.

Physical Attributes Pane

Use the Physical Attributes pane to display a tree of the options available for managing the switches in the currently selected fabric or group.

To select an option, click a folder to display the options available and then click the option. You see the table with information for the selected option in the Information pane. The Physical Attributes pane provides the following main folders:

Switches
Views and configures hardware, system, licensing, and configuration files.

Interfaces
Views and configures FC physical, FC logical, VFC (FCoE), Ethernet, SVC, and PortChannel interfaces.

Information Pane

Use the Information pane to display tables of information associated with the option selected from the menu tree in the Logical Domains or Physical Attributes panes. The Information pane toolbar provides buttons for performing one or more of the operations shown in Table 5.

Table 5. Information Pane Toolbar

Icons	Description
	Applies configuration changes.
	Refreshes table values.
	Copies data from one row to another.
	Pastes the data from one row to another.
	Undoes the most recent change.
	Finds a specified string in the table.
	Exports and saves information to a file.
	Prints the contents of the Information pane.
	Displays a non-editable copy of the table in the Information pane in its own window, which you can move around the screen.

Fabric Pane

Use the Fabric pane to display the graphical representation of your fabric. Table 4 on page 50 explains the graphics you may see displayed, depending on which devices you have in your fabric.

The bottom of the Fabric pane has the following tabs:

Fabric When displaying multiple fabrics, each fabric has its own tab. You can switch between fabrics by clicking on their respective tabs.

Log Displays messages that describe DCNM-SAN operations, such as fabric discovery.

Note: Fabric map display is based on what you select in the logical domain pane. When you select a fabric node, all the switches that belong to that fabric will be enabled. When you select the group node, all the switches that belong to the groups listed under that group node will be enabled. When you select only a group, all the switches that belong to the specific group will be enabled.

Note: You can view information about Events using the DCNM Web Client.

DCNM-SAN Client Quick Tour: Admin Perspective

This section describes the DCNM-SAN Client interface shown in Figure 3.

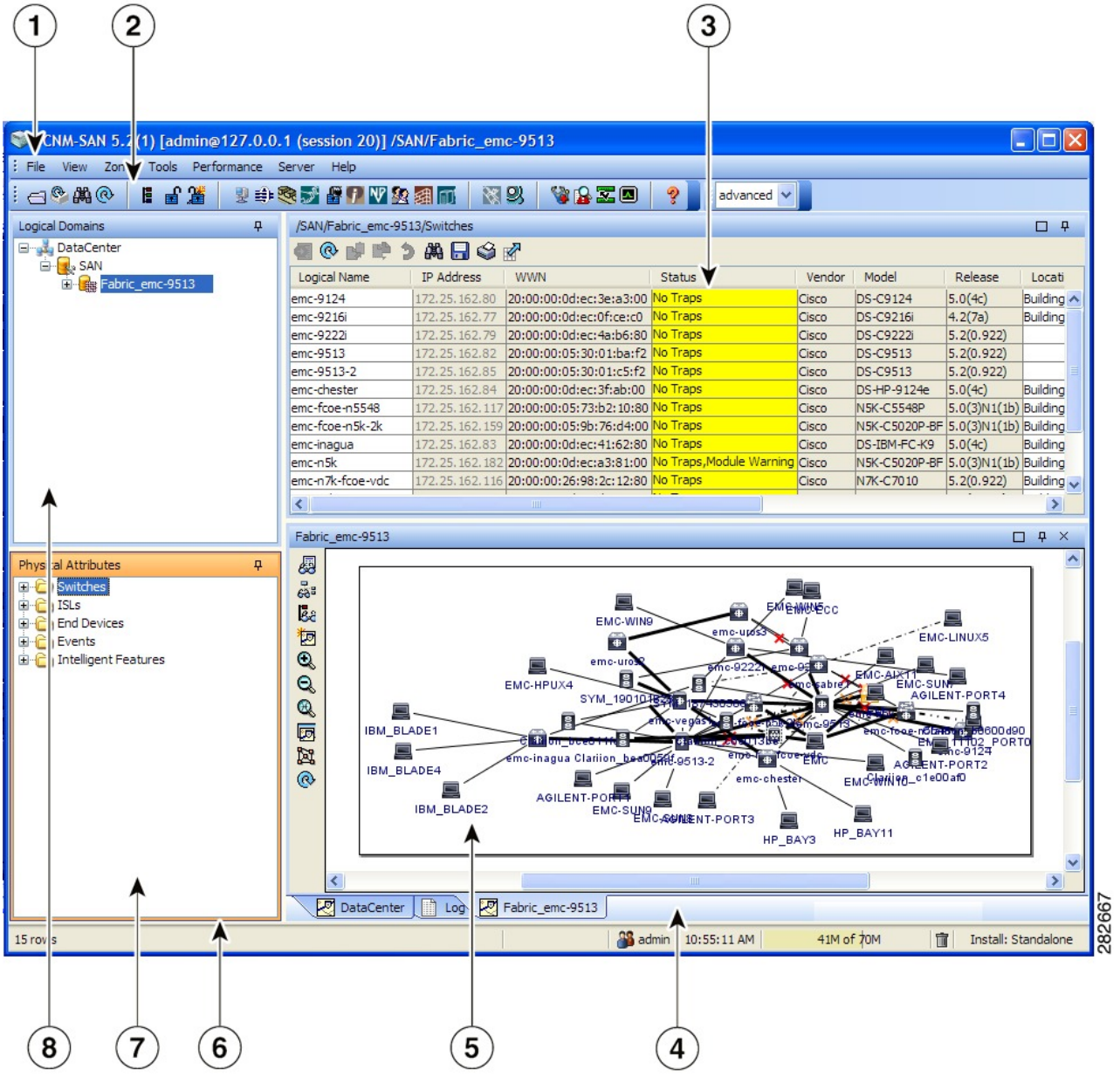

Figure 3. DCNM-SAN Main Window

1. Menu bar - Provides access to options that are organized by menus.

2. Toolbar - Provides icons for direct access to the most commonly used options on the File, Tools, and Help menus.
3. Information pane - Displays information about whatever option is selected in the menu tree.
4. Status Bar (right side) - Shows the last entry displayed by the discovery process and the possible error message.
5. Fabric pane - Displays a map of the network fabric, including switches, hosts, and storage. It also provides tabs for displaying log and event data.
6. Status Bar (left side) - Shows short-term transient messages, such as the number of rows displayed in a table.
7. Physical Attributes pane - Displays a tree of available configuration tasks depending on the fabric, VSAN, or zone selected previously. Lists the switches and end devices in the logical selection.
8. Logical Domains pane - Displays a tree of configured SAN, fabrics, VSANs, and zones, and provides access to user-defined groups. The label next to the segmented VSAN indicates the number of segments.

Note: You can resize each pane by dragging the boundaries between each region or by clicking the Minimize or Maximize controls.

Menu Bar

The menu bar at the top of the DCNM-SAN main window provides options for managing and troubleshooting the current fabric and for controlling the display of information on the Fabric pane. The menu bar provides the following menus:

File Opens a new fabric, rediscovers the current fabric, locates switches, sets preferences, prints the map, and exports the Fabric pane log.

View Changes the appearance of the map (these options are duplicated on the Fabric pane toolbar).

Zone Manages zones, zone sets, and inter-VSAN routing (IVR).

Tools Verifies and troubleshoots connectivity and configuration, as described in the DCNM-SAN Troubleshooting Tools section on page 10-35.

Performance
Runs and configures Performance Manager and Traffic Analyzer, and generates reports.

Server Runs administrative tasks on clients and fabrics. Provides DCNM-SAN Server management and a purge command. Lists fabrics being managed.

Help Displays online help topics for specific dialog boxes in the Information pane.

File

The file menu provides the following options:

Open Fabric
Opens a new switch fabric.

Locate Switches and Devices
Uses the SNMPv2 protocol to discover devices responding to SNMP requests with the read-only community string public. You may use this feature if you want to locate other IBM Storage Networking SAN c-type Family switches in the subnet, but are not physically connected to the fabric.

Rediscover
Initiates an on-demand discovery to learn recent changes from the switches and update the DCNM-SAN Client. You may use this option when DCNM-SAN Server is not in sync with switches in the fabric and you do not want to wait until the next polling cycle. The rediscover option does not delete the fabric and add it again. You may delete and add the fabric only if the rediscover option fails to update DCNM-SAN Server.

Resync All Open Fabrics
DCNM-SAN Server forces all the fabrics to close and re-open. You may use this option when DCNM-SAN Client is not in sync with DCNM-SAN Server.

Rediscover SCSI Targets
Initiates an on-demand discovery to learn recent changes from the SCSI target switches. You may use this option when DCNM-SAN Server is not in sync with SCSI target switches in the fabric and you do not want to wait until the next polling cycle.

Preferences
Sets your preferences to customize the behavior of the DCNM-SAN Client.

Import Enclosures
Imports saved enclosures.

Export

Map Image
Generates and export the map to a specified location.

Visio Exports the map to a Visio file.

Table Exports the table data to a text file.

Log Exports the log to a text file.

Events
Exports the events to a text file.

Enclosures
Exports the enclosure values to a text file.

Print Prints the map.

Exit Exit DCNM-SAN.

View

View menu provides the following options:

Refresh Map
Refreshes the current map.

Layout

Cancel
Cancels the current layout.

Spring
Displays the layout based on spring algorithm.

Quick Quickly displays the layout when the switch has many end devices.

Zoom

In Zooms in the view.

Out Zooms out the view.

Fit Fits the view in the fabric pane.

Grid Enables the grid view.

Overview Window
Allows you to center the Fabric pane on the area of the fabric that you want to see. This option is useful for large fabrics that cannot be displayed entirely within the Fabric pane.

Legend
Shows all the legends used in the fabric map.

Find in Map
Finds a device in the fabric map.

Zone

The zone menu provides the following options:

Edit Local Full Zone Database
Allows you to create zones across multiple switches. Zones provide a mechanism for specifying access control. Zone sets are a group of zones to enforce access control in the fabric. All zoning features are available through the Edit Local Full Zone Database dialog box.

Deactivate Zoneset
Deactivates an active zone set.

Copy Full Zone Database
Creates a new zone set. On the IBM Storage Networking SAN c-type Family switches, you cannot edit an active zone set. However, you can copy an active zone set to create a new zone set that you can edit.

Merge Analysis
Enables you to determine if zones will merge successfully when two SAN c-type switches are interconnected. If the interconnected switch ports allow VSANs with identical names or contain zones with identical names, then DCNM-SAN verifies that the zones contain identical members. You can use merge analysis tool before attempting a merge, or after fabrics are interconnected to determine zone merge failure causes.

Merge Fail Recovery
Recovers the port from its isolated state either by importing the neighboring switch's active zone set database and replacing the current active or by exporting the current database to the neighboring switch.

Migrate Non-MDS Database
Migrate a non-MDS database using DCNM-SAN (you may need to use the Zone Migration Wizard to accomplish this task).

IVR

Deactivate Zoneset
Deactivates an active zone set.

Copy Full Zone Database
Recovers an IVR zone database by copying the IVR full zone database from another switch.

Copy Full Topology
Recovers a topology by copying from the active zone database or the full zone database.

Tools

Tools menu provides the following options:

Health

Switch Health
Determines the status of the components of a specific switch.

Fabric Configuration
Analyzes the configuration of a switch by comparing the current configuration to a specific switch or to a policy file. You can save a switch configuration to a file and then compare all switches against the configuration in the file.

Show Tech Support
Collects large amount of information about your switch for troubleshooting purposes. When you issue a show tech support command from DCNM-SAN for one or more switches in a fabric, the results of each command are written to a text file, one file per switch, in a directory you specify. You can then view these files using DCNM-SAN.

Connectivity

End to End Connectivity
Determines connectivity and routes among devices with the switch fabric. This tool checks to see that every pair of end devices can talk to each other, using a Ping test and by determining if they are in the same VSAN or in the same active zone.

Ping Determines connectivity from another switch to a port on your switch.

Trace Route
Verifies connectivity between two end devices that are currently selected on the Fabric pane.

Compact Flash Report
Automatically scans the fabric and generate a report that shows the status of CompactFlash.

NPV

CFS Static Peer Setup
Manage the peer list used during CFS on NPV-enabled switches. After setting up the static peers list, the CFS discovery on the switches will be changed to static mode for all peers in the list. DCNM-SAN does not automatically update static peers list. You may need to update the list using the CFS Static Peer Setup Wizard when a new switch is added to the fabric.

Traffic Map Setup
Configures the list of external interfaces to the servers, and enabling or disabling disruptive load balancing. Using Traffic Map Setup you can specify the external ports that a server should use for traffic management.

Flex Attach Pre-Configure Server
Sets the port configurations for all the ports in a switch such as enabling or disabling FlexAttach, setting the default VSAN ID, and setting the interface status.

Flex Attach Move Server
Moves a server to another port on the same NPV device or another NPV device without changing the SAN.

Flex Attach Replace Server
Replaces a failed server with a new server on the same port without changing the SAN.

Data Mobility Manager

Server Based
Performs server-based data migration.

Storage based
Performs storage-based data migration.

Server LUN Discovery
Performs LUN discovery to select the LUNs available for migration and automates the session creation by matching the LUNs in the existing and new storage.

FCoE Launches the FCoE Configuration Wizard to create virtual Fibre Channel interfaces.

Port Channel
Creates PortChannels from selected ISL either manually or automatically.

DPVM Setup
Establishes dynamic port VSAN membership, enables autolearning, and activates the DPVM database.

IP SAN

FCIP Tunnel
Creates FCIP links between Gigabit Ethernet ports. Enables Fibre Channel write acceleration and IP compression.

iSCSI Setup
Creates zones for iSCSI initiators and adds a VSAN to a target-allowed VSAN list.

SAN Extension Tuner
Optimizes FCIP performance by generating either direct access (magnetic disk) or sequential access (magnetic tape) SCSI I/O commands and directing such traffic to a specific virtual target. This option is used to generate SCSI I/O commands (read and write) to the virtual target based on your configured options.

Security

Port Security
Prevents unauthorized access to a switch port in the IBM Storage Networking SAN c-type Family, rejects intrusion attempts and reports these intrusions to the administrator.

IP ACL
Creates an ordered list of IP filters in a named IPv4-ACL or IPv6-ACL profile using the IPv4-ACL Wizard.

Install

License
Facilitate download and installation of licenses in selected switches in the fabric.

Software
Verifies image compatibility and installs software images on selected switches in the fabric.

Flow Load Balance Calculator
Allows you to get the best load-balancing configuration for your FICON flows. The calculator does not rely on any switch or flow discovery in the fabric.

Device Manager
Invokes Device Manager for a switch.

Command Line Interface
Enables command-line operations.

Run CLI Commands
Runs command-line operations on more than one switch at a time.

Performance

The Performance Menu provides the following options:

Create Flows
Creates host-to-storage, storage-to-host, or bidirectional flows. You can add these flows to a collection configuration file to monitor the traffic between a host or storage element pair.

Server

The server menu provides the following options:

Admin
Opens the control panel.

Page Down Elements
Purges all down elements in the fabric.

Help

The help menu provides the following options:

Contents
Launches the online help contents.

Config Guide
Launches the DCNM-SAN Configuration Guide.

About Displays information about DCNM-SAN.

Toolbar

The DCNM-SAN main toolbar provides icons for accessing the most commonly used menu bar options as shown in Table 6.

Table 6. DCNM-SAN Client Main Toolbar

Icon	Description
	Opens switch fabric.
	Rediscovers current fabric.
	Finds in the map.

Table 6. DCNM-SAN Client Main Toolbar (continued)

Icon	Description
	Creates VSAN.
	Launches DPVM wizard.
	Launches Port Security wizard.
	Edits full zone database.
	Launches IVR zone wizard.
	Launches the FCoE configuration wizard.
	Launches PortChannel wizard.
	Launches FCIP wizard.
	Launches iSCSI wizard.
	Launches NPVM wizard.
	Launches QoS wizard.
	Configures users and roles.
	Launches IP-ACL wizard.
	Launches License Install wizard.
	Launches Software Install wizard.
	Performs switch health analysis.
	Performs fabric configuration analysis.
	Performs end-to-end connectivity analysis.
	Monitors ISL performance. Brings up real-time ISL performance information for all interfaces in the fabric, in the Information pane.
	Shows online help.

Logical Domains Pane

About this task

Use the Logical Domains pane to manage attributes for fabrics, VSANs, and zones, and to access user-defined groups. Starting from NX-OS Release 4.2(0), SAN and LAN nodes are listed under Datacenter node and all the fabrics are listed under SAN node. When you select Datacenter node in the tree, DCNM-SAN displays all the switches and ISLs. When you select LAN node, DCNM-SAN displays only Ethernet switches and Ethernet links. Under the fabric node, VSANs are ordered by a VSAN ID. The segmented VSANs are placed under the fabric node. The label next to the segmented VSAN indicates the number of segments. You can expand a segmented VSAN and the segments under that VSAN. Right-click one of the folders in the tree and click a menu item from the pop-up menu. You see the appropriate configuration dialog box.

The default name for the fabric is the name, IP address, or WWN for the principal switch in VSAN 1. If VSAN 1 is segmented, the default name is chosen from a principal switch with the smallest WWN. The fabric names you see are as follows:

- Fabric <sysName>
- Fabric <ipAddress>
- Fabric <sWWN>

You can change the fabric name using DCNM-SAN.

Procedure

1. Choose **Server** > **Admin**.
2. Double-click the fabric name and enter the new name of the fabric. You see the Control Panel dialog box.
3. Click **Apply** to change the name.

Filtering

DCNM-SAN has a filtering mechanism that displays only the data that you are interested in. To filter, first select the fabric and VSAN from the Logical Domains pane. This action narrows the scope of what is displayed in the Fabric pane. Any information that does not belong to the selected items is dimmed. Also, any information that does not belong to the selected items is not displayed in the tables in the Information pane. The filter that you select is displayed at the top right of the DCNM-SAN window.

To further narrow the scope, select attributes from the Physical Attributes pane. The DCNM-SAN table, display, and filter criteria change accordingly.

Physical Attributes Pane

Use the Physical Attributes pane to display a tree of the options available for managing the switches in the currently selected fabric, VSAN, or zone.

To select an option, click a folder to display the options available and then click the option. You see the table with information for the selected option in the Information pane. The Physical Attributes pane provides the following main folders:

Switches
: Views and configures hardware, system, licensing, and configuration files.

Interfaces
Views and configures FC physical, FC logical, VFC (FCoE), Ethernet, SVC, and PortChannel interfaces.

FC Services
Views and configures Fibre Channel network configurations.

IP Views and configures IP storage and IP services.

Security
Views and configures MDS management and FC-SP security.

FCoE Views and configures FCoE interfaces.

ISL Views and configures Inter-Switch Links.

End Devices
Views and configures end devices.

Note: You cannot view the detailed physical attributes of the data center switches or monitor the connections. When you select either a data center node or a LAN node the physical attributes pane will be blank.

Context Menu for Tables

When you right-click in the table, you see a pop-up menu with options that vary depending on the type of option you selected in the Physical Attributes pane. You can perform various operations by right-clicking the device listed in the table. To view various options available for switches, ISLs, and end devices, refer to the procedures in the sections that follows:

Viewing Switch Options

About this task

When you select the datacenter node, the switch table displays all the switches that are discovered. When you select the SAN node or the fabric node, the switch table displays all the Fibre Channel switches and when you select the LAN node, the switch table displays all the Ethernet switches.

Procedure

1. Click Switches in the Physical Attributes pane.
2. Right-click the device in the table.

   The pop-up menu provides the following options:

   Apply Changes
   Applies the changes to the switch.

   Refresh Values
   Refreshes the current values.

   Undo Changes
   Undoes modifications to the switch.

   Export to File
   Export the values to a file.

   Print Table
   Prints the table.

   Detach Table
   Detaches the table.

Switch Attributes
Changes the switch properties.

Interface Attributes
Changes the interface properties.

Element Manager
Manages this switch.

Command Line Interface
Enables to perform command line operations.

Copy Copies the switch.

Purge Purges the switch.

Fix Location
Fixes the switch in the current location.

Align Aligns the switch.

Show End Devices
Shows the end devices.

Expand Multiple Links
Expands the links to this switch.

Other Other options.

Group Groups switches.

Viewing ISL Options

About this task

When you select the data center node, the ISLs table displays all of the Fibre Channel and Ethernet links. When you select the LAN node, the ISLs table displays all the Ethernet links.

Procedure

1. In the Physical Attributes pane, click ISLs and then click Summary tab.
2. Right-click the device in the table.

   The pop-up menu provides the following options:

   Refresh Values
   Refreshes the current values.

   Copy Copies information from a specific field.

   Find Conducts search based on the input string.

   Export to File
   Exports the values to a file.

   Print Table
   Prints the table.

   Detach Table
   Detaches the table.

   Interface Attributes
   Changes the interface properties.

   Element Manager
   Manages the device.

FCIP Tunnel Attributes
Changes FCIP tunneling properties.

Create Port Channel
Creates port channel.

Re-enable
Reenables a disabled device.

Enable FC-SP
Enables FC-SP.

SAN Extention Tuner
Optimizes FCIP performance.

Purge Purges the device.

Note: When you select a port channel from the table, the pop-up menu will have the following additional options:

Member Attributes
Changes the member properties.

Channel Attributes
Changes the port channel properties.

Edit Edits the channel properties.

Viewing End Device Options

About this task

Use this procedure to view end device options.

Procedure

1. In the Physical Attributes pane, click **End Devices** and then click the **Summary** tab.
2. Right-click the device in the table.

   The pop-up menu provides the following options:

   Apply changes
   Applies the changes to the device.

   Refresh Values
   Refreshes the current values.

   Copy Copies the information specific to the field.

   Paste Pastes the copied text.

   Undo Changes
   Undoes modifications to the device.

   Find Searches for information depending on the input string.

   Export to File
   Exports the values to a file.

   Print Table
   Prints the table.

   Detach Table
   Detaches the table.

Device Attributes
Changes the device properties.

Interface Attributes
Changes the interface properties.

Element Manager
Manages this device.

command Line Interface
Enables you to perform command line operations.

Copy Copies the switch.

Purge Purges the switch.

Fix Location
Fixes the switch in the current location.

Align Aligns the switch.

Ping Pings another device.

Trace Route
Determines the route taken by packets across the network.

Select Depenent Ports
Selects dependent ports.

Group Groups devices.

Information Pane

Use the Information pane to display tables of information associated with the option selected from the menu tree in the Logical Domains or Physical Attributes panes. The Information pane toolbar provides buttons for performing one or more of the operations shown in Table 7.

Table 7. Information Pane Toolbar

Icon	Description
	Applies configuration changes.
	Refreshes table values.
	Opens the appropriate dialog box to make a new row in the table.
	Deletes the currently highlighted rows from the table.
	Copies data from one row to another.
	Pastes the data from one row to another.
	Undoes the most recent change.
	Finds a specified string in the table.

Table 7. Information Pane Toolbar (continued)

Icon	Description
	Exports and saves information to a file.
	Prints the contents of the Information pane.
	Displays a non-editable copy of the table in the Information pane in its own window, which you can move around the screen.

Note: After making changes, you must save the configuration, or the changes will be lost when the device is restarted.

Note: The buttons that appear on the toolbar vary according to the option that you select. They are activated or deactivated (dimmed) according to the field or other object that you select in the Information pane.

Detachable Tables

Detachable tables in DCNM-SAN allow you to detach tables and move them to different areas on your desktop so that you can compare similar tables from different VSANs. You can keep informational tables open from one view while you examine a different area in DCNM-SAN. To detach tables, click the Detach Table icon in the Information pane in DCNM-SAN.

Fabric Pane

Use the Fabric pane to display the graphical representation of your fabric. Table 8 explains the graphics you may see displayed, depending on which devices you have in your fabric.

Table 8. DCNM-SAN Graphics

Icon or Graphic	Description
	Director class SAN c-Type Fibre Channel switch.
	Non-director class SAN c-Type Fibre Channel switch.
	Nexus 7000 switch.
	Nexus FCoE or Fibre Channel switch.
	Catalyst LAN switch.
	Generic Fibre Channel switch.
	Dashed or dotted orange line through a device indicates that the device is manageable but there are operational problems.

Table 8. DCNM-SAN Graphics (continued)

Icon or Graphic	Description
	Dashed or dotted orange X through a device or link indicates that the device or ISL is not working properly.
	A red line through a device indicates that the device is not manageable.
	A red X through a device or link indicates that the device is down or that the ISL is down.
	Fibre Channel HBA (or enclosure).
	Fibre Channel target (or enclosure).
	iSCSI host.
	Fibre Channel ISL and edge connection.
	Fibre Channel PortChannel.
	IP ISL and edge connection.
	IP PortChannel.
	DWDM connection.
	NPV connection.
	Fibre Channel loop (storage).
	IP cloud (hosts. This icon is also used to represent a fabric when viewing a SAN (multiple fabrics) in the DCNM-SAN Fabric pane.
	Any device, cloud, or loop with a box around it means that there are hidden links attached.

If a switch or director is grayed out, DCNM-SAN can no longer communicate with it.

The bottom of the Fabric pane has the following tabs:

Fabric When displaying multiple fabrics, each fabric has its own tab. You can switch between fabrics by clicking on their respective tabs.

Log Displays messages that describe DCNM-SAN operations, such as fabric discovery.

When viewing large fabrics in the Fabric pane, it is helpful to do the following tasks:

- Turn off end device labels.
- Collapse loops.
- Collapse expanded multiple links (collapsed multiple links are shown as very thick single lines).
- Dim or hide portions of your fabric by VSAN.

Note: When a VSAN, zone, or zone member is selected in the VSAN tree, the map highlighting changes to identify the selected objects. To remove this highlighting, click the **Clear Highlight** button on the Fabric pane toolbar or choose **Clear Highlight** from the pop-up menu.

Context Menus

When you right-click an icon in the Fabric pane, you see a pop-up menu with options that vary depending on the type of icon selected. The various options available for different objects include the following:

- Open an instance of Device Manager for the selected switch.
- Open a CLI session for the selected switch.
- Copy the display name of the selected object.
- Execute a **`ping`** or **`traceroute`** command for the device.
- Show or hide end devices.
- View attributes.
- Quiesce and disable members for PortChannels.
- Set the trunking mode for an ISL.
- Create or add to a PortChannel for selected ISLs.

The Fabric pane has its own toolbar with options for saving, printing, and changing the appearance of the map. When you right-click the map, a pop-up menu appears that provides options (duplicated on the toolbar) for changing the appearance of the map.

Note: You can launch web-based or non-web-based applications from the Fabric pane. To do this, you assign an IP address to the storage port or enclosure. Then right-click to bring up the pop-up menu and select **Device Manager**.

Saving the Map

You can save the map in the Fabric Pane as an image, or as an editable Visio diagram. You can save the map with or without labels on the links. The created Visio diagram is editable and saved in two layers:

- The default layer includes all switches and links in the fabric.
- The end devices layer includes the end devices and can be turned off to remove end devices from the Visio diagram.

To save the map as a Visio diagram, choose **Files** > **Export** > **Visio** and choose **Map** or **Map with link labels**. The saved Visio diagram retains the viewing options that you selected from the Fabric pane. For example, if you collapse multiple links in the map and export the links as a Visio diagram, the Visio diagram shows those multiple links as one solid link.

The Show Tech Support option from the Tools menu also supports saving the map as a Visio diagram.

Purging Down Elements

The Fabric pane allows you to refresh the map at any time by clicking the **Refresh Map** icon. The **Refresh Map** icon redraws the map but does not purge elements that are down. To purge down elements you can:

- Choose **Server** > **Purge Down Elements**. This purges all down elements in the fabric.
- Right-click the Fabric pane and choose **Purge Down Elements**.

- Right-click a down element and choose **Purge**. This action purges only this element from the fabric.

Note: If you select an element that is not down and purge it, that element will reappear on the next fabric discovery cycle.

Multiple Fabric Display

DCNM-SAN can display multiple fabrics in the same pane as shown in Figure 4.

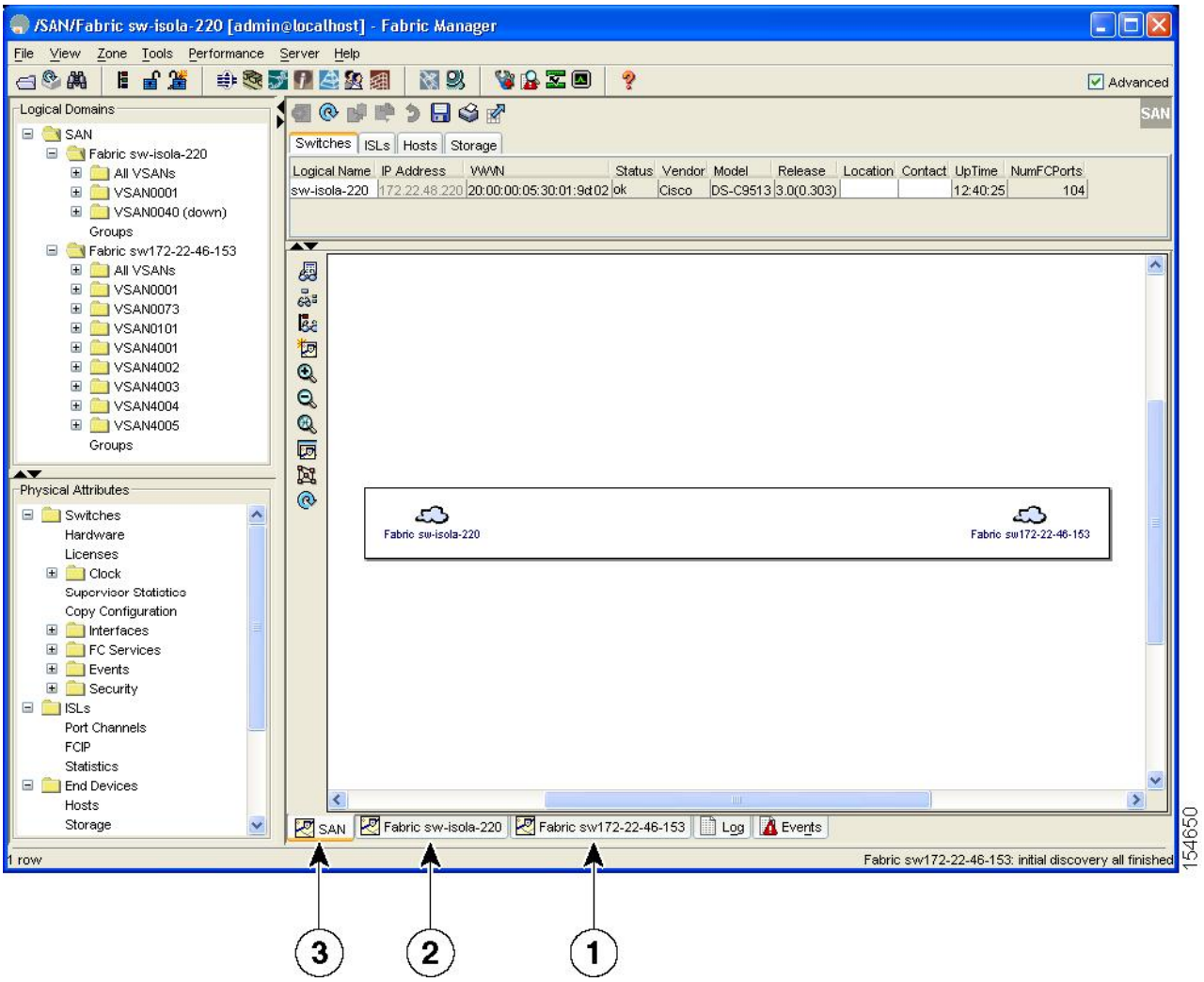

Figure 4. DCNM-SAN's Multiple Fabric Display Window

1. The Fabric view tab for fabric 172.23.46.152. When selected, the Fabric view displays fabric 172.23.46.152.
2. The Fabric view tab for fabric 172.23.46.153. When selected, the Fabric view displays fabric 172.23.46.153.
3. SAN tab (selected), showing two fabrics.

The information for both fabrics is displayed; you do not need to select a seed switch. To see details of a fabric, select the tab for that fabric at the bottom of the Fabric pane, or double-click the Cloud icon for the fabric in the SAN tab.

Note: Enclosure names should be unique. If the same enclosure name is used for each port, DCNM-SAN shows a host/target enclosure connected to both fabrics. To fix this problem, you can either disable auto-creation or create unique enclosure names.

Filtering by Groups

About this task

You can filter the Fabric pane display by creating groups of switches or end ports.

To add a switch or end port to an existing group in DCNM-SAN.

Note: User-defined groups tables are filtered based on switches in the group except for switches where CFS-controlled features are enabled when all CFS member switches are displayed to avoid misconfigurations.

Procedure

1. Right-click a switch or end port in the Fabric pane map and select **Group** > **Create**. You see the Edit User Defined Group dialog box as shown in Figure 5.

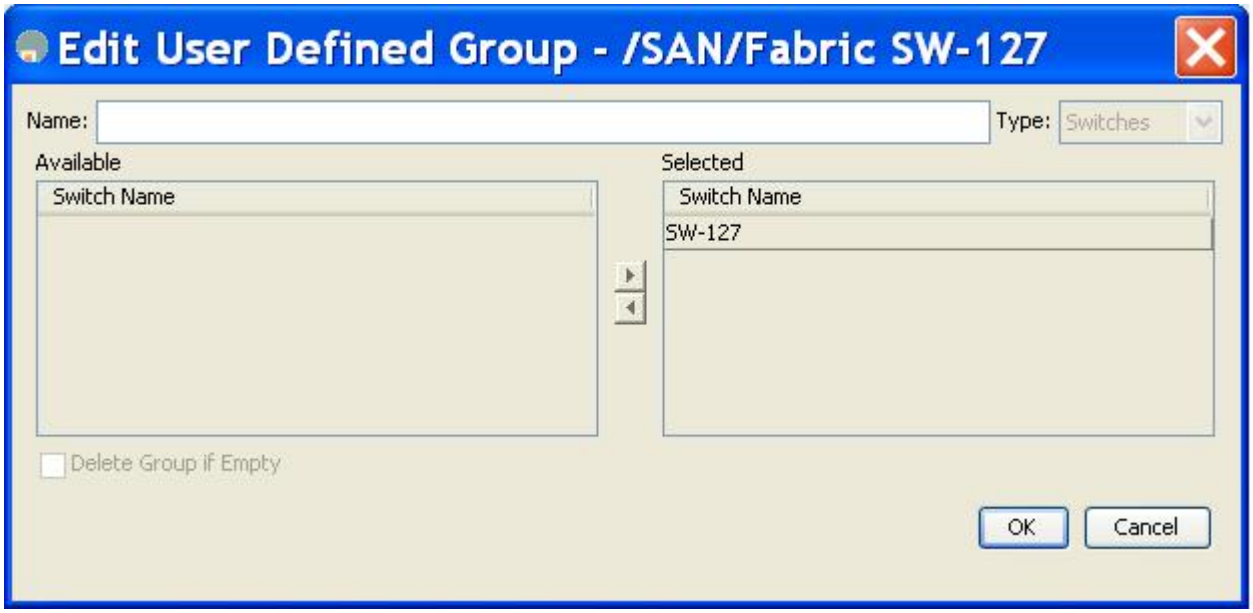

Figure 5. Edit User Defined Group Dialog Box

2. Enter a group name in the Name field.
3. Use the arrows to move additional switches or end ports from the Available column to the Selected column.
4. Click **OK** to save the group.
5. To add a switch or end port to an existing group in DCNM-SAN, do the following:
   a. Right-click a switch or end device and select **Group** > **Add To** > **YourGroupName**.

      You see the Edit User Defined Group dialog box.
   b. Use the arrows to move additional switches or end ports from the Available column to the Selected column.

c. Click **OK** to save the updated group.

6. To filter the display by a group you have created, do the following:
   a. Expand the Groups folder in the Logical Domains pane.

      You see the list of groups that you have created.
   b. Click the name of the group that you want to filter.

      In the Fabric pane, the switches or end devices in your group are shown normally; all other switches and end devices are shown in gray.
   c. Click the Groups folder in the Logical Domains pane to return the display to normal.

Status Bar

The status bar at the bottom of the DCNM-SAN window shows the last entry displayed by the discovery process, and the possible error message on the right side. The status bar displays a message stating that something has changed in the fabric and a new discovery is needed. The status bar shows both short-term, transient messages (such as the number of rows displayed in the table) and long-term discovery issues.

Launching DCNM-SAN Client

As of SAN-OS 3.x and NX-OS Release 4.x, the Fabric Manager Client login procedure has changed.

Launching Fabric Manager Client in SAN-OS Release 3.2(1) and Later

About this task

You can launch Fabric Manager Client.

Note: Network administrators must initially launch DCNM-SAN Client using DCNM-SAN Web Server, as described in the following procedure. Once an administrator has installed the DCNM-SAN Client icon on your desktop, you can double-click the icon to launch the DCNM-SAN Client.

Procedure

1. Open your browser and enter the IP address where you installed DCNM-SAN Server or enter localhost if you installed DCNM-SAN Server on your local workstation.

   You see the DCNM Web Client Login dialog box.
2. Enter your user name and password and click **Login**.

   You see the DCNM Web Client Summary page.
3. Click the **Download** link in the upper right corner of the page.

   You see the Download page for DCNM-SAN and Device Manager.
4. Click the link for DCNM-SAN.

   If you are launching DCNM-SAN Client for the first time, you see a message asking whether you want to create shortcuts for DCNM-SAN.

Figure 6. DCNM-SAN Create Shortcut(s) Message

5. Click **Yes** to create shortcuts for DCNM-SAN.

   Note: This message only appears the first time you launch DCNM-SAN Client. If you select **No**, your selection will be remembered, and you will not be prompted to make a selection again. In this case, you will need to launch DCNM-SAN Client using the DCNM-SAN Web Client.
6. When the software is installed, and icons are created on your desktop, double-click the DCNM-SAN icon to launch DCNM-SAN.

   You see the DCNM-SAN Login dialog box.
7. Enter the DCNM-SAN Server user name and password.
8. Check the **Use SNMP Proxy** check box if you want DCNM-SAN Client to communicate with DCNM-SAN Server through a TCP-based proxy server.
9. Click **Login**. Once you successfully log in to DCNM-SAN Server, you can set the seed switch and open the fabrics that you are entitled to access.

   Note: When you launch DCNM-SAN Client for the first time or when there are no available fabrics, you see the Discover New Fabric dialog box.

   You see the Discover New Fabric dialog box.

   Note: Only network administrators can discover new fabrics.

   Note: Even when remote AAA server authentication is enabled on the switch, use the local switch account that is not defined in the remote AAA server for fabric discovery. In other words, when a user is not found in the remote AAA server, then local switch user authentication will be allowed by the switch for SNMPv3 clients like DCNM.
10. Click the **Ethernet (CDP)** radio button to discover using Cisco Discovery Protocol (CDP).
11. Starting from NX-OS Release 4.2(0), Fabric Manager uses Cisco Discovery Protocol to discover Ethernet switches such as Nexus 5000, Nexus 7000, Catalyst 4000, and Catalyst 6000 switches. You need to use a CDP seed switch for a CDP discovery.

    Set the fabric seed switch to the IBM Storage Networking SAN c-type Family switch or Cisco Nexus 5000 Series that you want Fabric Manager to use.
12. Choose the Auth-Privacy option according to the privacy protocol you have configured on your switch:
    a. If you have not configured the switch with a privacy protocol, then choose **Auth-Privacy option MD5 (no privacy)**.
    b. If you have configured the switch with your privacy protocol, choose your configured Auth-Privacy option.

    Note: You may use SNMP v2 credentials for CDP discovery as most of the Catalyst switches do not use MD5-DES for configuration.

Note: If you want a clean fabric discovery, remove the fabric and rediscover it. If you want a clean LAN discovery, unmanage LAN, remove the CDP seed switch and then rediscover it.

13. Enter the username and password for the switch.
14. (Optional) To limit the discovery, specify the VSAN range.

    Scoping limits the resources discovered by DCNM-SAN client. You can either include a range of VSANs to be discovered or exclude a range of VSANs from being discovered.

    a. To limit the discovery to a range of VSANs, click Included **VSAN List** radio button. Specify the range of VSANs.
    b. To exclude a range of VSANs from being discovered, click **Excluded VSAN List** radio button. Specify the range of VSANs to be excluded.
15. Click **Discover**.

    You see the Control Panel dialog box and the included and excluded VSANs list under the Fabric tab.

    Note: You see a message in the dialog box when the server and client are running on the same workstation and there are unlicensed fabrics in the database. You also see a message when there are unmanaged fabrics (the state of the licenses is unknown).

    Note: In the open tab, you see all the discovered fabrics displayed in the control panel. You need to click on the **Open** button to see all the discovered Ethernet switches.
16. Check the check box(es) next to the fabric(s) you want to open in the Select column or click **Discover** to add a new fabric.

    Note: Only network administrators can continuously manage or unmanage fabrics. For more information, see the Selecting a Fabric to Manage Continuously section on page 8-4.
17. Click **Open** to open the selected fabric(s).

    Note: If you have an incomplete view of your fabric, rediscover the fabric with a user that has no VSAN restriction.

    - If the fabric includes a Cisco Nexus 5000 Series switch, then the Layer 2 node appears under the **Switches** > **Interfaces** > **Ethernet tree**, the VFC (FCoE) node appears under the **Switches** > **Interfaces tree**, and the FCoE node appears under the Switches tree in the Physical Attributes pane.
    - For Cisco Nexus 5000 Series switches in the fabric, the tooltip for the switch shows the bind information of a virtual Fibre Channel interface to its corresponding Ethernet interface, such as vfc2(eth1/4).

    You can launch DCNM-SAN Client from within a running instance of DCNM-SAN.

    a. Choose **File** > **Open** or click the **Open Switch Fabric** icon on the DCNM-SAN toolbar.

       You see the Control Panel dialog box.
    b. Check the check box(es) next to the fabric(s) you want to open in the Select column and click **Open**.

       Note: Changes made using DCNM-SAN are applied to the running configuration of the switches that you are managing. If you have made

changes to the configuration or performed an operation (such as activating zones), DCNM-SAN prompts you to save your changes before you exit.

Launching DCNM-SAN Client Using Launch Pad

About this task

Starting from NX-OS Release 4.2(0), you can use DCNM-SAN launch pad to connect to any server by specifying the IP address of the server. With launch pad, you can connect to any DCNM-SAN Server version 3.3(0) and later. Launch pad establishes connection with the server using HTTP protocol.

Procedure

1. Open your browser and enter the IP address where you installed DCNM-SAN Server or enter localhost if you installed DCNM-SAN Server on your local workstation.

   You see the DCNM-SAN Web Server Login dialog box.
2. Enter your user name and password and click **Login**.

   You see the DCNM-SAN Web Client Summary page.
3. Click the Download link in the upper right corner of the page.

   You see the Download page for DCNM-SAN and Device Manager.
4. Click the link for DCNM-SAN.

   You see the DCNM-SAN Server launch pad.
5. Enter the host name of the server or IP address in the **Server URL** drop-down list.
6. Click **Start**.

   Note: Launch pad retains the history of the server URLs used. You can choose one of the previously user Server URLs from the drop-down list.

Setting DCNM-SAN Preferences

To set your preferences for the behavior of the DCNM-SAN, choose **File** > **Preferences** from the DCNM-SAN menu bar. You see the Preferences dialog box with the following tabs for setting different components of the application:

- General
- SNMP
- Map

The default General preferences for DCNM-SAN are as follows:

Show Device Name by
: Displays the switches in the Fabric pane by IP address, DNS name, or logical name. The default setting for this value is Logical Name.

Show WorldWideName (WWN) Vendor
: Displays the world wide name vendor name in any table or listing displayed by DCNM-SAN. Check the **Prepend Name** check box to display the name in front of the IP address of the switch. Check the **Replacing Vendor Bytes** check box to display the name instead of the IP address. The default is the Prepend Name option.

Show End Device Using
: Displays end devices in the Fabric pane using alias or pWWN alias. The default setting for this value is Alias.

Show Shortened iSCSI Names
Displays the default setting for this value is OFF.

Show Timestamps as Date/Time
Displays timestamps in the date/time format. If this preference is not checked, timestamps are displayed as elapsed time. The default setting is enabled (checked).

Telnet Path
Displays the path for the telnet.exe file on your system. The default is telnet.exe, but you need to browse for the correct location.

Note: If you browse for a path or enter a path and you have a space in the pathname (for example, `c:\program files\telnet.exe`), then the path will not work. To get the path to work, you must manually place quotes around it (for example, "`c:\program files\telnet.exe`").

Use Secure Shell instead of Telnet
Specifies whether to use SSH or Telnet when using the CLI to communicate with the switch. If enabled, you must specify the path to your SSH application. The default setting is disabled.

Confirm Deletion
Displays a confirmation pop-up window when you delete part of your configuration using DCNM-SAN. The default setting is enabled (checked).

Export Tables with Format
Specifies the type of file that is created when you export a table using Device Manager. The options are tab-delimited or XML. The default setting is Tab-Delimited.

Show CFS Warnings
Shows warning messages if CFS is not enabled on all switches for a selected feature.

The default SNMP preferences for DCNM-SAN are as follows:

- Retry request 1 time(s) after 5 sec timeoutùYou can set the retry value to 0-5, and the timeout value to 3-30.
- Trace SNMP packets in LogùThe default setting for this value is ON.
- Enable Audible Alert when Event ReceivedùThe default setting for this value is OFF.

The default Map preferences for DCNM-SAN are as follows:

Display Unselected VSAN Members
Displays the unselected VSAN members in the Fabric pane. The default setting for this value is ON.

Display End Devices
Displays the fabric's end devices in the Fabric pane. The default setting for this value is ON.

Display End Device Labels
Displays the fabric's end device labels in the Fabric pane. The default setting for this value is OFF.

Expand Loops
Displays the loops in the fabric as individual connections in the Fabric pane. The default setting for this value is OFF.

Expand Multiple Links
Displays multiple links in the Fabric pane as separate lines instead of one thick line. The default setting for this value is OFF.

Open New Device Manager Each Time
Opens a new instance of Device Manager each time that you invoke it from a switch in your fabric. The default value is OFF, which means that only one instance of Device Manager is open at a time.

Select Switch or Link from Table
Allows you to select a switch or link in the Fabric pane by clicking the switch or link in a table in the Information pane. The default setting for this value is disabled (unchecked), which means clicking a switch or link in the table does not change the switch or link selection in the Fabric pane.

Layout New Devices Automatically
Automatically places new devices in the Fabric pane in an optimal configuration. The default setting for this value is OFF. In this mode, when you add a new device, you must manually reposition it if the initial position does not suit your needs.

Use Quick Layout when Switch has 30 or more End Devices
Displays the default setting for this value (30). You can enter any number in this field. Enter 0 to disable Quick Layout.

Override Preferences for Non-default Layout
Displays the default setting for this value (ON).

Automatically Save Layout
If this option is enabled, any changes in the layout are automatically saved. The default setting for this value is ON.

Detach Overview Window
Allows you to easily center the Fabric pane on the area of the fabric that you want to see. (This feature is useful for large fabrics that cannot be displayed entirely within the Fabric pane.) Bring up the overview window by clicking the **Show/Hide Overview Window** button. It overlays the fabric window and remains there until you click the **Show/Hide Overview Window** button again. If you enable this preference, you can detach the overview window and move it to one side while you access the Fabric pane. The default setting for this value is disabled (unchecked).

Network Fabric Discovery

DCNM-SAN collects information about the fabric topology through SNMP queries to the switches that are connected to DCNM-SAN. The switch replies after having discovered all devices connected to the fabric by using the information from its FSPF technology database and the Name Server database and collected using the Fabric Configuration Server's request/response mechanisms that are defined by the FC-GS-3/4 standard. When you start DCNM-SAN, you enter the IP address (or host name) of a seed switch for discovery.

After you start DCNM-SAN and the discovery completes, DCNM-SAN presents you with a view of your network fabric, including all discovered switches, hosts, and storage devices.

Network LAN Discovery

Starting from NX-OS Release 4.2(0), you can discover Nexus and Catalyst Ethernet switches using Cisco Discovery Protocol (CDP). DataCenter 3(DC3) switches are displayed under Datacenter and LAN nodes. DCNM-SAN displays basic information about DC3 switches and its ISLs.

Viewing Ethernet Switches

About this task

Use the following procedures to view Ethernet switch information.

Procedure

1. Click the LAN node under Datacenter node.
2. Click Switches tab in the Information pane.

   You can see the switch information as shown in Figure 7.

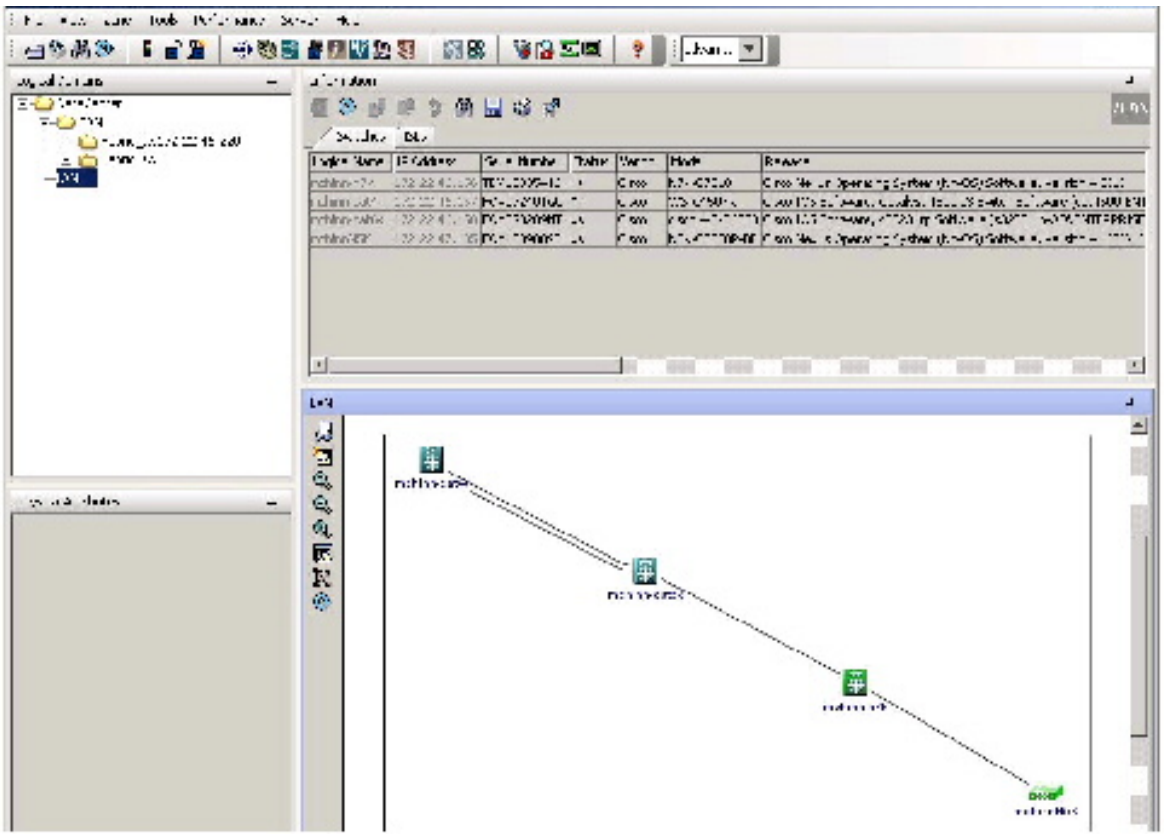

Figure 7. Ethernet Switch Information

Note: Datacenter is the parent node of SAN and LAN nodes. The SAN node remains in the tree as the parent for all the fabrics.

Removing a LAN

Procedure

1. Choose **Server** > **Admin**.

   You can see the switch information.

2. Click to select the switch IP of the LAN you want to remove.
3. Click **Remove**.

Modifying the Device Grouping

About this task

Because not all devices can respond to FC-GS-3 requests, different ports of a single server or storage subsystem may be displayed as individual end devices on the DCNM-SAN map.

Procedure

1. Expand End Devices and then choose Storage or Hosts in the Physical Attributes pane.

   You see the end devices displayed in the Information pane.
2. Click one of the devices in the Fabric pane, or click the Enclosures tab of the Information pane, and then click the device name (in the Name field) that you want to include in the enclosure.
3. Enter a name to identify the new enclosure in the Fabric pane map.
4. Click once on the device name in the Name field. To select more than one name, press the Shift key and click each of the other names.
5. Press **Ctrl-C** to copy the selected name(s).
6. Press **Ctrl-V** to paste the device name into the Name field.

   Note: To remove devices from an enclosure, triple click the device name and press **Delete**. To remove an enclosure, repeat this step for each device in the enclosure.

Using Alias Names as Enclosures

Procedure

1. Expand End Devices and choose **Hosts** or **Storage** from the Physical Attributes pane.

   You see the list of devices in the Information pane. The NxPorts tab is the default.
2. Right-click the enclosure names that you want to convert to alias names and choose **Alias** > **Enclosure**.

   The Alias Enclosures window appears. It contains a list of expressions. You can also add expressions to the list and modify expressions in the current list.
3. Click the **Apply Changes** icon to save the changes and then click **Close**.

   Note: DCNM-SAN uses the regular expressions to convert multiple alias names into one enclosure. The alias names should be in the same expression pattern rule. You can create enclosure names from selected aliases using the regular expressions list.

Using Alias Names as Descriptions

Procedure

1. Choose **End Devices** and from the Physical Attributes pane.
2. Click the **General** tab.

   You see the list of devices in the Information pane.

3. Select the device names that you want to populate the description with alias names and then click **Alias > Enclosure** button.

   You see the alias names are copied to corresponding rows in the description column.

   Note: DCNM-SAN does not parse or format the alias name while copying.

Controlling Administrator Access with Users and Roles

IBM Storage Networking SAN c-type Family switches support role-based management access whether using the CLI or DCNM-SAN. This lets you assign specific management privileges to roles and then assign one or more users to each role.

The default-role contains the access permissions needed by a user to access the GUI (DCNM-SAN and Device Manager). These access permissions are automatically granted to all users for them to use the GUI.

DCNM-SAN uses SNMPv3 to establish role-based management access. After completing the setup routine, a single role, user name, and password are established. The role assigned to this user allows the highest level of privileges, which includes creating users and roles. Use the DCNM-SAN to create roles and users and to assign passwords as required for secure management access in your network.

Note: Either to create a new SNMPv3 user or modify password of SNMPv3 user, the DCNM login user need to have enabled with DES/AES privacy password. Since the creating and modifying SNMP SET request need to be encrypted, the login user password needs to have the privacy password.

Using DCNM-SAN Wizards

DCNM-SAN Client provides the following wizards to facilitate common configuration tasks:

VSAN Creates VSANs on multiple switches in the fabric and sets VSAN attributes including interop mode, load balancing, and FICON.

Zone Edit Tool
Creates zone sets, zones, and aliases. Adds members to zones and edits the zone database.

IVR Zone
Creates IVR zone sets, zones, and aliases. Enables IVR NAT and auto-topology. Adds members to IVR zones and edits the IVR zone database.

FCoE Creates virtual Fibre Channel (FC) interfaces and VLAN-VSAN mappings and binds virtual FC interfaces to Ethernet interfaces or PortChannels.

PortChannel
Creates PortChannels from selected ISLs either manually or automatically. Sets PortChannel attributes such as channel ID and trunking mode.

FCIP Creates FCIP links between Gigabit Ethernet ports. Enables Fibre Channel write acceleration and IP compression.

DPVM
Establishes dynamic port VSAN membership, enables autolearning, and activates the DPVM database.

Port Security
Prevents unauthorized access to SAN c-Type switches and reports these intrusions to the administrator.

iSCSI Creates zones for iSCSI initiators and adds a VSAN to a target-allowed VSAN list.

NPV Reduces the number of Fibre Channel domain IDs in SANs.

QoS Sets QoS attributes for zones in the selected VSAN.

IP ACL
Creates ordered IP access control lists and distributes to selected switches in the fabric.

License Install
Facilitates download and installation of licenses in selected switches in the fabric.

Software Install
Verifies image compatibility and installs software images on selected switches in the fabric.

DCNM-SAN Troubleshooting Tools

DCNM-SAN has several troubleshooting tools available from the toolbar or Tools menu

Zone Merge Analysis
The zone merge analysis tool (available from the Zone menu) enables you to determine if zones will merge successfully when two SAN c-Type switches are interconnected. If the interconnected switch ports allow VSANs with identical names or contain zones with identical names, then DCNM-SAN verifies that the zones contain identical members. The merge analysis tool can be run before attempting a merge or after fabrics are interconnected to determine zone merge failure causes.

End-to-End Connectivity
DCNM-SAN's end-to-end connectivity analysis tool uses FC Ping to verify interconnections between SAN c-Type switches and end-device (HBAs and storage devices) in a VSAN. In addition to basic connectivity, DCNM-SAN can optionally verify the following:

- Paths are redundant.
- Zones contain at least two members.

End devices are connected to a manageable switch (have a currently active in-band or out-of-band management path.)

Switch Health Analysis
You can run an in-depth switch health analysis with DCNM-SAN. It verifies the status of all critical SAN c-Type switches, modules, ports, and Fibre Channel services. Over 40 conditions are checked. This tool provides a very fast, simple, and thorough way to assess SAN c-Type switch health.

Fabric Configuration Analysis
DCNM-SAN includes a fabric configuration analysis tool. It compares the configurations of all SAN c-Type switches in a fabric to a reference switch

or a policy file. You can define what functions to check and what type of checks to perform. The analysis can look for mismatched values and missing or extra values. If all configuration checking is performed for all functions, over 200 checks are performed for each SAN c-Type switch.

After the analysis is run, the results are displayed with details about the issues that were discovered. You can automatically resolve configuration differences by selecting them and clicking the Resolve button. DCNM-SAN automatically changes the configuration to match the reference switch or policy file.

Integrating DCNM-SAN and Data Center Network Management Software

DCNM-SAN and Data Center Network Management (DCNM) software are the two major components in the next-generation data center environment. DCNM-SAN configures IBM Storage Networking SAN c-type Family switches. The Scope of the DCNM-SAN software is confined to SAN while the scope of the DCNM-LAN software is limited to the LAN network.

In a typical data center environment, the mixture of SAN and LAN topology are becoming increasingly common. Since the two management software are not designed to work across their topology limits, users are not able to navigate to DCNM-SAN from DCNM-LAN software and vice versa.

Integrating DCNM-SAN and DCNM-LAN provides a single platform to manage the networks in data center 3.0 and it provides seamless user experience under specific configuration.

Launching a Switch from the Topology Map

About this task

Use this procedure to launch the switch from the topology map.

Procedure

1. In the DCNM-SAN fabric pane, right-click the Nexus switch in the LAN map that you want to open with DCNM.

   You see the pop-up menu.
2. In the pop-up menu, click **DCNM** and select the appropriate context.

Chapter 11. Device Manager

This chapter contains descriptions and instructions for using the Device Manager. This chapter contains the following sections:

Information About Device Manager

Device Manager provides a graphical representation of a IBM Storage Networking SAN c-type Family switch chassis, a Cisco Nexus 5000 Series switch chassis, or a Cisco Nexus 7000 Series switch chassis including the installed switching modules, the supervisor modules, the status of each port within each module, the power supplies, and the fan assemblies.

Note: Device Manager support for Cisco Nexus 7000 Series switches is only for FCoE. Non-FCoE modules appear as Unsupported Card.

The tables in the DCNM-SAN Information pane basically correspond to the dialog boxes that appear in Device Manager. However, while DCNM-SAN tables show values for one or more switches, a Device Manager dialog box shows values for a single switch. Also, Device Manager provides more detailed information for verifying or troubleshooting device-specific configuration than DCNM-SAN.

Device Manager Release 4.2 and later provides enhanced security using multiple perspectives (simple and advanced) allowing role based-access to its features. The Device Manager perspective filters out menu items that are not relevant to the user. Users with server admin role, can only access a subset of the fabric related features. The server admin role will not be able to manage Device Manager users or connected clients.

Device Manager Release 5.0 and later supports all the software features that are offered by NX-OS for managing Cisco MDS 9148 and 9124 Multilayer Fabric switches. Cisco MDS 9148 Multilayer Fabric Switch is a 48-port (1/2/4/8G) FC 1RU switch based on the Sabre ASIC and Cisco MDS 9124 Multilayer Fabric switch is a 1/2/4/8G switch module for HP BladeServer based on the Sabre ASIC. Device Manager and DCNM-SAN allow you to discover, display, configure, monitor and service both these new switches. Device Manager also supports the following Cisco Nexus 2000 Series Fabric Extenders on a Cisco Nexus 5000 Series switch that runs NX-OS Release 5.0(1):

Cisco Nexus 2148T Fabric Extender
: It has four 10-Gigabit Ethernet fabric interfaces for its uplink connection to the parent Cisco Nexus 5000 Series switch and eight 1-Gigabit Ethernet or 10-Gigabit Ethernet host interfaces for its downlink connection to servers or hosts.

Cisco Nexus 2232PP Fabric Extender
: It has eight 10-Gigabit Ethernet fabric interfaces with SFP+ interface adapters for its uplink connection to the parent Cisco Nexus 5000 Series

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switch and 32 10-Gigabit Ethernet fabric interfaces with SFP+ interface adapters for its downlink connection to servers or hosts.

Cisco Nexus 2248TP Fabric Extender
It has four 10-Gigabit Ethernet fabric interfaces with small form-factor pluggable (SFP+) interface adapters for its uplink connection to the parent Cisco Nexus 5000 Series switch and 48 1000BASE-T (1-Gigabit) Ethernet host interfaces for its downlink connection to servers or hosts.

Device Manager allows you to discover and display these Fabric Extenders. Device Manager and the DCNM-SAN client support provisioning and monitoring of the 48-port 8-Gbps Advanced Fibre Channel switching module (DS-X9248-256K9) and the 32-port 8-Gbps Advanced Fibre Channel switching module.

Device Manager Features

Device Manager provides two views: Device View and Summary View. Use Summary View to monitor interfaces on the switch. Use Device View to perform switch-level configurations including the following:

- Configure virtual Fibre Channel interfaces.
- Configure Fibre Channel over Ethernet (FCoE).
- Configure zones for multiple VSANs.
- Manage ports, PortChannels, and trunking.
- Manage SNMPv3 security access to switches.
- Manage CLI security access to the switch.
- Manage alarms, events, and notifications.
- Save and copy configuration files and software image.
- View hardware configuration.
- View chassis, module, port status, and statistics.

Using Device Manager Interface

This section describes the Device Manager interface as shown in Figure 8 on page 83.

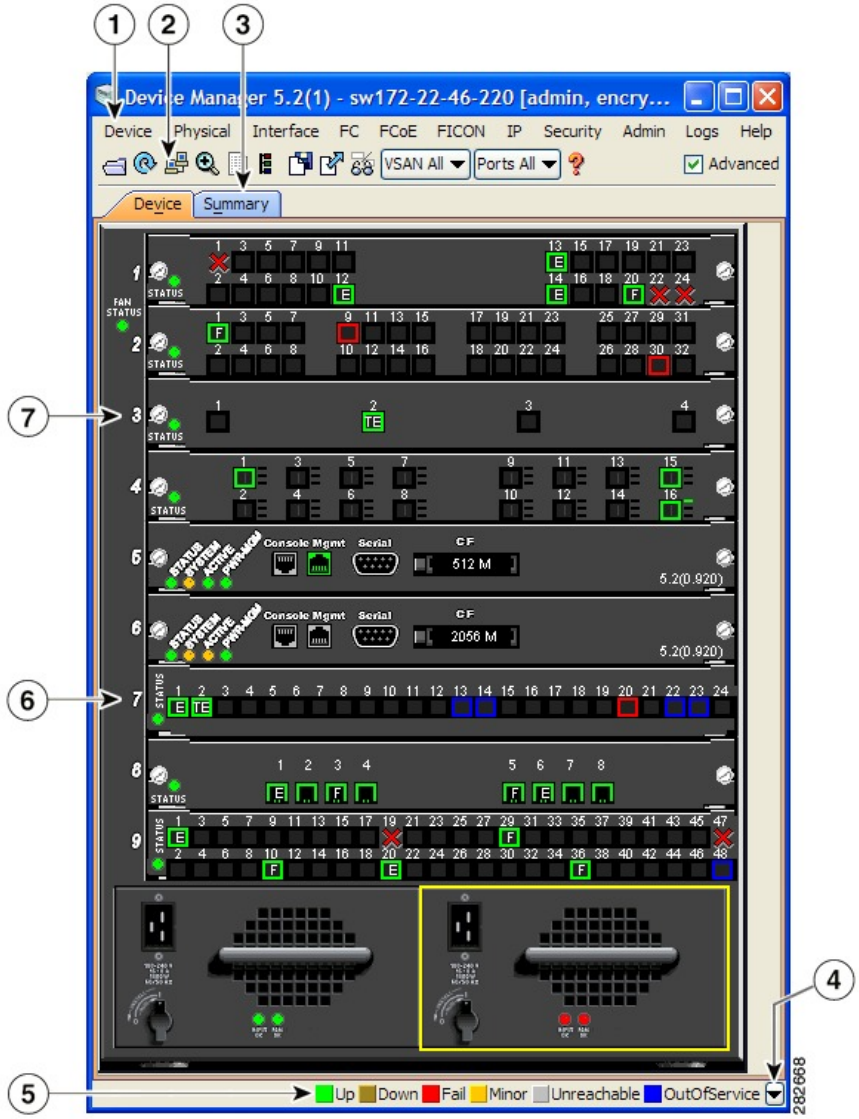

Figure 8. Device Manager, Device Tab

1. Menu bar
2. Toolbar
3. Tabs
4. Legend
5. Status
6. Supervisor modules
7. Switching or services modules

Menu Bar

The menu bar at the top of the Device Manager main window provides options for managing and troubleshooting a single switch. The menu bar provides the following options:

Device

Opens an instance of Device Manager, sets management preferences, sets the page layout, opens a Telnet/SSH session with the current switch, exports a device image, and closes the Device Manager application.

Physical
Allows you to view and manage inventory, modules, temperature sensors, power supplies, fans, and the entire system.

Interface
Allows you to configure and manage PortChannels, as well as Fibre Channel, Ethernet, iSCSI, and FICON ports. Also provides diagnostic, management and monitoring capabilities, as well as SPAN and port tracking.

Note: The **Interface** > **Port Channels** menu option does not appear if the Cisco Nexus 5000 Series switch is in NPV mode and runs a NX-OS release prior to 4.2(1).

FC Allows you to configure and manage VSAN, domain, and name server characteristics. Also provides advanced configuration capabilities.

FCoE Allows you to configure the FCoE parameters and map VSANs to VLANs on a Cisco Nexus 5000 Series switch.

Note: The FCoE menu option appears only if the Cisco Nexus 5000 Series switch runs NX-OS Release 4.0(1a) or later releases.

FICON
Allows you to configure and manage FICON VSANs, configure RLIR ERL information, swap selected FICON ports, and view FICON port numbers.

IP Allows you to configure and manage the following types of information: FCIP, iSCSI, iSNS, routes, VRRP, and CDP.

Security
Allows you to configure and manage FCSP, port security, iSCSI security, SNMP security, common roles, SSH, AAA, and IP ACLs.

Admin
Allows you to save, copy, edit, and erase the switch configuration, monitor events, manipulate Flash files, manage licenses, configure NTP, use CFS, and reset the switch. Also enables you to use the show tech support, show cores, and show image commands.

Logs Shows the various logs: message, hardware, events, and accounting. Also displays FICON link incidents, and allows you to configure the syslog setup.

Help Displays online help topics for specific dialog boxes in the Information pane.

Toolbar Icons

The Device Manager toolbar provides quick access to many Device Manager features. Once the icon is selected, a dialog box may open that allows configuration of the feature. The toolbar provides the main Device and Summary View icons as shown in Table 9.

Table 9. Device Manager Main Toolbar

Icon	Description
 Open Device	Opens the Device Manager view for another switch, with the option to open this view in a separate window.

Table 9. Device Manager Main Toolbar (continued)

Icon	Description
 Refresh Display	Communicates with the switch and displays the information in the Device Manager view.
 Command-Line Interface	Opens a separate CLI command window to the switch.
 Configure Selected	Opens a configuration dialog box for the selected component (line card or port).
 SysLog	Opens a window that lists the latest system messages that occurred on the switch.
 VSANs	Opens the VSAN dialog box that provides VSAN configuration for the switch.
 Save Configuration	Saves the current running configuration to the startup configuration.
 Copy	Copies configuration file between server and switch.
 Toggle FICON/Interface Port Labels	Toggles the FICON and interface port labels.
 Select VSAN	Filters the port display to show only those ports belonging to the selected VSAN.
 Help	Accesses online help for Device Manager.

Dialog Boxes

If a toolbar icon is selected, a dialog box may open that allows configuration of the selected feature. The dialog box may include table manipulation icons. See "Information Pane" on page 51 for descriptions of these icons.

Tabs

Click the Device tab on the Device Manager main window to see a graphical representation of the switch chassis and components.

Note: The Device view also shows the switch chassis information of the Cisco Nexus 2000 Series Fabric Extenders (FEXs) that are connected to a Cisco Nexus 5000 Series switch that runs NX-OS Release 5.0(1).

Click the Summary tab on the Device Manager main window to see a summary of active interfaces on a single switch, as well as Fibre Channel and IP neighbor devices. The Summary View also displays port speed, link utilization, and other traffic statistics. There are two buttons in the upper left corner of the Summary View tab used to monitor traffic. To monitor traffic for selected objects, click the Monitor Selected Interface Traffic Util% button. To display detailed statistics for selected objects, click the Monitor Selected Interface Traffic Details button. You can set the poll interval, the type or Rx/Tx display, and the thresholds.

Note: The Summary tab does not display the utilization statistics (Util%) of virtual Fibre Channel interfaces for Cisco Nexus 5000 Series switches that run NX-OS Release 4.2.

Legends

The legend at the bottom right of the Device Manager indicates port status, as follows:

Colors

Green The port is up.

Brown
The port is administratively down.

Red cross
The port is down or has failed as a result of either hardware failure, loopback Diagnostic failure, or link failure.

Red square
The port is down or has failed as a result of failure other than described for red cross.

Amber
The port has a minor fault condition as a result of either signal loss, synchronization loss, credit loss, LIP F8 receiver failure, non operational sequence receiver, or off-line sequence receiver failure.

Gray The port is unreachable.

Blue The port is out of service.

Labels

X Link failure

E ISL

TE Multi-VSAN ISL

F Host/storage

FL F loop

I iSCSI

SD SPAN destination

CH Channel

CU Control Unit

NP Proxy N-Port (NPV Mode)

TNP Trunking NP_Port (NPV Mode)

TF Trunking F_Port

f vFC Present (Cisco Nexus 5000 Series switches only)

Supervisor and Switching Modules

In the Device View, you can right-click an object and get information on it, or configure it. If you right-click a module, the menu shows the module number and gives you the option to configure or reset the module. If you right-click a port, the menu shows the port number and gives you the option to configure, monitor, enable/disable, set beacon mode, or perform diagnostics on the port.

Note: You can select multiple ports in Device Manager and apply options to all the selected ports at one time. Either select the ports by clicking the mouse and dragging it around them, or hold down the Control (Ctrl) key and click each port.

To enable or disable a port, right-click the port and click **Enable** or **Disable** from the pop-up menu. To enable or disable multiple ports, drag the mouse to select the ports and then right-click the selected ports. Then click **Enable** or **Disable** from the pop-up menu.

To manage trunking on one or more ports, right-click the ports and click Configure. In the dialog box that appears, right-click the current value in the Trunk column and click nonTrunk, trunk, or auto from the pull-down list.

To create PortChannels using Device Manager, click **PortChannels** from the Interface menu.

Note: To create a PortChannel, all the ports on both ends of the link must have the same port speed, trunking type, and administrative state.

Context Menus

Context menus are available in both Device Manager views by right-clicking a device or table.

From Device View:

Device
Right-click a system, module, or power supply to bring up a menu that gives you the option to configure or reset the device.

Port Right-click a port to bring up a menu that shows you the number of the port you have clicked, and to give you the option to configure, monitor, enable, disable, set beacon mode, or perform diagnostics on the port.

From Summary View:

Table Right-click the table header to show a list of which columns to display in that table: Interface, Description, VSANs, Mode, Connected To, Speed (Gb), Rx, Tx, Errors, Discards, and Log. Click the Description field to bring up the appropriate configuration dialog box for the port type.

Launching Device Manager

About this task

To launch Device Manager from your desktop, double-click the Device Manager icon and follow the instructions described in the DCNM Installation and Licensing Guide.

Procedure

1. You can choose one of the following three steps:
   a. Right-click the switch you want to manage on the Fabric pane map and choose **Device Manager** from the menu that appears.
   b. Double-click a switch in the Fabric pane map.
   c. Select a switch in the Fabric pane map and choose **Tools** > **Device Manager**.
   You see the Device Manager open dialog box as shown in Figure 9

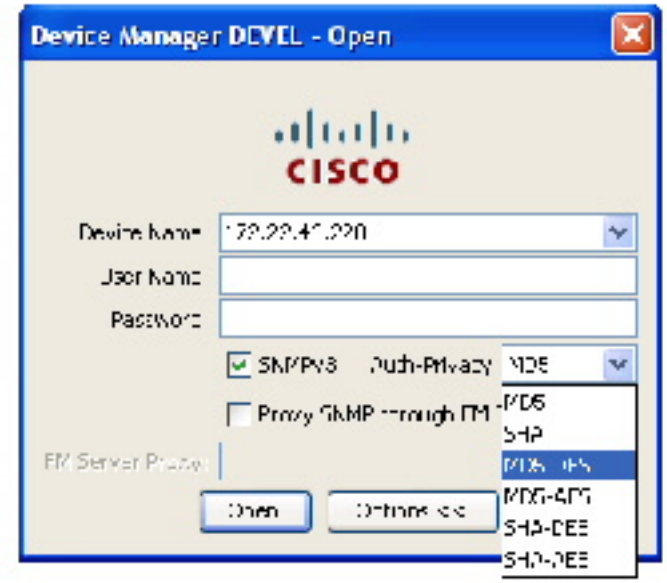

Figure 9. Device Manager: Open Dialog Box

2. Enter the IP address of the device.
3. Enter the user name and password.
4. Check the **Proxy SNMP through FMS** check box if you want Device Manager Client to use a TCP-based proxy server.
5. Choose the **Auth-Privacy** option according to the privacy protocol you have configured on your switch:
   a. If you have not configured the switch with a privacy protocol, select **Auth-Privacy option MD5 (no privacy)**.
   b. If you have configured the switch with your privacy protocol, select your Auth-Privacy choice.
6. Click **Open** to open the Device Manager.

Setting Device Manager Preferences

To set your preferences for the behavior of the Device Manager application, choose **Device** > **Preferences** from the Device menu. You can set the following preferences:

Retry Requests x Time(s) After x sec Timeout
Allows you to set the retry request values. The default settings are 1 time after a 5-second timeout.

Enable Status Polling Every x secs
Allows you to set the status polling value. The default setting is enabled (checked) with a time of 40 seconds.

Trace SNMP Packets in Message Log
Allows you to set whether Device Manager traces SNMP packets and logs the trace. The default setting is disabled (unchecked).

Register for Events After Open, Listen on Port 1163
Allows you to register this switch so that events are logged once you open Device Manager. The default setting is enabled (checked).

Show WorldWideName (WWN) Vendor
Displays the world wide name vendor name in any table or listing displayed by Device Manager. If Prepend is checked, the name is displayed in front of the IP address of the switch. If Replace is checked, the name is displayed instead of the IP address. The default setting is enabled (checked) with the Prepend option.

Show Timestamps as Date/Time
Displays timestamps in the date/time format. If this preference is not checked, timestamps are displayed as elapsed time. The default setting is enabled (checked).

Telnet Path
Sets the path for the telnet.exe file on your system. The default is telnet.exe, but you need to browse for the correct location.

Note: If you browse for a path or enter a path and you have a space in the pathname (for example, `c:\program files\telnet.exe`, then the path will not work. To get the path to work, manually place quotes around it (for example, "`c:\program files\telnet.exe`").

Use Secure Shell Instead of Telnet
Specifies whether to use SSH or Telnet when using the CLI to communicate with the switch. If enabled, you must specify the path to your SSH application. The default setting is disabled.

CLI Session Timeout x secs (0= disable)
Specifies the timeout interval for a CLI session. Enter 0 to disable (no timeout value). The default setting is 30 seconds.

Show Tooltips in Physical View
Determines whether tooltips are displayed in Physical (Device) View. The default setting is enabled (checked).

Label Physical View Ports With
Specifies the type of label to assign to the ports when you are in Physical (Device) View. The options are FICON and Interface. The default setting is Interface.

Export Table

Specifies the type of file that is created when you export a table using Device Manager. The options are Tab-Delimited or XML. The default setting is Tab-Delimited.

Chapter 12. Configuring Performance Manager

This chapter describes how DCNM-SAN is used to monitor and manage a network. This chapter includes the following topics:

Information About Performance Manager

This section includes the following topics:

Performance Manager gathers network device statistics historically and provides this information graphically using a web browser. It presents recent statistics in detail and older statistics in summary. Performance Manager also integrates with external tools such as Traffic Analyzer.

The Performance Manager has three operational stages:

Definition
The Flow Wizard sets up flows in the switches.

Collection
The Web Server Performance Collection screen collects information on desired fabrics.

Presentation
Generates web pages to present the collected data through DCNM-SAN Web Server.

Performance Manager can collect statistics for ISLs, hosts, storage elements, and configured flows. Flows are defined based on a host-to-storage (or storage-to-host) link. Performance Manager gathers statistics from across the fabric based on collection configuration files. These files determine which SAN elements and SAN links Performance Manager gathers statistics for. Based on this configuration, Performance Manager communicates with the appropriate devices (switches, hosts, or storage elements) and collects the appropriate information at fixed five-minute intervals.

Performance Manager uses a round-robin database to hold the statistical data collected from the fabric. This data is stored based on the configured parameters in the collection configuration file. At each polling interval, Performance Manager gathers the relevant statistics and stores them in the round-robin database. This database is a fixed size and will not grow beyond its preset limits.

Performance Manager creates a series of archived data to hold summarized information present in the real-time round-robin database. This archived data is

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used to generate daily, weekly, monthly, and yearly consolidated reports. In this way, Performance Manager maintains significant historical data without the cost of an ever-increasing database size.

Note: You must restart Performance Manager if you change the user credentials on DCNM-SAN Server.

Data Interpolation

One of the unique features of Performance Manager is its ability to interpolate data when statistical polling results are missing or delayed. Other performance tools may store the missing data point as zero, but this can distort historical trending. Performance Manager interpolates the missing data point by comparing the data point that preceded the missing data and the data point stored in the polling interval after the missing data. This maintains the continuity of the performance information.

Data Collection

About this task

One year's worth of data for two variables (Rx and Tx bytes) requires a round-robin database (rrd) file size of 76 K. If errors and discards are also collected, the rrd file size becomes 110 K. The default internal values are as follows:

- 600 samples of 5 minutes (2 days and 2 hours)
- 700 samples of 30 minutes (14 days)
- 775 samples of 2 hours (64 days)
- 300 samples of 1 day

A 1000-port SAN requires 110 MB for a year's worth of historical data that includes errors and discards. If there were 20 switches in this SAN with equal distribution of fabric ports, about two to three SNMP packets per switch would be sent every 5 minutes for a total of about 100 request or response SNMP packets required to monitor the data.

Because of their variable counter requests, it is more difficult to predict storage space requirements for flows. But in general you can expect that, each extra flow adds another 76 KB.

Note: Performance Manager does not collect statistics on nonmanageable and non-MDS switches. Loop devices (FL/NL) are not collected.

To setup a shared RRD path to collect PM data, perform these steps:

Note: After the Performance Manager server is ready, the new updated location will be used to save the RRD files. Performance Manager creates a new directory pm\db under the specified location. Ensure that RRD files are not altered, as the Performance Manager server is actively writing into the rrd files.

Procedure

1. Locate the server.properties file.

   For Windows setup, location is: `C:\Program Files\Cisco Systems\dcm\fm\conf`.

   For Linux setup, location is: `/usr/local/cisco/dcm/fm/conf`.

2. Add pm.rrdpath property file information to the server.properties file. Add server location accessible from the DCNM server in the format:
   `pm.rrdpath=\\server_ip\\public\\cisco\\data`
3. Save server.properties file.
4. Restart the DCNM server.

Using Performance Thresholds

The Performance Manager Configuration Wizard allows you to set up two thresholds that will trigger events when the monitored traffic exceeds the percent utilization configured. These event triggers can be set as either Critical or Warning events that are reported on the DCNM-SAN web client Events browser page.

Absolute value thresholds apply directly to the statistics gathered. These statistics, as a percent of the total link capacity, are compared to the percent utilization configured for the threshold type. If the statistics exceed either configured threshold, an event is shown on the DCNM-SAN web client Events tab.

Baseline thresholds create a threshold that adapts to the typical traffic pattern for each link for the same time window each day, week, or every two weeks. Baseline thresholds are set as a percent of the average (110% to 500%), where 100% equals the calculated weighted average. Figure 10 shows an example of setting a baseline threshold for a weekly or daily option.

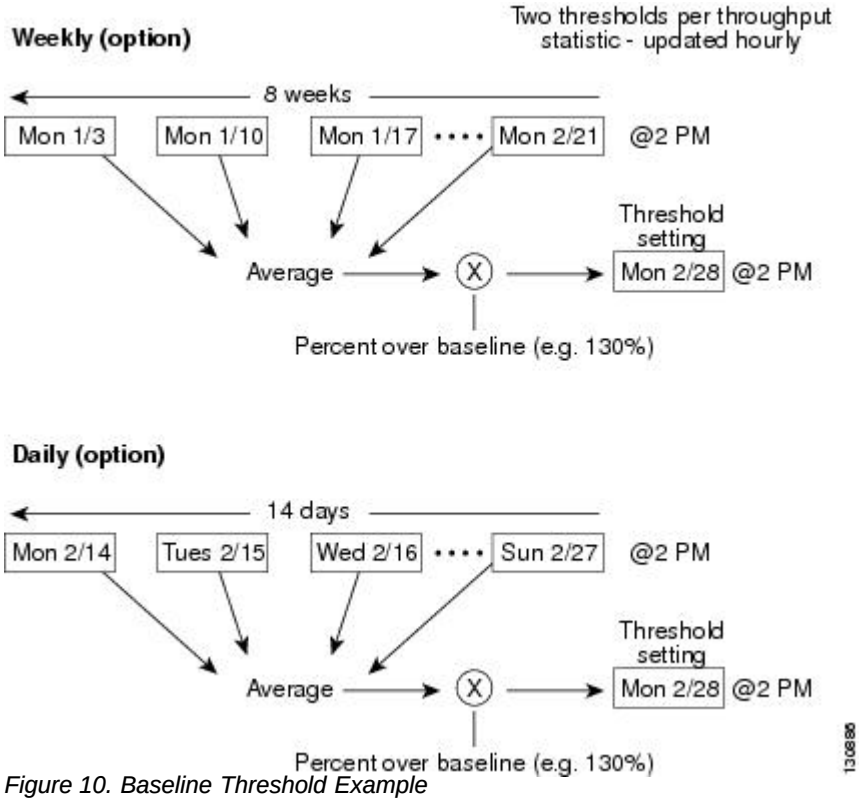

Figure 10. Baseline Threshold Example

The threshold is set for Monday at 2 p.m. The baseline threshold is set at 130% of the average for that statistic. The average is calculated from the statistics value that occurred at 2 p.m. on Monday, for every prior Monday (for the weekly option) or the statistics value that occurred at 2 p.m. on each day, for every prior day (for the daily option).

Flow Statistics

Flow statistics count the ingress traffic in the aggregated statistics table. You can collect two kinds of statistics:

- Aggregated flow statistics to count the traffic for a VSAN.
- Flow statistics to count the traffic for a source and destination ID pair in a VSAN.
- Aggregated flow statistics to count the traffic for a VSAN.
- Flow statistics to count the traffic for a source and destination ID pair in a VSAN.

If you enable flow counters, you can enable a maximum of 1 K entries for aggregate flow and flow statistics. Be sure to assign an unused flow index to a module for each new flow. Flow indexes can be repeated across modules. The number space for flow index is shared between the aggregate flow statistics and the flow statistics.

Generation 1 modules allow a maximum of 1024 flow statements per module. Generation 2 modules allow a maximum of 2048-128 flow statements per module.

Table 12-1 explains the Flow Type radio button that defines the type of traffic monitored.

Table 10. Performance Manager Flow Types

Flow type	Description
Host->Storage	Unidirectional flow, monitoring data from the host to the storage element
Storage->Host	Unidirectional flow, monitoring data from the storage element to the host
Both	Bidirectional flow, monitoring data to and from the host and storage elements

Flow Setup Wizards

The Performance Manager Flow and Performance Manager Setup wizards greatly simplify configuration. All you need to do is select the categories of statistics to capture and the wizards provide a list of flows and links to monitor. You can remove entries if desired, or just accept the provided list and start data collection. Statistics for host and storage links are not associated with a specific port on a switch, so you do not lose long term statistics if a connection is moved to a different port.

Creating a Flow Using Performance Manager Flow Wizard

About this task

To create flows using the Performance Manager Flow wizard, follow these steps:

Procedure

1. Choose **Performance** > **Create Flows**.

   Specify how you want to determine and add new flows as shown in Figure 11 on page 95. For this, you have to define traffic counters between source and destination devices, using one of these options:

- In a VSAN - For this option, click **VSAN**.
- Based on high traffic devices - For this option, click **Device Traffic**.

Note: PM collections must already be turned on in order to use this option. If PM collection is not turned on for the selected fabric, then an error message will appear and you cannot continue.

2. If you have clicked **VSAN**, then:

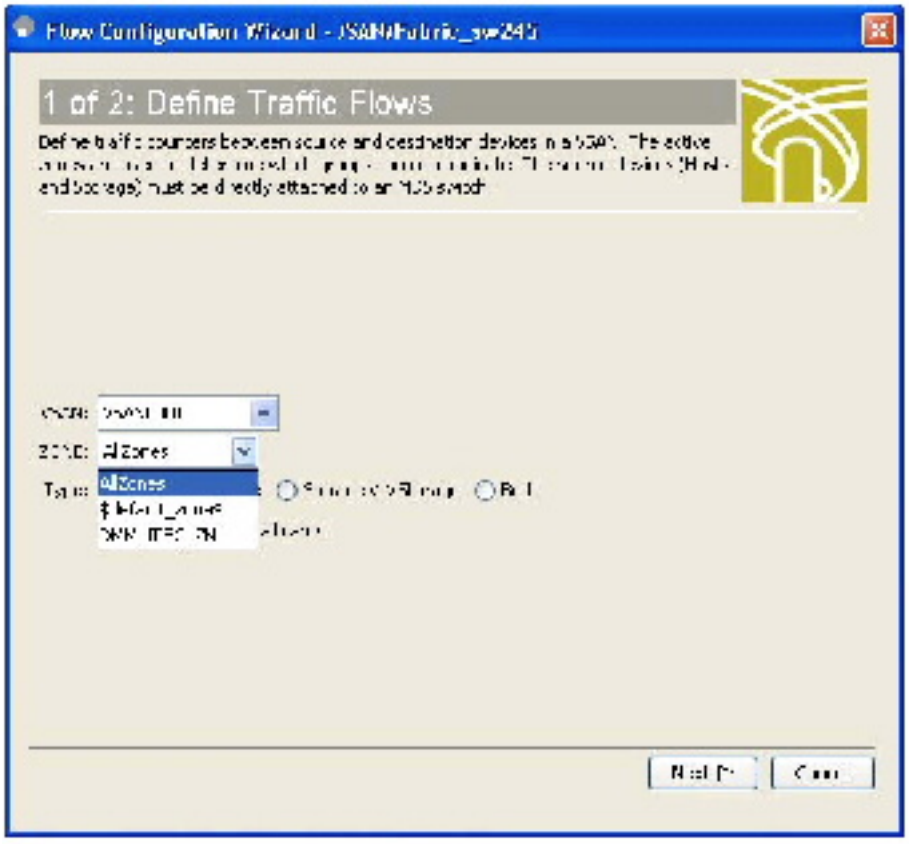

Figure 11. Create Flows Dialog Box

a. Click the drop-down menu in the **VSAN** field.
b. Choose the list of VSANs provided by the flow configuration wizard.
c. Click the drop-down menu in the **Zone** field.
d. Choose the list of zones provided by the flow configuration wizard.
e. Click **Next** to continue to the next window as shown in Figure 12 on page 96).

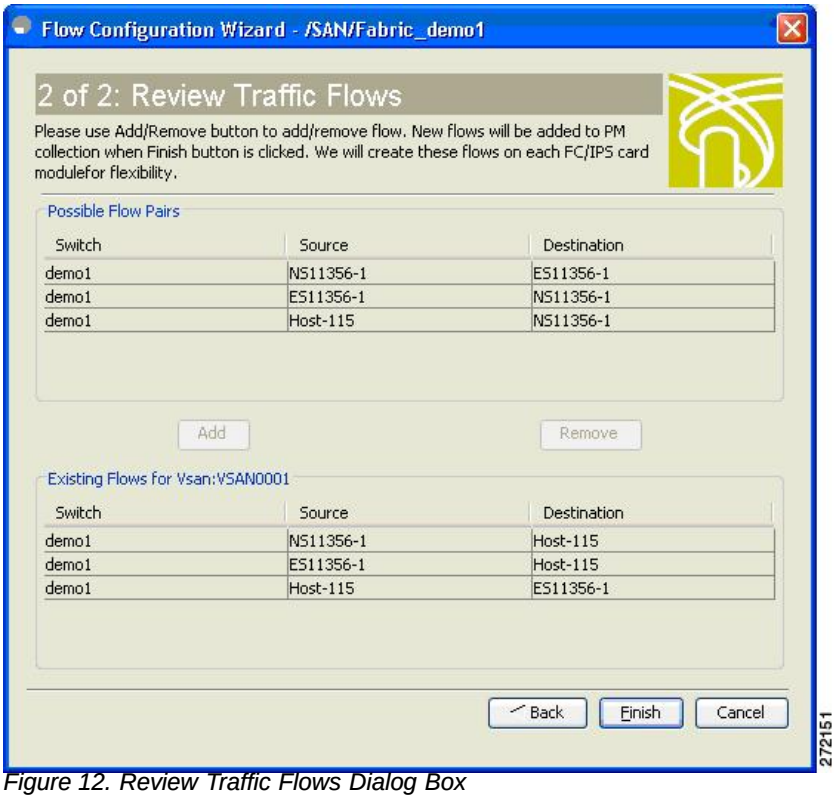

Figure 12. Review Traffic Flows Dialog Box

f. Choose items in the **Possible Flow Pairs** area.

g. The Review Traffic Flows window displays all VSAN flow pairs in the **Exisitng Flows for Vsan** area.

h. Click **Add** to create the selected flow.

i. Choose items in the **Existing Flows for Vsan** area.

j. Click **Remove** to remove the selected flow.

3. If you have clicked **Device Traffic**, then:

   a. Click **Next**. You see the Define Traffic Flows page.

   b. Specify a traffic utilization percentage threshold value in the **Show device ports with traffic** text box.

   c. Specify whether you want to look at the peak or average traffic values, over the last day or last week, for the traffic types:

      - Host<->Storage
      - Storage<->Storage
      - Both

   d. Click **Next**.

      If new flow pairs are found, you will see the Review Traffic Flows page, where possible flow pairs are shown in a table, along with the traffic parameters used to identify them.

   e. To see only rows having a specific source or destination device, specify the name of the device in the **Filter** text box.

   f. To create a flow, click the corresponding row in the **Possible Flow Pairs** table, and then click **Add**. To remove an existing flow, click the corresponding row in the **Existing Flow Pairs** table, and then click **Remove**.

4. Click **Finish** to restart the Performance Manager collection.

You see the Confirmation dialog box as shown in Figure 13.
To verify the newly created flow, choose **Physical Attributes** > **End Devices** >

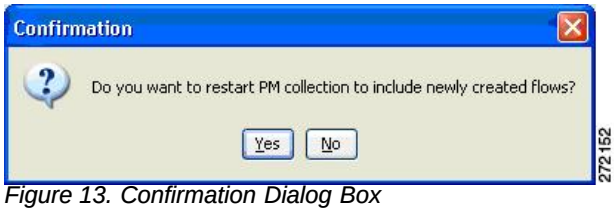

Figure 13. Confirmation Dialog Box

Flow Statistics. The newly created flows are displayed.

Note: Performance Manager Collection can be enabled for LAN devices and traffic counters are collected periodically.

Chapter 13. Monitoring the Network

This chapter describes how the DCNM-SAN manages the network. In particular, SAN discovery and network monitoring are two of its key network management capabilities.

This chapter contains the following sections:

Information About Network Monitoring

DCNM-SAN provides extensive SAN discovery, topology mapping, and information viewing capabilities. DCNM-SAN collects information on the fabric topology through SNMP queries to the switches connected to it. DCNM-SAN recreates a fabric topology, presents it in a customizable map, and provides inventory and configuration information in multiple viewing options such as fabric view, device view, summary view, and operation view.

Once DCNM-SAN is invoked, a SAN discovery process begins. Using information polled from a seedIBM Storage Networking SAN c-type Familyswitch, including Name Server registrations, Fibre Channel Generic Services (FC-GS), Fabric Shortest Path First (FSPF), and SCSI-3, DCNM-SAN automatically discovers all devices and interconnects on one or more fabrics. All available switches, host bus adapters (HBAs), and storage devices are discovered. The IBM Storage Networking SAN c-type Family switches use Fabric-Device Management Interface (FMDI) to retrieve the HBA model, serial number and firmware version, and host operating-system type and version discovery without host agents. DCNM-SAN gathers this information through SNMP queries to each switch. The device information discovered includes device names, software revision levels, vendor, ISLs, PortChannels, and VSANs.

Monitoring Health and Events

DCNM-SAN works with the IBM Storage Networking SAN c-type Family switches to show the health and status of the fabric and switches. Information about the fabric and its components is gathered from multiple sources, including Online System Health Management, Call Home, system messages, and SNMP notifications. This information is then made available from multiple menus on DCNM-SAN or Device Manager.

DCNM-SAN Events Tab

The DCNM-SAN Events tab, available from the topology window, displays the events DCNM-SAN received from sources within the fabric. These sources include SNMP events, RMON events, system messages, and system health messages. The Events tab shows a table of events, including the event name, the source and time of the event, a severity level, and a description of the event. The table is sortable by any of these column headings.

Note: DCNM SAN client displays events that are created after the client session is started. Any event created before the current user login session will not be retrieved and displayed.

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Event Information in DCNM-SAN Web Server Reports

The DCNM-SAN web server client displays collections of information gathered by the Performance Manager. This information includes events sent to the DCNM-SAN Server from the fabric. To open these reports, choose **Performance Manager** > **Reports**. This opens the web client in a web browser and displays a summary of all fabrics monitored by the DCNM-SAN Server. Choose a fabric and then click the Events tab to see a summary or detailed report of the events that have occurred in the selected fabric. The summary view shows how many switches, ISLs, hosts, or storage elements are down on the fabric and how many warnings have been logged for that SAN entity. The detailed view shows a list of all events that have been logged from the fabric and can be filtered by severity, time period, or type.

Events in Device Manager

Device Manager displays the events when you choose **Logs** > **Events**. Device Manager can display the current list of events or an older list of events that has been stored on the DCNM-SAN host. The event table shows details on each event, including time, source, severity, and a brief description of the event.

SAN Discovery and Topology Mapping

DCNM-SAN provides extensive SAN discovery, topology mapping, and information viewing capabilities. DCNM-SAN collects information on the fabric topology through SNMP queries to the switches connected to it. DCNM-SAN recreates a fabric topology, presents it in a customizable map, and provides inventory and configuration information in multiple viewing options.

Device Discovery

Once DCNM-SAN is invoked, a SAN discovery process begins. Using information polled from a seed IBM Storage Networking SAN c-type Family switch, including Name Server registrations, Fibre Channel Generic Services (FC-GS), Fabric Shortest Path First (FSPF), and SCSI-3, DCNM-SAN automatically discovers all devices and interconnects on one or more fabrics. All available switches, host bus adapters (HBAs), and storage devices are discovered. The IBM Storage Networking SAN c-type Family switches use Fabric-Device Management Interface (FMDI) to retrieve HBA model, serial number and firmware version, and host operating-system type and version discovery without host agents. DCNM-SAN gathers this information through SNMP queries to each switch. The device information discovered includes device names, software revision levels, vendor, ISLs, PortChannels, and VSANs.

For a VSAN change involving a third-party switch, DCNM-SAN will need a second discovery to show the correct topology due to the discovery dependency when there is any change in a mixed VSAN. The first discovery finds the third-party switch and the subsequent discovery will show the information on which VSAN it is going to join and can discover the end devices connected to it. You can wait for the subsequent discovery or trigger a manual discovery.

Topology Mapping

DCNM-SAN is built upon a topology representation of the fabric. DCNM-SAN provides an accurate view of multiple fabrics in a single window by displaying topology maps based on device discovery information. You can modify the topology map icon layout with an easy-to-use, drag-and-drop interface. The topology map visualizes device interconnections, highlights configuration information such as zones, VSANs, and ISLs exceeding utilization thresholds. The

topology map also provides a visual context for launching command-line interface (CLI) sessions, configuring PortChannels, and opening device managers.

Using the Topology Map

The DCNM-SAN topology map can be customized to provide a view into the fabric that varies from showing all switches, end devices, and links, to showing only the core switches with single bold lines for any multiple links between switches. Use the icons along the left side of the topology map to control these views or right-click anywhere in the topology map to access the map controls.

You can zoom in or out on the topology map to see an overview of the SAN or focus on an area of importance. You can also open an overview window that shows the entire fabric. From this window, you can right-click and draw a box around the area you want to view in the main topology map view.

Another way to limit the scope of the topology display is to select a fabric or VSAN from the Logical Domains pane. The topology map displays only that fabric or VSAN.

Moving the mouse pointer over a link or switch provides a simple summary of that SAN component, along with a status indication. Right-clicking on the component brings up a pop-up menu. You can view the component in detail or access configuration or test features for that component.

Double-click a link to bring link status and configuration information to the information pane. Double-click a switch to bring up Device Manager for that switch.

Saving a Customized Topology Map Layout

About this task

Changes made to the topology map can be saved so that the customized view is available any time you open the DCNM-SAN Client for that fabric.

Procedure

1. Click **File** > **Preferences** to open the DCNM-SAN preferences dialog box.
2. Click the **Map** tab and check **Automatically Save Layout** to save any changes to the topology map as shown in Figure 14 on page 102.

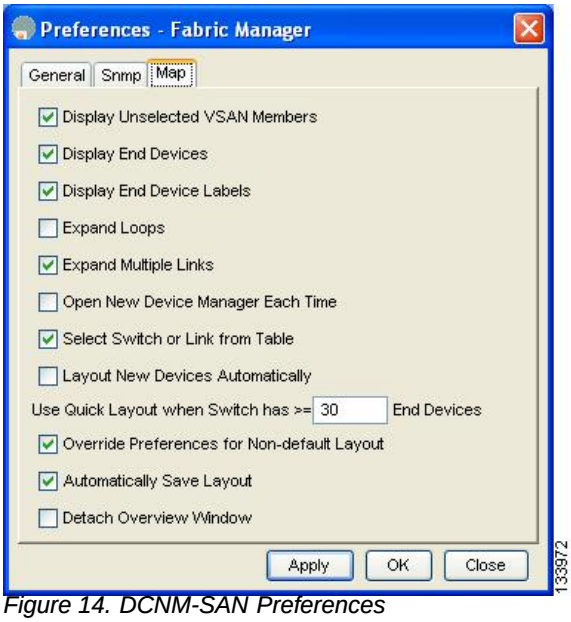

Figure 14. DCNM-SAN Preferences

3. Click **Apply**, and then click **OK** to save this change.

Using Enclosures with DCNM-SAN Topology Maps

Because not all devices can respond to FC-GS-3 requests, different ports of a single server or storage subsystem may be displayed as individual end devices on the topology map. See the "Modifying the Device Grouping" on page 77 to group these ports into a single enclosure for DCNM-SAN.

Clicking **Alias** > **Enclosure** displays hosts and storage elements in the Information pane. This is a shortcut to naming enclosures. To use this shortcut, highlight each row in the host or storage table that you want grouped in an enclosure then click **Alias** > **Enclosure**. This automatically sets the enclosure names of each selected row with the first token of the alias.

Mapping Multiple Fabrics

To log into multiple fabrics, the same username and password must be used. The information for both fabrics is displayed, with no need to select a seed switch. To see details of a fabric, click the tab for that fabric at the bottom of the Fabric pane, or double-click the fabrics cloud icon. To continuously manage a fabric using DCNM-SAN, follow the instructions in the Managing a DCNM-SAN Server Fabric section on page 8-4.

Inventory Management

The Information pane in DCNM-SAN shows inventory, configuration, and status information for all switches, links, and hosts in the fabric. Inventory management includes vendor name and model, and software or firmware versions. Select a fabric or VSAN from the Logical Domains pane, and then select the Summary tab in the Information pane to get a count of the number of VSANS, switches, hosts, and storage elements in the fabric. See the "DCNM-SAN Client Quick Tour: Admin Perspective" on page 52 for more information on the DCNM-SANDCNM-SAN user interface.

Using the Inventory Tab from DCNM-SAN Web Server

About this task

If you have configured DCNM-SAN Web Server, you can launch this application and access the Inventory tab to see a summary of the fabrics managed by the DCNM-SAN Server. The Inventory tab shows an inventory of the selected SAN, fabric, or switch. See Chapter 4, Cisco DCNM Web Client for more information on how to configure and use DCNM-SAN Web Server.

Procedure

1. Point your browser at the DCNM-SAN Web Server.
2. Click the **Events** tab and then the **Details** tab to view the system messages. The columns in the events table are sortable. In addition, you can use the **Filter** button to limit the scope of messages within the table.

Viewing Logs from Device Manager

You can view system messages from Device Manager if Device Manager is running from the same workstation as the DCNM-SAN Server. Choose **Logs** > **Events** > **current** to view the system messages on Device Manager. The columns in the events table are sortable. In addition, you can use the **Find** button to locate text within the table.

You can view switch-resident logs even if you have not set up your local syslog server or your local PC is not in the switch's syslog server list. Due to memory constraints, these logs will wrap when they reach a certain size. The switch syslog has two logs: an NVRAM log that holds a limited number of critical and greater messages and a non-persistent log that contains notice or greater severity messages. Hardware messages are part of these logs.

Note: To view syslog local logs, you need to configure the IP address of the DCNM-SAN Server in the syslog host.

Chapter 14. Monitoring Performance

This chapter describes how to configure Performance Monitoring tools for DCNM-SAN and Device Manager. These tools provide real-time statistics as well as historical performance monitoring.

This chapter contains the following sections:

Information About Performance Monitoring

Device Manager provides an easy tool for monitoring ports on the IBM Storage Networking SAN c-type Family switches. This tool gathers statistics at a configurable interval and displays the results in tables or charts. Real-time performance statistics are useful for dynamic troubleshooting and fault isolation within the fabric. Real-time statistics gather data on parts of the fabric in user-configurable intervals and display these results in DCNM-SAN and Device Manager. For a selected port, you can monitor any of a number of statistics including traffic in and out, errors, class 2 traffic, and FICON data.

Real-Time Performance Monitoring

Device Manager provides an easy tool for monitoring ports on the IBM Storage Networking SAN c-type Family switches. This tool gathers statistics at a configurable interval and displays the results in tables or charts. These statistics show the performance of the selected port in real-time and can be used for performance monitoring and troubleshooting. For a selected port, you can monitor any of a number of statistics including traffic in and out, errors, class 2 traffic, and FICON data. You can set the polling interval from ten seconds to one hour, and display the results based on a number of selectable options including absolute value, value per second, and minimum or maximum value per second.

Device Manager checking for oversubscription on the host-optimized four-port groups on relevant modules. Right-click the port group on a module and choose **Check Oversubscription** from the pop-up menu.

Device manager provides two performance views: the Summary View tab and the configurable monitor option per port.

Historical Performance Monitoring

Performance Manager gathers network device statistics historically and provides this information using DCNM-SAN client and web browser. It presents recent

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statistics in detail and older statistics in summary. Performance Manager also integrates with external tools such as Traffic Analyzer. See the "Information About Performance Monitoring" on page 105 for an overview of Performance Manager.

Configuring Performance Manager

This section includes the following topics:

- "Creating a Flow with Performance Manager"
- "Creating a Collection with Performance Manager"
- "Using Performance Thresholds"

Creating a Flow with Performance Manager

With the Flow Configuration Wizard you can create host-to-storage, storage-to-host, or bidirectional flows. Once defined, you can add these flows to a collection configuration file to monitor the traffic between a host/storage element pair. The flows created become part of the collection options in the Performance Manager Configuration Wizard.

Creating a Collection with Performance Manager

The Performance Manager Configuration Wizard steps you through the process of creating collections using configuration files. Collections are defined for one or all VSANs in the fabric. Collections can include statistics from the SAN element types described in Table 11.

Table 11. Performance Manager Collection Types

Collection Type	Description
ISLs	Collects link statistics for ISLs.
Host	Collects link statistics for SAN hosts.
Storage	Collects link statistics for a storage elements.
Flows	Collects flow statistics defined by the Flow Configuration Wizard.

Using Performance Thresholds

The Performance Manager Configuration Wizard allows you to set up two thresholds that trigger events when the monitored traffic exceeds the percent utilization configured. These event triggers can be set as either Critical or Warning events that are reported on the DCNM-SAN web client Events browser page.

You must choose either absolute value thresholds or baseline thresholds that apply to all transmit or receive traffic defined in the collection. Click the Use absolute values radio button on the last screen of the Performance Manager Configuration Wizard to configure thresholds that apply directly to the statistics gathered. These statistics, as a percent of the total link capacity, are compared to the percent utilization configured for the threshold type. If the statistics exceed either configured threshold, an event is shown on the DCNM-SAN web client Events tab.

As an example, the collection has absolute value thresholds set for 60% utilization (for warning) and 80% utilization (for critical). If Performance Manager detects that the traffic on a 1-Gigabit link in its collection exceeds 600 Mbps, a warning event is triggered. If the traffic exceeds 800 Mbps, a critical event is triggered.

Baseline thresholds are defined for a configured time of day or week (1 day, 1 week, or 2 weeks). The baseline is created by calculating the average of the statistical results for the configured time each day, week, or every 2 weeks. Table 12 shows an example of the statistics used to create the baseline value for a collection defined at 4 pm on a Wednesday.

Table 12. Baseline Time Periods for a Collection Started on Wednesday at 4pm

Baseline Time Window	Statistics Used in Average Calculation
1 day	Every prior day at 4 pm
1 week	Every prior Wednesday at 4 pm
2 weeks	Every other prior Wednesday at 4 pm

Baseline thresholds create a threshold that adapts to the typical traffic pattern for each link for the same time window each day, week, or every 2 weeks. Baseline thresholds are set as a percent of the average (110% to 500%), where 100% equals the calculated average.

As an example, a collection is created at 4 pm on Wednesday, with baseline thresholds set for 1 week, at 150% of the average (warning) and 200% of the average (critical). Performance Manager recalculates the average for each link at 4 pm every Wednesday by taking the statistics gathered at that time each Wednesday since the collection started. Using this as the new average, Performance Manager compares each received traffic statistic against this value and sends a warning or critical event if the traffic on a link exceeds this average by 150% or 200% respectively.

Table 13 shows two examples of 1-Gigabit links with different averages in our example collection and at what traffic measurements the Warning and Critical events are sent.

Table 13. Example of Events Generated for 1-Gigabit Links

Average	Warning Event Sent at 150%	Critical Event Sent at 200%
400 Mbps	600 Mbps	800 Mbps
200 Mbps	300 Mbps	400 Mbps

Set these thresholds on the last screen of the Collections Configuration Wizard by checking the Send events if traffic exceeds threshold check box.

Configuring the Summary View in Device Manager

About this task

Use this procedure to configure the Device Manager summary view.

Procedure

1. Click the **Summary** tab on the main display.

   You see all active ports on the switch, as well as the configuration options available from the Summary view shown in Figure 15 on page 108.

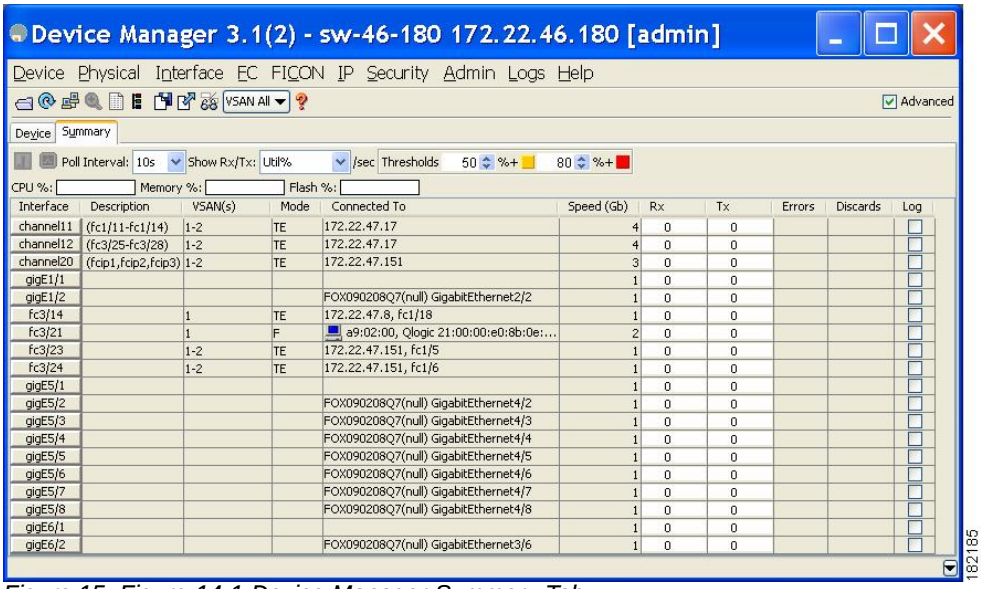

Figure 15. Figure 14-1 Device Manager Summary Tab

2. Choose a value from the **Poll Interval** drop-down list.
3. Decide how you want your data to be interpreted by looking at the **Show Rx/Tx** drop-down menu. The table updates each polling interval to show an overview of the receive and transmit data for each active port on the switch.
4. Select a value from the **Show Rx/Tx** drop-down list. If you select **Util%**, you need to also select values from the two **Show Rx/Tx** > **%Util/sec** drop-down lists. The first value is the warning level and the second value is the critical threshold level for event reporting.

   Note: You can also display percent utilization for a single port by selecting the port and clicking the **Monitor Selected Interface Traffic Util %** icon.

Configuring Per Port Monitoring using Device Manager

About this task

The configurable monitor per port option gives statistics for in and out traffic on that port, errors, class 2 traffic and other data that can be graphed over a period of time to give a real-time view into the performance of the port.

Procedure

1. Click the **Device** tab.
2. Right-click the port you are interested in and choose **Monitor** from the drop-down menu.

   You see the port real-time monitor dialog box shown in Figure 16 on page 109.

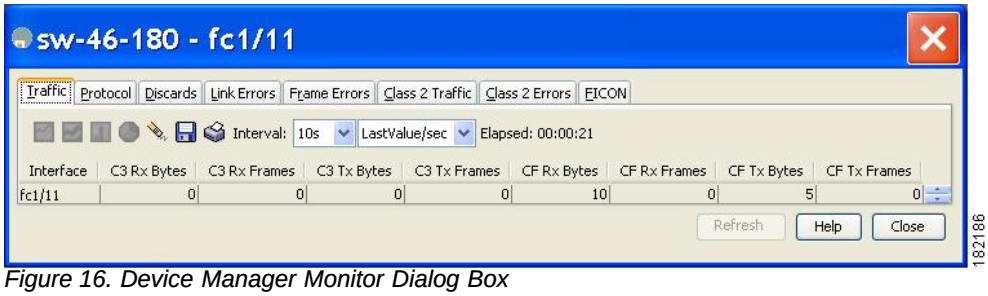

Figure 16. Device Manager Monitor Dialog Box

3. Select a value from the **Interval** drop-down list to determine how often data is updated in the table shown here.
4. Click a statistical value in the table then click one of the graphing icons to display a running graph of that statistic over time. You see a graph window that contains options to change the graph type.

   Tip: You can open multiple graphs for statistics on any of the active ports on the switch.

Displaying DCNM-SAN Real-Time ISL Statistics

About this task

This section includes the following topics:

You can configure DCNM-SAN to gather ISL statistics in real time. These ISL statistics include receive and transmit utilization, bytes per second, as well as errors and discards per ISL.

Procedure

1. Choose **Performance** > **ISLs in Real-Time**.

   You see any ISL statistics in the Information pane as shown in Figure 17.

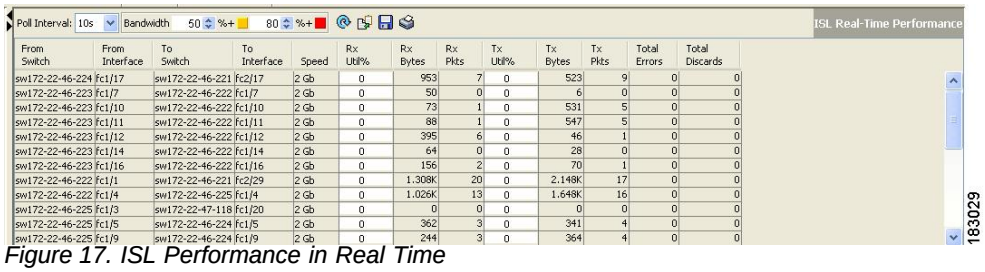

Figure 17. ISL Performance in Real Time

2. Select a value from the Poll Interval drop-down list.
3. Select two values from the Bandwidth utilization thresholds drop-down lists, one value for the minor threshold and one value for the major threshold.

   The table shown updates each polling interval to show the statistics for all configured ISLs in the fabric.
4. Select a row in the table to highlight that ISL in blue in the Topology map.

Viewing Performance Statics Using DCNM-SAN

About this task

You can configure DCNM-SAN to gather historic and real time statistics of ISLs or End devices. These statistics include receive and transmit utilization, bytes per second, as well as errors and discards per ISL or end device.

Procedure

1. Right-click the ISL or end device in the Fabric pane.
   You see a context menu as shown in the Figure 18.

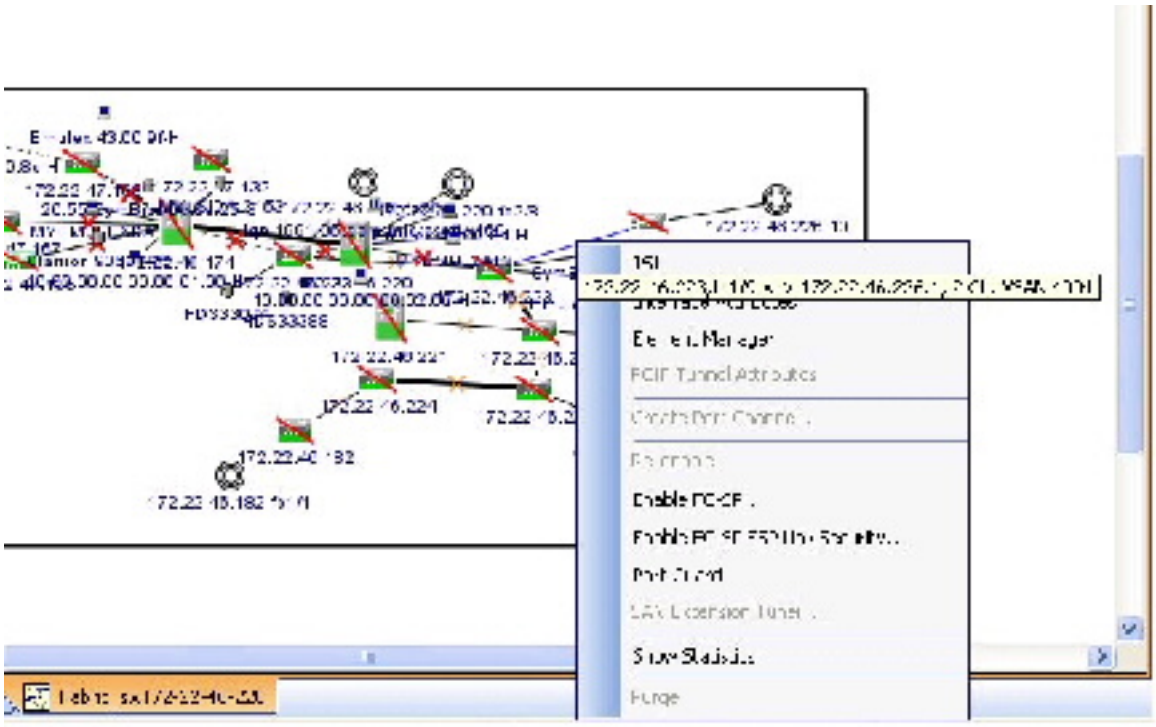

Figure 18. Show Statics Menu

2. Select **Show Statics**.

   Note: Show Statics menu will be enabled only if you add the fabric to the Performance Manager collection.

Displaying Performance Manager Reports

About this task

This section includes the following topics:

You can view Performance Manager statistical data using preconfigured reports that are built on demand and displayed in a web browser. These reports provide

summary information as well as detailed statistics that can be viewed for daily, weekly, monthly, or yearly results.

Procedure

1. Choose **Performance** > **Reports** to access Performance Manager reports from DCNM-SAN.

   This opens a web browser window showing the default DCNM-SAN web client event summary report.
2. Click the Performance tab to view the Performance Manager reports.

   Performance Manager begins reporting data ten minutes after the collection is started.

   Note: DCNM-SAN Web Server must be running for reports to work.

Displaying Performance Summary

The Performance Summary page presents a dashboard display of the throughput and link utilization for hosts, ISLs, storage, and flows for the last 24-hour period. The summary provides a quick overview of the fabric's bandwidth consumption and highlights any hotspots.

The report includes network throughput pie charts and link utilization pie charts. Use the navigation tree on the left to show summary reports for monitored fabrics or VSANs. The summary displays charts for all hosts, storage elements, ISLs, and flows. Each pie chart shows the percent of entities (links, hosts, storage, ISLs, or flows) that measure throughput or link utilization on each of six predefined ranges. Move the mouse over a pie chart section to see how many entities exhibit that range of statistics. Double-click any pie chart to bring up a table of statistics for those hosts, storage elements, ISLs, or flows.

Displaying Performance Tables and Details Graphs

Click **Host**, **Storage**, **ISL**, or **Flow** to view traffic over the past day for all hosts, storage, ISLs, or flows respectively. A table lists all of the selected entities, showing transmit and receive traffic and errors and discards, if appropriate. The table can be sorted by any column heading. The table can also be filtered by day, week, month, or year. Tables for each category of statistics display average and peak throughput values and provide hot-links to more detailed information.

Clicking a link in any of the tables opens a details page that shows graphs for traffic by day, week, month, and year. If flows exist for that port, you can see which storage ports sent data. The details page also displays graphs for errors and discards if they are part of the statistics gathered and are not zero.

If you double-click a graph on a Detail report, it will launch the Traffic Analyzer for Fibre Channel, if configured. The aliases associated with hosts, storage devices, and VSANs in the fabric are passed to the Traffic Analyzer to provide consistent, easy identification.

Displaying Performance of Host-Optimized Port Groups

You can monitor the performance of host-optimized port groups by selecting **Performance** > **End Devices** and selecting Port Groups from the Type drop-down list.

Displaying Performance Manager Events

Performance Manager events are viewed through DCNM-SAN Web Server. To view problems and events in DCNM-SAN Web Server, choose a fabric and then click the Events tab to see a summary or detailed report of the problems and events that have occurred in the selected fabric.

Generating Performance Manager Reports

- "Generating Top10 Reports in Performance Manager"
- "Generating Top10 Reports Using Scripts"

Generating Top10 Reports in Performance Manager

You can generate historical Top10 reports that can be saved for later review. These reports list the entities from the data collection, with the most active entities appearing first. This is a static, one-time only report that generates averages and graphs of the data collection as a snapshot at the time the report is generated. These Top10 reports differ from the other monitoring tables and graphs in Performance Manager in that the other data is continuously monitored and is sortable on any table column. The Top10 reports are a snapshot view at the time the report was generated and are static. These are one-time reports that generate averages and graphs of the data collection as a snapshot at the time the report is generated.

Note: Name the reports with a timestamp so that you can easily find the report for a given day or week.

These Top10 reports differ from the other monitoring tables and graphs in Performance Manager in that the other data is continuously monitored and is sortable on any table column. The Top10 reports are a snapshot view at the time the report was generated.

Note: Top10 reports require analyzing the existing data over an extended period of time and can take hours or more to generate on large fabrics.

Generating Top10 Reports Using Scripts

You can generate Top10 reports manually by issuing the following commands:

- On UNIX, run the script:

  ```
  /<user_directory>/.cisco_mds9000/bin/pm.sh display pm/pm.xml <output_directory>
  ```

On Windows, run the script:

```
c:\Program Files\Cisco Systems\MDS 9000\bin\pm.bat display pm\pm.xml <output_directory>
```

On UNIX, you can automate the generation of the Top10 reports on your DCNM-SANDCNM-SAN Server host by adding the following cron entry to generate the reports once an hour:

```
0 * * * * /<user_directory>/.cisco_mds9000/bin/pm.sh display pm/pm.xml <output_directory>
```

If your crontab does not run automatically or Java complains about an exception similar to Figure 19 on page 113, you need to add `-Djava.awt.headless=true` to the JVMARGS command in `/<user_directory>/.cisco_mds9000/bin/pm.sh`.

```
in thread main java.lang.InternalError Can't connect to X11 window server using '0.0'
as the value of the DISPLAY variable.
```

Figure 19. Example Java Exception

Configuring Performance Manager for Use with Traffic Analyzer

About this task

Performance Manager works in conjunction with the Traffic Analyzer to allow you to monitor and manage the traffic on your fabric. Using Traffic Analyzer with Performance Manager requires the following components:

- A configured Fibre Channel Switched Port Analyzer (SPAN) destination (SD) port to forward Fibre Channel traffic.
- A Port Analyzer Adapter 2 (PAA-2) to convert the Fibre Channel traffic to Ethernet traffic.
- Cisco Traffic Analyzer software to analyze the traffic from the PAA-2.

Procedure

1. Set up the Traffic Analyzer according to the instructions in the IBM Storage Networking SAN c-type Family Port Analyzer Adapter 2 Installation and Configuration Note.
2. Get the following three items of information:
   - The IP address of the management workstation on which you are running Performance Manager and Traffic Analyzer.
   - The path to the directory where Traffic Analyzer is installed.
   - The port that is used by Traffic Analyzer (the default is 3000).
3. Start the Traffic Analyzer.
   a. Choose **Performance** > **Traffic Analyzer** > **Open**.
   b. Enter the URL for the Traffic Analyzer, in the format:

      ```
      http://<ip address>:<port number>
      ```

      ip address
      is the address of the management workstation on which you have installed the Traffic Analyzer

      :port number
      is the port that is used by Traffic Analyzer (the default is :3000).

   c. Click **OK**.
   d. Choose **Performance** > **Traffic Analyzer** > **Start**
   e. Enter the location of the Traffic Analyzer, in the format:

      ```
      D:\<directory>\ntop.bat
      ```

      D: is the drive letter for the disk drive where the Traffic Analyzer is installed.

      directory
      is the directory containing the ntop.bat file.

   f. Click **OK**.
4. Create the flows you want Performance Manager to monitor, using the Flow Configuration Wizard. See the "Creating a Flow with Performance Manager" on page 106.

5. Define the data collection you want Performance Manager to gather, using the Performance Manager Configuration Wizard. See the "Creating a Collection with Performance Manager" on page 106.
   a. Choose the VSAN you want to collect information for or choose All VSANs.
   b. Check the types of items you want to collect information for (Hosts, ISLs, Storage Devices, and Flows).
   c. Enter the URL for the Traffic Analyzer in the format:

      ```
      http://<ip address>/<directory>
      ```

      where:

      ip address
      is the address of the management workstation on which you have installed the Cisco Traffic Analyzer, and directory is the path to the directory where the Traffic Analyzer is installed.
   d. Click **Next**.
   e. Review the data collection on this and the next section to make sure this is the data you want to collect.
   f. Click **Finish** to begin collecting data.

   Note: Data is not collected for JBOD or for virtual ports. If you change the data collection configuration parameters during a data collection, you must stop and restart the collection process for your changes to take effect.
6. Choose **Performance** > **Reports** to generate a report. Performance Manager Web Server must be running. You see Web Services; click **Custom** then select a report template.

   Note: It takes at least five minutes to start collecting data for a report. Do not attempt to generate a report in Performance Manager during the first five minutes of collection.
7. Click **Traffic Analyzer** at the top of the Host or Storage detail pages to view the Traffic Analyzer information, or choose **Performance** > **Traffic Analyzer** > **Open**. The Traffic Analyzer page will not open unless ntop has been started already.

   Note: For information on capturing a SPAN session and starting a Traffic Analyzer session to view it, refer to the IBM Storage Networking SAN c-type Family Port Analyzer Adapter 2 Installation and Configuration Note.

   Note: For information on viewing and interpreting your Performance Manager data, see the "Creating a Flow with Performance Manager" on page 106.

   For information on viewing and interpreting your Traffic Analyzer data, refer to the IBM Storage Networking SAN c-type Family Port Analyzer Adapter 2 Installation and Configuration Note.

   For performance drill-down, DCNM-SAN Server can launch the Traffic Analyzer in-context from the Performance Manager graphs. The aliases associated with hosts, storage devices, and VSANs are passed to the Traffic Analyzer to provide consistent, easy identification.

Exporting Data Collections

This section includes the following topics:

- "Exporting Data Collections to XML Files"
- "Exporting Data Collections in Readable Format"

Exporting Data Collections to XML Files

The RRD files used by Performance Manager can be exported to a freeware tool called rrdtool. The rrd files are located in pm/db on the DCNM-SAN Server. To export the collection to an XML file, enter the following command at the operating system command-line prompt:

```
/bin/pm.bat xport xxx yyy
```

In this command, *xxx* is the RRD file and *yyy* is the XML file that is generated. This XML file is in a format that rrdtool is capable of reading with the command:

```
rrdtool restore filename.xml filename.rrd
```

You can import an XML file with the command:

```
bin/pm.bat pm restore <xmlFile> <rrdFile>
```

This reads the XML export format that rrdtool is capable of writing with the command:

```
rrdtool xport filename.xml filename.rrd.
```

The **pm xport** and **pm restore** commands can be found on your DCNM-SAN Server at bin\PM.bat for Windows platforms or bin/PM.sh on UNIX platforms. For more information on the rrdtool, refer to the following website: http://www.rrdtool.org.

Exporting Data Collections in Readable Format

About this task

You can export the RRD files used by Performance Manager to a freeware tool called rrdtool and export the collection to an XML file. MDS SAN-OS Release 2.1(1a) introduces the inability to export data collections in comma-separated format (CSV). This format can be imported to various tools, including Microsoft Excel. You can export these readable data collections either from the DCNM-SAN Web Services menus or in batch mode from the command line on Windows or UNIX. Using DCNM-SAN Web Services, you can export one file. Using batch mode, you can export all collections in the pm.xml file.

Note: DCNM-SAN Web Server must be running for this to work.

Procedure

1. You can export data collections to Microsoft Excel using DCNM-SAN Web Server.
   a. Click the **Performance** tab on the main page.
      You see the overview table.
   b. Click the **Flows** sub-tab.
   c. Right-click the name of the entity you want to export and select **Export to Microsoft Excel**.
      You see the Excel chart for that entity in a pop-up window.

2. You can export data collections using command-line batch mode.
   a. Go to the installation directory on your workstation and then go to the bin directory.
   b. On Windows, enter `.\pm.bat export C:\Program Files\Cisco Systems\MDS 9000\pm\pm.xml <export directory>`. This creates the csv file (export.csv) in the export directory on your workstation.
   c. On UNIX, enter `./pm.sh export /usr/local/cisco_mds9000/pm/pm.xml <export directory>`. This creates the csv file (export.csv) in the export directory on your workstation.

   When you open this exported file in Microsoft Excel, the following information displays:
   - Title of the entity you exported and the address of the switch the information came from.
   - The maximum speed seen on the link to or from this entity.
   - The VSAN ID and maximum speed.
   - The timestamp, followed by the receive and transmit data rates in bytes per second.

Analyzing SAN Health

The SAN Health Advisor tool is a utility that used to monitor the performance and collect the statistics. You can perform the following tasks with this tool:

- Run Performance Monitor to collect I/O statistics
- Collect fabric inventory (switches and other devices)
- Create a graphical layout of fabric topology
- Create reports of error conditions and statistical data

You can install this tool at any SAN environment to collect I/O statistics for the specified time (usually 24 hours), generate health reports and automatically send reports to the designated system administrator for review at regular intervals.

When you start SAN Health Advisor tool, it runs in wizard mode, and prompts for inputs such as seed switch credentials, IP address of the server to which the data to be sent and all the necessary information for the software setup. As soon as the fabric is discovered, the tool starts capturing performance data, I/O statistics and error conditions.

The reports generated from the collection is stored in the `$INSTALLDIR/dcm/fm/reports` directory. These reports are automatically sent to the designated SAN administrator for review. In a situation where the tool fails to collect the data, it generates a report with an error message or exception. After sending the reports the tool automatically uninstalls itself and terminates all the processes that it established on the host machine.

The report that SAN Health Advisor tool generates will have the following details:

- Events
- System messages
- Analysis of connectivity
- Zone discrepancy
- System configuration
- Interface status

- Domain information
- Security settings

Installing the SAN Health Advisor Tool

About this task

SAN Health Advisor tool can be installed and run on Windows, UNIX, and Solaris platforms. Install the package that contains the .jar file with JRE version 6.0.

Note: The SAN Health tool is not installed by default when you install DCNM-SAN software.

Procedure

1. Double-click the San Health Advisor tool installer.
   You see the San Health Advisor tool Installer window as shown in Figure 20.

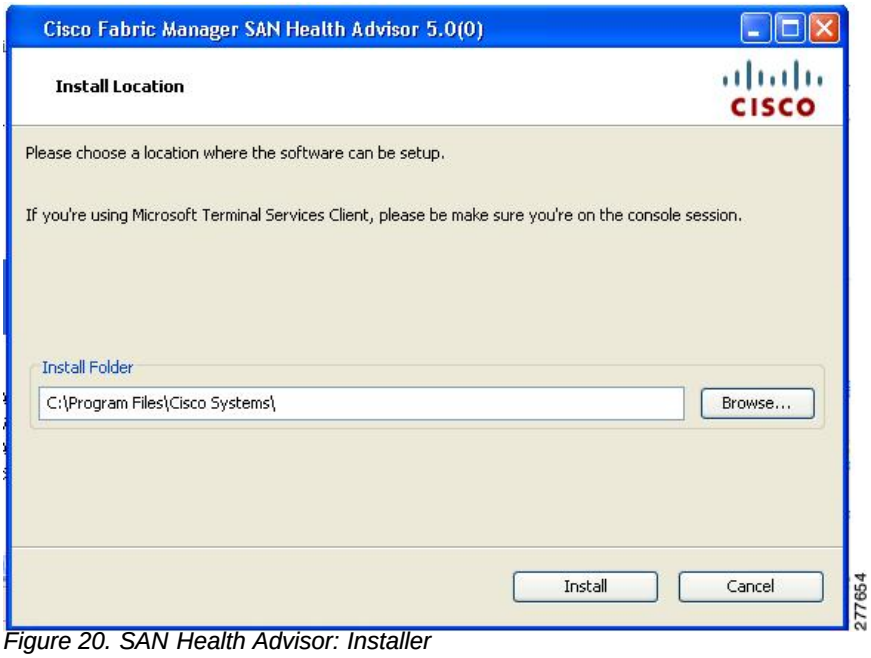

Figure 20. SAN Health Advisor: Installer

2. Select an installation folder on your workstation for SAN Health Advisor.
   On Windows, the default location is `C:\Program Files\Cisco Systems\`.
3. Click Install to start the installation.
   You see the installation progressing as shown in Figure 21 on page 118.

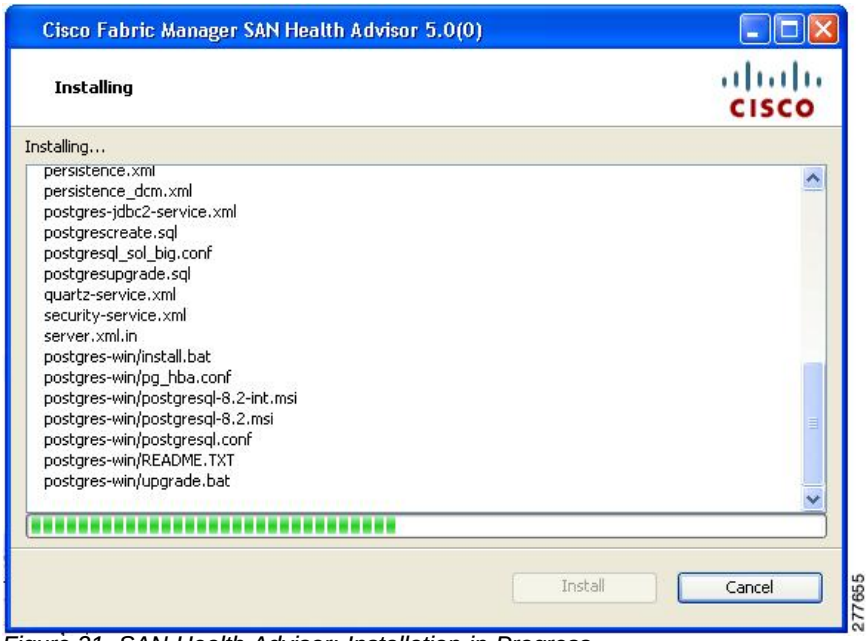

Figure 21. SAN Health Advisor: Installation in Progress

You see the Fabric Options dialog box as shown in Figure 22

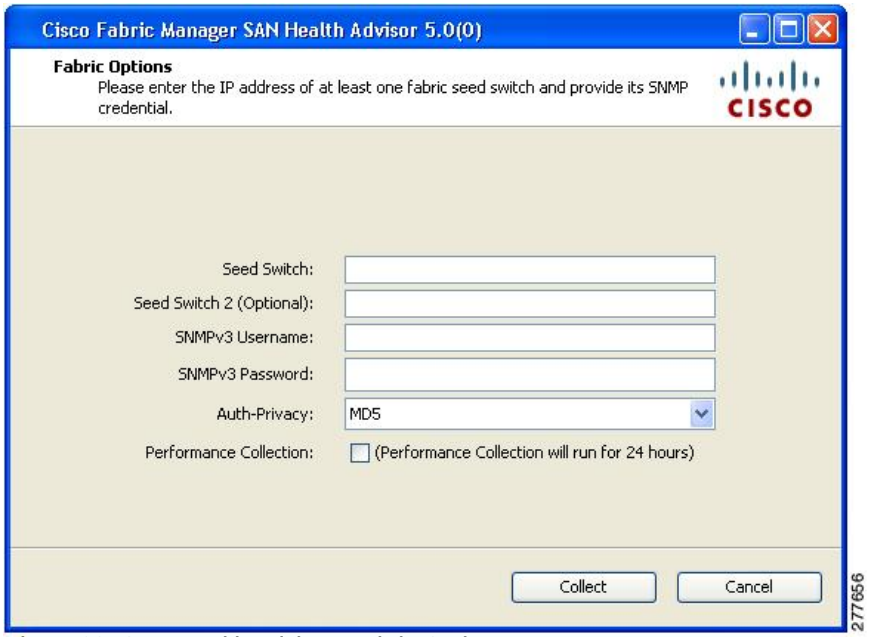

Figure 22. SAN Health Advisor: Fabric Options

4. In the Seed Switch text box, enter the IP address of the seed switch.
5. Enter the user name and password for the switch.
6. Select the authentication privacy option from the Auth-Privacy drop-down list box.
7. Click the **Performance Collection** check box to enable the process to run for 24 hours.
8. Click **Collect** to start gathering performance information.

   You see the collecting dialog box as shown in Figure 23 on page 119.

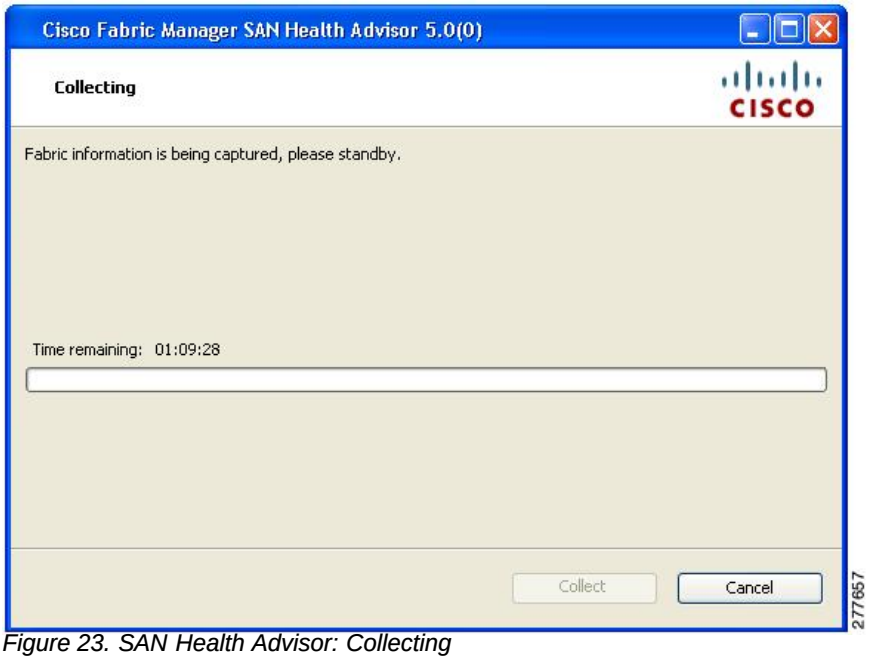

Figure 23. SAN Health Advisor: Collecting

If you want to stop gathering information in the middle of the process, click **Cancel**. You see the message indicating performance collection is complete as shown in Figure 24.

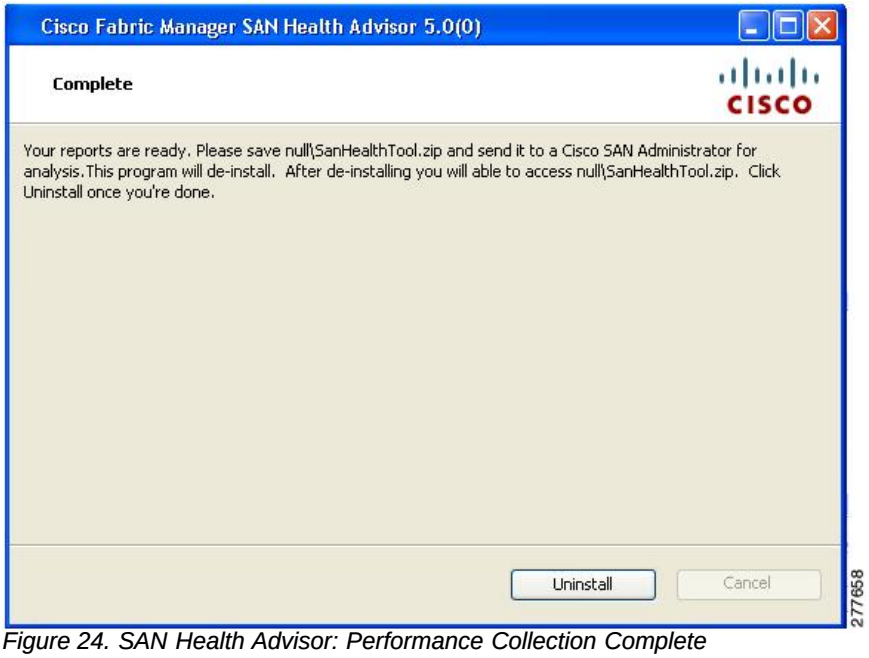

Figure 24. SAN Health Advisor: Performance Collection Complete

9. Click **Uninstall** to remove the SAN Health Advisor software.

Monitoring the LAN Switch Performance Counters

DCNM allows you to monitor LAN switch performance counters. The following counters can be monitored:

- Performance monitoring of interfaces (RX/TX traffic statistics, errors/discards, average/peak statistics etc.)
- Monitor VPC member Rx/Tx counters

- Monitor CPU/Memory statistics
- Monitor switch traffic
- Monitor Health Scores
- Monitor Events

Appendix A. DCNM Vacuum and Autovacuum Postgres Databases

This chapter describes how to vacuum the postgres database in Microsoft Windows and Linux.

This chapter includes the following sections:

- "Background Information"
- "Vacuum DCNM Postgresql Database in Windows"
- "Vacuum DCNM's Postgresql Database in Linux" on page 122

Background Information

It is absolutely critical to vacuum postgres databases in order for the databases to properly function. Through the life of the database, new entries are added and current entries are updated. By design, postgres does not immediately remove the iterations of a record as it gets updated. Therefore, postgres databases can contain a large number of stale, unused records. These old records should be removed at least every two weeks with the vacuum function in order to reduce disk usage and improve the speed of database queries. It is even more effective if you configure postgres to automatically vacuum the database without the need to stop the Data Center Network Manager (DCNM) services.

Note: *$INSTALLDIR* throughout this article refers to `C:\Program Files\Cisco Systems\` or `/usr/local/cisco/` based on the operating system, Microsoft Windows or Linux respectively. The install path could be changed from these defaults during installation.

Vacuum DCNM Postgresql Database in Windows

Procedure

1. Stop the DCNM services by clicking **Stop DCNM Servers button**, or enter the command as below:

   ```
   $INSTALLDIR/dcm/dcnm/bin/stopLANSANserver.bat
   ```

2. Obtain the database name, username, and password. Locate the postgresql.cfg.xml file on the DCNM server.
   - In DCNM Version 6.2.x, enter:

     ```
     $INSTALLDIR/dcm/jboss-4.2.2.GA/server/dcnm/conf/database/postgresql.cfg.xml
     ```

   - In DCNM Version 6.3.x, enter:

     ```
     $INSTALLDIR/dcm/Jboss-as-7.2.0.Final/standalone/conf/postgresql.cfg.xml
     ```

3. Open `PgAdmin III.exe`, which is a helpful GUI for the postgres database. Then, right-click the object in the list and connect to the database. Enter the password from Step 2 here.
4. Navigate through the drop-down menus to the dcmdb database.
5. Right-click **dcmdb** and select **Maintenance**. Select the **Vacuum**, **Full**, **Analyze**, and **Verbose** options in the Maintain Database dcmdb dialog box.

   Note: The vacuum operation usually completes within an hour, but can take much longer for larger databases. Remember to restart the DCNM services.

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Vacuum DCNM's Postgresql Database in Linux

About this task

Procedure

1. Stop dcnm by using the **appmgr stop dcnm** command.
2. Open the psql prompt:

   ```
   ./usr/local/cisco/dcm/db/bin/psql -U <dbUsername> dcmdb
   ```

3. Run the database vacuum and quit:

   ```
   dcmdb=> VACUUM FULL ANALYZE VERBOSE;
   ```

   Many pages of output pass on the screen. The vacuum is finished when you see a message similar to this one:

   Current limits are: 532000 page slots, 1000 relations, using 3182 kB.

   ```
   VACUUM
   dcmdb=>
   dcmdb=>\q
   ```

   The previous command exits the sql prompt.
4. Start DCNM services by using the **appmgr start dcnm** command.

Appendix B. DCNM-SAN Event Management

DCNM Event Management tool (EMAN) offers event management capability directly in IBM Storage Networking SAN c-type Family switches to monitor events and take informational or corrective action as events occur, or when a threshold is reached. EMAN captures the state of the switches during critical situations helping to take immediate recovery actions and gather information to perform root-cause analysis.

An event is generated when the object matches specified values or crosses specified thresholds. When it detects an event, EMAN will parse the event for the host name, severity and then determine the host-to-application dependency by comparing the event in the host table. EMAN monitors these events to detect the severity type such as warning, critical and emergency of the events. It will also list the impacted components such as a host, ISL or a storage port. Switch health and performance threshold are the two event types that the EMAN monitor.

This Appendix contains the following sections:

Benefits of the Event Management Tool

EMAN tracks resource utilization and resource depletion by monitoring events in 45000 ports and 240 switches. It also provides a mechanism to send notifications whenever the specified threshold values are exceeded by any of the components. This notification helps network administrators diagnose resource utilization issues and prioritize resources making it more scalable.

EMAN helps in addressing component issues real time by performing the following functions:

- Monitoring resource usage.
- Using resource threshold pre-sets.
- Generating alerts when resource utilization reaches the specified level
- Provides dependency path mapping.

DCNM-SAN Event Management

This section describes how DCNM handles asynchronous transfer events from the managed switches and contains the following topics:

Events

The following are the three primary methods by which DCNM detects events:

SNMP

The Simple Network Management Protocol v1 (SNMPv1) event detector

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allows an event to be generated when the object matches specified values or crosses specified thresholds. The SAN c-Type switch can contain up to 10 trap destinations. The unmanaged fabrics or switches are removed from the list of traps destinations.

Syslog
DCNM-SAN receives syslog messages and are logged in the events table in the database and archived on each switch.

Fabric Model
DCNM-SAN can function even without receiving SNMP traps from the managed switches. DCNM-SAN polls for traps every 5 minutes and does a deeper discovery every 30 minutes by default.

Purpose

Asynchronous event handling serves the following purposes:

Model Update
DCNM-SAN design the model of the physical and logical connectivity of each fabric. Asynchronous events enables real time synchronization with the fabric. In cases such as a linkdown, this model quickly updates the event without polling the fabric. However, for major changes such as an ISL link change, this model polls the fabric to synchronize.

Log All the events are logged into a database. The number of events that can be logged is set to 10,000 by default. You can view this log in the DCNM-SAN Client and in DCNM Web Client. The DCNM Web Client stores all events in the database unless you do not apply any filteres. The DCNM-SAN Client log is restricted to the fabric(s) that are opened in the client's interface. The DCNM-SAN Client automatically updates the table as new events appear.á

Map The DCNM-SAN Client's updates the map automatically when topology changes.

Forwarding

Events are forwarded in three ways:

Call Home
The IBM Storage Networking SAN c-type Family switches generates an email at the event of a critical event such as a module down etc. You can customize this email to include additional information. You can use DCNM-SAN client to configure the call home feature and it has no operational dependency on DCNM.

EMC Call Home
If you enable this feature, the DCNM server generates an EMC call home email at the event of a critical event such as a linkDown event etc. This email is created in XML format.

Event Forwarding
You can optionally choose to send an email or SNMP traps from DCNM for any or all events that are logged into the database.

DCNM-SAN Event Classification

This section describes the DCNM event classification and contains the following topics:

Port Events

Port events provides real-time information about the operational status of the host ports, storage ports, ISLs, NPV etc in your network. At the event of a fault, the DCNM EMAN generates an event or events that are rolled up into an alert. The port events are broadly classified into two as follows:

Service Impacting
Indicates the severity of the event that impacts the service. Examples are PMON, RMON and SFP events.

Outage
Indicates the severity of the event that impacts the functioning of the device. Exampls are link up/down and threshold events.

Event Log Format

Events log consists of parseable information that is available to higher level management applications in the following format:

```
<fabric>/<switch> <localTime> <severity> <type> <description>
```

Fabric/Switch
The name of the fabric or the switch.

LocalTime
The date and time of the event occurred. The time is in the following format: hh:mm:ss.ttt. The date is in the following format: MM/DD/YYYY.

Severity
Event severity level, combination of single events, or a range of event severity levels. The severity contains one of the following.

- Emergencies
- Alert
- Critical
- Error
- Warning
- Notice
- Informational
- Debugging

Type Type of events:

- Fabric
- FICON
- IVR
- License
- Other
- Port Alarm

- Port Up and Port Down
- Security
- Switch Hardware
- Switch Manageability
- Threshold
- VSAN
- Zone

Description

Description of the event in the following format:

`<portType>: <name>, Port: <interface>, VSAN: <vsanId(s)>, <condition>`

Event Types

Table 14. IVR Events

Event Name	Description
civrDomainConflictNotify	
civrZoneActivationDoneNotify	
civrZoneCompactNotify	
civrZoneDeactivationDoneNotify	
civrDomainConflictNotify	
civrAfidConfigNotify	

License

Table 15. Licence Events

Event Name	Description
clmLicenseExpiryNotify	
clmLicenseExpiryWarningNotify	
clmLicenseFileMissingNotify	
clmNoLicenseForFeatureNotify	

Port Alarm

Any RMON event that relates to an interface object.

Table 16. Port Alarm Event

Event Name	Description
cIfXcvrMonStatusChangeNotif	

Port Up and Port Down

Model-generated events relating to Host, Storage, ISL, NP_Links

Table 17. IVR Events

Event Name	Description
linkup	
linkDown	
cieLinkUp	

Table 17. IVR Events (continued)

Event Name	Description
cieLinkDown	
connUnitPortStatusChange	
fcNameServerEntryAdd	
fcNameServerEntryDelete	
fcTrunkIfDownNotify	
fcTrunkIfUpNotify	
cieDelayedLinkUpDownNotif	

Note: Port Moved events will not be logged.

Security

Table 18. Security Event Types

Event Name	Description
casServerStateChange	
cfcspAuthFailTrap	
ciscoPsmFabricBindDenyNotifyNew	
ciscoEnhIpsecFlowBadSa	
ciscoEnhIpsecFlowSetupFail	
ciscoEnhIpsecFlowSysFailure	
ciscoEnhIpsecFlowTunnelStart	
ciscoEnhIpsecFlowTunnelStop	
ciscoIPsecProvCryptomapAdded	
ciscoIPsecProvCryptomapAttached	
ciscoIPsecProvCryptomapDeleted	
ciscoIPsecProvCryptomapDetached	
ciscoIkeConfigOperStateChanged	
ciscoIkeConfigPolicyAdded	
ciscoIkeConfigPolicyDeleted	
ciscoIkeConfigPskAdded	
ciscoIkeConfigPskDeleted	
ciscoIkeFlowInNewGrpRejected	
ciscoIkeFlowOutNewGrpRejected	
ciscoIpsSgCertCrlFailure	
ciscoIpsSgSysFailure	
ciscoIpsSgTunnelStart	
ciscoIpsSgTunnelStop	

Switch Hardware

Table 19. Switch Hardware Events

Event Name	Description
cefcFRUInserted	
cefcFRURemoved	
cefcPowerStatusChange	
cefcPowerSupplyOutputChange	
cefcFanTrapStatusChange	
cefcUnrecognizedFRU	
cefcFRUInserted	
cefcFRURemoved	
cefcUnrecognizedFRU	
entPhysicalVendorType	
entPhysicalName	
entPhysicalModelName	
cefcPhysicalStatus	
cefcPowerStatusChange	
ácefcFRUPowerOperStatus	
cefcFRUPowerAdminStatus	
cefcFanTrapStatusChange	

Switch Manageability

Table 20. Switch Event Types

Event Name	Description
Switch Discovered	
Switch Rebooted	
Switch Unreachable	
Switch Manageable	
Switch Unmanageable	
Switch IP Changed	
warmStart	
coldStart	
ciscoRFProgressionNotif	
ciscoRFSwactNotif	

Threshold

Table 21. Threshold Events

Event Name	Description
cHcRisingAlarm	
cHcFallingAlarm	
hcRisingAlarm	

Table 21. Threshold Events (continued)

Event Name	Description
hcFallingAlarm	
risingAlarm	
FallingAlarm	

VSAN

Table 22. VSAN Events

Event Name	Description
vsanPortMembershipChange	
vsanStatusChange	

Zone

Table 23. Zone Events

Event Name	Description
zoneActivateNotify	
zoneCompactNotify	
zoneDefZoneBehaviourChngNotify	
zoneMergeFailureNotify	
zoneMergeSuccessNotify	
zoneServiceReqRejNotify	
zoneUnsuppMemInIntOpModeNotify	

Others

This table contains all other trap types such as ISCSI, VRRP, callhome, flex attach, FDMI, FICON, CFS, PMON config, SVC, SCSI, SNE, Core, Domain Manager, FCNS, FCOT, and UCS.

Table 24. Other Events

Event Name	Description
cIsnsClientInitalRegistration	
cIsnsClientLostConnection	
cIsnsClientNoServerDiscovered	
cIsnsClientStart	
cIsnsServerShutdown	
cIsnsServerStart	
cVrrpNotificationNewMaster	
cVrrpNotificationProtoError	
casServerStateChange	
ccCopyCompletion	
ccmAlertGroupTypeAddedNotif	
ccmAlertGroupTypeDeletedNotif	
ccmCLIRunningConfigChanged	

Table 24. Other Events (continued)

Event Name	Description
ccmCTIDRolledOver	
ccmEventNotif	
ccmSmtpMsgSendFailNotif	
ccmSmtpServerFailNotif	
cfaIfVirtualWwnChangeNotify	
cfaVirtualWwnMapChangeNotify	
cfdmiRejectRegNotify	
cficonPortInfoChange	
ciscoCFSDiscoveryCompleteNotif	
ciscoCFSFeatureActionNotif	
ciscoCFSMergeFailNotif	
ciscoCFSStatPeerStatusChngNotif	
ciscoConfigManEvent	
ciscoEnhIpsecFlowBadSa	
ciscoEnhIpsecFlowSetupFail	
ciscoEnhIpsecFlowSysFailure	
ciscoEnhIpsecFlowTunnelStart	
ciscoEnhIpsecFlowTunnelStop	
ciscoExtScsiLunDiscDoneNotify	
ciscoFCCCongestionRateLimitEnd	
ciscoFCCCongestionRateLimitStart	
ciscoFCCCongestionStateChange	
ciscoFeatOpStatusChange	
ciscoFeatureOpStatusChange	
ciscoFeatureSetOpStatusChange	
ciscoFlashCopyCompletionTrap	
ciscoFlashDeviceChangeTrap	
ciscoFlashDeviceInsertedNotif	
ciscoFlashDeviceInsertedNotifRev1	
ciscoFlashDeviceRemovedNotif	
ciscoFlashDeviceRemovedNotifRev1	
ciscoFlashMiscOpCompletionTrap	
ciscoFlashPartitioningCompletionTrap	
ciscoIPsecProvCryptomapAdded	
ciscoIPsecProvCryptomapAttached	
ciscoIPsecProvCryptomapDeleted	
ciscoIPsecProvCryptomapDetached	
ciscoIkeConfigOperStateChanged	
ciscoIkeConfigPolicyAdded	
ciscoIkeConfigPolicyDeleted	

Table 24. Other Events (continued)

Event Name	Description
ciscoIkeConfigPskAdded	
ciscoIkeConfigPskDeleted	
ciscoIkeFlowInNewGrpRejected	
ciscoIkeFlowOutNewGrpRejected	
ciscoIpsSgCertCrlFailure	
ciscoIpsSgSysFailure	
ciscoIpsSgTunnelStart	
ciscoIpsSgTunnelStop	
ciscoPmonPolicyChangeNotify	
ciscoPrefPathHWFailureNotify	
ciscoPsmFabricBindDenyNotify	
ciscoPsmFabricBindDenyNotifyNew	
ciscoPsmPortBindEPortDenyNotify	
ciscoPsmPortBindFPortDenyNotify	
ciscoSanBaseSvcClusterNewMaster	
ciscoSanBaseSvcInterfaceCreate	
ciscoSanBaseSvcInterfaceDelete	
ciscoScsiFlowStatsNotify	
ciscoScsiFlowVerifyNotify	
ciscoScsiFlowWrAccNotify	
ciscoSmeClusterNewMaster	
ciscoSmeInterfaceCreate	
ciscoSmeInterfaceDelete	
ciscoSystemClockChanged	
ciscoVshaStateChngNotify	
ciuUpgradeJobStatusNotify	
ciuUpgradeOpCompletionNotify	
cseFailSwCoreNotify	
cseFailSwCoreNotifyExtended	
cseHaRestartNotify	
cseShutDownNotify	
csiErrorTrap	
csiInformationTrap	
csiWarningTrap	
dmDomainIdNotAssignedNotify	
dmFabricChangeNotify	
dmNewPrincipalSwitchNotify	
fcNameServerDatabaseFull	
fcNameServerRejectRegNotify	
fcPingCompletionNotify	

Table 24. Other Events (continued)

Event Name	Description
fcTraceRouteCompletionNotify	
fcotInserted	
fcotRemoved	
fcsDiscoveryCompleteNotify	
fcsMgmtAddrChangeNotify	
fcsReqRejNotify	
fspfNbrStateChangeNotify	
ptopoConfigChange	
qlSB2PortLinkDown	
qlSB2PortLinkUp	
rscnElsRejectReqNotify	
rscnElsRxRejectReqNotify	
rscnIlsRejectReqNotify	
rscnIlsRxRejectReqNotify	
virtualNwIfCreateEntryNotify	
virtualNwIfDeleteEntryNotify	
vlanTrunkPortDynamicStatusChange	
vrrpTrapAuthFailure	
vrrpTrapNewMaster	
vtpConfigDigestError	
vtpConfigRevNumberError	
vtpLocalModeChanged	
vtpMtuTooBig	
vtpPruningStateOperChange	
vtpServerDisabled	
vtpVersionInUseChanged	
vtpVersionOneDeviceDetected	
vtpVlanCreated	
vtpVlanDeleted	
vtpVlanRingNumberConflict	
wwnmType1WwnAvailableNotify	
wwnmType1WwnShortageNotify	
wwnmTypeOtherWwnAvailableNotify	
wwnmTypeOtherWwnShortageNotify	

Appendix C. Vcenter Plugin

VMware Vcenter plugin allows you to monitor the Cisco Unified Computing System (Cisco UCS«), Cisco Nexus, and Cisco MDS 9000 Family platforms through Cisco DCNM.

The Cisco DCNM plug-in for VMware Vcenter adds a multihop view and monitoring of Ethernet and Fibre Channel IBM Storage Networking SAN c-type Family topologies. The increased visibility into virtualized infrastructure helps network administrators locate performance anomalies that may cause service degradation. It also aids to eliminate virtual computing and networking as a root cause of the problem.

This Appendix contains the following sections:

- "Associating Vcenter with the Datasource"
- "Registering Vcenter plugin"
- "Triggering the plugin"
- "Removing the plugin"

Associating Vcenter with the Datasource

To associate the Vcenter with the datasource, DCNM must discover the LAN and SAN devices.

Navigate to **Inventory** > **Discovery** > **LAN Switches or Inventory** > **Discovery** > **SAN Switches** to check if the LAN or SAN devices are discovered on the DCNM Web Client. In the **Inventory** > **Discovery** > **Virtual Machine Manager** block, click **+** to add the Vcenter to the datasource.

Registering Vcenter plugin

To register the Vcenter plugin, run the **RegisterPlugin** script. Enter the Vcenter IP address, Vcenter username, Vcenter password, and complete URL of the DCNM server. The plugin configuration file is stored in the DCNM server.

Example:

```
RegisterPlugin.bat -add 172.22.29.87 admin nbv123 https://dcnm-san-001:443
```

Triggering the plugin

When user clicks on the menu, it will show the login page first, and then will launch an internal browser which will show the host dashboard.

Removing the plugin

To remove the Vcenter plugin, run the **RegisterPlugin** script. Enter the Vcenter IP address, Vcenter username, Vcenter password, and complete URL of the DCNM server. The plugin configuration file is in the DCNM server.

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Appendix D. Interface Non-operational Reason Codes

If the administrative state for an interface is up and the operational state is down, the reason code differs based on the nonoperational reason code as described in Table 25.

Table 25. Reason Codes for Nonoperational States

Reason Code	Description	Applicable Modes
Link failure or not connected	Physical layer link is not operational.	All
SFP not present	The small form-factor pluggable (SFP) hardware is not plugged in.	
Initializing	The physical layer link is operational and the protocol initialization is in progress.	
Reconfigure fabric in progress	The fabric is currently being reconfigured.	
Offline	MDS SAN-OS waits for the specified R_A_TOV time before retrying initialization.	
Inactive	The interface VSAN is deleted or is in a suspended state. To make the interface operational, assign that port to a configured and active VSAN.	
Hardware failure	A hardware failure is detected.	
Error disabled	Error conditions require administrative attention. Interfaces may be error-disabled for various reasons. For example: • Configuration Failure • Incompatible buffer-to-buffer credit configuration. To make the interface operational, you must first fix the error conditions causing this state; and next, administratively shut down or enable the interface.	

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Table 25. Reason Codes for Nonoperational States (continued)

Reason Code	Description	Applicable Modes
Isolation due to ELP failure	Port negotiation failed.	Only E ports and TE ports
Isolation due to ESC failure	Port negotiation failed.	
Isolation due to domain overlap	The Fibre Channel domains (fcdomain) overlap.	
Isolation due to domain ID assignment failure	The assigned domain ID is not valid.	
Isolation due to other side E port isolated	The E port at the other end of the link is isolated.	
Isolation due to invalid fabric reconfiguration	The port is isolated due to fabric reconfiguration.	
Isolation due to domain manager disabled	The fcdomain feature is disabled.	
Isolation due to zone merge failure	The zone merge operation failed.	
Isolation due to VSAN mismatch	The VSANs at both ends of an ISL are different.	
Nonparticipating	FL ports cannot participate in loop operations. It may happen if more than one FL port exists in the same loop, in which case all but one FL port in that loop automatically enters nonparticipating mode.	Only FL ports and TL ports
PortChannel administratively down	The interfaces belonging to the PortChannel are down.	Only PortChannel interfaces
Suspended due to incompatible speed	The interfaces belonging to the PortChannel have incompatible speeds.	
Suspended due to incompatible mode	The interfaces belonging to the PortChannel have incompatible modes.	
Suspended due to incompatible remote switch WWN	An improper connection is detected. All interfaces in a PortChannel must be connected to the same pair of switches.	

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This statement explains the Japan Electronics and Information Technology Industries Association (JEITA) statement for products less than or equal to 20 A per phase.

高調波電流規格 JIS C 61000-3-2 適合品

This statement explains the JEITA statement for products greater than 20 A, single phase.

高調波電流規格 JIS C 61000-3-2 準用品

本装置は、「高圧又は特別高圧で受電する需要家の高調波抑制対策ガイドライン」対象機器（高調波発生機器）です。
- 回路分類：6（単相、ＰＦＣ回路付）
- 換算係数：0

This statement explains the JEITA statement for products greater than 20 A per phase, three-phase.

高調波電流規格 JIS C 61000-3-2 準用品

本装置は、「高圧又は特別高圧で受電する需要家の高調波抑制対策ガイドライン」対象機器（高調波発生機器）です。
- 回路分類：5（3相、ＰＦＣ回路付）
- 換算係数：0

Korean Communications Commission Class A Statement

This explains the Korean Communications Commission (KCC) statement.

이 기기는 업무용(A급)으로 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

Russia Electromagnetic Interference Class A Statement

This statement explains the Russia Electromagnetic Interference (EMI) statement.

ВНИМАНИЕ! Настоящее изделие относится к классу А.
В жилых помещениях оно может создавать
радиопомехи, для снижения которых необходимы
дополнительные меры

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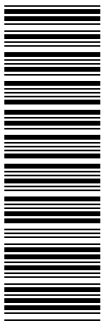

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