



ONTAP® Select 9

Installation and Cluster Deployment Guide

Using ONTAP Select Deploy 2.4.1

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Updated for ONTAP Select 9.2

 **NetApp**®

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Deciding whether to use this ONTAP Select guide

This guide includes everything you need to plan, deploy, and support an ONTAP Select cluster on VMware ESXi running with a NetApp purchased license. To deploy an ONTAP Select cluster with an evaluation license, see the applicable Quick Start Guide.

You should also review the *ONTAP Select Product Architecture and Best Practices Technical Report* for a more detailed description of the product.

Related information

[*ONTAP Select 9.2 Release Notes*](#)

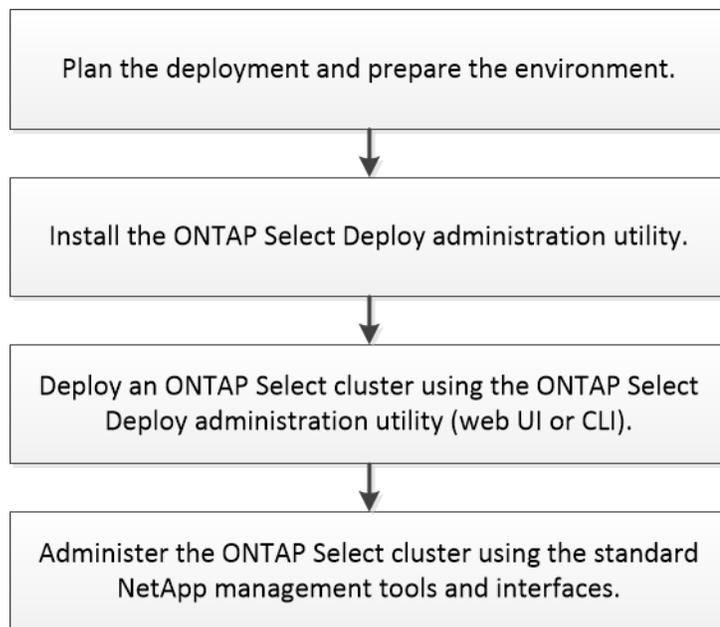
[*NetApp Technical Report 4517: ONTAP Select Product Architecture and Best Practices*](#)

[*ONTAP Select 9 Quick Start Guide: Deploying an Evaluation Multi-Node Cluster*](#)

[*ONTAP Select 9 Quick Start Guide: Deploying an Evaluation Single-Node Cluster*](#)

ONTAP Select installation and deployment workflow

Before you can deploy an ONTAP Select cluster, you must plan the deployment and prepare the hypervisor hosts where ONTAP Select will run. After you have prepared the deployment environment, you can install the ONTAP Select Deploy administration utility and then use the Deploy utility to deploy an ONTAP Select cluster. After the cluster has been deployed, you can administer the cluster using the standard NetApp management tools and interfaces.



Getting started with ONTAP Select

ONTAP Select is a software-only version of ONTAP running in a virtual machine on a hypervisor host. It is an implementation of the software defined storage (SDS) technology now emerging in the industry and a key component of the NetApp Data Fabric initiative. ONTAP Select complements the suite of mainstream hardware-based ONTAP offerings as well as other software-only options, including ONTAP Cloud. Before deploying ONTAP Select, you should understand its key characteristics, operational components, and features.

Key concepts and terminology

As you begin to explore ONTAP Select and plan a deployment, it is helpful to first become familiar with the key concepts at a high level. Based on this, you are better able to understand and deploy the product.

ONTAP Select Deploy

ONTAP Select Deploy is the administration utility that you must use to deploy ONTAP Select clusters. The Deploy utility runs in a dedicated Linux virtual machine. You can access the Deploy utility in one of several different ways, including through the web GUI and CLI management shell.

Hypervisor host versus ONTAP Select node

A *hypervisor host* is the core hardware platform, including the VMware ESXi virtualization software, that hosts an ONTAP Select virtual machine. When an ONTAP Select virtual machine is deployed and active on a hypervisor host, it is considered to be an *ONTAP Select node*.

ONTAP Select cluster

You can create an *ONTAP Select cluster* composed of one, two, or four nodes. A four-node cluster consists of two HA pairs. A two-node cluster consists of one HA pair. The single-node cluster does not provide an HA capability.

Preparation of the hypervisor host environment

Before using the Deploy administration utility to deploy an ONTAP Select cluster, you must prepare the hypervisor hosts where ONTAP Select will run, including the storage and networking environments. You must perform this host pre-configuration outside of the ONTAP Select product based on the current requirements and limitations.

Evaluation versus purchased licenses

Each ONTAP Select node runs with either an *evaluation license* or a *purchased license*.

An evaluation license allows you to evaluate ONTAP Select prior to deploying it in a production environment. Note that if you chose to deploy a cluster in evaluation mode, the evaluation license is automatically generated and applied by the ONTAP Select Deploy administration utility.

After you select the license type for a node, it cannot be changed. For example, you cannot upgrade an evaluation license to a purchased license. For more information about evaluation deployments, see the appropriate Quick Start Guide.

Purchased license with storage capacity

You cannot use an evaluation license in a production environment; instead, you must purchase a license for each ONTAP Select node. One of the attributes you need to select when purchasing a license is the *storage capacity* for the node. After purchasing a license with storage capacity, NetApp assigns a unique serial number to the node. You must use

this serial number to download a separate license file which you then apply to the node using the Deploy administration utility.

Note: The ONTAP Select storage capacity corresponds to the total allowable size of the virtual data and root disks attached to the ONTAP Select virtual machine.

Purchased license offerings and hypervisor configuration type

There are two offerings or platform levels available when you purchase a license for an ONTAP Select node.

- Standard
- Premium

The premium offering enhances the standard offering by providing support for SSD drives in addition to the HDD drives, as well as a larger virtual machine configuration.

When configuring a host using the ONTAP Select Deploy utility, there are two hypervisor instance types available: small and medium. These instance types correspond to the standard and premium offerings, respectively. For additional details, review the planning information related to the VMware environment.

Storage pools versus datastores

An ONTAP Select *storage pool* is a logical data container designed to abstract and hide the underlying physical storage. A storage pool is hypervisor-independent. When deployed on an ESXi hypervisor host, the ONTAP Select storage pool is synonymous with a VMware *datastore*.

ONTAP Select vNAS

The ONTAP Select vNAS solution allows an ONTAP Select node to access VMware datastores on external storage. With ONTAP Select vNAS, a local RAID controller is no longer needed; the RAID functionality is assumed to be provided by the remote storage. ONTAP Select vNAS can be configured in the following ways:

- VMware vSAN
- Generic external storage array

When using external storage, either VMware vSAN or an external storage array must be configured prior to creating an ONTAP Select cluster or expanding the storage capacity of an existing node.

Note: ONTAP Select vNAS can only be used with a single-node ONTAP Select cluster.

Node re-hosting

When you deploy a single-node cluster that uses external storage available through the ONTAP Select vNAS solution (either VMware vSAN or a generic external storage array), the ESXi virtual machine hosting the ONTAP Select node can be moved through actions that utilize the following VMware features:

- vMotion
- High Availability (HA)
- Distributed Resource Scheduler (DRS)

The ONTAP Select Deploy utility detects the movement of the virtual machine as part of executing an operation on the cluster, such as:

- cluster online
- cluster offline

- storage add

When a virtual machine is moved, the Deploy utility updates its internal database and configures the new ESXi host. All actions performed on the ONTAP Select node are blocked until the movement of the virtual machine and Deploy updates are completed.

Note: The existing restriction allowing only one ONTAP Select virtual machine instance per ESXi hypervisor host is still enforced.

Mediator service

The ONTAP Select Deploy utility includes a mediator service that connects to the nodes in active two-node clusters. This service monitors each HA pair and assists in managing failures.

Attention: If you have one or more active two-node clusters, the ONTAP Select Deploy virtual machine administering the clusters must be running at all times. If the Deploy virtual machine is halted, the mediator service is unavailable and HA capability is lost for the two-node clusters.

Storage efficiency

The storage efficiency feature consists of two ONTAP functions: inline compression and deduplication. The feature can only be enabled when SSD drives are used for all of the datastores in an HA pair or node. The storage efficiency feature is available in the following configurations:

- HA pair
All the datastores used by both nodes in the HA pair must reside on SSD drives (four-node and two-node clusters).
- Single node
All the datastores used by a single node must reside on SSD drives (single-node cluster).

Note: When storage efficiency is enabled, only datastores on SSD drives can be used by the HA pair or single node.

Administering an ONTAP Select cluster after it is deployed

After you deploy an ONTAP Select cluster, you must configure the cluster as you would any hardware-based ONTAP cluster. For example, you can configure the cluster using System Manager or the standard ONTAP command line interface.

Related concepts

[Appendix A: Understanding the ONTAP Select storage environment](#) on page 68

[Appendix B: Understanding the ONTAP Select networking environment](#) on page 74

Business needs and possible usage scenarios

ONTAP Select is suitable for several different types of applications based on the inherent flexibility provided through the hypervisor virtualization.

Private cloud

ONTAP Select is ideally suited to supporting one or more private clouds within your organization. Like the public cloud, a private cloud provides flexibility as well as rapid setup and teardown. In addition, a private cloud offers improved security and control.

Disaster recovery and secondary storage

You can use ONTAP Select to implement additional storage that augments your primary storage capabilities. The additional storage can be used to support your organization's disaster recovery efforts and data backup plans.

Development and testing

As you deploy various applications within your organization, you can use ONTAP Select as an integral part of the overall application development and testing process. For example, you may need temporary storage to hold test input or output data. The length of these types of deployments can vary based on the application characteristics and requirements.

Primary storage

In certain cases, you may choose to deploy ONTAP Select as your primary storage platform. These types of implementations vary and depend on the workload characteristics of the applications as well as your business objectives.

Remote office/Branch office

You can deploy ONTAP Select in remote office/branch office (ROBO) situations to support smaller offices while maintaining centralized administration and control.

Beginning with version 2.4 of the ONTAP Select Deploy utility, you can create a two-node ONTAP Select cluster with HA capability, which is ideal for remote and branch office deployments. And because any VMware vSphere license can be used, you can choose the vSphere Remote Office Branch Office Standard or Advanced license instead of the Enterprise or Enterprise Plus license.

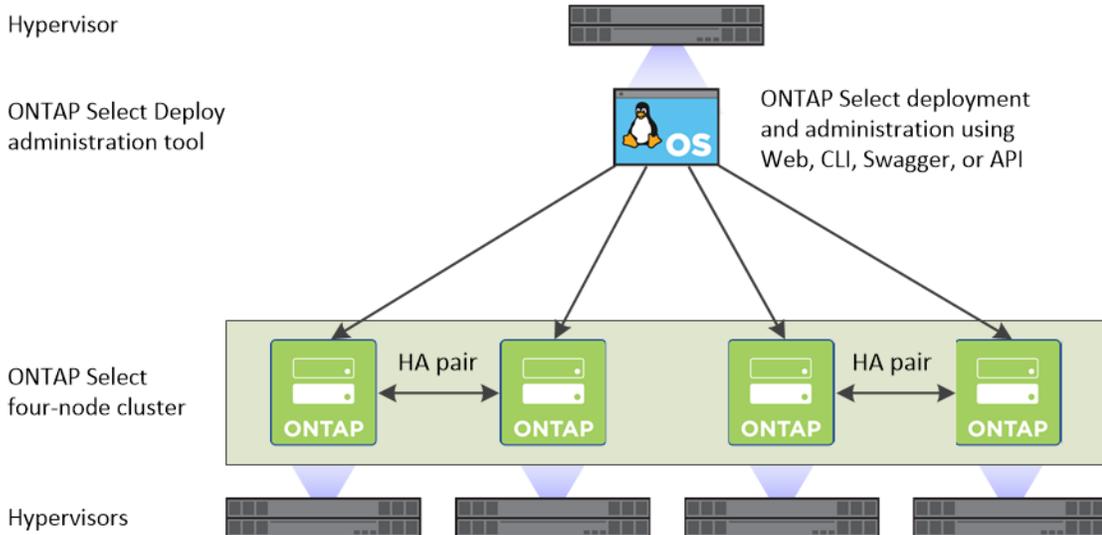
Dedicated versus collocated

From a high level, you can deploy ONTAP Select in two different ways regarding the workload on the hypervisor host servers.

- **Dedicated deployment**
With the dedicated deployment model, a single instance of ONTAP Select runs on the host server. No other significant processing runs on the same hypervisor host.
- **Collocated deployment**
With the collocated deployment model, ONTAP Select shares the host with other workloads. Specifically, there are additional virtual machines, each typically running computational applications. These compute workloads are therefore local to the ONTAP Select cluster. This model supports specialized application and deployment requirements. As with the dedicated deployment model, each ONTAP Select virtual machine must run on a separate and dedicated hypervisor host.

Illustration of a typical deployment environment

The following figure illustrates the ONTAP Select Deploy administration utility being used to deploy and support a four-node ONTAP Select cluster. The Deploy utility and ONTAP Select nodes run as separate virtual machines on dedicated hypervisor hosts.



Comparing ONTAP Select and ONTAP 9

Both hardware-based ONTAP and ONTAP Select provide enterprise class storage solutions. However, because they are designed and implemented differently, each can address different business requirements and usage scenarios. You should become familiar with the major differences between the platforms before planning an ONTAP Select deployment.

Different HA architecture

Depending on the number of nodes you define in a cluster, ONTAP Select provides an HA capability. For example, a four-node cluster consists of two HA pairs. The HA architecture used with ONTAP Select is based on a non-shared storage model. That is, one node in an HA pair cannot directly access the storage owned by the other node. This design can affect certain ONTAP Select operational characteristics.

Capacity licensing

ONTAP Select introduces a new consumption-based licensing model. You must purchase a license with storage capacity for each node when deploying an ONTAP Select cluster in a production mode (that is, non-evaluation licensing). Using the Deploy utility, you must apply a license file which establishes the storage capacity for the node.

ONTAP feature licensing

Each node in an ONTAP Select cluster is automatically licensed to use several ONTAP features. You do not need to manually install or apply these feature licenses.

ONTAP features not supported in ONTAP Select

Several ONTAP features are not supported with ONTAP Select. In most cases, these features require special hardware that is not available in the virtualized ONTAP Select environment.

Fibre Channel

Fibre Channel and Fibre Channel over Ethernet are not supported.

Interface groups

Interface groups (IFGRPs) are not supported.

Health monitors

The traditional health monitoring used with a hardware-based ONTAP deployment is specific to the underlying hardware components. Due to the virtualized environment used with ONTAP Select, health monitors are not active.

NIC offload support

Due to the virtualized environment used with ONTAP Select, the NIC offload facility is not supported.

Cluster IPspace

Any modification to Cluster IPspace, including adding or removing ports, is not supported.

ONTAP port properties

Modifying the properties of the ONTAP ports, including speed, duplex, and flow-control, is not supported.

SnapLock

This compliance solution based on WORM storage for file retention is not supported.

ONTAP Select Deploy utility

ONTAP Select Deploy is the administration utility that you must use to deploy and manage the ONTAP Select clusters. The Deploy administration utility is implemented as a Linux virtual machine and contains all the functionality you need to deploy and administer the ONTAP Select clusters.

The Deploy utility performs the following core functions:

- Record the details of each hypervisor host where ONTAP Select is deployed
- Configure the hosts and install the required licenses
- Deploy and manage the ONTAP Select clusters
- Maintain an inventory of ONTAP Select clusters and hosts
- Collect and send AutoSupport data to NetApp
- Maintain an internal set of ONTAP Select node images
- Support the hypervisor command formats and protocols

Ways you can access the Deploy utility

There are several options available when accessing the Deploy administration utility. All the external interfaces are functionally equivalent. You should select the access option that best matches your

specific deployment goals and requirements. In all cases, you must sign in using the administrator account with a valid password.

Web graphical user interface

You can access the Deploy utility through a modern web browser. The web GUI provides an intuitive and easy-to-use interface, and in most cases will be your primary interface when using the utility.

Command line interface

A text-based command line interface is available through the management shell. You can access the CLI management shell in the following ways:

- Secure shell (SSH)
- Virtual machine console

You typically use the virtual machine console as part of the installation and initial configuration process. However, in most situations SSH provides a more flexible and convenient option.

RESTful web services API

The RESTful web services API exposed to external clients provides another option when connecting to the Deploy utility. You can access the API using any mainstream programming language or tool that supports RESTful web services. Popular choices include:

- Python
- Java
- cURL

Using a programming or scripting language provides an opportunity to automate the deployment and management of the ONTAP Select clusters.

Swagger web page

Displaying the Swagger web page at the Deploy utility is an alternative way to access the RESTful web services API. However, instead of using a programming language, you access the management API through the Swagger web page using a browser. The Swagger page provides the following features:

- A detailed description of every call in the RESTful web services API
- The ability to manually issue any of the API calls

You can access the Swagger page using the IP or domain name of the Deploy virtual machine. To display the page, enter a URL with the following format in your browser (substituting the appropriate IP address or domain name for your Deploy VM instance):

```
http://<ip_address>/api/v2/ui
```

Planning to deploy ONTAP Select

Before deploying ONTAP Select, you should prepare for the deployment to assure success. As part of completing the planning and preparation, you should also consider creating a formal deployment plan.

Related concepts

[Planning to install the ONTAP Select Deploy utility](#) on page 28

[Appendix A: Understanding the ONTAP Select storage environment](#) on page 68

[Appendix B: Understanding the ONTAP Select networking environment](#) on page 74

General requirements and planning considerations

There are several general requirements and best practices that you should consider as part of planning an ONTAP Select deployment.

Cluster size and related considerations

There are several planning issues related to the cluster size that you should consider.

Number of nodes in the cluster

An ONTAP Select cluster is composed of one, two, or four nodes. You should determine the size of the cluster based on the application requirements. For example, if HA capability is needed for an enterprise deployment, then a four-node or two-node cluster should be used.

Dedicated versus collocated

Based on the application type, you should determine if the deployment follows the dedicated or collocated model. Note that the collocated model can be more complex due to the workload diversity and tighter integration.

Hypervisor host considerations

There are several planning issues related to the hypervisor host that you should consider.

Hypervisor for ONTAP Select nodes and administration utility

Both the Deploy administration utility and ONTAP Select nodes run as virtual machines. The hypervisor you choose for the Deploy utility is independent of the hypervisor you choose for the ONTAP Select nodes. However, both must run on supported versions of ESXi.

One instance of ONTAP Select per host

Each ONTAP Select node runs as a dedicated virtual machine. You can deploy only one instance of an ONTAP Select virtual machine on a specific hypervisor host.

Hypervisor consistency for the nodes within an HA pair

The two hosts within an HA pair must run on the same version and release of the hypervisor software.

Number of physical ports on each host

Each host must be configured to use either two or four physical ports. The following requirements apply:

- The host in a single-node cluster must have two physical ports.
- It is recommended that each host in a four-node cluster be configured with four ports, although two can be used instead if needed.

Integrating ONTAP Select with an ONTAP hardware-based cluster

You cannot add an ONTAP Select node directly to an ONTAP hardware-based cluster. However, you can optionally establish an intercluster link between an ONTAP Select cluster and a hardware-based ONTAP cluster.

Storage considerations

There are several planning issues related to host storage that you should consider.

Local storage

When using local storage managed by a RAID controller, you must decide the following:

- Whether to use one or more RAID groups
- Whether to use one or more LUNs

External storage

When using the ONTAP Select vNAS solution, you must decide where the remote datastores are located and how they are accessed. ONTAP Select vNAS supports the following configurations:

- VMware vSAN
- Generic external storage array

Estimate for the storage needed

You should determine how much storage is required for the ONTAP Select nodes. This information is required as part of acquiring the purchased licenses with storage capacity.

Note: Each node in an HA pair must have the same storage capacity.

Requirements related to the VMware environment

There are several requirements and planning issues you should consider related to the VMware environment.

Note: Some of the hardware-related requirements vary based on whether you choose the standard or premium platform capacity when licensing ONTAP Select.

Hypervisor requirements

There are several requirements related to the hypervisor where ONTAP Select runs.

Software compatibility

ONTAP Select can be deployed on the following hypervisors:

- VMware ESXi 5.5 Update 3a (build 3116895 or greater)

- VMware ESXi 6.0 GA (build 2494585 or greater)

VMware licensing

To deploy an ONTAP Select cluster, your organization must have a valid VMware vSphere license for the hypervisor hosts where ONTAP Select runs. You should use the licenses that are appropriate for your deployment.

Datstore characteristics

Each host must have a datstore that is at least 2 TB plus 266GB. The 2 TB is available for user data while the extra 266 GB is used by various ONTAP Select internal processes and so is required overhead. The datstore must be formatted using VMFS5 on internal direct-attached storage (DAS).

Core hardware requirements

The physical hypervisor host where you deploy ONTAP Select must meet several minimum hardware requirements. You can choose any platform for the hypervisor host, as long as it meets the minimum hardware requirements. The following vendors provide supported hardware platforms: Cisco, Dell, HP, Fujitsu, Lenovo, and Supermicro. Refer to the NetApp Interoperability Matrix Tool for more information.

Basic hardware requirements

There are several common hardware requirements that apply to both the standard and premium licensing options, including:

- Processor
 - Intel CPU 25xx v3 (Haswell) or higher
- Ethernet network ports
 - 4 x 10GbE (recommended)
 - 2 x 10GbE (minimum)
 - 2 x 1GbE (only for a single-node cluster)

Additional requirements for the standard and premium capacity offerings

There are several additional requirements based on the platform capacity option you choose when licensing ONTAP Select.

Note: The disk drive requirements apply when using a local RAID controller and drives. These requirements do not apply to external storage accessed through the ONTAP Select vNAS solution.

	Standard	Premium
CPU cores	Six physical cores or greater, with four reserved for ONTAP Select	Ten physical cores or greater, with eight reserved for ONTAP Select
Memory	24GB or greater with 16GB reserved for ONTAP Select	72GB or greater with 64GB reserved for ONTAP Select
Disk drives	8 to 24 internal HDD (NL-SAS, SATA, 10K SAS)	<ul style="list-style-type: none"> • 4 to 24 internal SSD • 8 to 24 internal HDD (NL-SAS, SATA, 10K SAS)

When creating an ONTAP Select cluster using the Deploy utility, the standard offering is supported with the small instance type, while the premium offering is supported with the medium instance type.

Best practices

You should consider the following recommendations regarding the hypervisor core hardware:

- All of the drives in a single ONTAP Select aggregate should be the same type. For example, you should not mix HDD and SSD drives in the same aggregate.

Related information

[NetApp Interoperability Matrix Tool](#)

RAID controller requirements

The RAID controller on the hypervisor host where you deploy ONTAP Select must meet several requirements.

Note: An ESXi host where ONTAP Select runs only requires a RAID controller when using local physical drives. If you use the ONTAP Select vNAS solution to access external storage, a local RAID controller is not needed.

The minimum requirements for the RAID controller include:

- 12 Gbps throughput
- 512 MB internal battery-backed or flash (SuperCAP) cache
- Configured in write back mode
 - Enable failback mode to “write through” (if supported)
 - Enable “always read ahead” policy (if supported)
- All local disks behind the RAID controller must be configured as a single RAID group
 - Disable the local drive cache for RAID group, which is fundamental to preserving data integrity.
- LUN configuration must be performed based on the following guidelines:
 - If the RAID group size exceeds the maximum ESXi LUN size of 64TB, you should configure multiple equal-sized LUNs consuming all the available storage within the RAID group.
 - If the RAID group size is smaller than the maximum ESXi LUN size of 64TB, you should configure one LUN consuming all available storage within the RAID group.

Related concepts

[Appendix A: Understanding the ONTAP Select storage environment](#) on page 68

ONTAP Select vNAS requirements

ONTAP Select vNAS is a solution allowing the datastores used by ONTAP Select to be external to the hypervisor host where the ONTAP Select virtual machine runs. These remote datastores can be accessed through VMware vSAN or a generic external storage array.

Basic requirements and restrictions

The ONTAP Select vNAS solution can only be used with a single-node ONTAP Select cluster. Multiple single-node clusters can access the same datastore as long as each ONTAP Select virtual machine runs on a separate ESXi host.

All related storage components, including hardware, software, and feature requirements, must adhere to the requirements described in the *VMware Compatibility Guide*. In addition, ONTAP Select supports all external storage arrays described in the *VMware Storage/SAN Compatibility Guide*, including iSCSI, NAS (NFSv3), Fibre Channel, and Fibre Channel over Ethernet. External array support is limited by the ESXi version supported by ONTAP Select. You should also refer to the NetApp Interoperability Matrix Tool for more information.

The following VMware features are supported when deploying a single-node cluster with ONTAP Select vNAS:

- VMotion
- High Availability (HA)
- Distributed Resource Scheduler (DRS)

Note: These VMware features are not supported with ONTAP Select clusters larger than one node or where local direct-attached storage (DAS) is used.

The following VMware features are not supported:

- Fault Tolerance (FT)
- Virtual datastore (VVOL)

Configuration requirements

If you plan to use a VMFS datastore on an external storage array (iSCSI, Fibre Channel, Fibre Channel over Ethernet), you must create a VMFS storage pool before configuring ONTAP Select to use the storage. When using an NFS datastore, there is no need to create a VMFS datastore. With a vSAN datastore, you must create the local VMFS datastores on the local hosts, which are then shared across the ESXi cluster. All vSAN datastores must be defined within the same ESXi cluster.

Attention: You must provide a capacity limit for every datastore on VMware vSAN or an external storage array when configuring a host or performing a storage add operation. The capacity you specify must be within the allowed storage limits of the external storage. An error will occur if you do not provide a capacity limit or the external storage runs out of space during the disk creation operation.

Best practices

Consult the available VMware documentation and adhere to the applicable best practices identified for ESXi hosts. In addition:

- Define dedicated network ports, bandwidth, and vSwitch configurations for the ONTAP Select networks and external storage (VMware vSAN and generic storage array traffic when using iSCSI or NFS)

- Configure the capacity option to restrict storage utilization (ONTAP Select cannot consume the entire capacity of an external vNAS datastore)
- Assure that all generic external storage arrays use the available redundancy and HA features where possible

Related concepts

[Recovering the Deploy utility for a two-node cluster](#) on page 56

Related information

[NetApp Interoperability Matrix Tool](#)

ONTAP Select two-node cluster with HA

In addition to the ONTAP Select four-node and single-node clusters, you can also deploy a two-node cluster. Each two-node cluster consists of a single HA pair.

Deploying a two-node cluster involves the same planning and configuration used with the four-node and single-node clusters. However, there are several differences you should be aware of when creating a two-node cluster, including:

- Target environment
The two-node cluster consists of one HA pair and has been specifically designed for remote office and branch office deployments.
Note: While designed primarily for the remote and branch office environment, you can also deploy a two-node cluster in the data center if needed.
- Licensing
You can deploy a two-node cluster using any VMware vSphere license. However, the VMware ROBO Standard and Advanced licenses are ideal for remote and branch office deployments.
- Mediator service
When a cluster consists of two nodes, it is not possible to achieve the quorum required when a node fails or loses communication. To resolve these types of split-brain situations, every instance of the ONTAP Select Deploy utility includes a mediator service. This service connects to each node in the active two-node clusters to monitor the HA pairs and assist in managing failures. The mediator service maintains the HA state information at a dedicated iSCSI target associated with each two-node cluster.
Attention: If you have one or more active two-node clusters, the ONTAP Select Deploy virtual machine administering the clusters must be running at all times. If the Deploy virtual machine is halted or fails, the mediator service is unavailable and HA capability is lost for the two-node clusters.
- Location of the cluster and mediator service
Because the two-node clusters are typically deployed in a remote or branch office, they can be remote from the corporate data center and the Deploy utility providing administrative support. With this configuration, the management traffic between the Deploy utility and cluster flows over the WAN. See the *Release Notes* for more information about limitations and restrictions.
- Backing up the Deploy configuration data
It is a best practice to back up the Deploy configuration data on a regular basis, including after creating a cluster. This becomes particularly important with two-node clusters, because of the mediator configuration data included with the backup.

Related concepts

[Recovering the Deploy utility for a two-node cluster](#) on page 56

Related information

[ONTAP Select 9.2 Release Notes](#)

Remote and branch office deployments

You can deploy ONTAP Select in a remote office/branch office (ROBO) environment. As part of planning a ROBO deployment, you must select the configuration supporting your objectives.

There are two primary configurations available when deploying ONTAP Select in a ROBO environment.

Note: You can use any VMware vSphere license when deploying ONTAP Select.

ONTAP Select two-node cluster with HA

The ONTAP Select two-node cluster consists of one HA pair and is ideal for ROBO deployments.

ONTAP Select single-node cluster with VMware vSAN

You can deploy an ONTAP Select single-node cluster in a ROBO environment. While a single node lacks native HA capability, you can deploy the cluster on top of a two-node VMware vSAN cluster. In this case, VMware vSAN provides the HA capability. You must have a VMware vSAN ROBO license.

Related concepts

[ONTAP Select two-node cluster with HA](#) on page 20

Network configuration

You must configure the hypervisor network correctly before deploying ONTAP Select.

Virtual switch options

You must configure a virtual switch on each of the ONTAP Select hosts to support the external network and internal network (multi-node clusters only). As part of deploying a multi-node cluster, you should test the network connectivity on the internal cluster network.

To learn more about how to configure a vSwitch on a hypervisor host, see the *ONTAP Select Product Architecture and Best Practices Technical Report*.

Related concepts

[Appendix B: Understanding the ONTAP Select networking environment](#) on page 74
[Host configuration preparation and assessment checklist](#) on page 30

Related tasks

[Confirming network connectivity among ONTAP Select nodes using the CLI](#) on page 46

Related information

[NetApp Technical Report 4517: ONTAP Select Product Architecture and Best Practices](#)

Required information for a VMware deployment

As part of preparing to deploy an ONTAP Select cluster in a VMware environment, you must collect information required when using the ONTAP Select Deploy administration utility to deploy and configure the cluster.

Some of the information you collect applies to the cluster itself, while other information applies to the individual nodes in the cluster.

Cluster-level information

You must collect information related to the ONTAP Select cluster.

Name of the cluster

Unique name of the cluster

Licensing mode

Evaluation or purchased licensing

IP configuration for the cluster

IP configuration for the clusters and nodes, including:

- Management IP address of the cluster
- Subnet mask
- Default gateway

Host-level information

You must collect information related to each of the nodes in the ONTAP Select cluster.

Name of the host

Unique name of the host.

Domain name of the host

Fully qualified domain name of the host

IP configuration for the nodes

Management IP address of each node in the cluster

Mirror node

Name of the associated node in the HA pair (multi-node clusters only)

Storage pool

Name of the storage pool that is used

Serial number

If you are deploying with a purchased license, the unique nine-digit serial number provided by NetApp

Access to a vCenter server

You must have access to the vCenter server managing the ESXi hypervisor hosts where ONTAP Select is deployed.

Location

You must have the fully qualified domain name or IP address of the vCenter server.

Administrative privileges

You must have a vCenter server account with administrative privileges.

Licensing ONTAP Select

ONTAP Select provides two types of node licenses or entitlement models that provide flexibility when evaluating and deploying the product. You should understand these licensing options before deploying an ONTAP Select cluster.

Selecting the licensing model for a deployment

One license is required for each ONTAP Select virtual machine and the license is associated with the Select VM through a unique serial number.

Evaluation license

You can use an evaluation license if you want to evaluate ONTAP Select before making the decision to purchase. The evaluation license is included with the ONTAP Select Deploy administration utility and is automatically applied to each ONTAP Select node during an evaluation deployment.

The evaluation license has the following characteristics:

- A purchased license with storage capacity is not required
- The node serial number is twenty digits and is automatically generated by ONTAP Select (that is, you do not acquire it directly from NetApp)
- Two TB of storage for user data is available
- The evaluation period lasts up to 90 days
- An ONTAP Select node that is initially deployed with an evaluation license cannot be converted to a purchased license

Purchased license

After you determine that ONTAP Select is suitable for your organization, you can purchase a license for each node to support your production deployment. As part of purchasing a license, you must select the storage capacity and acquire a license file for the node. You must apply the node license files using the Deploy utility.

The purchased license has the following characteristics:

- Each ONTAP Select virtual machine must be licensed by NetApp.
- You should contact your NetApp account team or partner for assistance when acquiring the licenses and associated serial numbers needed for each node.
- The serial number identifying each node is nine digits and assigned by NetApp.
- You must also acquire and apply a license file based on the node serial number. You can apply the license file during deployment or within 30 days after deploying the cluster.
- Storage is allocated in 1 TB increments and you can purchase up to 100 TB for a node.
- The storage capacity identifies the raw (not usable) capacity and corresponds to the total allowable size of the virtual data and root disks attached to the ONTAP Select virtual machine.
- After initially applying a license file to a node, you can add additional capacity as needed by contacting your NetApp account team or partner to procure an updated, larger capacity license.

- Both nodes in an HA pair must have the same capacity.
- An ONTAP Select node that is initially deployed with a purchased license cannot be converted to an evaluation license.

Comparing the evaluation and purchased licenses

The following table compares the two types of licenses for ONTAP Select nodes.

	Evaluation license	Purchased license
Node serial number	Automatically generated by ONTAP Select Deploy (20 digits).	Acquired directly from NetApp (9 digits).
License file with storage capacity needed?	No	Yes, within 30 days of cluster deployment
Maximum storage for user data	2 TB	100 TB
License duration	90 days	Unrestricted
Possible to convert the license?	No	No

Premium and standard capacity offerings for a purchased license

You can acquire a purchased license for an ONTAP Select node based on two offerings or levels regarding the platform capacity.

The offerings for a purchased license include:

- Premium
- Standard

The premium offering enhances the standard offering by providing support for both SSD and HDD drives as well as a larger virtual machine platform. When configuring an ONTAP Select host, you must choose the appropriate hypervisor configuration type based on the capacity offering. The following hypervisor instance types can be selected during host configuration using the ONTAP Select Deploy utility:

- Small
Standard or premium capacity license can be used
- Medium
Premium license must be used

For more information, refer to the planning information related to the appropriate hypervisor environment.

Related references

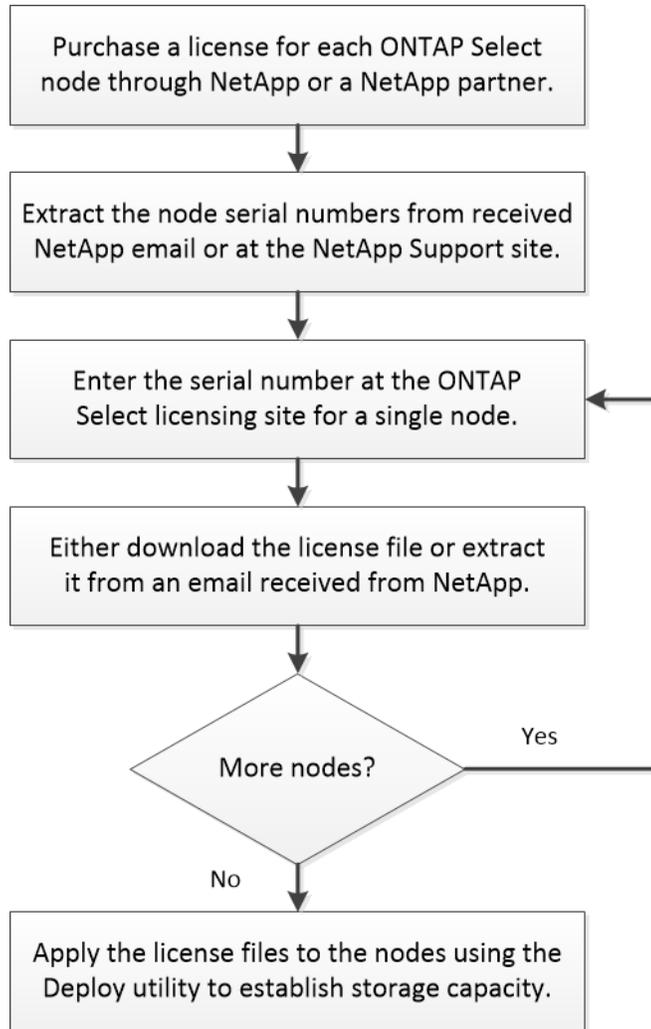
[Requirements related to the VMware environment](#) on page 16

Purchasing ONTAP Select licenses

Before deploying an ONTAP Select cluster in a production environment, you must purchase and apply a license for each node in the cluster. As part of purchasing the licenses, you must select the storage capacity.

Purchased license workflow

The following workflow illustrates the process of purchasing and applying a license for your ONTAP Select nodes. When initially purchasing a license, you must select the storage capacity for the node. Based on the assigned serial number, you can acquire and apply a license file to the node.



Acquiring a license file with storage capacity

You must acquire a license file for each ONTAP Select node running with a purchased license. The license file contains the storage capacity for the node and is associated with the node through the unique serial number assigned by NetApp.

Before you begin

You must have the nine-digit serial number assigned to the node by NetApp.

About this task

You must perform this task for each ONTAP Select node requiring a purchased license.

Steps

1. Access the ONTAP Select license site using a web browser:

<https://register.netapp.com/register/getlicensefile>

2. Sign in using your NetApp account credentials.
3. On the **License Generator** page, select the desired license offering from the dropdown box.
4. Fill in the remaining fields on the same page, including the **Product Serial #**, which is the serial number for the ONTAP Select node.
5. Click **Submit**.
6. After the request has been validated, select the delivery method for the license.
You can click either **Download License** or **Email License**.
7. Confirm that you received the license file based on your selected delivery method.

Planning to install the ONTAP Select Deploy utility

Before installing the ONTAP Select Deploy administration utility, you should first plan and prepare for the installation to assure success.

Related concepts

Planning to deploy ONTAP Select on page 15

Pairing the Deploy utility with the ONTAP Select clusters

You have several options when pairing an instance of the Deploy utility with the ONTAP Select clusters.

Restriction: With all deployment scenarios, a single ONTAP Select cluster and the nodes in the cluster can be managed by only one instance of the Deploy administration utility. A cluster cannot be managed by two or more different instances of the Deploy utility.

One instance of the utility for each ONTAP Select cluster

You can deploy and manage each ONTAP Select cluster using a dedicated instance of the Deploy utility. With this one-to-one configuration, there is a clear separation between each of the utility-to-cluster pairings. This configuration provides a high level of isolation with more flexibility and tolerance in the case of a system failure.

One instance of the utility for multiple ONTAP Select clusters

You can deploy and manage multiple ONTAP Select clusters in your organization using a single instance of the Deploy utility. With this one-to-many configuration, all processing and configuration data is managed by the same instance of the Deploy utility.

Requirements related to the VMware environment

Before installing the Deploy administration utility in a VMware environment, you should review the basic requirements and prepare for the deployment to assure success.

Requirements and restrictions for a deployment

There are several requirements and restrictions that you should consider when installing the ONTAP Select Deploy utility in a VMware environment.

ESXi host server hardware requirements

There are several minimum resource requirements that your ESXi hypervisor host must meet. You should make sure that the hosts where ONTAP Select is deployed meet the following basic requirements:

- ESXi Server:
 - Hardware and software must be 64-bit
 - Must adhere to the same supported versions as defined for an ONTAP Select node
- Virtual CPUs (2)

- Virtual memory (4 GB)
- Storage (40 GB)
- DHCP enabled (can also assign a static IP address)

Networking and connectivity

You must make sure that the Deploy virtual machine network interface is configured and has a single management IP address. By default, the IP address is assigned to the VM using DHCP. However, you can manually configure the interface and assign a static IP instead. Also, the Deploy VM must be able to connect to the vCenter server and the ONTAP Select hosts it will manage.

Required configuration information

As part of your deployment planning, you should determine the required configuration information before installing the ONTAP Select Deploy administration utility.

Name of the Deploy virtual machine

Name to use for the virtual machine

Name of the ESXi host

VMware ESXi host where the Deploy utility is installed

Name of the datastore

VMware datastore holding the virtual machine files (approximately 40 GB is required)

Network for the virtual machine

Network where the Deploy virtual machine is connected

Optional network configuration information

The Deploy virtual machine is configured using DHCP by default. However, if needed, you can manually configure the network interface for the virtual machine.

Host name

Name of the host

Host IP address

Static IPv4 address

Subnet mask

Subnetwork mask, based on the network the virtual machine is a part of

Gateway

Default gateway or router

Primary DNS server

Primary Domain Name Server

Secondary DNS server

Secondary Domain Name Server

Search domains

Search domains to use

Host configuration preparation and assessment checklist

You must prepare each of the hypervisor hosts where an ONTAP Select node is deployed. As part of preparing the hosts, you should carefully assess the deployment environment to make sure that the hosts are properly configured and ready to support the deployment of an ONTAP Select cluster.

Attention: The ONTAP Select Deploy administration utility does not perform the required network and storage configuration of the hypervisor hosts. You must manually prepare each host prior to deploying an ONTAP Select cluster. For more information about the ONTAP Select hypervisor environment, see *Understanding the ONTAP Select storage environment* and *Understanding the ONTAP Select networking environment*. You should also review the *ONTAP Select Product Architecture and Best Practices Technical Report* for more information.

Related concepts

[Appendix A: Understanding the ONTAP Select storage environment](#) on page 68

[Appendix B: Understanding the ONTAP Select networking environment](#) on page 74

[Planning to deploy ONTAP Select](#) on page 15

[Planning to install the ONTAP Select Deploy utility](#) on page 28

Related tasks

[Confirming network connectivity among ONTAP Select nodes using the CLI](#) on page 46

Related information

[NetApp Technical Report 4517: ONTAP Select Product Architecture and Best Practices](#)

General hypervisor preparation

You must prepare the hypervisor hosts.

Each host must be configured with the following:

- A pre-installed and supported hypervisor
- A VMware vSphere license

Also, the same vCenter server must be able to manage all the hosts where an ONTAP Select node is deployed within the cluster.

In addition, you should make sure that the firewall ports are configured to allow access to vSphere. These ports must be open to support serial port connectivity to the ONTAP Select virtual machines. By default, VMware allows access on the following ports:

- Port 23 and ports 1024 – 65535 (inbound traffic)
- Ports 0 – 65535 (outbound traffic)

NetApp recommends that the following firewall ports be opened to allow access to vSphere:

- Ports 7200 – 7400 (both inbound and outbound traffic)

Preparation of an ONTAP Select cluster network

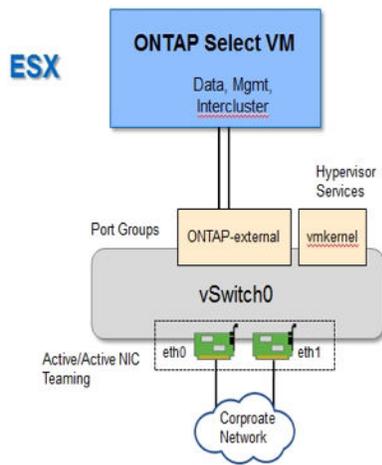
You can deploy ONTAP Select as either a multi-node cluster or a single-node cluster. In many cases, a multi-node cluster is preferable because of the additional storage capacity and HA capability.

Illustration of the ONTAP Select networks and nodes

The figures below illustrate the networks used with a single-node cluster and four-node cluster.

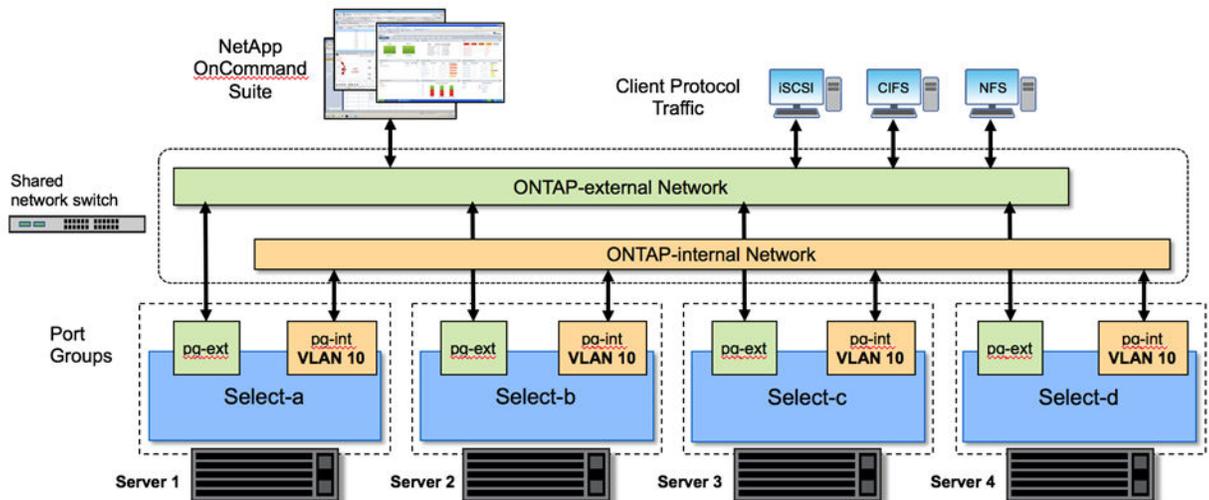
Single-node cluster showing one network

The following figure illustrates a single-node cluster. The external network carries client, management, and cross-cluster replication traffic (SnapMirror/SnapVault).



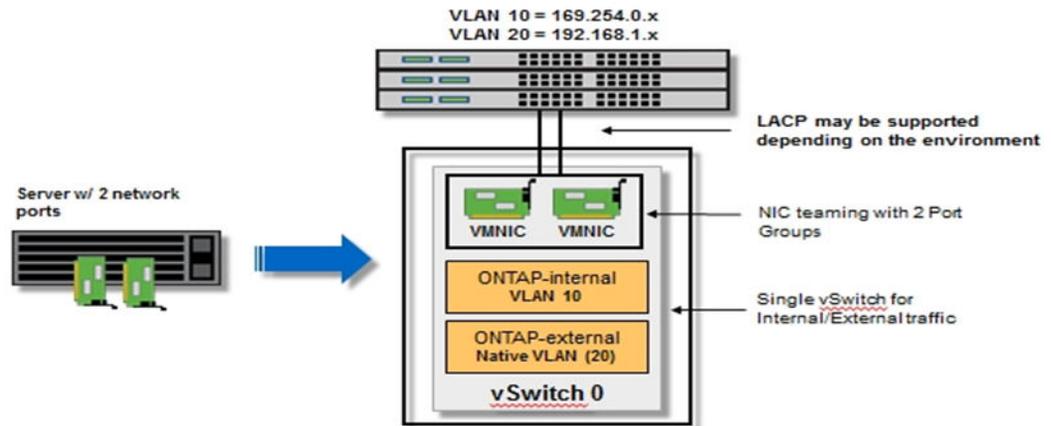
Four-node cluster showing two networks

The following figure illustrates a four-node cluster. The internal network enables communication among the nodes in support of the ONTAP cluster network services. The external network carries client, management, and cross-cluster replication traffic (SnapMirror/SnapVault).



Single node within a four-node cluster

The following figure illustrates the typical network configuration for a single ONTAP Select virtual machine within a four-node cluster. There are two separate networks: ONTAP-internal and ONTAP-external.



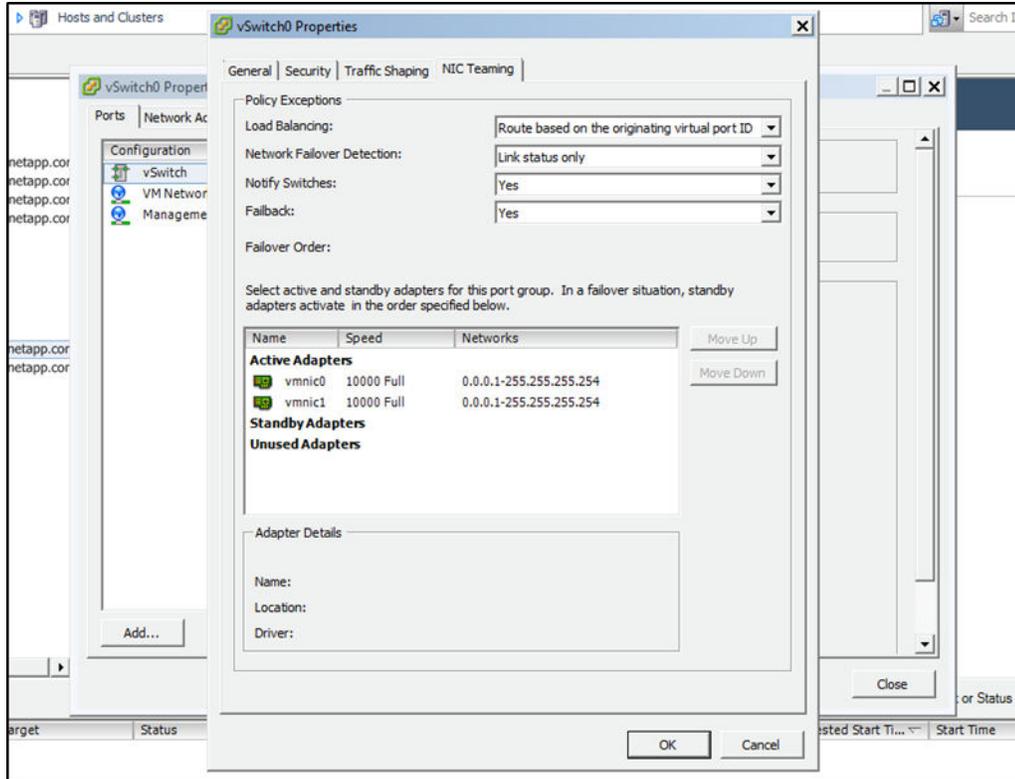
Configuration of the vSwitch on a hypervisor host

The vSwitch is the core hypervisor component used to support the connectivity for the internal and external networks. There are several things you should consider as part of configuring each hypervisor vSwitch.

vSwitch configuration for a host with two physical ports (2x10Gb)

When each host includes two 10Gb ports, you should configure the vSwitch as follows:

- Configure a vSwitch and assign both the ports to the vSwitch. Create a NIC team using the two ports.
 - Set the load balancing policy to “Route based on the originating virtual port ID”
 - Mark both adapters as “active”
 - Set the “Failback” setting to “Yes”



- Configure the vSwitch to use jumbo frames (9000 MTU).
- Configure a port group on the vSwitch for the internal traffic (ONTAP-internal):
 - The port group is assigned to ONTAP Select virtual network adapters e0c-e0f used for the cluster, HA interconnect, and mirroring traffic.
 - The port group should be on a non-routable VLAN because this network is expected to be private. You should add the appropriate VLAN tag to the port group to take this into account.
 - The load balancing, failback and failover order settings of the port group should be the same as the vSwitch.
- Configure a port group on the vSwitch for the external traffic (ONTAP-external):
 - The port group is assigned to ONTAP Select virtual network adapters e0a-e0b used for data and management traffic.
 - The port group can be on a routable VLAN. Also, depending on the network environment, you should add an appropriate VLAN tag or configure the port group for VLAN trunking.
 - The load balancing, failback and failover order settings of the port group should be same as vSwitch.

The above vSwitch configuration is for a host with 2x10Gb ports in a typical network environment. If your host or network configuration differs, and for more information on the recommended best practices related to network configuration, you should review the *ONTAP Select Product Architecture and Best Practices Technical Report*.

Installing and configuring the ONTAP Select Deploy utility

The ONTAP Select Deploy administration utility is packaged as a virtual machine based on the Open Virtualization Format (OVF) standard; the single compressed file has the .ova suffix. You must download the file and then install and configure the Deploy virtual machine on ESXi.

Steps

1. [Downloading the virtual machine image](#) on page 34
2. [Deploying the virtual machine](#) on page 34
3. [Signing in to the Deploy utility using SSH](#) on page 35

Downloading the virtual machine image

To begin the installation process, you must download the appropriate virtual machine image file from the NetApp Support Site.

Steps

1. Access the NetApp Support Site using a web browser and click the **Downloads** tab at the top of the page.
2. Click **Software** and log in to the site.
3. Scroll to the line displaying **ONTAP Select** and select **Deploy Install** on the right and click **Go!**.
4. Click **View & Download** for the desired software level.
5. Click **CONTINUE** and accept the End User License Agreement (EULA).
6. Select and download the appropriate installation file, responding to all prompts as needed for your environment.

Related information

[NetApp Support](#)

Deploying the virtual machine

You must create the ONTAP Select Deploy virtual machine based on the OVF virtual machine image.

Before you begin

You must have prepared to deploy the ONTAP Select Deploy virtual machine as follows:

- Enabled the OVF functionality in your browser by installing the VMware Client Integration Plug-in or performing similar configuration as needed
- Enabled DHCP in the VMware environment if you will dynamically assign an IP address to the Deploy virtual machine

Steps

1. Access the vSphere client and sign in.
2. Navigate to the appropriate location in the vCenter hierarchy and select **Deploy OVF Template**.
3. Select the OVA file and complete the Deploy OVF Template wizard, selecting the options as appropriate for your environment.

You must define the password for the administrator account. You need to provide this password when signing in to the Deploy utility. You must also choose DHCP or define a static IP address.

4. After the virtual machine is deployed, select the new virtual machine and power it on if it is not already powered on based on your input to the deployment wizard.
5. Click the **Console** tab to access the ESXi host setup shell and monitor the power on process.

Related references

[Required configuration information](#) on page 29

Signing in to the Deploy utility using SSH

After the Deploy virtual machine is installed and started, you should use SSH to access the management shell. This allows you to confirm that the Deploy utility is operational and to prepare to perform support procedures using the CLI.

Before you begin

You must have the current password for the administrator user account. The password for the account is defined when the Deploy utility virtual machine is installed.

Steps

1. Sign in using the administrator account and management IP address of the Deploy virtual machine; for example:

```
ssh admin@<ip_address>
```

2. Type the password for the account when prompted.
3. Type `?` to display a list of shell commands.

Related tasks

[Changing the Deploy administrator password using the CLI](#) on page 47

[Signing in to the Deploy utility web interface](#) on page 36

Deploying an ONTAP Select cluster

You can use the web user interface provided with the ONTAP Select Deploy administration utility to deploy a multi-node or single-node ONTAP Select cluster.

Tip: You can also deploy ONTAP Select clusters using the Deploy utility CLI.

Related concepts

[Planning to deploy ONTAP Select](#) on page 15

[Deploying an ONTAP Select cluster using the CLI](#) on page 61

Signing in to the Deploy utility web interface

You must sign in to the Deploy utility web user interface before creating or administering an ONTAP Select cluster.

Before you begin

You must have the current password for the administrator user account. The password for the account is defined when the Deploy utility virtual machine is installed.

Steps

1. Point your browser to the Deploy utility using the IP address or domain name; for example:
`http://<ip_address>/`
2. Provide the account information and sign in.

Related tasks

[Signing in to the Deploy utility using SSH](#) on page 35

Preparing to create your first ONTAP Select cluster

You should prepare to use the ONTAP Select Deploy utility before deploying your first cluster to assure success.

Understanding the GUI workflow options and characteristics

When you use the Deploy utility web user interface, the pages displayed and workflow options presented can vary based on several factors.

The Deploy utility web interface is affected by the following:

- Current task being performed
- Previous tasks completed and the state of the system
- Characteristics of the cluster being created

Initial page displayed after signing in

When you sign in to the web user interface, the page initially displayed depends on whether any hosts have been added yet or not.

- No hosts have been added
When you sign in but no hypervisor hosts have yet been added, the **Getting Started** page is displayed with the **Welcome to ONTAP Select** popup window superimposed over the page. The popup window describes the prerequisites that must be in place before you proceed. After clicking **OK** in the popup, the **Getting Started** page is enabled, allowing you to add your first hypervisor host.
- At least one host has been added
When you sign in and at least one hypervisor host has already been added, the **Clusters** page is displayed. To display the **ONTAP Select Prerequisites** popup window with the prerequisite information, click the **?** icon at the top of the page and select **Prerequisites**.

Ways to add a hypervisor host

There are several ways you can add a hypervisor host to the pool of available hosts prior to creating a cluster. You can add a host in the following ways:

- **Getting Started** page
After signing in, this page is displayed when no hosts have been added yet. You can add one or more hypervisor hosts on this page.
- **Hypervisor Hosts** page
When at least one host has already been added, you can add additional hosts by clicking the **Hypervisor Hosts** tab at the top of the page and then **Add**.
- **Create Cluster** page
As part of the cluster create workflow, you must set up two HA pairs (four-node cluster), one HA pair (two-node cluster), or one host (for a single-node cluster). In both cases, when selecting the host(s) for the cluster, you can add a new host by clicking **Add Hypervisor** on the **Select hosts** popup window.

Minimum datastore capacity

As part of the workflow used to create a cluster, you must select the instance type and the minimum datastore capacity on the **Select hosts** popup window. The **Min Datastore Capacity** value you select on the window is used in the following ways:

- Filter the list of hosts in the window by showing only the hosts that have at least one datastore with the minimum capacity
- Limit the amount of storage used by ONTAP Select in the datastore, even if the available capacity is larger

If you select zero or leave the value blank, no filtering is applied to the list. Also, the entire storage capacity of the datastore is used.

Understanding the typical workflow when deploying your first cluster

After installing the ONTAP Select Deploy utility, you can create your first cluster. When creating the cluster, you are guided through a series of steps and choices.

1. Prepare the hypervisor hosts and acquire the capacity license files
You must install and prepare the hypervisor servers that will host the ONTAP Select nodes. You should also purchase licenses and acquire the capacity license files for each node. You can perform these tasks before using the Deploy utility.
2. Sign in to the Deploy web user interface
You must sign in to the Deploy utility using the administrator user account. Because it is assumed that the Deploy utility is newly installed and no hosts have yet been added, the **Welcome to**

ONTAP Select popup window is displayed over the **Getting Started** page. The popup window lists the required prerequisites.

3. Confirm that you have configured the hypervisor hosts
You must acknowledge that all the prerequisites in the **Welcome to ONTAP Select** popup window have been met. Click **OK** to acknowledge that all prerequisites and requirements have been met.
4. Add your first host
You must add your first host on the **Getting Started** page. You can also add additional hosts on the same page as needed, based on your deployment plans. All the hosts you add are listed on the right side of the page. Each host has a type value which is initially **unknown** and then becomes **ESX** when the host is ready to be used in a cluster.
5. Define the configuration of the cluster
After you have added your hosts, you must click **Create Cluster** to begin creating the cluster. The process flows through the following steps:
 - a. Provide the basic cluster details
 - b. Select and configure the hosts that are part of the cluster
 - c. Configure the cluster network
6. Confirm the network connectivity on the internal cluster network
Before creating a multi-node cluster, you should run the network connectivity checker available through the Deploy CLI. This tool tests the connectivity among the hypervisor hosts on the internal cluster network.
7. Initiate the cluster creation process
After reviewing the cluster summary, you can initiate the cluster creation request. On the **Clusters** page, the request advances through four states as follows:
 - a. Configuring host
 - b. Deploying nodes
 - c. Creating data disks
 - d. Post deploy setup

The state displayed on the page automatically refreshed at a regular interval.

Creating your first ONTAP Select cluster

When you create an ONTAP Select cluster using the Deploy utility web interface, you are guided through a specific sequence of steps. The exact process varies depending on whether you deploy a multi-node cluster or a single-node cluster.

Best practice: After creating a cluster, you should back up the ONTAP Select Deploy configuration data.

Related concepts

[Preparing to create your first ONTAP Select cluster](#) on page 36

Related tasks

[Signing in to the Deploy utility web interface](#) on page 36

[Confirming network connectivity among ONTAP Select nodes using the CLI](#) on page 46

Configuring AutoSupport on page 48

Expanding storage and license capacity on page 49

Creating a multi-node cluster

You can use the ONTAP Select Deploy web user interface to deploy a four-node or two-node ONTAP Select cluster.

Before you begin

You must prepare the hypervisor hosts where ONTAP Select runs and have a capacity license file for each node in the cluster. You should be familiar with the network connectivity checker as provided in the Deploy utility CLI.

About this task

You use the same procedure to create either a four-node and a two-node cluster. However, with a two-node cluster you only define one HA pair.

An ONTAP Select cluster is created with the following characteristics and assumptions:

- No hosts have yet been added using the Deploy utility
- The cluster contains four or two nodes
- A purchased license is used
- Capacity license files are applied to each node

Note: You can provide the serial number for a node, but you must apply the license file within thirty days.

Steps

1. Sign in to the Deploy utility through the web interface using the administrator account.
2. Confirm that you have met the configuration requirements and prerequisites as described in the **Welcome to ONTAP Select** popup window and click **OK**.
3. On the **Getting Started** page, define your first hypervisor host and click **Add**.
You can add the ESXi host directly or by connecting to a vCenter server. The hosts you add are displayed in a table on the right side of the page. Initially, each host has a **Type** value of **unknown**.
4. Add the additional hypervisor hosts needed for the cluster.
A four-node cluster requires three more hosts. A two-node cluster requires one more host.
5. Refresh the page as needed and confirm that the **Type** value of every host is **ESX**.
6. Click **Next** to begin the process of creating an ONTAP Select cluster.
7. In the **Cluster Details** section of the page, provide all the required information describing the cluster and click **Done**.
The ONTAP image you select is used for each node in the new cluster.
8. In the **Setup HA Pair 1** section of the page, click **Select Hosts**.
9. In the **Select hosts for the HA pair** popup window, select the hypervisor configuration instance type and minimum datastore capacity that applies to the two nodes in the HA pair.

A **Small** instance and **Medium** instance are the two available hypervisor configuration types. These instance types are supported by the standard and premium offerings of the purchased license, respectively. The license applied to a node must match or exceed the instance type.

10. Select two hosts from the list and click **Done**.

The list of available hosts is filtered based on the instance type and minimum datastore capacity. You can select hosts from the list or add more hosts by clicking **Add Hypervisor**.

11. Click **License HA Pair** to display a list of available licenses for the nodes in the HA pair.
12. If the required licenses are not available in the list, click **Upload License(s)** and select the licenses from your local workstation, then click **Open** to upload the licenses to the Deploy utility.

Each license is displayed in the list, including the serial number, type, and capacity.

13. Select the licenses from the list and click **Done**.

Instead of a license, you can select **Enter Serial Number** to provide a serial number assigned by NetApp. If you provide a serial number, you must apply a license within 30 days.

14. Click **Configure Hosts** and select the networks and datastore for the first host.

The values on the page may be pre-populated based on the previous configuration choices as well as the configuration of the hypervisors.

15. Select the networks and datastore for the second host in the HA pair and click **Done**.

If all SSD drives are used for both hosts, you can optionally enable storage efficiency.

16. If you are creating a four-node cluster, do the following:

- a. In the **Setup HA Pair 2** section of the page, click **Select Hosts**.
- b. Configure the second HA pair following the same steps that you used for the first HA pair.

17. After all the required HA pairs have been configured, click **Configure Network** to configure the cluster network.

18. Provide all network configuration parameters in the **Configure Network** window and click **Done**.

The three values at the bottom of the page related to DNS and NTP are optional.

19. Review and confirm the configuration of the cluster.

You can change the configuration by clicking **Edit** in the applicable section.

20. Run the network connectivity checker at the CLI management shell to test the connectivity of the internal cluster network.

Note: You must sign in to the CLI management shell to perform this test. Refer to the separately documented support task. After the test is completed successfully, you can create the cluster.

21. Click **Create Cluster** to begin the cluster creation process and then click **OK** in the **Cluster create operation started** popup window.

It can take up to 30 minutes for the cluster to be created.

22. On the **Clusters** page, select the new cluster and monitor the cluster creation process.

The page is automatically refreshed at regular intervals. Notice that three tabs are available at the top of the page.

After you finish

You should configure the ONTAP Select AutoSupport feature. You should also back up the ONTAP Select Deploy configuration data.

Related tasks

Backing up the Deploy configuration data on page 53

Creating a single-node cluster

You can use the ONTAP Select Deploy web user interface to deploy a single-node ONTAP Select cluster.

Before you begin

You must prepare the hypervisor host where ONTAP Select runs and have a capacity license file for the node.

About this task

An ONTAP Select cluster is created with the following characteristics and assumptions:

- No hosts have yet been added using the Deploy utility
- The cluster contains one node
- A purchased license is used
- A capacity license file is applied to the node

Note: You can provide the serial number for a node, but you must apply the license file within thirty days.

Steps

1. Sign in to the Deploy utility through the web interface using the administrator account.
2. Confirm that you have met the configuration requirements and prerequisites as described in the **Welcome to ONTAP Select** popup window and click **OK**.
3. On the **Getting Started** page, define a hypervisor host and click **Add**.
You can add the ESXi host directly or by connecting to a vCenter server. The host you add is displayed in a table on the right side of the page. Initially, the host has a **Type** value of **unknown**.
4. Refresh the page as needed and confirm that the **Type** value of the host is **ESX**.
5. Click **Next** to begin the process of creating an ONTAP Select cluster.
6. In the **Cluster Details** section of the page, provide all the required information describing the cluster and click **Done**.
7. In the **Setup Host** section of the page, click **Select Hosts**.
8. In the **Select hosts for the HA pair** popup window, select the hypervisor configuration instance type and minimum datastore capacity that applies to the host.
A **Small** instance and **Medium** instance are the two available hypervisor configuration types. These instance types are supported by the standard and premium offerings of the purchased license, respectively. The license applied to a node must match or exceed the instance type.
9. Select the host from the list and click **Done**.

The list of available hosts is filtered based on the instance type and minimum datastore capacity. You can select hosts from the list or add more hosts by clicking **Add Hypervisor**.

10. Click **License Host** to display a list of available licenses for the single node.
11. If the required licenses are not available in the list, click **Upload License(s)** and select a license from your local workstation and click **Open** to upload the license to the Deploy utility.
Each license is displayed in the list, including the serial number, type, and capacity.
12. Select the license from the list and click **Done**.
Select **Enter Serial Number** to provide a serial number instead. You must apply a license within 30 days.
13. Click **Configure Hosts** and select the networks and datastore for the host and click **Done**.
The values on the page may be pre-populated based on the previous configuration choices as well as the configuration of the hypervisor.
14. Click **Configure Network** to configure the cluster network.
15. Provide all network configuration parameters in the **Configure Network** window and click **Done**.
The three values at the bottom of the page related to DNS and NTP are optional.
16. Review and confirm the configuration of the cluster.
You can change the configuration by clicking **Edit** in the applicable section.
17. Click **Create Cluster** to begin the cluster creation process and then click **OK** in the **Cluster create operation started** popup window.
It can take up to 30 minutes for the cluster to be created.
18. On the **Clusters** page, select the new cluster and monitor the cluster creation process.
The page is automatically refreshed at regular intervals. Notice that three tabs are available at the top of the page.

After you finish

You should configure the ONTAP Select AutoSupport feature. You should also back up the ONTAP Select Deploy configuration data.

Related tasks

[Backing up the Deploy configuration data](#) on page 53

Administering an ONTAP Select cluster

After you complete the deployment of an ONTAP Select cluster, you are ready to begin the process of administering the ONTAP-managed storage.

Initial state of the cluster after deployment

You should be aware of the initial state of the ONTAP Select cluster immediately after it is deployed. Based on this, you can decide how to configure and administer the cluster.

Summary of the cluster configuration state

After an ONTAP Select cluster is deployed, it has the following characteristics:

- Two types of customer-specified LIFs are assigned:
 - Cluster management (one per cluster)
 - Node management (one per node)
- Two administrative SVMs are active:
 - Default SVM
 - Cluster SVM
- The root aggregate is created
- All features are licensed and available

Note: There are no data SVMs created. Also, the multi-node cluster has an internal network with autogenerated LIFs.

ONTAP features enabled by default

ONTAP Select automatically licenses several features for each node. The following ONTAP features are included:

- NFS
- CIFS
- iSCSI
- FlexClone
- SnapRestore
- SnapVault
- SnapMirror
- Deduplication and compression
- ONTAP multitenancy capability

Performing additional configuration

After your ONTAP Select cluster is deployed, you can configure and manage the cluster just as you would a hardware-based ONTAP system. For example, you can use OnCommand System Manager or the ONTAP CLI to configure the ONTAP Select cluster.

NetApp client software

You can connect to ONTAP Select using the following supported NetApp client software:

- OnCommand System Manager
- OnCommand Unified Manager for ONTAP
- OnCommand Performance Manager
- Virtual Storage Console for VMware vSphere
- SnapCenter (Microsoft Windows and SQL Server Plug-ins)

To identify the supported versions of the client software, go to the corresponding storage solution at the NetApp Interoperability Matrix Tool for the specific product. If the client software supports ONTAP 9, then the same version is also supported with ONTAP Select.

Restriction: The use of SnapCenter and the corresponding plug-ins requires server-based licenses. Storage system licensing of the SnapCenter plug-ins is not currently supported with ONTAP Select.

Any other NetApp client software that is not included in the list is not supported by ONTAP Select.

Possible configuration options

There are several options available when configuring the cluster, including the following:

- Creating the networking configuration
- Laying out your aggregates
- Creating the data Storage Virtual Machines (SVMs)

Purchased licenses with storage capacity

If you decided not to install the license files with storage capacity as part of deploying the ONTAP Select cluster, you must acquire and install the license files before the grace period expires for clusters running with a purchased license.

Mirrored aggregates

There are two data spares created for each ONTAP Select node (one in Pool0 and one in Pool1). To implement high availability for your data, you must create a mirrored aggregate using these spares.

Related references

[Where to find additional information](#) on page 79

Related information

[NetApp Interoperability Matrix Tool](#)

Upgrading the ONTAP Select nodes

After you deploy an ONTAP Select cluster, you can update the ONTAP image of each node as needed using the standard ONTAP software upgrade procedure.

Restriction: You cannot use the Deploy administration utility to perform upgrades of existing ONTAP Select nodes. The Deploy utility can only be used to install new ONTAP Select nodes.

Attention: You cannot revert an ONTAP Select node to a version prior to the version that was originally installed. For example:

- ONTAP Select 9.1 is initially installed
You can upgrade the node to version 9.2 and then revert back to version 9.1 if needed.
- ONTAP Select 9.2 is initially installed
You cannot revert to version 9.1 because this version is prior to the version that was originally installed.

Related information

[NetApp Support](#)

[ONTAP 9 Upgrade and Revert/Downgrade Guide](#)

[ONTAP 9 Upgrade Express Guide](#)

Supporting ONTAP Select and the ONTAP Select Deploy utility

After deploying an ONTAP Select cluster, you should prepare to support the cluster and the ONTAP Select Deploy administration utility. While it is typically more convenient to use the web user interface, in most cases you can also choose to use the command line interface. However, there are some tasks that you can only perform using either the web user interface or the CLI.

Related tasks

[Signing in to the Deploy utility web interface](#) on page 36

[Signing in to the Deploy utility using SSH](#) on page 35

Confirming network connectivity among ONTAP Select nodes using the CLI

You can test the network connectivity among two or more ONTAP Select nodes on the internal cluster network. You typically run this test before a multi-node cluster is created to detect issues that might cause the cluster create operation to fail. However, you can also run the test after a cluster is created and online.

Before you begin

All the ONTAP Select nodes included in the test must be added and configured using the web GUI or CLI. You must also have the host ids assigned to the hosts.

About this task

You must use the network connectivity checker from the command line interface. Each time you issue a CLI command to start the test, a new process run is created in the background and assigned a unique run identifier. Only one run can be active at a time.

The test has two modes that determine its operation:

- **Quick**
This mode performs a basic non-disruptive test. A PING test is performed, along with a test of the network MTU size and vSwitch.
- **Extended**
This mode performs a more comprehensive test over all the redundant network paths. If you run this on an active ONTAP Select cluster, the performance of the cluster can be impacted.

Note: It is recommended that you always perform a quick test before creating a multi-node cluster. After the quick test completes successfully, you can optionally perform an extended test based on your production requirements.

Steps

1. Sign in to the Deploy utility CLI using the administrator account.
2. Display the current runs of the network connectivity checker and verify that no runs are active:
`network connectivity-check show-all`
3. Start the network connectivity checker and note the run identifier in the command output:

```
network connectivity-check start --host-ids host_id1 host_id2 host_id3
host_id4 --vswitch-type StandardVSwitch --mode quick
```

4. Monitor the progress of the network connectivity checker based on the run identifier:

```
network connectivity-check show --run-id 2
```

After you finish

The network connectivity checker normally cleans up by removing any temporary vmkernel ports and IP addresses added to the ONTAP-Internal port group. However, if the connectivity checker fails to remove the temporary vmkernel ports, you must perform a manual cleanup operation by rerunning the CLI command with the `--cleanup` option. If you do not remove the temporary vmkernel ports from the ONTAP-Internal port group on a Standard Vswitch, the ONTAP Select virtual machine may not be created successfully.

Changing the Deploy administrator password

You can change the password for the Deploy virtual machine administrator account as needed using the web user interface.

Steps

1. Sign in to the Deploy utility web user interface using the administrator account.
2. Click the figure icon at the top right of the page and select **Change Password**.
3. Provide the current and new password as prompted and click **Apply**.

Changing the Deploy administrator password using the CLI

You can change the password for the Deploy virtual machine administrator account as needed using the command line interface.

Steps

1. Sign in to the Deploy utility CLI using the administrator account.
2. Change the password:


```
user password modify
```
3. Respond to all prompts as appropriate for your environment.

Displaying the ONTAP Select event messages

The ONTAP Select Deploy utility includes an event logging facility that provides information about the activity of the system. You should view the contents of the event log to debug any issues or when directed to do so by support.

About this task

You can filter the list of event messages based on several characteristics, including:

- Category
- Type
- Level

- Instance

Steps

1. Sign in to the Deploy utility web user interface using the administrator account.
2. Click the **Administration** tab at the top of the page.
3. Click **Events** and then click **Deploy**.
4. Optionally click **Filtering** and create a filter to limit the event messages displayed.

Configuring AutoSupport

You should configure AutoSupport immediately after creating the first ONTAP Select cluster. You can update the configuration as needed at any time.

About this task

The AutoSupport configuration you define is applied to both the Deploy utility and the ONTAP Select clusters you create using the Deploy utility. If you use a proxy server, you can configure the proxy URL as follows: `http://<proxy_username>:<password>@<proxyURLorIP>:<port>`.

Steps

1. Sign in to the Deploy utility web user interface using the administrator account.
2. Click the **Administration** tab at the top of the page.
3. Click **AutoSupport** and then click **Configure**.
4. Provide the configuration data as appropriate for your environment and click **Save**.

After you finish

AutoSupport is the primary troubleshooting tool used by NetApp in supporting ONTAP Select. Therefore, you should not disable AutoSupport unless absolutely necessary. If you do disable AutoSupport, data is still collected but not transmitted to NetApp.

Related tasks

[Generating and downloading an AutoSupport package](#) on page 48

Generating and downloading an AutoSupport package

ONTAP Select includes the ability to generate an AutoSupport package. You should generate a package to debug any issues or when directed to do so by support.

About this task

You can generate the following AutoSupport packages under the direction and guidance of NetApp support:

- Deploy logs
Log files created by the ONTAP Select Deploy utility
- Troubleshooting
Troubleshooting and debugging information about the hypervisor host where ONTAP Select runs

- Performance
Performance information about the hypervisor host where ONTAP Select runs
- Corefile
The corefile generated by the ONTAP Select node

Steps

1. Sign in to the Deploy utility web user interface using the administrator account.
2. Click the **Administration** tab at the top of the page.
3. Click **AutoSupport** and then click **Generate**.
4. Select the type and provide a description for the package; you can optionally provide a case.
5. Click **Generate AutoSupport**.
Each AutoSupport package is assigned a unique sequence number.
6. On the left side of the page, click **History** and locate the correct package; you can click **Refresh** as needed.
7. Optionally click the download icon to save the AutoSupport file to your local workstation.

Expanding storage and license capacity

You can expand the storage and required licensing capacity for your nodes and HA pairs as needed.

Before you begin

You must have the datastore(s) with sufficient capacity attached and available to the hypervisor where ONTAP Select is running. In addition, you must be licensed for the storage expansion. If your current node license is insufficient, you can update the license as part of this task. In this case, you must have a new capacity license file for the node available for upload from your local workstation.

When updating the storage capacity of a node that is part of an HA pair, the partner node must have a datastore available with the same capacity.

About this task

If needed, you can update the license capacity for a node as part of performing the storage expansion. Alternatively, you can update the license prior to expanding the storage.

Note: If an ONTAP Select node is deployed with an evaluation license, you can expand the storage up to the limit imposed by the license. However, you cannot update the evaluation license.

Steps

1. Sign in to the Deploy utility through the web interface using the administrator account.
2. On the **Clusters** page, select the cluster containing the node you want to update.
3. Click the HA pair or host to expand the display and review the current configuration, including: license type, datastore capacity, and datastores in use.
4. Choose the node you want to update and click the pencil icon next to **Datastore Capacity** to display the **Expand Node Capacity** popup window.
5. Type a value for **Additional Capacity** and notice that the **New Capacity** is also updated.

6. Under **Additional Local Datastore**, select the datastore for the new storage.
7. If the node is part of an HA pair, select the corresponding datastore on the partner node under **Additional Partner Datastore**.

The partner datastore must have enough capacity to support the additional capacity selected for the local datastore.
8. Under **ONTAP Credentials**, type the username and password defined for the cluster.
9. Click **Expand Storage**.

While the storage expansion operation is active, you cannot modify the configuration of the nodes in the cluster.
10. If your current capacity is insufficient to allow the storage expansion, you must update your license:
 - a. Click **Select License**.
 - b. Type the ONTAP account credentials.
 - c. Click **Update License** and select a license file and click **Open**.

The serial number of the new license file must match the node's current serial number.
 - d. Click **Done**.

You can also update the node license capacity on the **Expand Node Capacity** popup window by clicking the pencil icon next to **License** for the node.

Viewing the status of the mediator service

Each ONTAP Select two-node cluster is monitored by the mediator service, which assists in managing the HA capability shared by the nodes. You can view the status of the mediator service with respect to each of the two-node clusters defined to the ONTAP Select Deploy utility.

About this task

You can view the configuration of each mediator, including the current status, the two ONTAP Select nodes, and the iSCSI target where the HA control information is stored. Hover over the objects on the page to display detailed information.

Steps

1. Sign in to the Deploy utility web user interface using the administrator account.
2. Click the **Administration** tab at the top of the page.
3. Click **Mediators** and then click **Status**.
4. Optionally define a filter to customize your view of the two-node clusters monitored by the mediator service.

Moving an ONTAP Select cluster to the offline and online states

After you have created a cluster, you can change its status to offline and then online as needed using the web user interface.

Before you begin

After a cluster is created it is initially in the online state.

Steps

1. Sign in to the Deploy utility web user interface using the administrator account.
2. Click the **Clusters** tab at the top of the page and select the desired cluster from the list.
3. Click the gear icon on the right of the cluster and select **Offline**.
If the offline option is not available, then the cluster is already in the offline state.
4. Click **Yes** in the popup window to confirm the request.
5. Click **Refresh** occasionally and hover over the icon to the left of the cluster name until the state of the cluster is offline.
6. Click the gear icon on the right of the cluster and select **Online**.
7. Click **Refresh** occasionally and hover over the icon on the left until the state of the cluster is online.

Deleting an ONTAP Select cluster

You can delete an ONTAP Select cluster when it is no longer needed using the web user interface.

Before you begin

The cluster must be in the offline state.

Steps

1. Sign in to the Deploy utility web user interface using the administrator account.
2. Click the **Clusters** tab at the top of the page and select the desired cluster from the list.
3. Click the gear icon on the right of the cluster and select **Delete**.
If the delete option is not available, then the cluster is not in an offline state. You must assure that the cluster is offline.
4. Click **Refresh** occasionally until the cluster is removed from the list.

Result

After the cluster is deleted, all the hosts that were part of the cluster are moved to the unassigned state.

Deleting an ONTAP Select cluster using the CLI

You can delete an ONTAP Select cluster when it is no longer needed using the command line interface.

About this task

The cluster must be in the offline state.

Steps

1. Sign in to the Deploy virtual machine CLI using the administrator account.
2. Display the cluster status:

```
cluster show --cluster-name mo-cluster38
```
3. If the cluster is not offline, move it to an offline state:

```
cluster offline --cluster-name mo-cluster38
```
4. After confirming that the cluster is in an offline status, delete the cluster:

```
cluster delete --cluster-name mo-cluster38
```

Result

After the cluster is deleted, all the hosts that were part of the cluster are moved to the unassigned state.

Accessing the ONTAP Select video console

You can access the video console of the ESXi virtual machine where ONTAP Select is running.

About this task

You might need to access the virtual machine console to troubleshoot an issue or when asked to do so by NetApp support.

Steps

1. Access the vSphere client and sign in.
2. Navigate to the appropriate location in the **vCenter** hierarchy to locate the ONTAP Select virtual machine.
3. Right click the virtual machine and select **Open Console**.

Migrating a Deploy instance to a new virtual machine using the CLI

You can migrate an existing instance of the Deploy administration utility to a new virtual machine using the command line interface.

Before you begin

You must be familiar with the procedures used to download and deploy the ONTAP Select Deploy virtual machine in a VMware environment.

About this task

This procedure is based on creating a new virtual machine that uses the configuration data from the original virtual machine. The new and original virtual machines must run the same version and release of the Deploy utility. You cannot migrate to a different version and release of the Deploy utility.

Steps

1. [Backing up the Deploy configuration data](#) on page 53
2. [Installing a new instance of the Deploy virtual machine](#) on page 54
3. [Restore the Deploy configuration data to the new virtual machine](#) on page 54

Related tasks

[Installing and configuring the ONTAP Select Deploy utility](#) on page 34

Backing up the Deploy configuration data

You must create a backup of the configuration data from a Deploy virtual machine as part of migrating the virtual machine. You should also create a backup after creating an ONTAP Select cluster. The data is saved to a single file that you must download to your local workstation.

About this task

The backup file you create captures all the configuration data from the virtual machine. This data describes aspects of your deployment environment, including the ONTAP Select hosts and clusters. By default, the backup file is stored in the home directory of the administration user at the Deploy virtual machine but you can specify a different target directory as needed.

Steps

1. Sign in to the Deploy utility CLI using SSH with the administrator account.
2. Create a backup of the configuration data to the home directory at the Deploy virtual machine:


```
configuration backup --path /home/admin
```
3. Record the name of the backup file displayed after the command completes.
4. In a separate command shell on your local workstation, use the sftp utility to download the configuration file:

```
sftp admin@10.63.65.101 (type password and press Enter)
get db_backup_06232016161751.txt
exit
```

Installing a new instance of the Deploy virtual machine

You must create a new instance of the Deploy virtual machine which you can update with the configuration data from the original virtual machine.

About this task

This task is described at a high level.

Step

1. Create a new instance of the Deploy virtual machine:
 - a. Downloading the virtual machine image.
 - b. Deploying the virtual machine.
 - c. Optionally configuring the network interface.
 - d. Accessing the Deploy utility using SSH.

Restore the Deploy configuration data to the new virtual machine

You must restore the configuration data from the original Deploy utility virtual machine to the new virtual machine. The data is in a single file that you must upload from your local workstation.

Before you begin

You must have the configuration data from a previous backup. The data is contained in a single file and must be available on your local workstation.

Steps

1. In a command shell on your local workstation, use the sftp utility to upload the configuration file to the new Deploy virtual machine image:

```
sftp admin@10.63.65.102 (type password and press Enter)
put db_backup_06232016161751.txt
exit
```

2. Sign in to the Deploy utility CLI using SSH with the administrator account.
3. Restore the configuration data from the home directory:

```
configuration restore --path /home/admin
```

Upgrading an existing Deploy virtual machine using the CLI

You can upgrade an existing Deploy utility virtual machine in-place using the command line interface.

Before you begin

It is recommended that you back up the configuration of the Deploy virtual machine before beginning the upgrade. Make sure that Deploy is not used to perform any other tasks during the upgrade.

About this task

You can only perform this procedure when upgrading from a previous Deploy version (for example, from Deploy 2.1 to 2.2).

After you finish

It is recommended that you back up the configuration of the Deploy virtual machine after the upgrade procedure is completed.

Steps

1. [Downloading the upgrade package](#) on page 55
2. [Uploading the package to the Deploy virtual machine](#) on page 55
3. [Applying the upgrade package](#) on page 56

Related tasks

[Backing up the Deploy configuration data](#) on page 53

Downloading the upgrade package

To begin the upgrade process, you must download the appropriate Deploy virtual machine upgrade file from the NetApp Support Site. The upgrade package is formatted as a single compressed file with the tar.gz suffix.

Steps

1. Access the NetApp Support Site using a web browser and click the **Downloads** tab at the top of the page.
2. Click **Software** and log in to the site.
3. Scroll to the line displaying **ONTAP Select** and select **Deploy Upgrade** on the right and click **GO!**.
4. Click **View & Download** for the desired software level.
5. Click **CONTINUE** and accept the End User License Agreement (EULA).
6. Select and download the appropriate upgrade file, responding to all prompts as needed for your environment.

Related information

[NetApp Support](#)

Uploading the package to the Deploy virtual machine

After acquiring the upgrade package, you must upload the file to the Deploy virtual machine.

Before you begin

You must have the upgrade file available on your local workstation. You must also have the password for the administrator user account.

About this task

This task describes one method for uploading the file to the Deploy virtual machine. There may be other more suitable options in your environment.

Step

1. In a command shell on your local workstation, use the sftp utility to upload the license file to the Deploy virtual machine:

```
sftp admin@10.63.65.101 (type password and press Enter)
put ONTAPdeploy_upgrade.tar.gz (use appropriate file name)
Exit
```

Result

The upgrade file is stored in the home directory of the admin user.

Applying the upgrade package

After the upgrade file has been uploaded to the Deploy virtual machine, you can apply the upgrade.

Before you begin

You must know which directory the upgrade file has been placed in at the Deploy utility virtual machine. Also, assure that Deploy is not used to perform any other tasks while the upgrade is performed.

Steps

1. Sign in to the Deploy utility CLI using SSH with the administrator account.
2. Perform the upgrade using the appropriate directory path and file name:

```
upgrade /home/admin/ONTAPdeploy_upgrade.tar.gz
```

Recovering the Deploy utility for a two-node cluster

If the ONTAP Select Deploy utility fails or becomes unavailable for some reason, you lose the ability to administer ONTAP Select nodes and clusters. In addition, all two-node clusters lose HA capability because the mediator service included with Deploy is unavailable. If an unrecoverable failure occurs, you must recover the Deploy utility instance to restore administrative and HA functionality.

Preparing to recover an instance of the Deploy utility

You should prepare before attempting to recover an instance of the Deploy utility to assure success.

Required skills and information

You should be familiar with several administrative procedures and have the required information.

Installing the Deploy virtual machine

You must be able to install a new instance of the ONTAP Select Deploy utility in a VMware environment.

Restoring a backup of the Deploy configuration

You should be able to restore a backup of the Deploy configuration data, depending on the recovery procedure used.

ONTAP command line interface

You must be able to sign in to the ONTAP CLI of the ONTAP Select cluster and use the shell interface.

Availability of Deploy utility configuration backup

You must determine if you have a backup of the configuration data from the failed Deploy utility instance that contains the ONTAP Select two-node cluster. You might have a backup that does not contain the cluster.

IP address of the original Deploy virtual machine

You must know the IP address of the original Deploy utility virtual machine that failed.

Deciding which recovery procedure to use

You must decide which procedure to use when recovering an instance of the ONTAP Select Deploy utility. Your decision is based on whether or not you have a backup of the configuration data from the original failed Deploy utility that contains the ONTAP Select two-node cluster.

Do you have a Deploy backup containing the two-node cluster?	Recovery procedure to use
Yes	<i>Restoring a Deploy utility instance using a configuration backup</i>
No	<i>Reconfiguring and recovering a Deploy utility instance</i>

Related tasks

[Restoring a Deploy utility instance using a configuration backup](#) on page 57

[Reconfiguring and recovering a Deploy utility instance](#) on page 58

Restoring a Deploy utility instance using a configuration backup

If you have a backup of the failed Deploy utility instance containing the two-node cluster, you can restore the configuration data to the new Deploy virtual machine instance. You must then complete the recovery by performing additional configuration of the two nodes in the ONTAP Select cluster.

Before you begin

You must have a backup of the configuration data from the original failed Deploy virtual machine that contains the two-node cluster. You must be able to sign in to the ONTAP CLI of the two-node cluster and know the ONTAP names of the two nodes.

About this task

Because the configuration backup you restore contains the two-node cluster, the mediator iSCSI targets and mailboxes are recreated in the new Deploy utility virtual machine.

Steps

1. Prepare a new instance of the ONTAP Select Deploy utility:
 - a. Install a new Deploy utility virtual machine.
 - b. Restore the Deploy configuration from a previous backup to the new virtual machine.

Refer to the related tasks for more detailed information about the install and restore procedures.
2. Sign in to the ONTAP command line interface of the ONTAP Select two-node cluster.
3. Enter advanced privilege mode:


```
set adv
```
4. If the IP address of the new Deploy virtual machine is different than the original Deploy virtual machine, you must remove the old mediator iSCSI targets and add new targets:

- a. `storage iscsi-initiator remove-target -node * -target-type mailbox`
- b. `storage iscsi-initiator add-target -node <node1_name> -label mediator -target-type mailbox -target-portal <ip_address> -target-name <target>`
- c. `storage iscsi-initiator add-target -node <node2_name> -label mediator -target-type mailbox -target-portal <ip_address> -target-name <target>`

The <ip_address> parameter is the IP address of the new Deploy virtual machine.

These commands allow the ONTAP Select nodes to discover the mailbox disks on the new Deploy utility virtual machine.

5. Determine the names of the mediator disks:

```
disk show --container-type mediator
```

6. Assign the mailbox disks to the two nodes:

- a. `disk assign -disk <mediator-disk1-name> -owner <node1-name>`

- b. `disk assign -disk <mediator-disk2-name> -owner <node2-name>`

7. Verify that storage failover is enabled:

```
storage failover show
```

Related tasks

[Installing and configuring the ONTAP Select Deploy utility](#) on page 34

[Restore the Deploy configuration data to the new virtual machine](#) on page 54

Reconfiguring and recovering a Deploy utility instance

If you do not have a backup of the failed Deploy utility instance containing the two-node cluster, you must configure the mediator iSCSI target and mailbox in the new Deploy virtual machine. You must then complete the recovery by performing additional configuration of the two nodes in the ONTAP Select cluster.

Before you begin

You must have the name of the mediator target for the new Deploy utility instance. You must be able to sign in to the ONTAP CLI of the two-node cluster and know the ONTAP names of the two nodes.

About this task

You can optionally restore a configuration backup to the new Deploy virtual machine even though it does not contain the two-node cluster. Because the two-node cluster is not recreated with the restore, you must manually add the mediator iSCSI target and mailbox to the new Deploy utility instance through the Deploy Swagger page. You must be able to sign in to the two-node cluster and know the ONTAP names of the two nodes.

Note: The goal of the recovery procedure is to restore the two-node cluster to a healthy state, where normal HA takeover and giveback operations can be performed.

Steps

1. Prepare a new instance of the ONTAP Select Deploy utility:
 - a. Install a new Deploy utility virtual machine.
 - b. Optionally restore the Deploy configuration from a previous backup to the new virtual machine.

If you restore a previous backup, the new Deploy instance will not contain the two-node cluster. Refer to the related tasks for more detailed information about the install and restore procedures.

2. Sign in to the ONTAP command line interface of the ONTAP Select two-node cluster.
3. Enter advanced privileged mode:


```
set adv
```
4. Get the mediator iSCSI target name:


```
storage iscsi-initiator show -target-type mailbox
```
5. Access the Swagger page at the new Deploy utility virtual machine and sign in using the `admin` account:


```
http://<ip_address>/api/v2/ui
```

You must use the IP address of your Deploy virtual machine.
6. Click **Mediator** and then click **PUT**.
7. Provide values for `mediator_ip` and `iqn_name` and then click **Try it out!** to create the mediator iSCSI target.

Use either 'localhost' or the IP address of the Deploy virtual machine for the `mediator_ip` parameter. Use the target name for the `iqn_name` parameter.

If the request is successful, you will receive HTTP status code 200.
8. If the IP address of the new Deploy virtual machine is different than the original Deploy virtual machine, you must use the ONTAP CLI to remove the old mediator iSCSI targets and add new targets:
 - a.

```
storage iscsi-initiator remove-target -node * -target-type mailbox
```
 - b.

```
storage iscsi-initiator add-target -node <node1_name> -label mediator -target-type mailbox -target-portal <ip_address> -target-name <target>
```
 - c.

```
storage iscsi-initiator add-target -node <node2_name> -label mediator -target-type mailbox -target-portal <ip_address> -target-name <target>
```

The `<ip_address>` parameter is the IP address of the new Deploy virtual machine.

These commands allow the ONTAP Select nodes to discover the mailbox disks on the new Deploy utility virtual machine.
9. Determine the names of the mediator disks:


```
disk show --container-type mediator
```
10. Assign the mailbox disks to the two nodes:
 - a.

```
disk assign -disk <mediator-disk1-name> -owner <node1-name>
```
 - b.

```
disk assign -disk <mediator-disk2-name> -owner <node2-name>
```
11. Verify that storage failover is enabled:


```
storage failover show
```

Related tasks

[Installing and configuring the ONTAP Select Deploy utility](#) on page 34

[Restore the Deploy configuration data to the new virtual machine](#) on page 54

Understanding the EMS notifications

After you install a purchased license with storage capacity, ONTAP Select monitors the license and generates Event Management System (EMS) notifications based on activity. You should understand the associated EMS notifications.

license.capac.valid (notice)

This message occurs when a valid capacity license has been installed on a node in your organization.

license.capac.warning (notice)

This message occurs when the total storage capacity of all disks currently assigned to your system is close to exceeding the limit of your current license. If the capacity limit is exceeded, a forced shutdown of the system may result.

license.capac.enforce (alert)

This message occurs when the total storage capacity of all disks currently assigned to your system exceeds the limit of your capacity license. The system will shut down within the next 72 hours.

license.capac.shutdown (alert)

This message occurs when the total storage capacity of all disks currently assigned to your system has exceeded the limit of your capacity license. The system will shut down within the next 10 minutes.

Deploying an ONTAP Select cluster using the CLI

You can use the command line interface provided with the ONTAP Select Deploy administration utility to create a multi-node or single-node ONTAP Select cluster.

Related tasks

[Signing in to the Deploy utility using SSH](#) on page 35

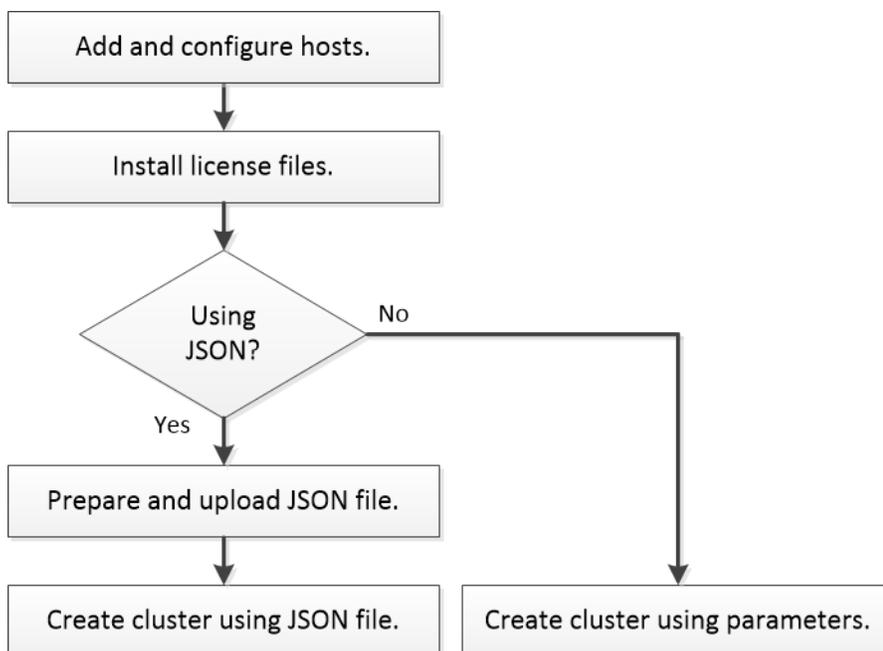
Related information

[ONTAP Select 9 Quick Start Guide: Deploying an Evaluation Multi-Node Cluster](#)

[ONTAP Select 9 Quick Start Guide: Deploying an Evaluation Single-Node Cluster](#)

Deploy CLI cluster creation workflow

The following workflow illustrates the process of creating an ONTAP Select cluster using the command line interface provided with the Deploy utility.



Adding an ONTAP Select host

Adding a host is the first task you must perform as part of creating an ONTAP Select cluster. When you add a host, the Deploy administration utility records the information in the local Deploy utility configuration database.

Before you begin

You must have the basic configuration information for the ONTAP Select host.

About this task

If vSphere authentication is performed by an Active Directory server, you must format the username parameter as follows:

```
--username DOMAIN\user
```

Steps

1. Sign in to the Deploy utility CLI using SSH with the administrator account.

2. Add the host:

```
host add --host-id vsanane38.coco.netapp.com --username
admin@vsphere.local --password mypwd --vcenter vsa-vc-60.coco.netapp.com
```

The username and password parameters apply to the vCenter server account.

3. Display the status of the host:

```
host show-all
```

4. Confirm the status of the host is authenticated before continuing.

Configuring an ONTAP Select host

After a host has been added, you must configure the host. This task allows you to provide the configuration details needed prior to including the host in an ONTAP Select cluster.

Before you begin

You must have the complete configuration information for the ONTAP Select host and already added the host using the Deploy administration utility. You must have created the storage pool using VMware vSphere. Also, you must have configured the networking on the host.

Steps

1. Sign in to the Deploy utility CLI using SSH with the administrator account.

2. Configure the host:

```
host configure --host-id vsanane38.coco.netapp.com --location coco --
storage-pool vsanane38_1 --serial-number 320000xxx --instance-type small
--internal-network vsanane38_internal --management-network
vsanane38_network --data-network vsanane38_network
```

For each of the three networks identified in the command, you must identify the portgroup name.

Note: When configuring a host that uses external storage, you should also include the parameter `--capacity-limit` to control the amount of storage that ONTAP Select consumes from the storage pool.

3. Display the status of the host:

```
host show-all
```

4. Confirm that the status of the host is configured before continuing.

Installing the ONTAP Select license file

When you deploy an ONTAP Select cluster with a purchased license, you must acquire and install a license file with storage capacity for each node in the cluster. You can install a license for a node

either before the cluster is deployed or within 30 days after the cluster is deployed. In both cases, after the license is registered with the Deploy virtual machine, it is applied to the node.

Before you begin

The host must be added and configured. Also, you must acquire the license file with storage capacity and save it on your local workstation.

About this task

You should perform this task for each of the nodes in an ONTAP Select cluster.

Steps

1. [Uploading a license file to the Deploy virtual machine](#) on page 63
2. [Registering a license for an ONTAP Select node](#) on page 63

Uploading a license file to the Deploy virtual machine

After acquiring a license file with storage capacity, you must upload the file containing the license to the Deploy virtual machine.

Before you begin

You can receive the license file for a ONTAP Select node either as a downloaded file or in an email. Whatever the delivery method, you must have the license file available on your local workstation. Also, you must have the password for the admin user account.

Step

1. In a command shell on your local workstation, use the sftp utility to upload the license file to the Deploy virtual machine:

```
sftp admin@10.63.65.101 (type password and press Enter)
put NLF-320000022.txt
exit
```

Registering a license for an ONTAP Select node

After a license file with storage capacity has been uploaded to the Deploy virtual machine, you can register the license so that it is applied when the ONTAP Select cluster is deployed.

Before you begin

You must have uploaded the license file to the Deploy virtual machine. Also, you must have the password for the admin user account.

About this task

As part of registering the license for a node, you should confirm its state. A node can be in one of the following states:

- licensed
- unlicensed
- not_used

Steps

1. Sign in to the Deploy utility CLI using SSH with the administrator account.

2. Register the license:

```
license add --serial-number 320000xxx --file-name NLF-320000xxx.txt
```

3. Display the license:

```
license show-all
```

Optionally describing a cluster using JSON

You can create an ONTAP Select cluster using a CLI shell command using either input parameters or a single JSON file. If you choose to create a cluster using JSON, you must first create the JSON file describing the cluster. Then as part of creating the cluster, you must upload the JSON file to the Deploy virtual machine.

You can create a JSON file describing an ONTAP Select cluster based on the sample definition provided by NetApp.

Related tasks

[Creating a cluster using JSON](#) on page 67

Sample JSON cluster definition

Before describing a cluster using JSON, you should understand the structure and attributes of the JSON file. You can use the following example as the basis for creating a single-node ONTAP Select cluster.

To adapt this sample to a multi-node cluster, you should add the following:

- Additional objects to the nodes array (one or three)
- A mirror attribute for each of the node objects (identifying the paired node)

```
{
  "admin_password": "mypassword",
  "dns_info": {
    "dns_ips": [ "10.99.17.5" ],
    "domains": [ "lab2.netapp.com" ]
  },
  "eval": false,
  "inhibit_rollback": false,
  "cluster_mgmt_ip": "10.99.17.101",
  "gateway": "10.99.17.1",
  "netmask": "255.255.255.0",
  "name": "dp-cluster-ct11-2",
  "nodes": [
    {
      "host": "vsanane01.coco.netapp.com",
      "name": "dmp-esx-1",
      "node_mgmt_ip": "10.99.17.102"
    }
  ],
  "ntp_servers": [ "10.99.17.4" ]
}
```

Understanding the JSON attributes

Some of the JSON attributes define characteristics of the ONTAP Select cluster, while others apply to an individual node. You should understand these attributes before creating the JSON file describing your ONTAP Select cluster.

Cluster level attributes

There are several JSON attributes that apply to the cluster.

- `admin_password`
Password for the ONTAP admin user account
- `dns_info`
Includes two arrays defining the DNS services:
 - `dns_ips`
The IP address of one or more DNS servers
 - `domains`
Search list for short or partial domain names
- `eval`
Indicates if the cluster is deployed with an evaluation license (default is false)
- `inhibit_rollback`
Prevents resource cleanup after a failed cluster deployment (default is false)
- `cluster_mgmt_ip`
IP address of the cluster management LIF
- `gateway`
Gateway or default router
- `netmask`
Network mask
- `name`
Name of the cluster
- `nodes`
Array of one or four ONTAP Select nodes
- `ntp_servers`
One or more IP addresses for the NTP servers

Node level attributes

There are several JSON attributes that apply to each node in the cluster.

- `host`
Hostname of the hypervisor (domain name or IP address)
- `mirror`
Name of the other host in the HA pair (must be one of the other virtual machine names in the four-node cluster)
- `name`
Node name or virtual machine name which is deployed on the host (optional)

- `node_mgmt_ip`
IP address of the node management LIF

Creating an ONTAP Select cluster

You can create an ONTAP Select cluster using the ONTAP Select Deploy management shell in one of two different ways. You can either use a command with input parameters or use a command with a single JSON file describing the cluster.

Best practice: After creating a cluster, you should back up the ONTAP Select Deploy configuration data.

Creating a cluster using input parameters

You can create an ONTAP Select cluster using a CLI command with the associated input parameters. This version of the command does not require a JSON file.

Before you begin

Before creating a multi-node cluster, you should run the network connectivity checker to confirm the connectivity among the cluster nodes on the internal network.

About this task

This example task illustrates how to create a single-node cluster, a two-node cluster, and a four-node cluster.

Steps

1. Sign in to the Deploy utility CLI using SSH with the administrator account.
2. Create the ONTAP Select cluster.

- Create a single-node cluster:

```
cluster create --name mo-cluster38 --cluster-mgmt-ip 10.96.141.17 --
node-mgmt-ips 10.96.141.25 --netmask 255.255.248.0 --gateway
10.96.141.1 --node-names mo-node38 --node-hosts
vsanane38.coco.netapp.com
```

- Create a two-node cluster:

```
cluster create --name mo-cluster38 --cluster-mgmt-ip 10.96.141.17 --
node-mgmt-ips 10.96.141.25 10.96.141.26 --netmask 255.255.248.0 --
gateway 10.96.141.1 --node-names mo-node25 mo-node26 --node-hosts
vsanane25.coco.netapp.com vsanane26.coco.netapp.com --node-mirrors mo-
node26 mo-node25
```

Several of the parameters include values for the two nodes. Where needed, the parameters are related to each other based on the position of the values. For example, the values in the parameter `--node-mirrors` are mapped to the values in the parameter `--node-names`. In this case, the first value of `--node-mirrors` (`mo-node26`) is mapped to the first value of `--node-names` (`mo-node25`).

- Create a four-node cluster:

```
cluster create --name mo-cluster38 --cluster-mgmt-ip 10.96.141.17 --
node-mgmt-ips 10.96.141.25 10.96.141.26 10.96.141.27 10.96.141.28 --
netmask 255.255.248.0 --gateway 10.96.141.1 --node-names mo-node25 mo-
node26 mo-node27 mo-node28 --node-hosts vsanane25.coco.netapp.com
vsanane26.coco.netapp.com vsanane27.coco.netapp.com
```

```
vsanane28.coco.netapp.com --node-mirrors mo-node26 mo-node25 mo-node28
mo-node27
```

Several of the parameters include values for the four nodes. Where needed, the parameters are related to each other based on the position of the values. For example, the values in the parameter `--node-mirrors` are mapped to the values in the parameter `--node-names`. In this case, the first value of `--node-mirrors` (`mo-node26`) is mapped to the first value of `--node-names` (`mo-node25`).

3. Display the cluster status:

```
cluster show-all
```

After you finish

You should configure the ONTAP Select AutoSupport feature. You should also back up the ONTAP Select Deploy configuration data.

Creating a cluster using JSON

You can create an ONTAP Select cluster using an ONTAP Select Deploy CLI with an associated JSON file.

Before you begin

Before creating a multi-node cluster, you should run the network connectivity checker to confirm the connectivity among the cluster nodes on the internal network.

Steps

1. In a command shell on your local workstation, use the `sftp` utility to upload the JSON file to the Deploy virtual machine:

```
sftp admin @10.63.65.101
put json_file.txt
exit
```

2. Sign in to the Deploy utility CLI using SSH with the administrator account.
3. Create the cluster:

```
cluster create-using-json --file-name json_file.txt
```

4. Display the status of cluster:

```
cluster show-all
```

After you finish

You should configure the ONTAP Select AutoSupport feature. You should also back up the ONTAP Select Deploy configuration data.

Appendix A: Understanding the ONTAP Select storage environment

As part of preparing the host servers that are part of an ONTAP Select cluster, you should understand the storage environment including configuration options and requirements.

At a high level, you have two options when configuring the storage that ONTAP Select uses:

- Locally managed storage
- External storage provided through ONTAP Select vNAS

Related concepts

[Appendix B: Understanding the ONTAP Select networking environment](#) on page 74

Related information

[NetApp Technical Report 4517: ONTAP Select Product Architecture and Best Practices](#)

General storage concepts and characteristics

There are several general storage concepts that apply to the ONTAP Select environment. You should first be familiar with these general concepts before exploring the specific storage components and characteristics.

Phases of storage configuration

The major configuration phases of the ONTAP Select host storage include the following:

1. Pre-deployment prerequisites
You must make sure that each hypervisor host is configured and ready for an ONTAP Select deployment. The configuration involves the physical drives, RAID controllers and groups, and LUNs, as well as related network preparation. This configuration is performed outside of ONTAP Select.
2. Configuration using the hypervisor administrator utility
You can configure certain aspects of the storage using the hypervisor administration utility (for example, vSphere in a VMware environment). This configuration is performed outside of ONTAP Select.
3. Configuration using the ONTAP Select Deploy administration utility
You can use the Deploy administration utility to configure the core logical storage constructs. This is performed either explicitly through CLI commands or automatically by the utility as part of a deployment.
4. Post-deployment configuration
After an ONTAP Select deployment completes, you can configure the cluster using the ONTAP CLI or System Manager. This configuration is performed outside of ONTAP Select Deploy.

Managed versus unmanaged storage

Storage that is accessed and directly controlled by ONTAP Select is considered to be managed storage. Any other storage on the same hypervisor host is considered to be unmanaged.

All the managed storage devices used by ONTAP Select must be locally attached to the host server.

Homogeneous physical storage

All the physical drives comprising the ONTAP Select managed storage must be homogeneous. That is, all the hardware must be the same regarding the following characteristics:

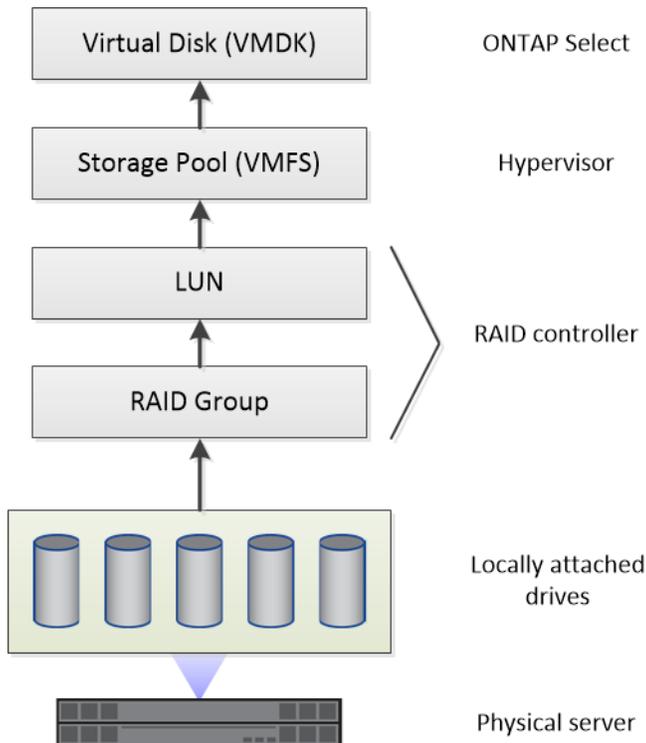
- Type (SAS, SSD)
- Speed (RPM)

Storage limitations and restrictions

There are several restrictions that apply to the ONTAP Select storage environment. Some are best practices while others are actual limitations. You should be aware of these restrictions in the applicable context.

Illustration of the local storage environment

Each hypervisor host contains local disks and other logical storage components that can be used by ONTAP Select. These storage components are arranged in a layered structure, from the physical disk drives to the ONTAP software.



Characteristics of the local storage components

There are several concepts that apply to the local storage components used in an ONTAP Select environment. You should be familiar with these concepts before preparing for an ONTAP Select deployment. These concepts are arranged according to category: RAID groups and LUNs, storage pools, and virtual disks.

Considerations for RAID groups and LUNs

There are several issues related to the RAID groups and LUNs that you should be aware of as part of preparing to deploy ONTAP Select.

Grouping physical drives into RAID groups

One or more physical disks can be locally attached to the host server and available to ONTAP Select. The physical disks are assigned to RAID groups, which are then presented to the hypervisor host operating system as one or more LUNs. Each LUN is presented to the hypervisor host operating system as a physical hard drive.

When configuring an ONTAP Select host, you should be aware of the following:

- All managed storage must be accessible through a single RAID controller
- Depending on the vendor, each RAID controller supports a maximum number of drives per RAID group.

One or more RAID groups

Each ONTAP Select host must have a single RAID controller. You should create a single RAID group for ONTAP Select. However, in certain situations you might consider creating more than one RAID group. Refer to the *ONTAP Select Product Architecture and Best Practices Technical Report* for more information.

Considerations when configuring storage pools

There are several issues related to the storage pools that you should be aware of as part of preparing to deploy ONTAP Select.

Note: In a VMware environment, a storage pool is synonymous with a VMware datastore.

Storage pools and LUNs

Each LUN is seen as a local disk on the hypervisor host and can be part of one storage pool. Each storage pool is formatted with a file system that the hypervisor host OS can use.

Configuring the storage pools

You must make sure that the storage pools are created properly as part of an ONTAP Select deployment. You can create a storage pool using the hypervisor administration tool. For example, with VMware you can use the vSphere client to create a storage pool. The storage pool is then passed in to the ONTAP Select Deploy administration utility.

Managing the virtual disks

There are several issues related to the virtual disks that you should be aware of as part of preparing to deploy ONTAP Select.

Virtual disks and file systems

The ONTAP Select virtual machine is allocated multiple virtual disk drives. Each virtual disk is actually a file contained in a storage pool and is maintained by the hypervisor. There are several types of disks used by ONTAP Select, primarily system disks and data disks.

You should also be aware of the following regarding virtual disks:

- The storage pool must be available before the virtual disks can be created.

- The virtual disks cannot be created before the virtual machine is created.
- You must rely on the ONTAP Select Deploy administration utility to create all virtual disks (that is, an administrator must never create a virtual disk outside of the Deploy utility).

Configuring the virtual disks

The virtual disks are managed by ONTAP Select. They are created automatically when you create a cluster using the Deploy administration utility.

Illustration of the external storage environment

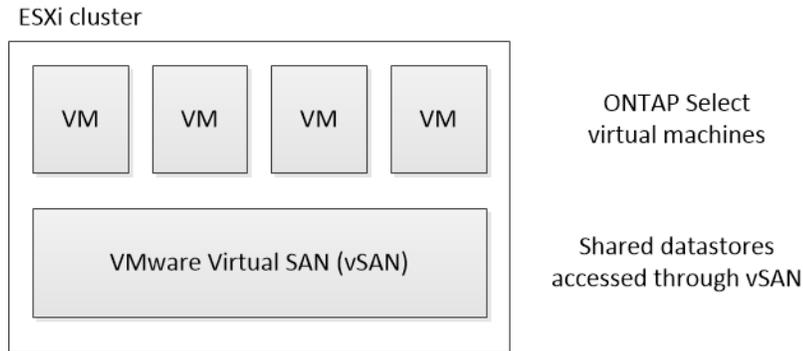
The ONTAP Select vNAS solution enables ONTAP Select to use datastores residing on storage that is external to the hypervisor host. The datastores can be accessed through the network using VMware vSAN or directly at an external storage array.

ONTAP Select can be configured to use the following types of VMware ESXi network datastores which are external to the hypervisor host:

- vSAN (Virtual SAN)
- VMFS
- NFS

vSAN datastores

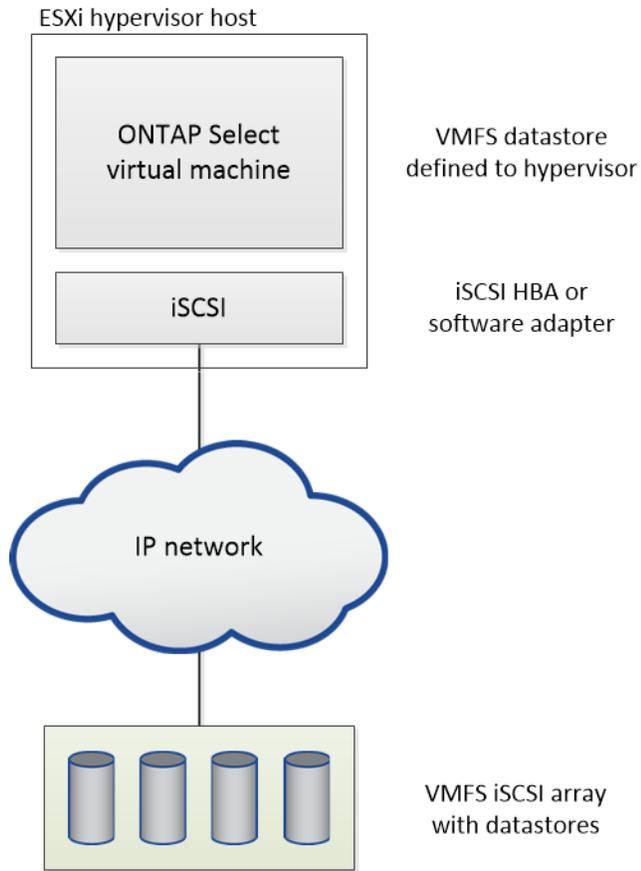
Every ESXi host can have one or more local VMFS datastores. Normally these datastores are only accessible to the local host. However, VMware vSAN allows each of the hosts in an ESXi cluster to share all of the datastores in the cluster as if they were local. The following figure illustrates how vSAN creates a pool of datastores that are shared among the hosts in the ESXi cluster.



VMFS datastore on external storage array

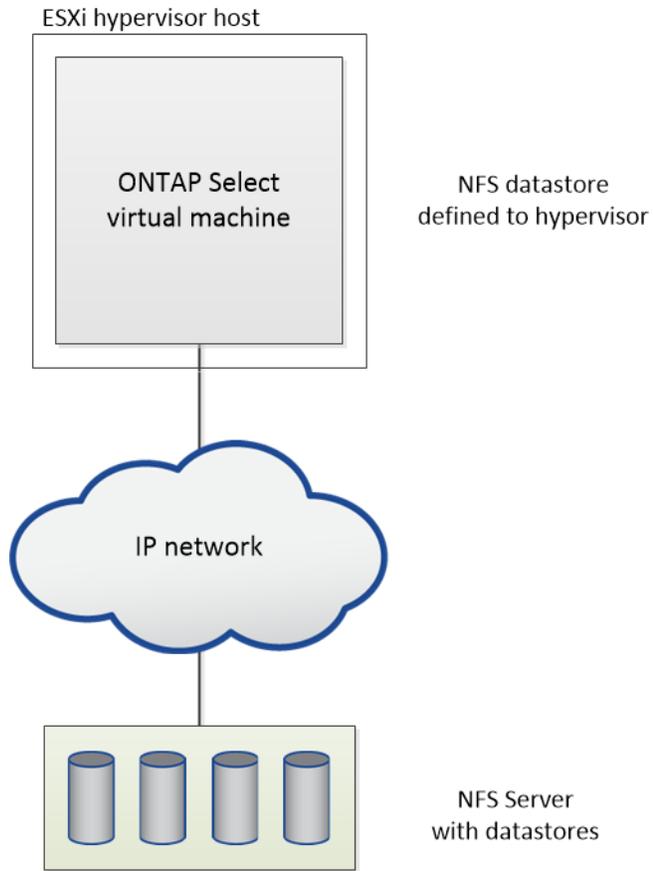
You can create a VMFS datastore residing on an external storage array. The storage is accessed using one of several different network protocols. The following figure illustrates a VMFS datastore on an external storage array accessed using the iSCSI protocol.

Note: ONTAP Select supports all external storage arrays described in the VMware Storage/SAN Compatibility Guide, including iSCSI, Fibre Channel, and Fibre Channel over Ethernet.



NFS datastore on external storage array

You can create an NFS datastore residing on an external storage array. The storage is accessed using the NFS network protocol. The following figure illustrates an NFS datastore on external storage that is accessed through the NFS server appliance.



Appendix B: Understanding the ONTAP Select networking environment

As part of preparing each of the host servers within an ONTAP Select cluster, you should understand the networking environment including the configuration options and requirements.

Note: You should review *ONTAP Select Product Architecture and Best Practices Technical Report* to learn more about how to configure the host networking.

Related concepts

[Appendix A: Understanding the ONTAP Select storage environment](#) on page 68

Related information

[NetApp Technical Report 4517: ONTAP Select Product Architecture and Best Practices](#)

General network concepts and characteristics

There are several general networking concepts that apply to the ONTAP Select environment. You should first be familiar with these general concepts before exploring the specific characteristics and options available with the single-node and multi-node clusters.

Physical networking

The physical network supports an ONTAP Select cluster deployment primarily by providing the underlying layer two switching infrastructure. The configuration related to the physical network includes both the hypervisor host and the broader switched network environment.

Host NIC options

Each ONTAP Select hypervisor host must be configured with either two or four physical ports. The exact configuration you choose depends on several factors, including:

- Whether the cluster contains one or multiple ONTAP Select hosts
- What hypervisor operating system is used
- How the virtual switch is configured
- Whether LACP is used with the links or not

Physical switch configuration

You must make sure that the configuration of the physical switches supports the ONTAP Select deployment. The physical switches are integrated with the hypervisor-based virtual switches. The exact configuration you choose depends on several factors. The primary considerations include the following:

- How will you maintain separation between the internal and external networks?
- Will you maintain a separation between the data and management networks?
- How will the layer two VLANs be configured?

Related concepts

Logical networking

Logical networking

ONTAP Select uses two different logical networks, separating the traffic according to type. Specifically, traffic can flow among the hosts within the cluster as well as to the storage clients and other machines outside of the cluster. The virtual switches managed by the hypervisors help support the logical network.

Internal network

With a multi-node cluster deployment, the individual ONTAP Select nodes communicate using an isolated “internal” network. This network is not exposed or available outside of the nodes in the ONTAP Select cluster.

Note: The internal network is only present with a multi-node cluster.

The internal network has the following characteristics:

- Used to process ONTAP intra-cluster traffic including:
 - Cluster
 - High Availability Interconnect (HA-IC)
 - RAID Synch Mirror (RSM)
- Single layer-two network based on a VLAN
- Static IP addresses are assigned by ONTAP Select:
 - IPv4 only
 - DHCP not used
 - Link-local address
- The MTU size is 9000 bytes

External network

The external network processes traffic between the nodes of an ONTAP Select cluster and the external storage clients as well as the other machines. The external network is a part of every cluster deployment and has the following characteristics:

- Used to process ONTAP traffic including:
 - Data (NFS, CIFS, iSCSI)
 - Management (cluster and node; optionally SVM)
 - Intercluster (optional)
- Optionally supports VLANs:
 - Data port group
 - Management port group
- IP addresses that are assigned based on the configuration choices of the administrator:
 - IPv4 or IPv6

- MTU size is 1500 bytes by default (can be adjusted)

The external network is present with clusters of all sizes.

Virtual machine networking environment

The hypervisor host provides several networking features.

ONTAP Select relies on the following capabilities exposed through the virtual machine:

- Virtual machine ports
There are six ports available for use by ONTAP Select. They are assigned and used based on several factors, including the size of the cluster.
- Virtual switch
The virtual switch (vSwitch) software within the hypervisor environment joins the ports exposed by the virtual machine with the physical Ethernet NIC ports. You must configure a vSwitch for every ONTAP Select host.

Single-node cluster deployment

ONTAP Select can be deployed as a single-node cluster. The single node includes a virtual switch that provides access to the external network.

Virtual machine ports

Each of the virtual machine ports handles a specific type of ONTAP Select traffic.

The ports are assigned as follows:

- Port e0a – Data and management
- Port e0b – Data and management

ONTAP LIFs

There are several logical interfaces used by the ONTAP Select node in a single-node cluster. Some of the LIFs are required, while others are optional based on your goals. The LIFs are created in one of two different ways.

Required LIFs assigned by the administrator

You must configure the following LIFs during an ONTAP Select deployment:

- Node management
There is one LIF per node, and the IP address you assign can be either IPv4 or IPv6
- Cluster management
There is one LIF per cluster, and the IP address you assign can be either IPv4 or IPv6.

These LIFs operate on the external network. Also note that while the use of an IPv6 address is possible, the creation of an IPv6 LIF by the ONTAP Select Deploy administration utility is not supported.

Optional LIFs assigned by the administrator

You can optionally configure several LIFs after an ONTAP Select deployment is completed. Using the System Manager or ONTAP CLI, you can configure the following LIFs:

- NAS data

You can configure one or more NAS data LIFs per SVM. Each IP address you assign can be either IPv4 or IPv6.

- SAN data
You can configure one or more SAN (that is, iSCSI) data LIFs per SVM. Each IP address you assign can be either IPv4 or IPv6.
- SVM management
There is one management LIF per SVM and the IP address you assign can be either IPv4 or IPv6.
- Intercluster management
You can create one or more intercluster management LIFs per node. The IP addresses you assign can be either IPv4 or IPv6.

These LIFs operate on the external network.

Four-node cluster deployment

ONTAP Select can be deployed as a four-node cluster. Each node in the cluster includes a virtual switch that provides access to the network. The nodes communicate directly with each other using the cluster internal network.

Virtual machine ports

Each of the virtual machine ports handles a specific type of ONTAP Select traffic. A specific port is associated with either the internal network or the external network, but not both.

The ports are assigned as follows:

- Port e0a – Data and management
- Port e0b – Data and management
- Port e0c – Cluster
- Port e0d – Cluster
- Port e0e – RSM
- Port e0f – HA-IC

Note: The first two ports are associated with the external network, while the last four ports are associated with the internal cluster network.

ONTAP LIFs

There are several logical interfaces used by each ONTAP Select node in a four-node deployment. Some of the LIFs are required, while others are optional based on your goals. The LIFs are created in one of three different ways.

Required LIFs automatically assigned by ONTAP Select

The following LIFs are automatically generated by ONTAP Select during a deployment:

- Cluster
There are two cluster LIFs per node. Static link-local IP addresses are generated and assigned to virtual machine ports e0c and e0d.
- RAID Sync Mirror

There is one RSM LIF per node. A static link-local IP address is generated and assigned to virtual machine port e0e.

- High Availability Interconnect
There is one HA-IC LIF per node. A static link-local IP address is generated and assigned to virtual machine port e0f.

These LIFs operate on the internal network.

Required LIFs assigned by the administrator

You must configure the following LIFs during an ONTAP Select deployment:

- Node management
There is one LIF per node and the IP address you assign can be either IPv4 or IPv6.
- Cluster management
There is one LIF per cluster, and the IP address you assign can be either IPv4 or IPv6.

These LIFs operate on the external network. Also note that while the use of an IPv6 address is possible, the creation of an IPv6 LIF by the ONTAP Select Deploy administration utility is not supported.

Optional LIFs assigned by the administrator

You can optionally configure several LIFs using the System Manager or ONTAP CLI after an ONTAP Select deployment is completed. Unless noted, you can assign either an IPv4 or IPv6 address. You can configure the following LIFs:

- NAS data
You can configure one or more NAS data LIFs per SVM.
- SAN data
You can configure one or more SAN (that is, iSCSI) data LIFs per SVM.
- SVM management
There is one management LIF per SVM.
- Intercluster management
You can create one or more intercluster management LIFs per node.

These LIFs operate on the external network.

Where to find additional information

After you deploy an ONTAP Select cluster, you should see the additional available resources to help manage and utilize the deployment.

ONTAP Select resources

- [NetApp ONTAP Select Resources](#)
Provides documentation, videos, and other helpful links needed to plan, deploy, and support an ONTAP Select cluster.

ONTAP 9 resources

- [ONTAP 9 Documentation Center](#)
Provides all of the documentation for ONTAP 9.
- [NetApp ONTAP Resources](#)
Provides documentation and other helpful links needed to plan, administer, and support ONTAP 9.

NetApp resources

- [NetApp Support](#)
Access troubleshooting tools, documentation, and technical support assistance.
- [NetApp Interoperability Matrix Tool](#)
Access requirements and compatibility information related to using ONTAP Select.
- [NetApp library of technical reports and white papers](#)
Access technical reports, white papers, and other documents.

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