



ONTAP® Select 9

Installation and Cluster Deployment Guide for VMware

Using ONTAP Select Deploy 2.11

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Deciding whether to use the Installation and Cluster Deployment Guide for VMware

This guide describes how to plan, deploy, and support an ONTAP Select cluster with a NetApp purchased license on VMware ESXi.

To deploy an ONTAP Select cluster with an evaluation license, you should see the 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 9.5 Release Notes*](#)

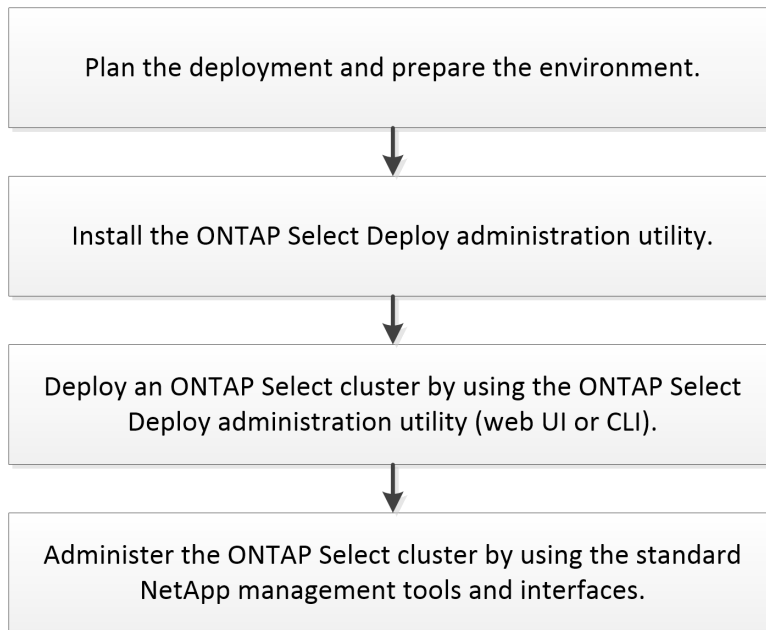
[*NetApp Technical Report 4517: ONTAP Select Product Architecture and Best Practices*](#)

[*ONTAP Select 9 Quick Start Guide: Deploying an Evaluation Cluster on VMware*](#)

[*ONTAP Select 9 Installation and Cluster Deployment Guide for KVM*](#)

ONTAP Select installation and deployment workflow

You can use the ONTAP Select installation and deployment workflow to deploy and administer an ONTAP Select cluster.



Getting started with ONTAP Select

ONTAP Select is a software-only version of ONTAP that is deployed as a virtual machine on a hypervisor host. ONTAP Select complements the suite of mainstream hardware-based ONTAP offerings as well as other software-only options, including ONTAP Cloud. Before using ONTAP Select, you should understand the key characteristics, operational components, and features of the software.

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 user interface 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, four, six, or eight nodes. Multi-node clusters always contain one or more HA pairs. For example, a four-node cluster consists of two HA pairs. A two-node cluster consists of one HA pair. A 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

Every 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. If you deploy a cluster in evaluation mode, the evaluation license is automatically generated and applied by the ONTAP Select Deploy administration utility. For more information about evaluation deployments, see the quick start guide.

If you deploy a cluster in a production environment, you must purchase a license, a process which involves choosing the licensing model and storage capacity.

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

Capacity tiers licensing model

The capacity tiers licensing model is the original option when licensing storage for an ONTAP Select deployment. It is based on the ONTAP model used with NetApp AFF and

FAS. A separate license is required for each node. The storage capacity is locked to the node and perpetual (no renewal required).

Capacity pools licensing model

The capacity pools licensing model is introduced with ONTAP Select 9.5 using Deploy 2.10. A separate license is required for each storage capacity pool. The capacity pool license is locked to a License Manager instance (that is effectively a Deploy instance) and must be renewed based on the terms of your purchase. You can license and use any number of capacity pools in your organization. However, because the capacity pools are shared by the ONTAP Select nodes, fewer licenses are typically required than when using capacity tiers licensing.

License Manager

The License Manager is a new software component which supports capacity pools licensing. It is currently part of the Deploy administration utility. LM leases storage to the ONTAP Select nodes from the shared pools it manages. The *License Lock ID* is a numeric string which uniquely identifies each LM instance, and therefore each Deploy instance. You must use both the capacity pool license serial number and LLID to generate a license file.

License capacity platform levels

There are two capacity platform levels or tiers available when you purchase a license for an ONTAP Select deployment.

- Standard
- Premium

The premium offering enhances the standard offering by providing support for SSD drives (in addition to HDD drives), software RAID (in addition to hardware RAID), and a larger virtual machine configuration.

When configuring a node 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, see *Planning to deploy ONTAP Select*.

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*.

Cluster MTU

Cluster MTU is a feature that allows you to configure the MTU size used on the internal network for an ONTAP Select multi-node cluster. The Deploy administration utility adjusts the MTU size as you configure the HA pairs to accommodate your networking environment. You can also manually set the value.

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.

Node re-hosting

When you deploy a 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.

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.

MetroCluster SDS

MetroCluster SDS is a feature that provides another configuration option when deploying a two-node ONTAP Select cluster. Unlike a typical two-node ROBO deployment, with MetroCluster SDS the nodes in the HA pair can be separated by a much greater distance. This physical separation enables several additional use cases, such as disaster recovery. You must have a premium license to use MetroCluster SDS. In addition, the network between the nodes must support a minimum latency requirement.

Credential store

The Deploy credential store is a secure database holding account credentials. It is used primarily during authentication when registering hypervisor hosts as part of creating a new cluster. You should refer to *Authentication using the credential store* for more information about the credential store when planning an ONTAP Select deployment.

Storage efficiency

ONTAP Select provides storage efficiency options that are similar to the storage efficiency options present on FAS and AFF arrays. Conceptually, ONTAP Select with direct-attached storage (DAS) SSDs (using a premium license) is similar to an AFF array. Configurations using DAS with HDDs should be considered similar to a FAS array. The main difference between the two configurations is that ONTAP Select with DAS SSDs supports inline aggregate level deduplication and aggregate level background deduplication. The remaining storage efficiency options are available for both configurations.

Beginning with ONTAP Select 9.5, vNAS default configurations enable a write optimization feature known as single instance data logging (SIDL). With the current ONTAP Select release, the ONTAP storage efficiency policies are not qualified with SIDL enabled. SIDL can be disabled for each aggregate, in which case the background storage efficiency policies are supported for the aggregate. See the *ONTAP Select Product Architecture and Best Practices Technical Report (TR-4517)* for more information.

Cluster refresh

After creating a cluster, you can make changes to the cluster or virtual machine configuration outside of the Deploy utility using the ONTAP or hypervisor administration tools. You can also migrate a virtual machine which changes its configuration. If these configuration changes occur, the Deploy utility is not automatically updated and can become out of sync with the state of the cluster. You can use the *cluster refresh* feature to update the Deploy configuration database. Cluster refresh is available through the Deploy web user interface, CLI management shell, and REST API.

Software RAID

When using direct-attached storage (DAS), RAID functionality is traditionally provided through a local hardware RAID controller. You can also configure a node to use *software RAID* where the ONTAP Select node provides the RAID functionality. When configuring an ONTAP Select node to use software RAID, a hardware RAID controller is no longer needed.

ONTAP Select image install

Beginning with ONTAP Select Deploy 2.8, the Deploy administration utility only contains a single version of ONTAP Select. The version included is the most current available at the time. For example, Deploy 2.8 contains ONTAP Select 9.4. The *ONTAP Select image install* feature allows you to add earlier versions of ONTAP Select to your instance of the Deploy utility which can then be used to deploy ONTAP Select clusters. See *Adding an ONTAP Select image to the Deploy utility* for more information.

Attention: You should only add an ONTAP Select image with a version that is earlier than the original version included with your instance of the Deploy utility. For example, Deploy 2.8 contains ONTAP Select 9.4. In this case, you can add ONTAP Select 9.3 or earlier. Adding later versions of ONTAP Select as they become available is not a supported configuration.

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 97

[Appendix B: Understanding the ONTAP Select networking environment](#) on page 103

[Planning to deploy ONTAP Select](#) on page 17

[Authentication using the credential store](#) on page 19

Related information

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

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. The following ROBO configurations are supported on VMware ESXi:

- Two-node cluster with HA capability
- Single-node cluster

Because all VMware vSphere licenses are supported, you can choose the vSphere Remote Office Branch Office Standard or Advanced license instead of the Enterprise or Enterprise Plus license.

Dedicated versus collocated

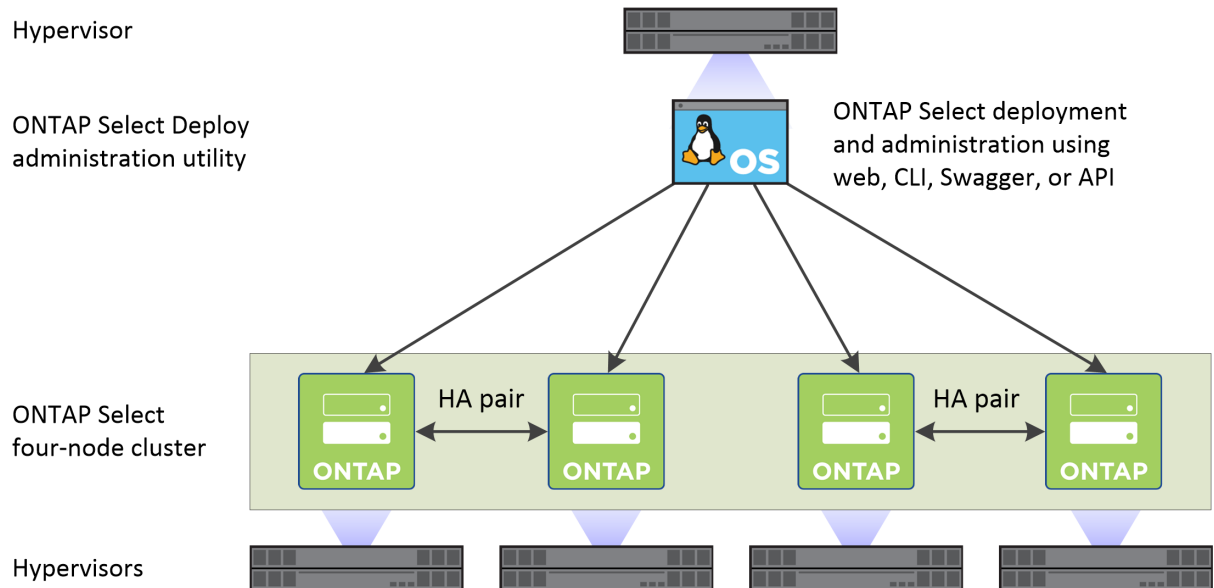
From a high level, you can deploy ONTAP Select in two different ways regarding the workload on the hypervisor host servers.

- **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 consumption-based licensing model. You must purchase a license with storage capacity for each node or shared capacity pool when deploying an ONTAP Select cluster in a production environment. Using the Deploy utility, you must apply the license files which establish the storage capacity for the cluster nodes.

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.

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 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.

REST web services API

The REST 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 REST 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.

ONTAP Select online documentation web page

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

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

You can access the online documentation 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/ui`

Related information

[*ONTAP Select 9 Deploy API Guide*](#)

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 33

[Appendix A: Understanding the ONTAP Select storage environment](#) on page 97

[Appendix B: Understanding the ONTAP Select networking environment](#) on page 103

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, four, six, or eight 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 multi-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.

Attention: You should not directly modify the configuration of an ONTAP Select virtual machine unless directed to do so by NetApp support. A virtual machine should only be configured and modified through the Deploy administration utility. Making changes to an ONTAP Select virtual machine outside of the Deploy utility without assistance from NetApp support can cause the virtual machine to fail and render it unusable.

Hypervisor independent

Both ONTAP Select and the ONTAP Select Deploy administration utility are hypervisor-independent. The following hypervisors are supported for both:

- VMware ESXi
- Kernel-based Virtual Machine (KVM)

Note: Refer to the hypervisor-specific planning information and release notes for additional details regarding the supported platforms.

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. You have complete flexibility when pairing the two:

- Deploy utility running on VMware ESXi can create and manage ONTAP Select clusters on either VMware ESXi or KVM
- Deploy utility running on KVM can create and manage ONTAP Select clusters on either VMware ESXi or KVM

One or more instances of ONTAP Select node per host

Each ONTAP Select node runs as a dedicated virtual machine. You can create multiple nodes on the same hypervisor host, with the following restrictions:

- Multiple nodes from a single ONTAP Select cluster cannot run on the same host. All the nodes on a specific host must be from different ONTAP Select clusters.
- You must use external storage.
- If you use software RAID, you can only deploy one ONTAP Select node on the host.

Hypervisor consistency for the nodes within a cluster

All of the hosts within an ONTAP Select cluster must run on the same version and release of the hypervisor software.

Number of physical ports on each host

You must configure each host to use one, two, or four physical ports. Although you have flexibility when configuring the network ports, you should follow these recommendations where possible:

- A host in a single-node cluster should have two physical ports.
- Each host in a multi-node cluster should have four physical ports

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 a cluster peering relationship 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.

RAID type

When using direct-attached storage (DAS) on ESXi, you should decide whether to use a local hardware RAID controller or the software RAID feature included with ONTAP Select. If you use software RAID, see *Software RAID requirements* for more information.

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. Refer to *Storage capacity restrictions* for more information.

Licensing model for production deployment

You must select the *capacity tiers* or *capacity pools* licensing model for each ONTAP Select cluster deployed in a production environment. Review *Licensing ONTAP Select* for more information.

Related concepts

[Licensing ONTAP Select](#) on page 36

Related references

[Storage capacity restrictions](#) on page 24

Authentication using the credential store

The ONTAP Select Deploy credential store is a database holding account information. Deploy uses the account credentials to perform host authentication as part of cluster creation and management. You should be aware of how the credential store is used as part of planning an ONTAP Select deployment.

Note: The account information is stored securely in the database using the AES encryption algorithm and SHA-256 hashing algorithm.

Types of credentials

The following types of credentials are supported:

- host
Used to authenticate a hypervisor host as part of deploying an ONTAP Select node directly to ESXi or KVM
- vcenter
Used to authenticate a vCenter server as part of deploying an ONTAP Select node to ESXi when the host is managed by VMware vCenter

Access

The credential store is accessed internally as part of performing normal administrative tasks using Deploy, such as adding a hypervisor host. You can also manage the credential store directly through the Deploy web user interface and CLI.

Related tasks

[Adding an account to the credential store](#) on page 63

Preparing for a MetroCluster SDS deployment

MetroCluster SDS is a configuration option when creating a two-node ONTAP Select cluster. It is similar to a Remote Office/Branch Office (ROBO) deployment, however the distance between the two nodes can be up to 10 km. This enhanced two-node deployment provides additional use case scenarios. You should be aware of the requirements and restrictions as part of preparing to deploy MetroCluster SDS.

Before deploying MetroCluster SDS, you must assure that the following requirements are met.

Licensing

Each node must have a premium ONTAP Select license.

Hypervisor platforms

MetroCluster SDS can be deployed on the same VMware ESXi and KVM hypervisors as supported for a two-node cluster in a ROBO environment.

Network configuration

Layer 2 connectivity is required between the participating sites. Both 10GbE and 1GbE are supported, including the following configurations:

- 1 x 10GbE
- 4 x 1GbE

Note: The data serving ports and interconnect ports must be connected to the same first switch.

Latency between the nodes

The network between the two nodes must support a mean latency of 5 ms with an additional 5 ms periodic jitter. Before deploying the cluster, you must test the network using the procedure described in the *ONTAP Select Product Architecture and Best Practices* technical report.

Mediator service

As with all two-node ONTAP Select clusters, there is a separate mediator service contained in the Deploy virtual machine that monitors the nodes and assists in managing failures. With the enhanced distance available with MetroCluster SDS, this creates three distinct sites in the network topology. Latency on the link between the mediator and a node should be 125 ms round-trip or less.

Storage

Direct-attached storage (DAS) is supported using either HDD and SSD disks. vNAS is also supported, including external storage arrays and vSAN in a VMware environment.

Note: When deploying MetroCluster SDS, you cannot use vSAN in a distributed or "stretched" topology.

Static IP address assigned to Deploy

You must assign a static IP address to the Deploy administration utility. This requirement applies to all Deploy instances that manage one or more ONTAP Select two-node clusters.

Related information

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

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.

Note: You should refer to the current release notes to review any additional known restrictions or limitations.

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.

Software compatibility

ONTAP Select can be deployed on the following hypervisors:

- VMware ESXi 6.0 GA (build 2494585 or greater)
- VMware ESXi 6.5 U2 (build 8294253 or greater)
- VMware ESXi 6.7 GA (build 8169922 or greater)

Note: NetApp supports ONTAP Select on these versions of ESXi as long as VMware also continues to support the same versions.

Upgrading to VMware ESXi 6.5 U2 or later

If you currently have ONTAP Select deployed on VMware ESXi 6.5 U1, you should upgrade to ESXi 6.5 U2 or later as soon as possible. Using ESXi 6.5 U1 can expose you to a virtual machine failure due to a known VMware bug.

VMware vCenter and standalone ESXi hosts

If an ESXi hypervisor host is managed by a vCenter server, you must register the host to the Deploy administration utility using the vCenter credentials. You cannot register the host as a standalone host using the ESXi credentials.

Related information

[*ONTAP Select 9.5 Release Notes*](#)

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 Xeon processors for Server (see [Intel Xeon Processors](#) for more information)
- Ethernet network ports
 - 4 x 10GbE (recommended)
 - 2 x 10GbE
 - 1 x 10GbE
 - 4 x 1GbE (only for a two-node ROBO cluster)
 - 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, as well as software RAID. 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 60 internal HDD (NL-SAS, SATA, 10K SAS)	<ul style="list-style-type: none"> • 4 to 60 internal SSD • 8 to 60 internal HDD (NL-SAS, SATA, 10K SAS)
ONTAP Select Deploy instance type	Small	Small or medium

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 requires local physical drives when using a hardware RAID controller or the software RAID capability provided with ONTAP Select. If you use the ONTAP Select vNAS solution to access external storage, a local RAID controller and software RAID capability are not used.

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 should be configured as a single RAID group; multiple RAID controllers can be used if needed:
 - 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 97

Software RAID requirements

When deploying an ONTAP Select cluster on the VMware ESXi hypervisor, you can utilize the software RAID capability provided by ONTAP Select instead of a local hardware RAID controller. There are several requirements and restrictions you must be aware before deploying a cluster using software RAID.

General requirements

The environment for a software RAID deployment on VMware ESXi must meet the following core requirements:

- VMware ESXi version:
 - ESXi 6.5 U2 (build 8294253) or later
 - ESXi 6.7 GA (build 8169922) or later
- ONTAP Select 9.5 or later
- ONTAP Select Deploy 2.10 or later
- New ONTAP Select clusters only

Note: You must deploy a new cluster with ONTAP Select 9.5 or later, using the Deploy administration utility. You cannot use software RAID with an existing node that has been upgraded from a previous version to ONTAP Select 9.5.

- ONTAP Select premium license
- Local SSD drives only
- Separation of system disks from the root and data aggregates
- No hardware RAID controller on the host

Note: If a hardware RAID controller is present, see the *ONTAP Select Product Architecture and Best Practices Technical Report (TR-4517)* for additional configuration requirements.

- VMware VMotion, HA, and DRS are not supported

ONTAP Select node configuration

You must configure each ONTAP Select node and hypervisor host as follows to separate the system disks from the root and data aggregates:

- Create a system storage pool
You must create a storage pool for the ONTAP Select system data. You must attach the storage pool as part of configuring the ONTAP Select node.
- Attach necessary physical disks
The hypervisor host must have the required SSD disks attached and available for use by the ONTAP Select virtual machine. These drives hold the root and data aggregates. You must attach the storage disks as part of configuring the ONTAP Select node.

Storage capacity restrictions

As part of planning an ONTAP Select deployment, you should be aware of the restrictions related to storage allocation and use.

The most important storage restrictions are presented below. You should also review the *NetApp Interoperability Matrix Tool* for more detailed information.

Calculating raw storage capacity

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. You should consider this when allocating capacity.

Minimum storage capacity for a single-node cluster

The minimum size of the storage pool allocated for the node in a single-node cluster is:

- Evaluation: 500 GB
- Production: 1.0 TB

The minimum allocation for a production deployment consists of 1 TB for user data, plus approximately 266 GB used by various ONTAP Select internal processes, which is considered required overhead.

Minimum storage capacity for a multi-node cluster

The minimum size of the storage pool allocated for each node in a multi-node cluster is:

- Evaluation: 1.9 TB

- Production: 2.0 TB

The minimum allocation for a production deployment consists of 2 TB for user data, plus approximately 266 GB used by various ONTAP Select internal processes, which is considered required overhead.

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

Storage capacity and multiple storage pools

You can configure each ONTAP Select node to use up to 400 TB of storage when using local direct-attached storage, VMware vSAN, or external storage arrays. However, a single storage pool has a maximum size of 64 TB when using direct-attached storage or external storage arrays. Therefore, if you plan to use more than 64 TB of storage in these situations, you must allocate multiple storage pools as follows:

- Assign the initial storage pool during the cluster creation process
- Increase the node storage by allocating one or more additional storage pools

Note: A 2% buffer is left unused in each storage pool and does not require a capacity license. This storage is not used by ONTAP Select, unless a capacity cap is specified. If a capacity cap is specified, then that amount of storage will be used unless the amount specified falls in the 2% buffer zone. The buffer is needed to prevent occasional errors that occur when attempting to allocate all of the space in a storage pool.

Storage capacity and VMware vSAN

When using VMware vSAN, a datastore can be larger than 64 TB. However, you can only initially allocate up to 64 TB when creating the ONTAP Select cluster. After the cluster is created, you can allocate additional storage from the existing vSAN datastore. The vSAN datastore capacity that can be consumed by ONTAP Select is based on the VM storage policy set.

Related information

[*NetApp Interoperability Matrix Tool*](#)

ONTAP Select vNAS requirements

ONTAP Select vNAS is a solution allowing the ONTAP Select datastores 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 be used with an ONTAP Select cluster of any size.

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 cluster with ONTAP Select vNAS:

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

Note: These VMware features are supported with single-node and multi-node ONTAP Select clusters. When deploying a multi-node cluster, you should make sure that two or more nodes from the same cluster do not run on the same hypervisor host.

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. If you use an NFS datastore, there is no need to create a separate VMFS datastore. 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 76

Related information

[NetApp Interoperability Matrix Tool](#)

ONTAP Select two-node cluster with HA

You can 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 other cluster node configurations. 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.

Static IP address assigned to Deploy

You must assign a static IP address to the Deploy administration utility. This requirement applies to all Deploy instances that manage one or more ONTAP Select two-node clusters.

Related concepts

[Recovering the Deploy utility for a two-node cluster](#) on page 76

Related information

[ONTAP Select 9.5 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 ONTAP 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 support

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 in one of the following ways to provide storage protection:

- Shared external storage using VMware HA
- VMware vSAN

Note: If you use vSAN, you must have a VMware vSAN ROBO license.

Related concepts

[ONTAP Select two-node cluster with HA](#) on page 26

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*.

Upgrading to VMXNET3

Beginning with ONTAP Select 9.5 using Deploy 2.10, VMXNET3 is the default network driver included with new cluster deployments on VMware ESXi. If you upgrade an existing ONTAP Select node to version 9.5, the driver is not automatically upgraded. You must manually upgrade to VMXNET3. You should contact NetApp support for assistance with the upgrade.

Cluster MTU

A separate internal network is used to connect the ONTAP Select nodes in a multi-node cluster. Typically the MTU size for this network is 9000. However, there are situations where this MTU size is too large for the network connecting the ONTAP Select nodes. To accommodate the smaller frames, the MTU size used by ONTAP Select on the internal network can be in the range of 7500-9000 bytes.

The MTU size is displayed in the **Cluster Details** section of the cluster creation page. The value is determined by the Deploy administration utility as follows:

1. Initial default of 9000.
2. As you add the hosts and networks for the HA pairs, the MTU value is reduced as needed, based on the configuration of the vSwitches in the network.
3. The final cluster MTU value for the cluster is set after you have added all the HA pairs and are ready to create the cluster.

Note: You can manually set the cluster MTU value if needed, based on the design of your network.

Two-NIC host with standard vSwitch

In order to improve ONTAP Select performance in a two-NIC configuration, you should isolate the internal and external network traffic using two port groups. This recommendation applies to the following specific configuration:

- ONTAP Select multi-node cluster
- Two NICs (NIC1 and NIC2)
- Standard vSwitch

In this environment, you should configure the traffic using two port groups as follows:

Port group 1

- Internal network (cluster, RSM, and HA-IC traffic)
- NIC1 is active
- NIC2 is standby

Port group 2

- External network (data and management traffic)
- NIC1 is standby
- NIC2 is active

See the *ONTAP Select Product Architecture and Best Practices Technical Report (TR-4517)* for more information about two-NIC deployments and other advanced networking configurations.

Network traffic requirements

You must make sure that your firewalls are configured properly to allow the network traffic to flow among the various participants in an ONTAP Select deployment environment.

Participants

There are several participants or entities that exchange network traffic as part of an ONTAP Select deployment. These are introduced, and then used in the summary description of the network traffic requirements.

- Deploy
ONTAP Select Deploy administration utility
- vSphere/ESXi
Either a vSphere server or ESXi host, depending on how the host is managed in your cluster deployment
- Hypervisor server
ESXi hypervisor host
- OTS node
An ONTAP Select node
- OTS cluster
An ONTAP Select cluster
- Admin WS
Local administrative workstation

Summary of network traffic requirements

The following table describes the network traffic requirements for an ONTAP Select deployment.

Protocol / Port	Direction	Description
TLS (443)	Deploy to vSphere/ESXi	VMware VIX API
902	Deploy to vSphere/ESXi	VMware VIX API
ICMP	Deploy to hypervisor server	Ping

Protocol / Port	Direction	Description
ICMP	Deploy to each OTS node	Ping
SSH (22)	Admin WS to each OTS node	Administration
TLS (443)	Deploy to OTS nodes and clusters	Access ONTAP
iSCSI (3260)	Each OTS node to Deploy	Mediator / Mailbox disk

Related concepts

[Appendix B: Understanding the ONTAP Select networking environment](#) on page 103

[Host configuration and preparation checklist](#) on page 47

Related tasks

[Confirming network connectivity among ONTAP Select nodes using the CLI](#) on page 63

Related information

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

VMware vCenter plug-in

When deploying ONTAP Select in a VMware environment, you can use the VMware vCenter plug-in instead of the Deploy administration utility.

The VMware vCenter plug-in is packaged with the Deploy administration utility. To use the plug-in, you must install the Deploy utility and then use the Deploy user interface to install the plug-in to your vCenter server. After the plug-in is installed, you can use the vSphere web user interface to deploy and administer ONTAP Select clusters. Aside from managing the plug-in itself (installing, removing, updating), the functionality provided with the plug-in is equivalent to the Deploy utility user interface.

The vCenter plug-in is available with Deploy 2.11.2 and later. You should review the *ONTAP Select VMware vCenter Plug-in User Guide* for the requirements and restrictions as well as information about installing and using the plug-in.

Related information

[ONTAP Select 9 VMware vCenter Plug-in User Guide](#)

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

Storage disks

List of disks if using software RAID

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 define a vCenter server account and associate it with a role containing the necessary administrative privileges. The following minimum administrative privileges are needed to create and manage an ONTAP Select cluster:

Datastore

- Allocate space
- Browse datastore
- Low level file operations
- Update virtual machine files
- Update virtual machine metadata

Host

Configuration

- Change SNMP settings
- Network configuration
- System management

Local operations

- Create virtual machine
- Delete virtual machine
- Reconfigure virtual machine

Network

Assign network

Virtual machine

- **Configuration**
All privileges in the category
- **Interaction**
All privileges in the category
- **Inventory**
All privileges in the category
- **Provisioning**
All privileges in the category

vApp

All privileges in the category

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 17

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: In 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 smaller failure domains.

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.

Note: One instance of the Deploy utility can administer up to 400 ONTAP Select nodes or 100 clusters.

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)

Network connectivity

You must make sure that the ONTAP Select Deploy virtual machine network interface is configured and has a single management IP address. You can use DHCP to dynamically assign an IP address or manually configure a static IP address.

Depending on your deployment decisions, the Deploy VM must be able to connect to the vCenter server, ESXi hypervisor hosts, and ONTAP Select nodes it manages. You must configure your firewalls to allow the required traffic.

Deploy uses the VMware VIX API to communicate with the vCenter server and ESXi hosts. Initially, it establishes a connection using SOAP over SSL on TCP port 443. After this, a connection is opened using SSL on port 902. In addition, Deploy issues PING commands to verify there is an ESXi host at the IP address you specify.

Deploy must also be able to communicate with the ONTAP Select node and cluster management IP addresses using the following protocols:

- PING command (ICMP)
- SSH (port 23)
- SSL (port 443)

Support for IP version 4

ONTAP Select Deploy only supports IP version 4 (IPv4). IP version 6 (IPv6) is not supported. This restriction affects ONTAP Select in the following ways:

- You must assign an IPv4 address to the management LIF of the Deploy virtual machine.
- Deploy cannot create ONTAP Select nodes configured to use IPv6 on the ONTAP LIFs.

VMware vCenter language restriction

If you use ONTAP Select Deploy to create a cluster running on ESXi with vCenter on a Windows Server, you must use an English language version. ONTAP Select Deploy does not support vCenter on non-English versions of Windows.

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

Licensing ONTAP Select

You can create an ONTAP Select cluster with a temporary evaluation license or purchase a license for production deployments. You should understand the available licensing options and processes before deploying an ONTAP Select cluster.

Attention: ONTAP Select enforces several restrictions related to storage allocation and use. Before you deploy an ONTAP Select cluster or purchase a license, you should be familiar with these restrictions. Review *Storage capacity restrictions* for more information.

Related references

[Storage capacity restrictions](#) on page 24

Licensing options for a deployment

A license is required for every ONTAP Select node, each running as a virtual machine. The details of how a license is acquired and applied vary based on the deployment type and licensing model.

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 as part of an evaluation deployment.

Licensing characteristics

The ONTAP Select evaluation license has the following characteristics:

- A purchased license with storage capacity is not required
- The node serial number is twenty digits and automatically generated by ONTAP Select Deploy (that is you do not acquire it directly from NetApp)
- The evaluation period provided by the license can be up to 90 days
- The maximum storage allocated by each node is the same as a production license

Upgrading to a production license

You can upgrade an ONTAP Select evaluation cluster to use a production license. You should be aware of the following restrictions:

- You must use the Deploy administration utility to perform the license upgrade
- License upgrade is only supported with ONTAP Select 9.5P1 using Deploy 2.11 or later
- A capacity tier license can be used, however capacity pools licensing is not supported
- Each node must have enough storage allocated to support the minimum required for a production license, based on the cluster size

See *Converting an evaluation license to a production license* for more information.

Related tasks

[Converting an evaluation license to a production license](#) on page 89

Related references

[Storage capacity restrictions](#) on page 24

Purchased license

After you determine that ONTAP Select is suitable for your organization, you can purchase the licenses needed to support a production deployment. You must choose either the capacity tiers or capacity pools licensing model as well as the storage capacity for each deployment.

Common licensing characteristics

The *capacity tiers* and *capacity pools* licensing models are very different in several respects. However, the two licensing models share several common characteristics, including:

- You must purchase one or more licenses as needed when deploying ONTAP Select in a production environment.
- The storage capacity for a license is allocated in 1 TB increments.
- The storage capacity identifies the raw capacity and corresponds to the total allowable size of the data disks available to the ONTAP Select virtual machine.
- Both the standard and premium performance tiers are supported.
- You should contact your NetApp account team or partner for assistance as needed when acquiring the necessary licenses.
- You must upload the license files to the Deploy administration utility, which then applies the licenses based on the licensing model.
- After installing and applying a license, you can add additional capacity by contacting your NetApp account team or partner to procure an updated license.
- Both nodes in an HA pair must have the same storage and license capacity.
- An ONTAP Select node that is initially deployed with a purchased license cannot be converted to an evaluation license.

Capacity tiers licensing model

There are several characteristics unique to the capacity tiers licensing model, including:

- You must purchase a license for each ONTAP Select node.
- Each capacity tier license has a storage capacity and is locked to a specific node.
- A nine-digit license serial number is generated by NetApp for each ONTAP Select node.
- The storage allocated to a node is perpetual (no renewal required).
- The node serial number is nine digits and equal to the license serial number.
- You can apply the license file during cluster deployment or within 30 days after creating a cluster.

Capacity pools licensing model

There are several characteristics unique to the capacity pools licensing model, including:

- You must purchase a license for each shared capacity pool.
- Each capacity pool license has a storage capacity and is locked to a specific License Manager instance.

- A nine-digit license serial number is generated by NetApp for each capacity pool.
- The storage allocated to a capacity pool is valid only for a specific time based on the purchase (renewal required).
- The node serial number is twenty digits and is generated by the License Manager based on the capacity pool license serial number.
- Each node automatically leases storage capacity for its local data aggregates from a shared capacity pool.

For more details on the capacity pools licensing model, see *Understanding the capacity pools licensing model*.

Related concepts

[Understanding the capacity pools licensing model](#) on page 40

Standard and premium capacity offerings for a purchased license

You can purchase an ONTAP Select capacity tier or capacity pool license in one of two platform levels or tiers. The capabilities provided by the standard and premium offerings differ in several aspects.

Standard capacity

The standard capacity offering provides the following capabilities:

- Instance type
Small instance type only.
- Drive type
Hard disk drives (HDD) only.
- RAID type
Local hardware RAID controller only.

Premium capacity

The premium capacity offering provides the following capabilities:

- Instance type
Small or medium instance type.
- Drive type
Hard disk drives (HDD) or Solid state drives (SSD).
- RAID type
Local hardware RAID controller or software RAID.

Related references

[Requirements related to the VMware environment](#) on page 21

Understanding license enforcement

When you deploy an ONTAP Select cluster, the storage capacity associated with the license is enforced by ONTAP Select. You should understand how license capacity and duration are enforced before deploying a cluster or purchasing a license.

Calculating storage allocation

As a first step in enforcing storage capacity, ONTAP Select must determine how much storage is in use or attempting to be allocated at a node. Only the disks or disk partitions actually being used with an ONTAP data aggregate are included. There might be other storage in a storage pool that is not used or cannot be used as part of a data aggregate, and is therefore not included in the calculation. For example, the spare or parity disks used with software RAID are not included in the storage calculation.

License capacity enforcement by ONTAP Select

Every time the ONTAP Select administrator attempts to create, expand, or change a data aggregate, the updated storage allocation is tested against the node's capacity limit. If the target exceeds the capacity limit, the following actions are taken based on the type of license in use:

- Capacity tier license
The aggregate operation fails.
- Capacity pool license
The node requests a new lease from the shared pool with a larger capacity limit. The aggregate operation fails if the larger capacity cannot be obtained.
- Evaluation license
The aggregate operation fails.

License capacity enforcement by the ONTAP Select Deploy administration utility

In addition to the enforcement by the ONTAP Select node, the Deploy utility also enforces the capacity limit when creating a cluster or updating the storage configuration of an existing cluster. The license enforcement by Deploy is only active when a node uses the capacity tiers licensing model with a local hardware RAID controller.

License duration enforcement by ONTAP Select

A license can expire and go out of compliance in the following situations:

- Capacity pool license
The license for a shared capacity pool expires based on the terms of the purchase. For example, a license might expire after one year. If the license is not renewed, the capacity pool goes out of compliance.
- Capacity pool lease
The lease for a data aggregate can last between one hour and several days depending on the user configuration (default lease duration is 24 hours). If a new lease is not obtained, the data aggregate goes out of compliance.
- Evaluation license
An evaluation license can remain valid for up to 90 days, after which it expires and goes out of compliance.

When a license or lease expires and the storage goes out of compliance, you can still access the associated data. However, if the node is shut down or the data aggregated is moved offline, attempts to reuse the storage fail.

Note: A capacity tier license is perpetual with no expiration or renewal.

Understanding the capacity pools licensing model

The capacity pools licensing model is available with ONTAP Select 9.5 using Deploy 2.10 and later. When using this licensing model, you should understand the operational details and restrictions before attempting to deploy a cluster.

Operational details

The capacity pools licensing model is different from the capacity tiers model. Instead of a dedicating storage capacity to each individual node, the storage capacity is allocated to a pool and shared among many nodes. Additional components and processes have been created to support the capacity pools model.

License Manager

The License Manager is a software component introduced with ONTAP Select 9.5 using ONTAP Select Deploy 2.10. LM runs as a separate process within each instance of the Deploy administration utility. Some of the functions provided by LM include:

- Generate a unique twenty-digit serial number for each node based on the capacity pool license serial number
- Create leases for capacity from the shared capacity pools based on requests from the ONTAP Select nodes
- Report pool usage information through the Deploy user interface

Lease characteristics

The storage allocated for every data aggregate at a node using a capacity pool license must have an associated lease. The node requests a storage lease and if the capacity is available, the License Manager responds with a lease. Each lease has the following explicit or implicit attributes:

- License Manager
Every ONTAP Select node is associated with one License Manager instance
- Capacity pool
Every ONTAP Select node is associated with one capacity pool
- Storage allocation
A specific capacity value is assigned in the lease
- Expiration date and time
Leases have a duration of between one hour and seven days depending on the user configuration.

License Lock ID

Each instance of the License Manager, and therefore each corresponding Deploy utility instance, is identified with a unique 128-bit number. This number is combined with the nine-digit capacity pool license serial number to lock the pool to a specific License Manager instance (which is effectively a Deploy instance). You must provide both values at the NetApp support site as part of generating the NetApp License File (NLF).

You can determine the License Lock ID for your Deploy instance using the web user interface in the following ways:

- **Getting Started page**
This page is displayed when you first sign in to Deploy. You can also display the page by clicking the drop down box at the top right of the page and selecting **Getting Started**. The LLID is displayed in the **Add Licenses** section.
- **Administration**
Click the **Administration** tab at the top of the page, then click **Systems** and **Settings**.

Basic lease operations

An ONTAP Select node must locate or request a valid capacity lease every time a data aggregate is created, expanded, or changed. A lease obtained from a previous request that is still valid can be used, or a new lease can be requested if needed. The following steps are taken by the ONTAP Select node to locate a capacity pool lease:

1. If an existing lease is located at the node, it is used as long as all of the following are true:
 - Lease has not expired
 - Storage request for the aggregate does not exceed the lease capacity
2. If an existing lease cannot be located, the node requests a new lease from the License Manager

Returning storage capacity to a capacity pool

Storage capacity is allocated from a capacity pool as needed and each new request can reduce the available storage in the pool. Storage capacity is returned to the pool in several situations, including:

- Lease for a data aggregate expires and is not renewed by the node
- Data aggregate is deleted

Note: If an ONTAP Select virtual machine is deleted, any active leases remain in effect until they expire. When this occurs, the capacity is returned to the pool.

Node serial number with capacity pools licensing

With the capacity tiers licensing model, the nine-digit node serial number is the same as the license serial number assigned to the node. However, the serial numbers assigned to nodes using the capacity pools licensing model have a different format.

The serial number of a node using capacity pools licensing has the following format:

```
999 ppppppppp nnnnnnnnn
```

Note: Spaces have been added for clarity, but are not part of the actual serial number.

Each section of the node serial number is described in the following table, from left to right.

Section of serial number	Description
'999'	Constant three-digit value reserved by NetApp.
ppppppppp	Variable nine-digit license serial number assigned to the capacity pool by NetApp
nnnnnnnnn	Variable eight-digit value generated by the License Manager for each node using the capacity pool

Attention: When opening a case with NetApp support involving a node that uses a capacity pool license, you cannot provide the full twenty-digit node serial number. Instead, you must provide the

nine-digit capacity pool license serial number. You can derive the license serial number from the node serial number as shown above. Skip the first three digits of the node serial number ('999') and extract the next nine digits (ppppppppp).

Deployment restrictions

The restrictions that apply when using the capacity pool licensing model are presented below.

Consistent licensing model per cluster

All of the nodes within a single ONTAP Select cluster must use the same licensing model, either capacity tiers or capacity pools. You cannot mix the licensing types for the nodes within a single cluster.

All nodes in a cluster use the same License Manager instance

All the nodes with a capacity pool license in an ONTAP Select cluster must use the same License Manager instance. Because there is one instance of License Manager within each Deploy instance, this restriction is a restatement of the existing requirement that all nodes in a cluster must be managed by the same Deploy instance.

One capacity pool per node

Each node can lease storage from exactly one capacity pool. A node cannot use two or more pools.

Same pool for nodes in an HA pair

Both nodes in a single HA pair must lease storage from the same capacity pool. However, different HA pairs within the same cluster can lease storage from different pools managed by the same License Manager.

Storage license duration

You must choose a license duration when acquiring the storage license from NetApp. For example, a license could be valid for one year.

Data aggregate lease duration

When an ONTAP Select node requests a storage lease for a data aggregate, the License Manager provides a lease for a specific duration based on the configuration of the capacity pool. You can configure the lease duration for each pool between one hour and seven days. The default lease duration is 24 hours.

Static IP address assigned to Deploy

You must assign a static IP address to the Deploy administration utility when capacity pools licensing is used.

Comparing capacity pools and capacity tiers licensing

The following table compares the two production licensing models supported by ONTAP Select.

	Capacity tiers	Capacity pools
License serial number	Nine digits generated by NetApp and assigned to a node	Nine digits generated by NetApp and assigned to a capacity pool
License lock	Locked to ONTAP Select node	Locked to License Manager instance
License duration	Perpetual (no renewal required)	Fixed duration based on purchase (renewed required)
Lease duration for data aggregate	Not applicable	One hour to seven days
Node serial number	Nine digits and equal to license serial number	Twenty digits and generated by License Manager

Summary of benefits

There are several benefits when using the capacity pools licensing model instead of the capacity tiers licensing model.

More efficient use of storage capacity

When using capacity tiers licensing, you allocate a fixed storage capacity to each node. Any unused space cannot be shared with the other nodes and is effectively wasted. With capacity pools licensing, each node only consumes the capacity it needs, based on the size of the data aggregates. And because the capacity is anchored in a central pool, it can be shared among many nodes in your organization.

Significantly reduced administrative overhead resulting in lower cost

If you use capacity tier licenses, you must obtain and install a license for each node. When using capacity pools, there is one license for each shared pool. This can dramatically reduce the administrative overhead and result in lower cost.

Improved usage metrics

The Deploy web user interface provides enhanced usage information for the capacity pools. You can quickly determine how much storage is used and available in a capacity pool, which nodes are using storage from a pool, and what pools a cluster is allocating capacity from.

Purchasing ONTAP Select licenses

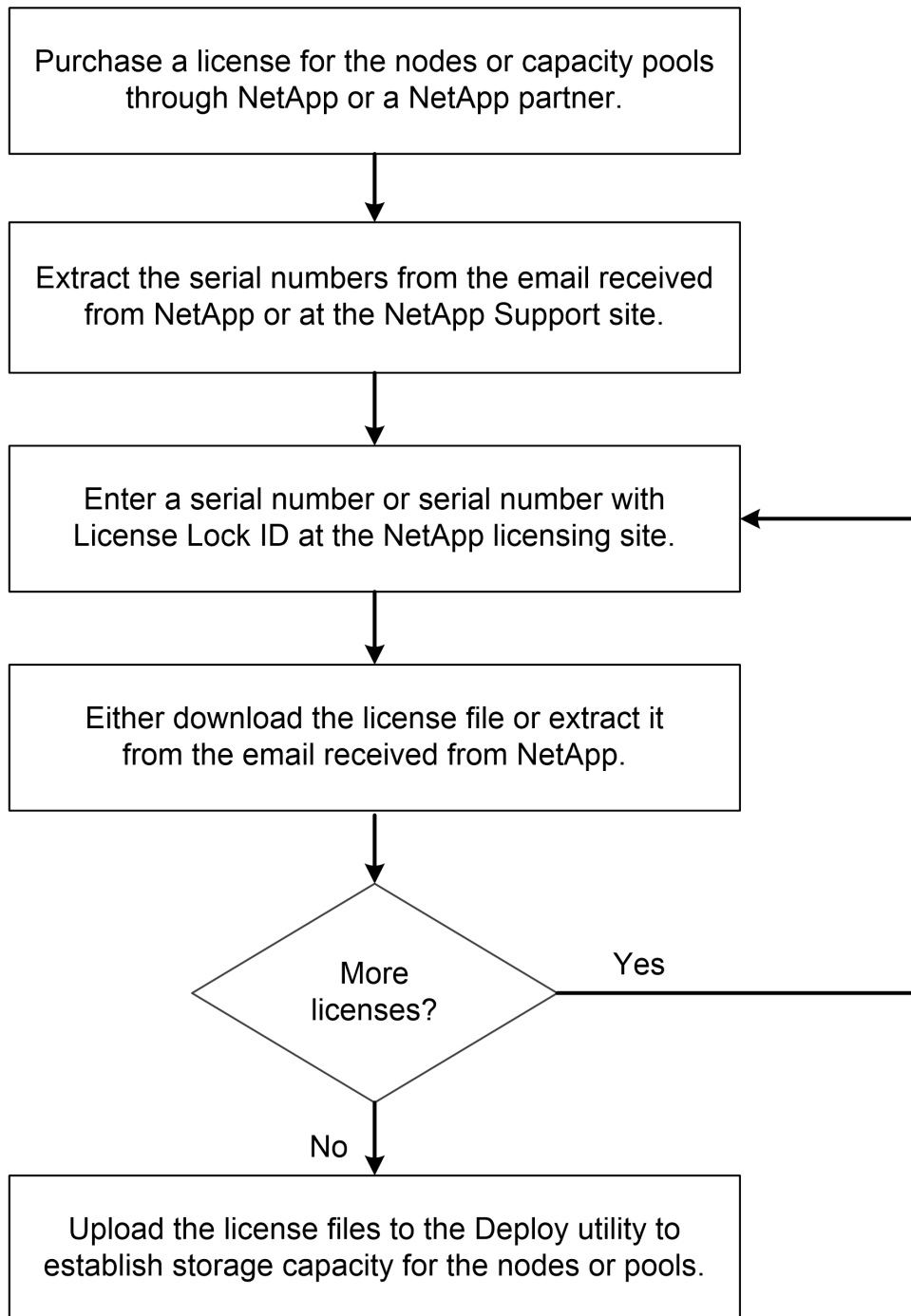
Before deploying an ONTAP Select cluster in a production environment, you must purchase and apply a license for each node or capacity pool.

Licensing workflow

The following workflow illustrates the process of purchasing and applying a license for your ONTAP Select deployment. When purchasing a license, you must select the licensing model and storage capacity.

The exact process varies based on whether you are using a capacity tier or capacity pool license:

- Nine-digit license serial number
Serial number applies to either a node (capacity tiers) or a storage pool (capacity pools)
- License Lock ID
You must have the License Lock ID for your Deploy instance when using a capacity pool license
- Licensing web site
You obtain a capacity tier and capacity pool license at different web sites



Acquiring a capacity tier license file

You must acquire a license file for each ONTAP Select node running with a capacity tier license. The license file defines the storage capacity for the node and is locked to the node through the unique nine-digit serial number assigned by NetApp.

Before you begin

You must have the nine-digit license serial number assigned to the node by NetApp. Before attempting to acquire a license file, you should wait at least twenty four hours after the shipped date of your purchase order.

About this task

You must perform this task for each ONTAP Select node requiring a capacity tier 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.

After you finish

You must upload the license file to the Deploy administration utility before it can be applied to an ONTAP Select node.

Related tasks

[Managing the capacity tier licenses](#) on page 67

Acquiring a capacity pool license file

You must acquire a license file for each capacity pool used by the ONTAP Select nodes. The license file defines the storage capacity and expiration for the pool. It is locked to the License Manager through a combination of the unique license serial number assigned by NetApp and the License Lock ID associated with the Deploy instance.

Before you begin

You must have the nine-digit license serial number assigned to the capacity pool by NetApp. Before attempting to acquire a license file, you should wait at least twenty four hours after the shipped date of your purchase order.

About this task

You must perform this task for each capacity pool used by the ONTAP Select nodes.

Steps

1. Access the NetApp Support Site using a web browser and sign in.
2. Click **Products** at the top and then click **Software Licenses**.
3. Type the license serial number for the capacity pool and click **Go!**.
4. On the license details page, navigate to the **Product Details** column.
5. Click **Get NetApp License File** on the appropriate row.
6. Type the License Lock ID for your ONTAP Select Deploy instance and click **Submit**.

7. Select the appropriate delivery method and click **Submit**.
8. Click **OK** on the delivery confirmation window.

After you finish

You must upload the license file to the Deploy administration utility before the capacity pool can be used by an ONTAP Select node.

Related tasks

[Managing the capacity pool licenses](#) on page 67

ONTAP features enabled by default

ONTAP Select automatically licenses several features for each node.

Licenses for the following features are included when you deploy an ONTAP Select cluster:

- NFS
- CIFS
- iSCSI
- FlexClone
- SnapRestore
- SnapVault
- SnapMirror
- Deduplication and compression
- ONTAP multitenancy capability
- NetApp Volume Encryption (non-restricted countries only)

You must purchase a separate license for any other features, including:

- SnapLock Enterprise
- FabricPool
- FlexCache

Note: You do not need a FabricPool license when utilizing StorageGRID Webscale.

Host configuration and preparation 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 97

[Appendix B: Understanding the ONTAP Select networking environment](#) on page 103

[Planning to deploy ONTAP Select](#) on page 17

[Planning to install the ONTAP Select Deploy utility](#) on page 33

Related tasks

[Confirming network connectivity among ONTAP Select nodes using the CLI](#) on page 63

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

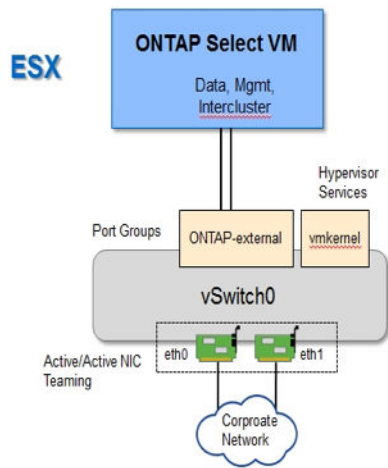
You can deploy ONTAP Select as either a multi-node cluster or a single-node cluster. In many cases, a multi-node cluster is preferable because of the additional storage capacity and HA capability.

Illustration of the ONTAP Select networks and nodes

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

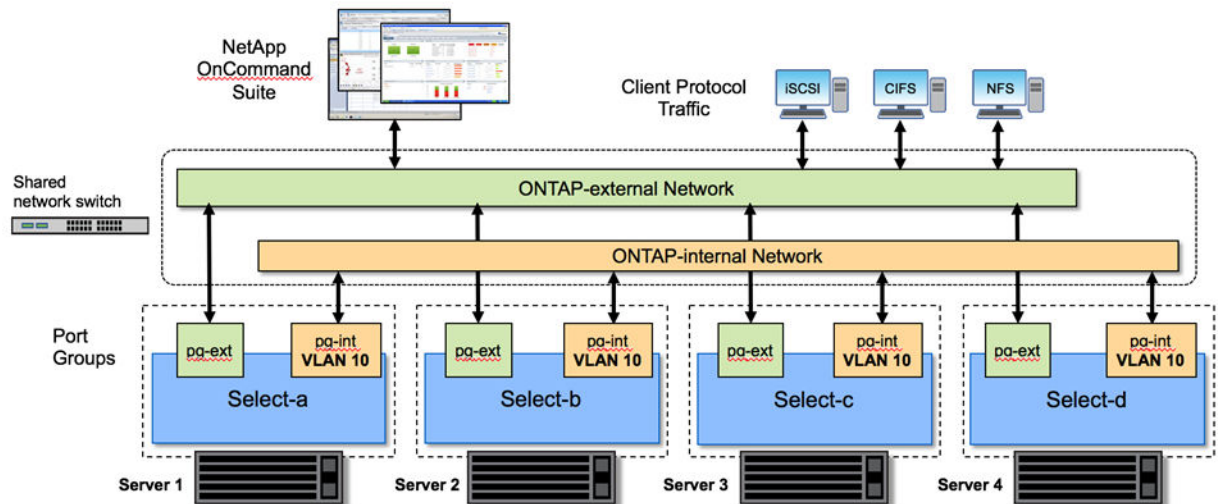
Single-node cluster showing one network

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



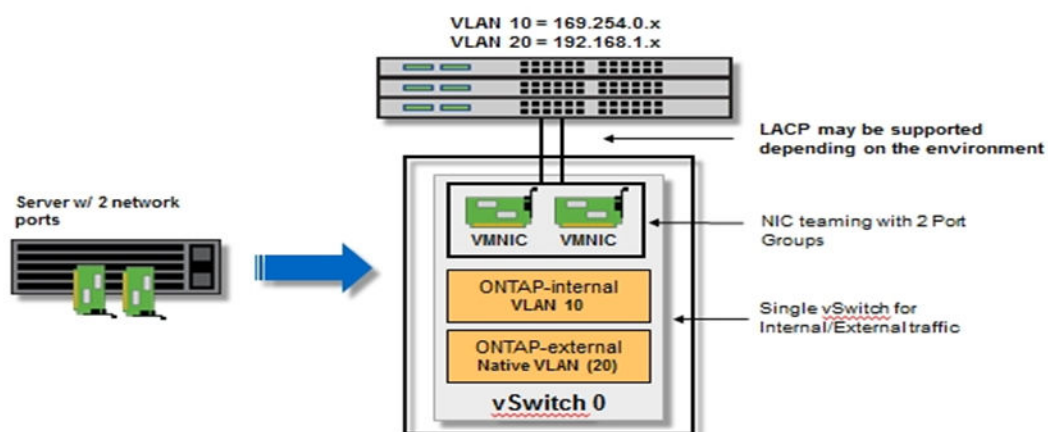
Four-node cluster showing two networks

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.



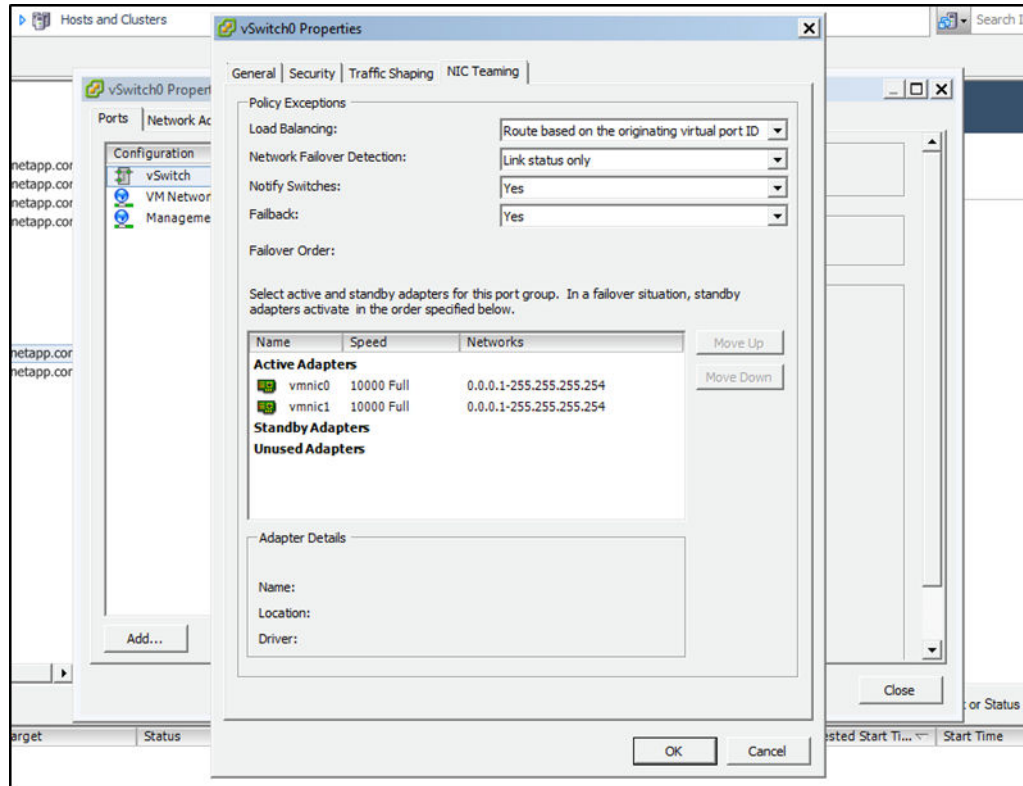
Configuration of the vSwitch on a hypervisor host

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-e0g 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-e0c 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.

After you finish

The Deploy administration utility contains a single version of ONTAP Select. If you want to deploy clusters using an earlier version of ONTAP Select, you must first add the ONTAP Select image to your Deploy instance. See *Adding an ONTAP Select image to the Deploy utility* for more information.

Steps

1. [Downloading the virtual machine image](#) on page 51
2. [Deploying the virtual machine](#) on page 52
3. [Signing in to the Deploy utility web interface](#) on page 53
4. [Signing in to the Deploy utility using SSH](#) on page 53

Related tasks

[Adding an ONTAP Select image to the Deploy utility](#) on page 80

Downloading the virtual machine image

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

Steps

1. Access the NetApp Support Site using a web browser and click **Support Quick Links**.
2. Click **Download Software** under **Top Tasks** and sign in to the site.
3. Scroll to **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 install and start the ONTAP Select Deploy virtual machine using the OVF virtual machine image. As part of the installation process, you must configure the network interface to use DHCP or a static IP configuration.

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

You must have the configuration information to be used when creating the virtual machine, including the name of the virtual machine, external network, and host name. When defining a static network configuration, you need the following additional information:

- IP address of the Deploy virtual machine
- netmask
- IP address of the gateway (router)
- IP address of the primary DNS server
- IP address of the second DNS server
- DNS search domains

About this task

If you use vSphere, the Deploy OVF template wizard includes a form to provide all of the Deploy configuration information, including the network configuration. However, if you choose not to use this form, you can instead use the console of the Deploy virtual machine to configure the network.

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.

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. If needed, you can configure the Deploy network using the virtual machine console:
 - a. Click the **Console** tab to access the ESXi host setup shell and monitor the power on process.
 - b. Wait for the following prompt:


```
Host name :
```
 - c. Type the host name and press **Enter**.

- d. Wait for the following prompt:

```
Use DHCP to set networking information? [n]:
```

- e. Type **n** to define a static IP configuration or **y** to use DHCP, and press **Enter**.
- f. If you choose a static configuration, provide all network configuration information as required.

Related references

[Required configuration information](#) on page 34

Signing in to the Deploy utility web interface

You can sign in to the web user interface to confirm the Deploy utility is available, and to the create and manage ONTAP Select clusters.

Before you begin

You must have the current password for the administrator (admin) account. If you are signing in for the first time and used vCenter to install the Deploy virtual machine, you should use the password set during installation. If you are signing in for the first time and did not use vCenter, use the default password for the account which is *admin123*.

Steps

1. Point your browser to the Deploy utility using the IP address or domain name:
`https://<ip_address>/`
2. Provide the account information and sign in.
3. If the **Welcome to ONTAP Select** popup window is displayed, you should review the prerequisites and click **OK** to continue.
4. If this is the first time signing in and you did not install Deploy using the wizard available with vCenter, provide the following configuration information when prompted:
 - New password for the administrator account (required)
 - AutoSupport (optional)
 - vCenter server with account credentials (optional)

Related tasks

[Signing in to the Deploy utility using SSH](#) on page 53

Signing in to the Deploy utility using SSH

You can sign in to the management shell using SSH to confirm the Deploy utility is available, and to the create and manage ONTAP Select clusters.

Before you begin

You must have the current password for the administrator (admin) account. If you are signing in for the first time and used vCenter to install the Deploy virtual machine, you should use the password set during installation. If you are signing in for the first time and did not use vCenter, use the default password for the account which is *admin123*.

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. If this is the first time signing in and you did not install Deploy using the wizard available with vCenter, provide the following configuration information when prompted:
 - New password for the administrator account (required)
 - Company name (required)
 - Proxy URL (optional)
4. Type ? and press **Enter** to display a list of the available management shell commands.

Related tasks

[Changing the Deploy administrator password using the CLI](#) on page 65

[Signing in to the Deploy utility web interface](#) on page 53

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 17

[Deploying an ONTAP Select cluster using the CLI](#) on page 90

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 typical workflow when deploying your first cluster

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

1. Prepare the hypervisor hosts and acquire the capacity license files
You must install and prepare the hypervisor servers that 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 installed and initially configured (including a password change if needed), the **Getting Started** cluster launch page is displayed.
3. Add your first host
You can 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 an initial type value of **unknown** which becomes **ESX** when the host is authenticated and ready to be used in a cluster.
4. Define the configuration of the cluster
After you have added the hosts, you must click **Create Cluster** to begin creating the cluster. The process flows through the following steps:
 - a. Provide the cluster configuration details
 - b. Configure the nodes, including the hypervisor, network, and storage
5. Confirm the network connectivity on the internal cluster network
The network connectivity checker is integrated with the web user interface and is run as part of creating a multi-node cluster. The tool is also available through the Deploy CLI. This tool tests the connectivity among the hypervisor hosts on the internal cluster network.
6. 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.

Note: The Deploy administration utility contains a single version of ONTAP Select. If you want to deploy clusters using an earlier version of ONTAP Select, you must first add the ONTAP Select image to your Deploy instance. See *Adding an ONTAP Select image to the Deploy utility* for more information.

Related concepts

[Preparing to create your first ONTAP Select cluster](#) on page 55

Related tasks

[Signing in to the Deploy utility web interface](#) on page 53

[Confirming network connectivity among ONTAP Select nodes using the CLI](#) on page 63

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Creating a multi-node cluster

You can use the ONTAP Select Deploy web user interface to deploy an ONTAP Select multi-node cluster consisting of two, four, six, or eight nodes.

Before you begin

You must prepare the hypervisor hosts where the ONTAP Select nodes will run and have the needed storage license files based on your licensing model. You should be familiar with the network connectivity checker. You must have the password for the Deploy administrator account, which was configured as part of installing the Deploy administration utility.

About this task

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

- The cluster contains an even number of nodes (two, four, six, or eight)
- The nodes are always joined into HA pairs
- The needed storage licenses have been purchased and the license files are available

Steps

1. Sign in to the Deploy utility through the web interface using the administrator account (admin) and provide the current password.
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** cluster launch page, click **Upload** and select a license from your local workstation and click **Open** to upload the license.

The license you add is displayed in a table on the right side of the page. You should add all of the necessary licenses. If you are using capacity tier licenses, you must add one license for each node.
4. Click **Refresh** and confirm that the licenses have been added correctly.
5. Click **Next** to add a hypervisor host and then click **Add**.

You can add the ESXi host directly or by connecting to a vCenter server. You should provide the appropriate host details.

The host you add is displayed in a table on the right side of the page.
6. Click **Refresh** and confirm the **Type** value for the host is **ESX**.

The username and password you provided for the host or vCenter server is added to the Deploy credential database.
7. Add additional hypervisor hosts for the nodes in the ONTAP Select cluster.
8. Click **Next** to begin the cluster creation process.
9. In the **Cluster Details** section of the page, provide all the required information describing the cluster and click **Done**.

Unless you have reason to set the cluster MTU size, you should take the default value and allow Deploy to make any adjustments as needed.
10. Under **Node Setup**, provide the node management IP addresses and select the licenses for the two nodes in the HA pair; you can upload a new license if needed.

You can also change the node names if needed.
11. Provide the configuration for the **Hypervisor and Network** section.

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 you select for the node must match or exceed the instance type.

You must select the hypervisor host as well as the management, data, and internal networks.

The internal network cannot be the same as the management or data network.
12. Provide the configuration for the **Storage** section and click **Done**.

If you select **Enable Software RAID**, you must include one storage pool for system files, and four or more disks for the root and data aggregates.
13. If you are creating a cluster with four or more nodes, configure the nodes in the additional HA pairs following the same steps you used for the first HA pair.
14. Review and confirm the configuration of the cluster.

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

16. Run the network connectivity checker which is part of the web user interface to test the connectivity of the internal cluster network.
17. Provide the ONTAP administrator password and 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. Monitor the four-step cluster creation process to confirm the cluster is created successfully.

The page is automatically refreshed at regular intervals.

Attention: If the cluster creation operation is initiated but fails to complete, the ONTAP administrative password you define is not registered. In this case, you can access the management interface for the ONTAP Select cluster using the password `changeme123` for the `admin` account.

After you finish

You should confirm that the ONTAP Select AutoSupport feature is configured. You should back up the ONTAP Select Deploy configuration data.

Related tasks

[Backing up the Deploy configuration data](#) on page 73

[Adding an account to the credential store](#) on page 63

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 the ONTAP Select node will run and have a storage license file. You must have the password for the Deploy administrator account, which was configured as part of installing the Deploy administration utility.

About this task

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

- The cluster contains one node
- A storage license has been purchased and a license file is available

Steps

1. Sign in to the Deploy utility through the web interface using the administrator account (`admin`) and provide the current password.
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** cluster launch page, click **Upload** and select a license from your local workstation and click **Open** to upload the license.

The license you add is displayed in a table on the right side of the page.

4. Click **Refresh** and confirm that the license has been added correctly.
5. Click **Next** to add a hypervisor host and then click **Add**.

You can add the ESXi host directly or by connecting to a vCenter server. You should provide the appropriate host details.

The host you add is displayed in a table on the right side of the page.

6. Click **Refresh** and confirm the **Type** value for the host is **ESX**.

The username and password you provided for the host or vCenter server is added to the Deploy credential database.

7. Click **Next** to begin the cluster creation process.

8. In the **Cluster Details** section of the page, provide all the required information describing the cluster and click **Done**.

9. Under **Node Setup**, provide the node management IP address and select the license for the node; you can upload a new license if needed.

You can also change the node name if needed.

10. Provide the configuration for the **Hypervisor and Network** section.

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 you select for the node must match or exceed the instance type.

You must select the hypervisor host as well as the management and data networks.

11. Provide the configuration for the **Storage** section and click **Done**.

If you select **Enable Software RAID**, you must include one storage pool for system files, and four or more disks for the root and data aggregates.

12. Review and confirm the configuration of the cluster.

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

13. Click **Next**.

14. Provide the ONTAP administrator password and 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.

15. Monitor the four-step cluster creation process to confirm the cluster is created successfully.

The page is automatically refreshed at regular intervals.

Attention: If the cluster creation operation is initiated but fails to complete, the ONTAP administrative password you define is not registered. In this case, you can access the management interface for the ONTAP Select cluster using the password `changeme123` for the `admin` account.

After you finish

You should confirm that the ONTAP Select AutoSupport feature is configured. You should back up the ONTAP Select Deploy configuration data.

Related tasks

[Backing up the Deploy configuration data](#) on page 73

[Adding an account to the credential store](#) on page 63

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
(both SnapLock and FabricPool require separate licenses)

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

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 (refer to the NetApp Interoperability Matrix Tool for more details)

To identify the supported versions of the client software, refer to the NetApp Interoperability Matrix Tool. 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 data spare disks created by the Deploy administration utility on each ONTAP Select node from the usable datastore space (such as, Pool0 and Pool1). To implement high availability for your data on a multi-node cluster, you must create a mirrored aggregate using these spares.

Related references

[Where to find additional information](#) on page 108

Related information

[NetApp Interoperability Matrix Tool](#)

Upgrading the ONTAP Select nodes

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

ONTAP Select Deploy only for new cluster deployments

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 cluster nodes.

Reverting an ONTAP Select node

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.

Using the VMXNET3 network driver

Beginning with ONTAP Select 9.5 using Deploy 2.10, VMXNET3 is the default network driver included with new cluster deployments on VMware ESXi. If you upgrade an existing ONTAP Select node to version 9.5, the network driver is not automatically upgraded. You must manually upgrade to VMXNET3. You should contact NetApp support for assistance with the upgrade.

Review current release notes

You should review the current release notes for additional information and any required procedures before upgrading an ONTAP Select node.

Related information

[NetApp Support](#)

[Upgrade, revert, or downgrade](#)

[Software express upgrade](#)

[ONTAP Select 9.5 Release Notes](#)

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. And 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 53

[Signing in to the Deploy utility using SSH](#) on page 53

Adding an account to the credential store

You can add a new account to the Deploy credential store database.

Before you begin

You should be familiar with the types of credentials and how they are used by ONTAP Select Deploy.

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 **Credentials** and then click **Add**.
4. Provide the account credentials and click **Add**.
5. Click the check icon on the right to authenticate the account.

After you finish

After the account is added, you can edit the configuration and delete it from the credential store as needed.

Related concepts

[Authentication using the credential store](#) on page 19

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 deployed to detect issues that might cause the operation to fail. You can also run the connectivity test after a cluster is deployed and online.

Before you begin

All the ONTAP Select nodes included in the test must be configured and powered on.

About this task

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 control 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 the 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
```

3. Start the network connectivity checker and note the run identifier in the command output:

```
network connectivity-check start -host-names HOSTNAMES -vswitch-type  
VSWITCH_TYPE-mode MODE
```

Example

```
network connectivity-check start -host-names 10.234.81.14  
10.234.81.15 -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 RUN_ID
```

After you finish

The network connectivity checker normally cleans up by removing any temporary ports and IP addresses added to the ONTAP-Internal port group. However, if the connectivity checker fails to remove the temporary ports, you must perform a manual cleanup operation by rerunning the CLI command with the `-mode cleanup` option. If you do not remove the temporary ports from the ONTAP-Internal port group, 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 **Submit**.

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

Displaying the ONTAP Select Deploy 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 the Deploy system

You should set the basic system configuration parameters that affect how the Deploy utility operates.

About this task

The Deploy configuration data you provide is used by AutoSupport.

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 **System** and then click **Settings**.

4. Provide the configuration data as appropriate for your environment and click **Save**.

If you use a proxy server, you can configure the proxy URL as follows:

`http://USERNAME:PASSWORD@<FQDN|IP>:PORT`

Example

```
http://user1:mypassword@proxy.company-demo.com:80
```

Enabling AutoSupport

You can enable and disable the AutoSupport feature as needed.

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. Enable or disable the AutoSupport feature as needed.

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.

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 hosts and ONTAP Select nodes
- Performance
Performance information about the hypervisor hosts and ONTAP Select nodes

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 number.

5. Click **Generate AutoSupport**.

Each AutoSupport package is assigned a unique sequence identification 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.

Managing the capacity tier licenses

You can add, edit, and delete ONTAP Select capacity tier licenses as needed.

Steps

1. Sign in to the Deploy utility through the web interface using the administrator account.
2. Click the **Administration** tab at the top of the page.
3. Click **Licenses** and then click **Capacity Tier**.
4. Optionally click **Filtering** and create a filter to limit the licenses displayed.
5. You can edit or delete an existing license by clicking the appropriate icon on the right for the license.
6. To add a new license, click **Add** at the top of the page and then click **Upload License(s)** and select a license file from your local workstation.

Managing the capacity pool licenses

You can add, edit, and delete ONTAP Select capacity pool licenses as needed.

Steps

1. Sign in to the Deploy utility through the web interface using the administrator account.
2. Click the **Administration** tab at the top of the page.
3. Click **Licenses** and then click **Capacity Pool**.
4. Optionally click **Filtering** and create a filter to limit the licenses displayed.
5. To add a new license, click **Add** at the top of the page and then click **Upload License(s)** and select a license file from your local workstation.
6. You can delete an existing license by clicking the appropriate icon on the right for the license.
7. To see a list of the capacity pools:
 - a. Click **Summary**.
 - b. Select and expand a pool to see the clusters and nodes leasing storage from the pool.
 - c. View the current status of the license under **License Information**.
 - d. You can change the duration of the leases issued for the pool under **Lease expiration**.
8. To see a list of the clusters:
 - a. Click **Details**.

- b. Select and expand the cluster to see storage utilization.

Editing storage and license capacity

You can expand the storage and licensing capacity for your ONTAP Select nodes 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

You can perform one or more actions when editing the storage configuration of an ONTAP Select node, including:

- Increase the allocated storage capacity
- Refresh the storage license
- Add a storage pool

You can perform one or more actions each time you edit the configuration.

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.

Steps

1. Sign in to the Deploy utility through the web interface using the administrator account.
2. Click the **Clusters** tab at the top of the page and select the cluster containing the node you want to update.
3. Click + next to a node to display the **Edit Node Storage** popup window which presents the current license, capacity, and storage pool details for the node.

If the node is part of an HA pair, the storage configuration for both nodes is shown. The storage allocated must be the same at both nodes.

4. Type a value for **Additional Capacity** and notice that the **New Capacity** field is also updated.
A warning message is displayed if the existing license does not support the new capacity or the node does not have a storage pool large enough to support the request.
5. If your current license capacity is insufficient to allow the storage expansion, you must update your license:

- a. Click **Select License**.
- b. Provide 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 **Close**.

You can only refresh the license file based on the serial number assigned to the node. You cannot use a license file for a different serial number.

6. If there is not a storage pool large enough to handle the request, you must add a storage pool:
 - a. Click the dropdown box next to **Additional Local Storage Pool**.
 - b. Select a storage pool
7. Under **ONTAP Credentials**, provide the username and password for the cluster administrator account.
8. Click **Edit Storage**.

While the storage expansion operation is active, you cannot modify the configuration of the nodes in the cluster.

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 **Take Offline**.

If the offline option is not available, 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. To bring the cluster back online, click the gear icon on the right of the cluster and select **Bring 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.

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 -name CLUSTERNAME`
3. If the cluster is not offline, move it to an offline state:
`cluster offline -name CLUSTERNAME`
4. After confirming the cluster is in an offline status, delete the cluster:
`cluster delete -name CLUSTERNAME`

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**.

Refreshing the Deploy cluster configuration

After creating an ONTAP Select cluster, you can make changes to the cluster or the virtual machine configuration outside of the Deploy utility using the ONTAP or hypervisor administration tools. The configuration of a virtual machine can also change after it is migrated. When these changes to the cluster or virtual machine occur, the Deploy utility configuration database is not automatically updated and can become out of sync with the state of the cluster. You should perform a cluster refresh in these and other situations to update the Deploy database based on the current state of the cluster.

Before you begin

Required information

You must have the current configuration information for the cluster, including:

- ONTAP administrator credentials
- Cluster management IP address
- Names of the nodes in the cluster

Stable cluster state

The cluster must be in a stable state. You cannot refresh a cluster when it is in the process of being created or deleted, or when it is in the *create_failed* or *delete_failed* state.

After a VM migration

After a virtual machine running ONTAP Select has been migrated, you must create a new host using the Deploy utility before performing a cluster refresh.

About this task

You can perform a cluster refresh to update the Deploy configuration database using the web user interface.

Note: Instead of using the Deploy GUI, you can use the `cluster refresh` command in the Deploy CLI shell to refresh a cluster.

Cluster and virtual machine configuration

Some of the configuration values that can change and cause the Deploy database to become out of sync include:

- Cluster and node names
- ONTAP network configuration
- ONTAP version (after an upgrade)
- Virtual machine names
- Host network names
- Storage pool names

Cluster and node states

An ONTAP Select cluster or node can be in a state that prevents it from operating properly. You should perform a cluster refresh operation to correct the following conditions:

- Node in *unknown* state
An ONTAP Select node can be in the *unknown* state for several reasons, including the node is not found.
- Cluster in *degraded* state
If a node is powered off, it might still appear to be online in the Deploy utility. In this situation, the cluster is in a *degraded* state.

Steps

1. Sign in to the Deploy utility web user interface using the administrator account.
2. Click the **Clusters** tab at the top left of the page and select the desired cluster from the list.
3. Click the gear icon at the top right and select **Cluster Refresh** from the drop-down list.
4. Provide the current ONTAP Select username and password for the cluster under **Cluster Credentials**.
5. Click **Refresh**.

After you finish

If the operation is successful, the field **Last successful refresh** is updated. You should back up the Deploy configuration data after the cluster refresh operation has completed.

Related tasks

[Backing up the Deploy configuration data](#) on page 73

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 73
2. [Installing a new instance of the Deploy virtual machine](#) on page 73
3. [Restore the Deploy configuration data to the new virtual machine](#) on page 74

Backing up the Deploy configuration data

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

Before you begin

Make sure that Deploy is not performing any other tasks during the backup operation.

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 clusters.

Steps

1. Sign in to the Deploy utility CLI using SSH with the administrator account.
2. Create a backup of the Deploy configuration data, which is stored in an internal directory at the Deploy server:
`deploy backup create`
3. Provide a password for the backup when prompted.
The backup file is encrypted based on the password.
4. Display the available backups in the system:
`deploy backup show -detailed`
5. Select your backup file based on the date in the **Created** field and record the **Download URL** value.
You can access the backup file through the URL.
6. Using a web browser or utility such as CURL, download the backup file to your local workstation with the URL.

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. Download the virtual machine image.
 - b. Deploy the virtual machine and configure the network interface.
 - c. Access the Deploy utility using SSH.

Related tasks

[Installing and configuring the ONTAP Select Deploy utility](#) on page 51

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 backup file to the Deploy virtual machine.

Example

```
sftp admin@10.234.81.101 (provide password when prompted)
put deploy_backup_20180601162151.tar.gz
exit
```

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

```
deploy backup restore -path PATHNAME -filename FILENAME
```

Example

```
deploy backup restore -path /home/admin -filename
deploy_backup_20180601162151.tar.gz
```

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

Beginning with Deploy 2.8, you can only use this procedure to upgrade from the two previous major versions of ONTAP Select Deploy. For example, you can only upgrade to Deploy 2.8 from Deploy 2.6 and 2.7.

Attention: You should review the current release notes for additional information and any required procedures before upgrading an ONTAP Select node.

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 75
2. [Uploading the package to the Deploy virtual machine](#) on page 75
3. [Applying the upgrade package](#) on page 76

Related tasks

[Backing up the Deploy configuration data](#) on page 73

Related information

[ONTAP Select 9.5 Release Notes](#)

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.

Steps

1. Access the NetApp Support Site using a web browser and click **Support Quick Links**.
2. Click **Download Software** under **Top Tasks** and sign in to the site.
3. Scroll to **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 installation 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 options more suitable for your environment.

Step

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

Example

```
sftp admin@10.234.81.101 (provide password when prompted)
put ONTAPdeploy2.8_upgrade.tar.gz
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:

```
deploy upgrade -package-path FILEPATH
```

Example

```
deploy upgrade -package-path /home/admin/
ONTAPdeploy2.10_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 your hypervisor environment.

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.

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.

IP address of the original Deploy virtual machine

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

Storage capacity licensing

You must determine whether capacity pools or capacity tiers licensing is used. If you use capacity pools licensing, you must reinstall each capacity pool license after recovering or restoring the Deploy instance.

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 77

[Reconfiguring and recovering a Deploy utility instance](#) on page 78

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
```

After you finish

If you use capacity pools licensing, you must reinstall each capacity pool license. See *Reinstalling a capacity pool license* for additional details.

Related tasks

[Installing and configuring the ONTAP Select Deploy utility](#) on page 51

[Restore the Deploy configuration data to the new virtual machine](#) on page 74

[Reinstalling a capacity pool license](#) on page 87

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 ONTAP Select online documentation web page at the Deploy. 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 online documentation web page at the new Deploy utility virtual machine and sign in using the `admin` account:


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

You must use the IP address of your Deploy virtual machine.
6. Click **Mediator** and then **GET /mediators**.
7. Click **Try it out!** to display a list of mediators maintained by Deploy.

Note the ID of the desired mediator instance.
8. Click **Mediator** and then **POST**.
9. Provide the value for *mediator_id*.
10. Click the **Model** next to *iscsi_target* and complete the *name* value.

Use the target name for the *iqn_name* parameter.
11. Click **Try it out!** to create the mediator iSCSI target.

If the request is successful, you will receive HTTP status code 200.

12. 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.

13. Determine the names of the mediator disks:


```
disk show --container-type mediator
```
14. 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>`
15. Verify that storage failover is enabled:


```
storage failover show
```

After you finish

If you use capacity pools licensing, you must reinstall each capacity pool license. See *Reinstalling a capacity pool license* for additional details.

Related tasks

[Installing and configuring the ONTAP Select Deploy utility](#) on page 51

[Restore the Deploy configuration data to the new virtual machine](#) on page 74

[Reinstalling a capacity pool license](#) on page 87

Adding an ONTAP Select image to the Deploy utility

You can add an ONTAP Select image to your instance of the Deploy administration utility. After the image has been installed, you can use it when deploying an ONTAP Select cluster.

Before you begin

You should remove any unneeded ONTAP Select images from your instance of Deploy.

About this task

You should only add an ONTAP Select image with a version that is earlier than the original version included with your instance of the Deploy utility. Adding later versions of ONTAP Select as they become available from NetApp is not a supported configuration.

Steps

1. [Downloading the install image](#) on page 81
2. [Uploading the install image to the Deploy virtual machine](#) on page 81

3. [Adding the install image](#) on page 82
4. [Displaying the available install images](#) on page 82

Related tasks

[Removing ONTAP Select images from the Deploy utility](#) on page 82

Downloading the install image

To begin the process of adding an ONTAP Select image to an instance of the Deploy utility, you must download the install image from the NetApp Support Site. The ONTAP Select install image is formatted as a single compressed file.

Steps

1. Access the NetApp Support Site using a web browser and click **Support Quick Links**.
2. Under **Top Tasks**, click **Download Software** and sign in.
3. Scroll to **ONTAP Select** and select **ONTAP Image 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.

Uploading the install image to the Deploy virtual machine

After acquiring the ONTAP Select install image, you must upload the file to the Deploy virtual machine.

Before you begin

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

About this task

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

Step

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

Example

```
sftp admin@10.234.81.101 (provide password when prompted)
put image_v_93_install_esx.tgz
exit
```

Result

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

Adding the install image

You can add the ONTAP Select installation image to the Deploy images directory so it is available when deploying a new cluster.

Before you begin

You must know which directory the install image file has been placed in at the Deploy utility virtual machine. It is assumed the file is in the administrator's home directory.

Steps

1. Sign in to the Deploy utility CLI using SSH with the administrator (admin) account.
2. Start the Bash shell:
`shell bash`
3. Place the install image file into the images directory.

Example

```
tar -xf image_v_93_install_esx.tgz -C /opt/netapp/images/
```

Displaying the available install images

You can display the ONTAP Select images that are available when deploying a new cluster.

Steps

1. Access the online documentation web page at the Deploy utility virtual machine and sign in using the administrator (admin) account:
`http://<FQDN|IP_ADDRESS>/api/ui`
Use the domain name or IP address of the Deploy virtual machine.
2. Navigate to the bottom of the page and click **Deploy** and then click **GET /images**.
3. Click **Try it out!** to display the available ONTAP Select images.
4. Confirm that the desired image is available.

Removing ONTAP Select images from the Deploy utility

You can remove ONTAP Select images from your instance of the Deploy administration utility when they are no longer needed.

About this task

You can remove older ONTAP Select images that are not currently in use by a cluster or planned for use with a future cluster deployment.

Attention: You should not remove any ONTAP Select images that are in use by a cluster.

Steps

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

2. Display the clusters managed by Deploy and record the ONTAP images in use:

```
cluster show
```

Note the version number and hypervisor platform in each case.

3. Start the Bash shell:

```
shell bash
```

4. Display all of the available ONTAP Select images:

```
ls -lh /opt/netapp/images
```

5. Optionally remove an ESXi image.

Example

```
rm -r /opt/netapp/images/DataONTAPv-9.3RC1-vidconsole-esx.ova
```

6. Optionally remove a KVM image.

Example

```
rm -r /opt/netapp/images/DataONTAPv-9.3RC1-serialconsole-kvm.raw.tar
```

Upgrading VMware ESXi to version 6.5 and higher

If you are running ONTAP Select on VMware ESXi, you can upgrade the ESXi software from an earlier supported version to ESXi 6.5 or 6.7. Before upgrading, you should understand the process and select the appropriate upgrade procedure.

Preparing to upgrade VMware ESXi

Before upgrading the ESXi software on the hypervisors hosting an ONTAP Select cluster, you should prepare and select the upgrade procedure that is appropriate for your environment.

Attention: If you choose to upgrade to VMware ESXi 6.5, you should upgrade to ESXi U2 (build 8294253) or greater. Using ESXi 6.5 U1 can expose you to a virtual machine failure due to a known VMware bug.

Becoming familiar with how to upgrade VMware ESXi

Upgrading the ESXi software is a process described and supported by VMware. The hypervisor upgrade process is part of the larger upgrade procedure when using ONTAP Select. Refer to the VMware document [Upgrading ESXi Hosts](#) for more information.

Selecting an upgrade procedure

Several upgrade procedures are available. You should select the applicable procedure based on the following criteria:

- ONTAP Select cluster size
Both single-node and multi-node clusters are supported.
- Use of ONTAP Select Deploy
Upgrade is possible both with and without the Deploy utility.

Best practice: You should select an upgrade procedure that uses the Deploy administration utility.

Performing an ESXi upgrade using the Deploy administration utility is the more general and resilient option. However, there may be instances when Deploy is unavailable or cannot be used. For example, upgrading to ESXi 6.5 is not supported with earlier versions of ONTAP Select and the Deploy administration utility. If you are using these earlier versions and attempt an upgrade, the ONTAP Select virtual machine can be left in a state where it cannot be booted. In this case, you must select an upgrade procedure that does not use Deploy. Refer to [1172198](#) for more information.

Upgrading the Deploy administration utility

Before performing an upgrade procedure using the Deploy utility, you may need to upgrade your Deploy instance. In general, you should upgrade to the most recent version of Deploy. At a minimum, you must use Deploy 2.5 or later. The Deploy utility must support the version of ONTAP Select you are using. Refer to the *ONTAP Select Release Notes* for more information.

After the update procedure is complete

If you select an upgrade procedure that uses the Deploy utility, you should perform a cluster refresh operation using Deploy after all of the nodes have been upgraded. See *Refreshing the Deploy cluster configuration* for more information.

Related tasks

[Upgrading an existing Deploy virtual machine using the CLI](#) on page 74

[Refreshing the Deploy cluster configuration](#) on page 71

Upgrading a single-node cluster using Deploy

You can use the Deploy administration utility as part of the procedure to upgrade the VMware ESXi hypervisor hosting an ONTAP Select single-node cluster.

Before you begin

You must use Deploy version 2.5 or later.

Steps

1. Sign in to the Deploy utility CLI using SSH with the administrator account.
2. Move the node to the offline state.

Example

```
node stop --cluster-name <CLUSTERNAME> --node-name <NODENAME>
```

3. Upgrade the hypervisor host where ONTAP Select is running to ESXi 6.5 or 6.7 using the procedure provided by VMware.

Refer to *Preparing to upgrade VMware ESXi* for more information.

4. Move the node to the online state.

Example

```
node start --cluster-name <CLUSTERNAME> --node-name <NODENAME>
```

5. After the node comes up, verify that the cluster is healthy.

Example

```
ESX-1N::> cluster show
Node                      Health  Eligibility
-----
sdot-d200-011d           true   true
```

After you finish

You should perform a cluster refresh operation using the Deploy administration utility.

Upgrading a multi-node cluster using Deploy

You can use the Deploy administration utility as part of the procedure to upgrade the VMware ESXi hypervisors hosting an ONTAP Select multi-node cluster.

Before you begin

You must use Deploy version 2.5 or later.

About this task

You must perform this upgrade procedure for each of the nodes in the cluster, one node at a time. If the cluster contains four or more nodes, you should upgrade the nodes in each HA pair sequentially before proceeding to the next HA pair.

Steps

1. Sign in to the Deploy utility CLI using SSH with the administrator account.
2. Move the node to the offline state.

Example

```
node stop --cluster-name <CLUSTERNAME> --node-name <NODENAME>
```

3. Upgrade the hypervisor host where ONTAP Select is running to ESXi 6.5 or 6.7 using the procedure provided by VMware.

Refer to *Preparing to upgrade VMware ESXi* for more information.

4. Move the node to the online state.

Example

```
node start --cluster-name <CLUSTERNAME> --node-name <NODENAME>
```

5. After the node comes up, verify that storage failover is enabled and the cluster is healthy.

Example

```
ESX-2N_I2_N11N12::> storage failover show
Node          Partner          Takeover
Possible State Description
-----
sdot-d200-011d sdot-d200-012d true   Connected to sdot-d200-012d
sdot-d200-012d sdot-d200-011d true   Connected to sdot-d200-011d
2 entries were displayed.
```

```
ESX-2N_I2_N11N12:> cluster show
```

Node	Health	Eligibility
sdot-d200-011d	true	true
sdot-d200-012d	true	true

2 entries were displayed.

After you finish

You must perform the upgrade procedure for each host used in the ONTAP Select cluster. After all the ESXi hosts are upgraded, you should perform a cluster refresh operation using the Deploy administration utility.

Upgrading a single-node cluster without Deploy

You can upgrade the VMware ESXi hypervisor hosting an ONTAP Select single-node cluster without using the Deploy administration utility.

Steps

1. Sign in to the ONTAP command line interface and halt the node.
2. Using VMware vSphere, confirm that the ONTAP Select virtual machine is powered off.
3. Upgrade the hypervisor host where ONTAP Select is running to ESXi 6.5 or 6.7 using the procedure provided by VMware.

Refer to *Preparing to upgrade VMware ESXi* for more information.

4. Using VMware vSphere, access vCenter and do the following:
 - a. Add a floppy drive to the ONTAP Select virtual machine.
 - b. Power on the ONTAP Select virtual machine.
5. Sign in to the ONTAP CLI using SSH with the administrator account.
6. After the node comes up, verify that the cluster is healthy.

Example

```
ESX-1N:> cluster show
```

Node	Health	Eligibility
sdot-d200-011d	true	true

After you finish

You should perform a cluster refresh operation using the Deploy administration utility.

Upgrading a multi-node cluster without Deploy

You can upgrade the VMware ESXi hypervisors hosting an ONTAP Select multi-node cluster without using the Deploy administration utility.

About this task

You must perform this upgrade procedure for each of the nodes in the cluster, one node at a time. If the cluster contains four or more nodes, you should upgrade the nodes in each HA pair sequentially before proceeding to the next HA pair.

Steps

1. Sign in to the ONTAP command line interface and halt the node.
2. Using VMware vSphere, confirm that the ONTAP Select virtual machine is powered off.
3. Upgrade the hypervisor host where ONTAP Select is running to ESXi 6.5 or 6.7 using the procedure provided by VMware.
Refer to *Preparing to upgrade VMware ESXi* for more information.
4. Using VMware vSphere, access vCenter and do the following:
 - a. Add a floppy drive to the ONTAP Select virtual machine.
 - b. Power on the ONTAP Select virtual machine.
5. Sign in to the ONTAP CLI using SSH with the administrator account.
6. After the node comes up, verify that storage failover is enabled and the cluster is healthy.

Example

```
ESX-2N_I2_N11N12::> storage failover show
                        Takeover
Node                   Partner    Possible State Description
-----
sdot-d200-011d sdot-d200-012d true      Connected to sdot-d200-012d
sdot-d200-012d sdot-d200-011d true      Connected to sdot-d200-011d
2 entries were displayed.
```

```
ESX-2N_I2_N11N12::> cluster show

Node                   Health Eligibility
-----
sdot-d200-011d         true   true
sdot-d200-012d         true   true
2 entries were displayed.
```

After you finish

You must perform the upgrade procedure for each host used in the ONTAP Select cluster.

Reinstalling a capacity pool license

Every active capacity pool license is locked to a specific License Manager instance, which is contained within an instance of the Deploy administration utility. If you are using a capacity pool license and then restore or recover the Deploy instance, the original license is no longer valid. You must generate a new capacity license file, and then install the license to the new Deploy instance.

Before you begin

- Determine all the capacity pool licenses used by the original Deploy instance
- If you restore a backup as part of creating the new Deploy instance, determine if the backup is current and up-to-date
- Locate the ONTAP Select nodes that were most recently created by the original Deploy instance (only if an up-to-date backup from the original Deploy instance is not restored to the new Deploy instance)
- Restore or recreate the Deploy instance

About this task

At a high level, this task is composed of three parts. You must regenerate and install all the capacity pool licenses used by the Deploy instance. After all the licenses have been reinstalled to the new Deploy instance, you can reset the serial sequence number if needed. Finally, if the Deploy IP address has changed, you must update every ONTAP Select node that uses a capacity pools license.

Steps

1. Contact NetApp support and have all the capacity pool licenses for the original Deploy instance unbound and unregistered.
2. Acquire and download a new license file for each of the capacity pool licenses.
See *Acquiring a capacity pool license file* for more information.
3. Install the capacity pool licenses at the new Deploy instance:
 - a. Sign in to the Deploy utility web user interface using the administrator account.
 - b. Click the **Administration** tab at the top of the page.
 - c. Click **Licenses** and then **Capacity Pool**.
 - d. Click **Add** and then **Upload License(s)** to select and upload the licenses.
4. If you created the new Deploy instance without restoring a backup, or you used a backup that was not current and up-to-date, you must update the serial sequence number:
 - a. Sign in to the Deploy utility command line interface using the administrator account.
 - b. Display the serial number for a node most recently created by the original Deploy instance:
`node show -cluster-name CLUSTER_NAME -name NODE_NAME -detailed`
 - c. Extract the last eight digits from the twenty-digit node serial number to obtain the last serial sequence number used by the original Deploy instance.
 - d. Add 20 to the serial sequence number to create the new serial sequence number.
 - e. Set the serial sequence number for the new Deploy instance:
`license-manager modify -serial-sequence SEQ_NUMBER`
5. If the IP address assigned to the new Deploy instance is different than the IP address of the original Deploy instance, you must update the IP address at every ONTAP Select node that uses a capacity pools license:
 - a. Sign in to the ONTAP command line interface of the ONTAP Select node.
 - b. Enter advanced privilege mode:
`set adv`
 - c. Display the current configuration:
`system license license-manager show`
 - d. Set the License Manager (Deploy) IP address used by the node:
`system license license-manager modify -host NEW_IP_ADDRESS`

Related tasks

[Acquiring a capacity pool license file](#) on page 45

Converting an evaluation license to a production license

You can upgrade an ONTAP Select evaluation cluster to use a production capacity tier license with the Deploy administration utility.

Before you begin

- You must use ONTAP Select 9.5P1 with Deploy 2.11 or later
- Each node must have enough storage allocated to support the minimum required for a production license.
- You must have capacity tier licenses for each node in the evaluation cluster.

About this task

When the upgrade is started, all the nodes are upgraded and then the cluster is moved back online.

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.
3. At the top of the cluster details page, click **Click here** to modify the cluster license.
You can also click **Modify** next to evaluation license in the **Cluster Details** section.
4. Select an available production license for each node or upload additional licenses as needed.
5. Provide the ONTAP credentials and click **Modify**.

The license upgrade for the cluster can take several minutes. Allow the process to complete before leaving the page or making any other changes.

After you finish

The twenty-digit node serial numbers originally assigned to each node for the evaluation deployment continue to be used after upgrading to production licenses.

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.

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

Before creating an ONTAP Select cluster on the ESXi hypervisor, you should note the following:

Preparing to attach storage to the ONTAP Select node

If you use a local hardware RAID controller, you must create at least one storage pool at each node for the system data as well as the root and data aggregates. You must attach the storage pool as part of configuring the ONTAP Select node.

If you use software RAID, you must create a storage pool for the system data and make sure the SSD drives are available for the root and data aggregates. You must attach the storage pool and disks as part of configuring the ONTAP Select node.

Available ONTAP Select versions

The Deploy administration utility contains a single version of ONTAP Select. If you want to deploy clusters using an earlier version of ONTAP Select, you must first add the ONTAP Select image to your Deploy instance. See *Adding an ONTAP Select image to the Deploy utility* for more information.

Licensing ONTAP Select for a production deployment

Before deploying an ONTAP Select cluster in a production environment, you must purchase a storage capacity license and download the associated license file. You can license the storage at each node using the *capacity tiers* model, or license a shared pool using the *capacity pools* model.

Related tasks

[Signing in to the Deploy utility using SSH](#) on page 53

[Adding an ONTAP Select image to the Deploy utility](#) on page 80

Related information

[ONTAP Select 9 Quick Start Guide: Deploying an Evaluation Cluster on VMware](#)

[ONTAP Select 9 Quick Start Guide: Deploying an Evaluation Cluster on KVM](#)

Installing the ONTAP Select license file

When you deploy an ONTAP Select cluster in a production environment, you must acquire and install the license file or files needed to accommodate the storage used by the nodes.

Before you begin

You must have the license file available on your local workstation.

Note: This task uses a capacity tier license for each ONTAP Select node.

About this task

You should perform this task for each of the ONTAP Select license files.

Steps

1. [Uploading a license file to the Deploy virtual machine](#) on page 91
2. [Registering a license for an ONTAP Select node](#) on page 91

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 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.

Example

```
sftp admin@10.234.81.101 (provide password when prompted)
put NLF-320000nnn.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.

Steps

1. Sign in to the Deploy utility CLI using SSH with the administrator account.
2. Register the license:


```
license add -file-name FILENAME
```

Provide the administrator account password when prompted.
3. Display the licenses in the system to confirm the license was added properly:


```
license show
```

Adding an ESXi hypervisor host

You must register a hypervisor host where the ONTAP Select node will run. As part of this, the Deploy administration utility authenticates either to the vCenter server managing the host or directly to the ESXi standalone host.

About this task

Before you register a host that is managed by vCenter, you must add an account credential for the vCenter server. If the host is not managed by vCenter, you can provide the host credential as part of registering the host. You should use this procedure to add each host.

Steps

1. Sign in to the Deploy utility CLI using SSH with the administrator account.
2. If the host is managed by a vCenter server, add the vCenter account credential:

```
credential add -hostname <FQDN/IP> -type vcenter -username
VCENTER_USERNAME
```

Example

```
credential add -hostname vc.select.company-demo.com -type vcenter -
username administrator@vsphere.local
```

Provide the password for the vCenter account when prompted.

3. Register the host:

- Register a standalone host not managed by vCenter:

```
host register -name <FQDN/IP> -hypervisor-type ESX -username
ESX_USERNAME
```

Provide the password for the ESXi host account when prompted.

- Register a host managed by vCenter:

```
host register -name <FQDN/IP> -hypervisor-type ESX -mgmt-server <FQDN/
IP>
```

Example

```
host register -name 10.234.81.14 -hypervisor-type ESX -mgmt-server
vc.select.company-demo.com
```

4. Display the state of the host and confirm it is authenticated.

```
host show -name <FQDN/IP> -detailed
```

Example

```
host show -name 10.234.81.14 -detailed
```

Related tasks

[Adding an account to the credential store](#) on page 63

Creating and configuring an ONTAP Select cluster

You must create and then configure the ONTAP Select cluster. After the cluster is configured, you can configure the individual nodes.

Before you begin

You must decide how many nodes the cluster contains and have the associated configuration information.

About this task

When you create an ONTAP Select cluster, the Deploy utility automatically generates the node names based on the cluster name and node count that you provide. Deploy also generates the unique node identifiers.

Steps

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

```
cluster create -name CLUSTERNAME -node-count NODES
```

Example

```
cluster create -name test-cluster -node-count 1
```

3. Configure the cluster:

```
cluster modify -name CLUSTERNAME -mgmt-ip IP_ADDRESS -netmask NETMASK -  
gateway IP_ADDRESS -dns-servers <FQDN/IP>_LIST -dns-domains DOMAIN_LIST
```

Example

```
cluster modify -name test-cluster -mgmt-ip 10.234.81.20 -netmask  
255.255.255.192 -gateway 10.234.81.1 -dns-servers 10.221.220.10 -dns-  
domains select.company-demo.com
```

4. Display the configuration and state of the cluster.

```
cluster show -name CLUSTERNAME -detailed
```

Configuring an ONTAP Select node

You must configure each of the nodes in the ONTAP Select cluster.

Before you begin

You must have the configuration information for the node. The capacity tier license file should be uploaded and installed at the Deploy utility.

About this task

You should use this procedure to configure each node. A capacity tier license is applied to the node in this example.

Steps

1. Sign in to the Deploy utility CLI using SSH with the administrator account.
2. Determine the names assigned to the cluster nodes:

```
node show -cluster-name CLUSTERNAME
```

3. Select the node and perform basic configuration:

```
node modify -name NODENAME -cluster-name CLUSTERNAME -host-name <FQDN/  
IP> -license-serial-number NUMBER -instance-type TYPE -passthrough-disks  
false
```

Example

```
node modify -name test-cluster-01 -cluster-name test-cluster -host-
name 10.234.81.14 -license-serial-number 320000nnnn -instance-type
small -passthrough-disks false
```

The RAID configuration for the node is indicated with the *-passthrough-disks* parameter. If you are using a local hardware RAID controller, this value must be *false*. If you are using software RAID, this value must be *true*.

A capacity tier license is used for the ONTAP Select node.

4. Display the network configuration available at the host:

```
host network show -host-name <FQDN/IP> -detailed
```

Example

```
host network show -host-name 10.234.81.14 -detailed
```

5. Perform network configuration of the node:

```
node modify -name NODENAME -cluster-name CLUSTERNAME -mgmt-ip IP -mgmt-
network NETWORK_NAME -data-network NETWORK_NAME -internal-network
NETWORK_NAME
```

When deploying a single-node cluster, you do not need an internal network and should remove *-internal-network*.

Example

```
node modify -name test-cluster-01 -cluster-name test-cluster -mgmt-ip
10.234.81.21 -mgmt-network sDOT_Network -data-network sDOT_Network
```

6. Display the configuration of the node:

```
node show -name NODENAME -cluster-name CLUSTERNAME -detailed
```

Example

```
node show -name test-cluster-01 -cluster-name test-cluster -detailed
```

Attaching storage to an ONTAP Select node

You must configure the storage used by each of the nodes in the ONTAP Select cluster. Each node must be assigned at least one storage pool.

Before you begin

You must have created the storage pool using VMware vSphere.

About this task

This procedure assumes that a local hardware RAID controller is used. You should configure the storage at each node in the ONTAP Select cluster.

Steps

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

2. Display the storage pools available at the host:

```
host storage pool show -host-name <FQDN/IP>
```

Example

```
host storage pool show -host-name 10.234.81.14
```

You can also obtain the available storage pools through VMware vSphere.

3. Attach an available storage pool to the ONTAP Select node:

```
node storage pool attach -name POOLNAME -cluster-name CLUSTERNAME -node-name NODENAME -capacity-limit LIMIT
```

If you include the `-capacity-limit` parameter, specify the value as GB or TB.

Example

```
node storage pool attach -name sDOT-02 -cluster-name test-cluster -node-name test-cluster-01 -capacity-limit 500GB
```

4. Display the storage pools attached to the node:

```
node storage pool show -cluster-name CLUSTERNAME -node-name NODENAME
```

Example

```
node storage pool show -cluster-name test-cluster -node-name test-cluster-01
```

Deploying an ONTAP Select cluster

After the cluster and nodes have been configured, you can deploy the cluster.

Before you begin

Before deploying 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. Sign in to the Deploy utility CLI using SSH with the administrator account.
2. Deploy the ONTAP Select cluster:

```
cluster deploy -name CLUSTERNAME
```

Example

```
cluster deploy -name test-cluster
```

Provide the password to be used for the ONTAP administrator account when prompted.

3. Display the status of the cluster to determine when it has been successfully deployed successfully.

```
cluster show -name CLUSTERNAME
```

After you finish

You should back up the ONTAP Select Deploy configuration data.

Related tasks

[Backing up the Deploy configuration data](#) on page 73

[Confirming network connectivity among ONTAP Select nodes using the CLI](#) on page 63

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.

Related concepts

[Appendix B: Understanding the ONTAP Select networking environment](#) on page 103

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.

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, NL-SAS, SATA, SSD)

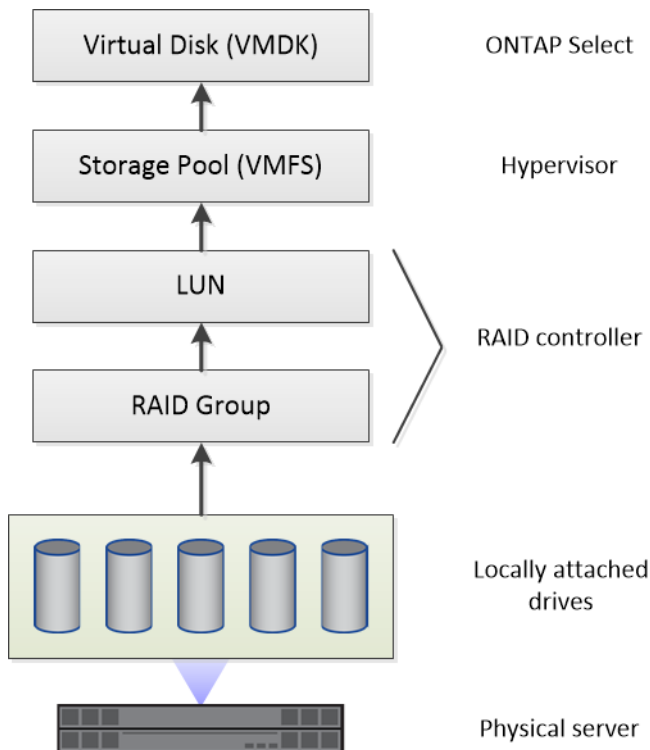
- Speed (RPM)

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

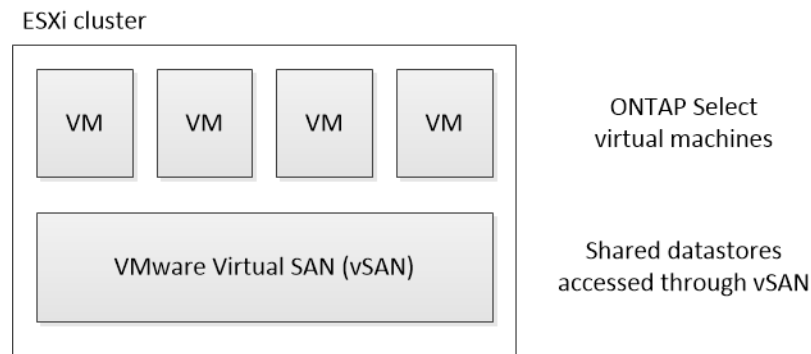
The ONTAP Select vNAS solution enables ONTAP Select to use datastores residing on storage that is external to the hypervisor host. The datastores can be accessed through the network using VMware vSAN or directly at an external storage array.

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

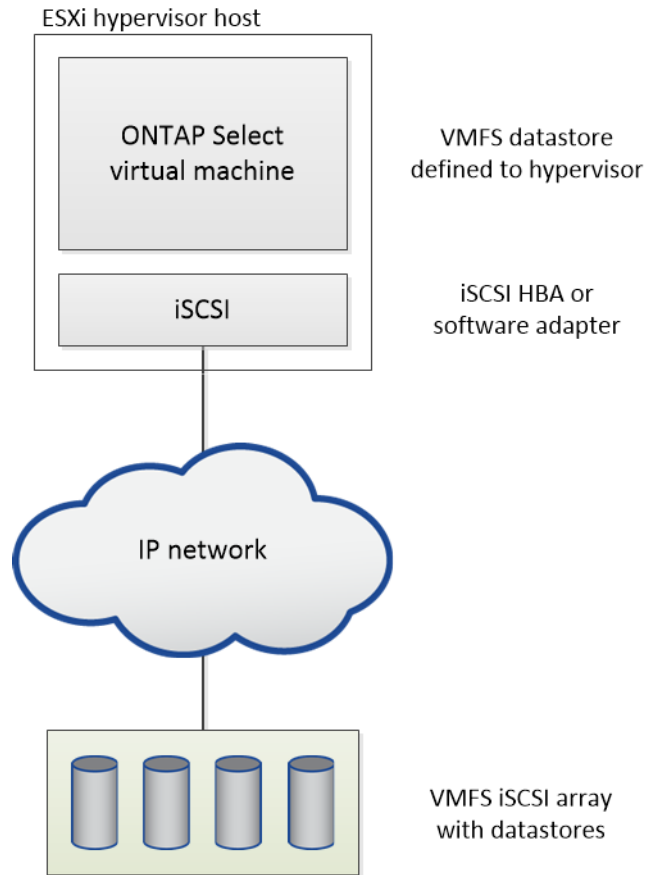
Every ESXi host can have one or more local VMFS datastores. Normally these datastores are only accessible to the local host. However, VMware vSAN allows each of the hosts in an ESXi cluster to share all of the datastores in the cluster as if they were local. The following figure illustrates how vSAN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



VMFS datastore on external storage array

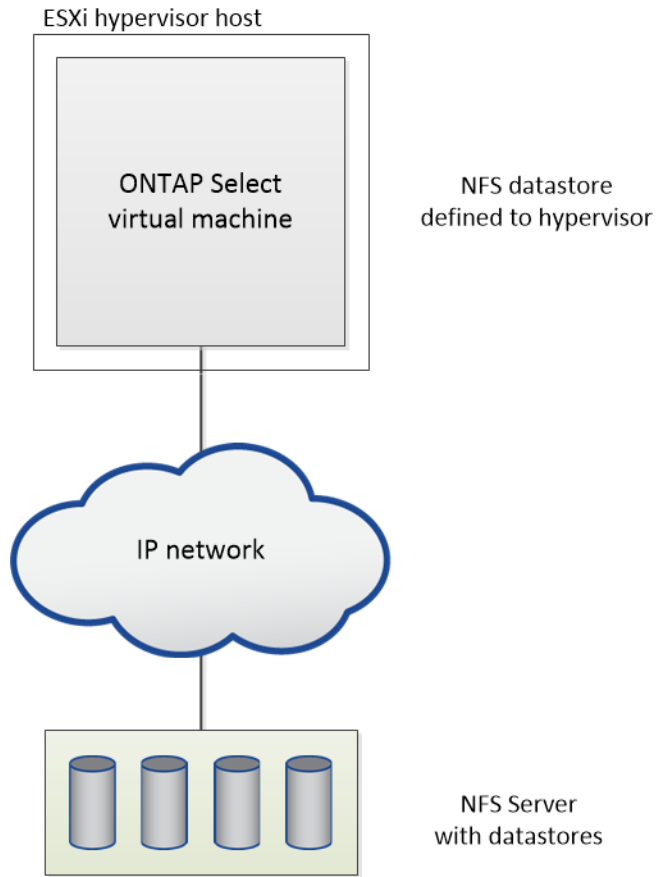
You can create a VMFS datastore residing on an external storage array. The storage is accessed using one of several different network protocols. The following figure illustrates a VMFS datastore on an external storage array accessed using the iSCSI protocol.

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 the *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 97

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?

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 by default and can be adjusted within 7500-9000 range (inclusive)

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 several 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 software within the hypervisor environment, whether vSwitch (VMware) or Open vSwitch (KVM), joins the ports exposed by the virtual machine with the physical Ethernet NIC ports. You must configure a vSwitch for every ONTAP Select host, as appropriate for your environment.

Single-node cluster deployment

ONTAP Select can be deployed as a single-node cluster. The hypervisor host 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
- Port e0c – 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

You can deploy a four-node ONTAP Select cluster. Each hypervisor host used 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.

Note: A four-node cluster is a common configuration and provides a good deployment example. The same concepts also apply when creating larger clusters, including six-node and eight-node clusters.

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
- Port e0g – Data and management

Note: Ports e0a, e0b, and e0g are associated with the external network. The remaining 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.

Note: IP version 6 (IPv6) is not supported with a two-node cluster due to the iSCSI traffic between the nodes and the Deploy mediator service.

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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