NFS Configuration for ESXi® using VSC Express Guide
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Deciding whether to use the NFS Configuration for ESXi using VSC Express Guide

This guide describes how to quickly set up NFS access for ESXi hosts to datastores using ONTAP volumes.

You should use this guide if you want to configure NFS access for ESXi hosts to a volume in the following way:

• You are working with clusters running ONTAP 9.
• You want to use best practices, not explore every available option.
• You do not want to read a lot of conceptual background.
• You want to use Virtual Storage Console to provision a datastore and create a volume.
• You want to use OnCommand System Manager to create aggregates and SVMs (if required), not the ONTAP command-line interface or an automated scripting tool.

If you use OnCommand System Manager to create an aggregate, be aware that the UI navigation in OnCommand System Manager 9.3 and later is different from the UI navigation in previous releases. This guide provides the common steps that you must perform to complete a task in any ONTAP 9 release. If you want the exact steps for navigating to a particular screen or window, you should view the OnCommand System Manager Online Help for your version of ONTAP.

Cluster management using System Manager

• Your data network uses the default IPspace, the default broadcast domain, and the default failover group.
If your data network is flat, these default objects prescribe that LIFs will fail over correctly in the event of a link failure. If you are not using the default objects, you should refer to the Network Management Guide for information about how to configure LIF path failover.

• You want to use the NetApp Plug-In for VMware VAAI.
VMware vStorage APIs for Array Integration (VAAI) enable you to perform copy offload and space reservations. The NetApp Plug-In for VMware VAAI uses this to improve host performance because operations do not need to go through the ESXi host, thereby taking advantage of space- and time-efficient cloning in ONTAP.
Using VMware VAAI for datastore provisioning is a best practice.

• NFS access will be through NFSv3 and NFSv4 for use with VMware VAAI.

If this guide is not suitable for your situation, you should see the following documentation instead:

• NFS management


• NetApp Technical Report 4597: VMware vSphere with ONTAP
NFS Client Configuration for ESXi workflow

When you make storage available to an ESXi host using NFS, you provision a volume on the SVM using Virtual Storage Console for VMware vSphere and then connect to the NFS export from the ESXi host.

Verifying that the configuration is supported

For reliable operation, you must verify that the entire configuration is supported. The Interoperability Matrix lists the supported configurations for NFS and for Virtual Storage Console.

Steps

1. Go to the Interoperability Matrix to verify that you have a supported combination of the following components:

   NetApp Interoperability Matrix Tool
• ONTAP software
• NFS storage protocol
• ESXi operating system version
• Guest operating system type and version
• Virtual Storage Console for VMware vSphere (VSC) software
• NetApp NFS Plug-In for VAAI

2. Click the configuration name for the selected configuration. Details for that configuration are displayed in the Configuration Details window.

3. Review the information in the following tabs:
   - Notes
     Lists important alerts and information that are specific to your configuration.
   - Policies and Guidelines
     Provides general guidelines for all NAS configurations.

Completing the NFS client configuration worksheet

You require network addresses and storage configuration information to perform NFS client configuration tasks.

Target network addresses

You require a subnet with two IP addresses for NFS data LIFs for each node in the cluster. There should be two separate networks for high availability. The specific IP addresses are assigned by ONTAP when you create the LIFs as part of creating the SVM.

If possible, separate network traffic on separate physical networks or on VLANs.

Subnet for LIFs: _______________________

![Diagram of network setup with host, switches, and nodes representing the configuration.]
<table>
<thead>
<tr>
<th>Node or LIF with port to switch</th>
<th>IP address</th>
<th>Network mask</th>
<th>Gateway</th>
<th>VLAN ID</th>
<th>Home port</th>
</tr>
</thead>
<tbody>
<tr>
<td>Node 1 / LIF to switch 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Node 2 / LIF to switch 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Node 3 / LIF to switch 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Node 4 / LIF to switch 1</td>
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<tr>
<td>Node 1 / LIF to switch 2</td>
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<tr>
<td>Node 2 / LIF to switch 2</td>
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<td>Node 3 / LIF to switch 2</td>
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<td>Node 4 / LIF to switch 2</td>
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</tr>
</tbody>
</table>

**Storage configuration**

If the aggregate and SVM are already created, record their names here; otherwise, you can create them as required:

<table>
<thead>
<tr>
<th>Node to own NFS export</th>
<th>Aggregate name</th>
<th>SVM name</th>
</tr>
</thead>
</table>

**NFS export information**

<table>
<thead>
<tr>
<th>Export size</th>
<th>Export name (optional)</th>
<th>Export description (optional)</th>
</tr>
</thead>
</table>

**SVM information**

If you are not using an existing SVM, you require the following information to create a new one:

<table>
<thead>
<tr>
<th>SVM name</th>
<th>Aggregate for SVM root volume</th>
<th>SVM user name (optional)</th>
<th>SVM password (optional)</th>
</tr>
</thead>
</table>
Installing Virtual Storage Console

Virtual Storage Console for VMware vSphere automates many of the configuration and provisioning tasks required to use NetApp storage with an ESXi host. Virtual Storage Console is a plug-in to vCenter Server.

**Before you begin**
You must have administrator credentials on the vCenter Server used to manage the ESXi host.

**About this task**
- Virtual Storage Console is installed as a virtual appliance that includes Virtual Storage Console, vStorage APIs for Storage Awareness (VASA) Provider, and Storage Replication Adapter (SRA) for VMware vSphere capabilities.

**Steps**
1. Download the version of Virtual Storage Console that is supported for your configuration, as shown in the Interoperability Matrix tool.

   *NetApp Support*

2. Deploy the virtual appliance and configure it following the steps in the *Deployment and Setup Guide*.

Adding the storage cluster or SVM to VSC for VMware vSphere

Before you can provision the first datastore to an ESXi host in your Datacenter, you must add the cluster or a specific storage virtual machine (SVM) to Virtual Storage Console for VMware vSphere. Adding the cluster enables you to provision storage on any SVM in the cluster.

**Before you begin**
You must have administrator credentials for the storage cluster or the SVM that is being added.

**About this task**
Depending on your configuration, the cluster might have been discovered automatically, or might have already been added.

**Steps**
1. Log in to the vSphere Web Client.
2. Select Virtual Storage Console.
3. Select Storage Systems and then click the Add icon.
4. In the Add Storage System dialog box, enter the host name and administrator credentials for the storage cluster or SVM and then click OK.

Configuring your network for best performance

Ethernet networks vary greatly in performance. You can maximize the performance of the network by selecting specific configuration values.

Steps
1. Connect the host and storage ports to the same network.
   It is best to connect to the same switches.
2. Select the highest speed ports available.
   10 GbE or faster ports are best. 1 GbE ports are the minimum.
3. Enable jumbo frames if desired and supported by your network.
   Jumbo frames should have an MTU of 9000 for ESXi hosts and storage systems and 9216 for most switches.
   All devices in the data path, including ESXi NICs, storage NICs, and switches, must support jumbo frames.

Configuring the ESXi host

Configuring the ESXi host involves configuring ports and vSwitches, and using ESXi host best practice settings. After verifying that these settings are correct, you can then create an aggregate and decide where to provision the new volume.

Configuring host ports and vSwitches

The ESXi host requires network ports for the NFS connections to the storage cluster.

About this task
It is recommended that you use IP Hash as the NIC teaming policy, which requires a single VMkernel port on a single vSwitch.

The host ports and storage cluster ports used for NFS must have IP addresses in the same subnet.

This task lists the high-level steps for configuring the ESXi host. If you require more detailed instructions, see the VMware publication VMware vSphere Storage for your version of ESXi.

Steps
1. Log in to the vSphere Client, and then select the ESXi host from the inventory pane.
2. On the Manage tab, click Networking.
3. Click Add Networking, and then select VMkernel and Create a vSphere standard switch to create the VMkernel port and vSwitch.
4. Configure jumbo frames for the vSwitch (MTU size of 9000, if used).

**Configuring the ESXi host best practice settings**

You must ensure that the ESXi host best practice settings are correct so that the ESXi host can correctly manage the loss of an NFS connection or a storage.

**Steps**

1. From the VMware vSphere Web Client **Home** page, click **vCenter > Hosts**.
2. Right-click the host, and then select **Actions > NetApp VSC > Set Recommended Values**.
3. In the **NetApp Recommended Settings** dialog box, ensure that all of the options are selected, and then click **OK**.

   MPIO Settings do not apply to NFS. However, if you use other protocols, you should ensure that all options are selected.

   The vCenter Web Client displays the task progress.

**Creating an aggregate**

If you do not want to use an existing aggregate, you can create a new aggregate to provide physical storage to the volume which you are provisioning.

**About this task**

If you have an existing aggregate that you want to use for the new volume, you can skip this procedure.

**Steps**

1. Enter the URL `https://IP-address-of-cluster-management-LIF` in a web browser and log in to System Manager using your cluster administrator credential.
2. Navigate to the **Aggregates** window.
3. Click **Create**.
4. Follow the instructions on the screen to create the aggregate using the default RAID-DP configuration, and then click **Create**.

**Result**

The aggregate is created with the specified configuration and added to the list of aggregates in the Aggregates window.
Deciding where to provision the new volume

Before you create an NFS volume, you must decide whether to place it in an existing SVM and, if so, how much configuration the SVM requires. This decision determines your workflow.

**Choices**

- If you want a new SVM, follow the steps that you do for creating an NFS-enabled SVM.
  
  *Creating a new NFS-enabled SVM* on page 11

  You must choose this option if NFS is not enabled on an existing SVM.

- If you want to provision a volume on an existing SVM that has NFS enabled but not configured, follow the steps that you do for configuring NFS access to an existing SVM.

  *Configuring NFS access to an existing SVM* on page 14

  You should choose this option if you created the SVM for SAN access by using the relevant Express Guide.

- If you want to provision a volume on an existing SVM that is fully configured for NFS access, follow the steps that you do for verifying settings on an existing SVM.

  *Verifying settings on an existing SVM* on page 15

Creating a new NFS-enabled SVM

Setting up a new SVM involves creating the new SVM and enabling NFS. You can then configure NFS access on the ESXi host and verify that NFS is enabled for ESXi by using Virtual Storage Console.

**Before you begin**

- Your network must be configured and the relevant physical ports must be connected to the network.

- You must know which of the following networking components the SVM will use:
  - The node and the specific port on that node where the data logical interface (LIF) will be created
  - The subnet from which the data LIF’s IP address will be provisioned, or optionally the specific IP address you want to assign to the data LIF

- Any external firewalls must be appropriately configured to allow access to network services.

**About this task**

With OnCommand System Manager, you can use a wizard that guides you through the process of creating the SVM, configuring DNS, creating a data LIF, and enabling NFS.

**Steps**

1. Navigate to the SVMs window.

2. Click Create.

3. In the Storage Virtual Machine (SVM) Setup window, create the SVM:
a. Specify a unique name for the SVM.
   The name must either be a fully qualified domain name (FQDN) or follow another convention
   that ensures unique names across a cluster.

b. Select **NFS** for the data protocol.
   If you plan to use additional protocols on the same SVM, you should select them even if you
   do not want to configure them immediately.

c. Keep the default language setting, C.UTF-8.
   This language is inherited by the volume that you create later, and a volume's language cannot
   be changed.

d. Optional: If you enabled the CIFS protocol, change the security style to **UNIX**.
   Selecting the CIFS protocol sets the security style to NTFS by default.

e. Optional: Select the root aggregate to contain the SVM root volume.
   The aggregate that you select for the root volume does not determine the location of the data
   volume.

f. Optional: In the **DNS Configuration** area, ensure that the default DNS search domain and
   name servers are the ones that you want to use for this SVM.
g. Click **Submit & Continue**.

The SVM is created, but protocols are not yet configured.

4. In the **Data LIF Configuration** section of the **Configure CIFS/NFS protocol** page, specify the details of the first data LIF of the first datastore.
   a. Assign an IP address to the LIF automatically from a subnet you specify or manually enter the address.
   b. Click **Browse** and select a node and port that will be associated with the LIF.

   ![Data LIF Configuration](image)

   Do not enter any information to provision a volume. You can provision datastores later using Virtual Storage Console.

5. Click **Submit & Continue**.

   The following objects are created:
   - A data LIF named after the SVM with the suffix “_nfs_lif1”
   - An NFS server

6. For all other protocol configuration pages that are displayed, click **Skip**, and then configure the protocol later.

7. When the **SVM Administration** page is displayed, configure or defer configuring a separate administrator for this SVM:
   - Click **Skip**, and then configure an administrator later if required.
   - Enter the requested information, and then click **Submit & Continue**.

8. Review the **Summary** page, record any information that you might require later, and then click **OK**.

   NFS clients need to know the IP address of the data LIF.
Result
A new SVM is created with NFS enabled.

Adding NFS access to an existing SVM

To add NFS access to an existing SVM, you must first create a data logical interface (LIF). You can then configure NFS access on the ESXi host and verify that NFS is enabled for ESXi using Virtual Storage Console.

Before you begin

• You must know which of the following networking components the SVM will use:
  ◦ The node and the specific port on that node where the data LIF will be created
  ◦ The subnet from which the data LIF’s IP address will be provisioned, or optionally the specific IP address you want to assign to the data LIF
• Any external firewalls must be appropriately configured to allow access to network services.
• The NFS protocol must be allowed on the SVM. This is the case if you created the SVM while following another Express Guide to configure a SAN protocol.

Steps

1. Navigate to the Details pane where you can configure the protocols of the SVM:
   a. Select the SVM that you want to configure.
   b. In the Details pane, next to Protocols, click NFS.

2. In the Configure NFS protocol dialog box, create a data LIF:
   a. Assign an IP address to the LIF automatically from a subnet you specify or manually enter the address.
   b. Click Browse and select a node and port that will be associated with the LIF.

   ![Data LIF Configuration](image)

   Do not enter any information to provision a volume. You can provision datastores later using the Virtual Storage Console.

3. Click Submit & Close, and then click OK.
Verifying that NFS is enabled on an existing SVM

If you choose to use an existing SVM, you must first verify that NFS is enabled on the SVM. You can then configure NFS access and verify that NFS is enabled for ESXi by using Virtual Storage Console.

**Steps**
1. Navigate to the SVMs window.
2. Click the SVM Settings tab.
3. In the Protocols pane, click NFS.
4. Verify that NFS is displayed as enabled.
   If NFS is not enabled, you must enable it or create a new SVM.

Provisioning a datastore and creating its containing volume

A datastore contains virtual machines and their VMDKs on the ESXi host. The datastore on the ESXi host is provisioned on a volume on the storage cluster.

**Before you begin**
Virtual Storage Console for VMware vSphere (VSC) must be installed and registered with the vCenter Server that manages the ESXi host.
VSC must have sufficient cluster or storage virtual machine (SVM) credentials to create the volume.

**About this task**
VSC automates the datastore provisioning, including creating a volume on the specified SVM.

**Steps**
1. From the vSphere Web Client Home page, click Hosts and Clusters.
2. In the navigation pane, expand the datacenter where you want to provision the datastore.
3. Right-click the ESXi host, and then select NetApp VSC > Provision Datastore.
   Alternatively, you can right-click the cluster when provisioning to make the datastore available to all hosts in the cluster.
4. Provide the required information in the wizard:
Verifying NFS access from an ESXi host

After you have provisioned a datastore, you can verify that the ESXi host has NFS access by creating a virtual machine on the datastore and powering it on.

Steps
1. From the vSphere Web Client Home page, click Hosts and Clusters.
2. In the navigation pane, expand the datacenter to locate the datastore you previously created.
3. Click Create a new virtual machine and provide the required information in the wizard.
   To verify NFS access, you should select the datacenter, ESXi host, and datastore that you previously created.
   The virtual machine appears in the vSphere Web Client inventory.
4. Power on the virtual machine.

Deploying the NetApp NFS Plug-in for VMware VAAI

The plug-in is a software library that integrates the VMware Virtual Disk Libraries that are installed on the ESXi host. Downloading and installing the NetApp NFS Plug-In for VMware VAAI enables you to improve the performance of cloning operations by using the copy offload and space reservation options.

About this task

To provide consistent access to the virtual machines residing on the ESXi host on which you are installing the NFS plug-in, you can migrate virtual machines or install the NFS plug-in during planned maintenance.

Steps
1. Download the NetApp NFS Plug-In for VMware VAAI.
   NetApp Support
   You should download the online bundle (NetAppNasPlugIn.vib) of the most recent plug-in
2. Verify that VAAI is enabled on each ESXi host.
   In VMware vSphere 5.0 and later, VAAI is enabled by default.
3. In Virtual Storage Console, go to Tools > NFS VAAI Tools.
4. Click Select File to upload the NetAppNasPlugIn.vib file.
5. Click Upload.
   You see an uploaded successfully message.
6. Click Install on host.
7. Select the ESXi hosts on which you want to install the plug-in, click Install, and then click OK.
8. Reboot the ESXi host to enable the plug-in.
   After installing the plug-in, you must reboot the ESXi host before installation is complete.
   You do not need to reboot the storage system.
Mounting datastores on hosts

Mounting a datastore gives a host access to storage. When datastores are provisioned by Virtual Storage Console, they are automatically mounted to the host or cluster. You might need to mount a datastore on a host after you add the host to your VMware environment.

Steps

1. From the vSphere Web Client Home page, click Hosts and Clusters:

2. In the navigation pane, expand the datacenter that contains the host:

3. Right-click the host, and then select NetApp VSC > Mount Datastores.

4. Select the datastores that you want to mount, and then click OK.

Related information

Virtual Storage Console, VASA Provider, and Storage Replication Adapter for VMware vSphere Administration Guide for 7.1 release

Where to find additional information

After you have successfully tested NFS client access, you can perform additional NFS configuration or add SAN access. When protocol access is complete, you should protect the root volume of the SVM. There are express guides, comprehensive guides, and technical reports to help you achieve these goals.

NFS configuration

You can further configure NFS access using the following comprehensive guides and technical reports:

• NFS configuration
Describes how to use CLI commands to configure advanced NFS client access to files contained in a new volume or qtree.

- **NFS management**
  Describes how to manage file access using the NFS protocol, including authentication, authorization, and security.

- **NetApp Technical Report 4597: VMware vSphere with ONTAP**
  Describes the best practices that should be followed when using ONTAP and VMware vSphere server virtualization environments.

  Provides a comprehensive list of best practices, limits, recommendations, and considerations when configuring LDAP, NIS, DNS, and local user and group files for authentication purposes.

  Provides an overview of ONTAP with a focus on NFSv4.

**Root volume protection**

After configuring protocols on the SVM, you should ensure that its root volume is protected:

- **Data protection**
  Describes how to create load-sharing mirrors on every node of an ONTAP cluster to protect the SVM root volume, which is a NetApp best practice for NAS-enabled SVMs. Also describes how to quickly recover from volume failures or losses by promoting the SVM root volume from a load-sharing mirror.
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