Installing the NetApp® NFS Plug-in 1.0 for VMware® VAAI

Installing the NetApp NFS Plug-in for VAAI (VMware vStorage APIs for Array Integration) involves enabling VMware vStorage for NFS on the NetApp storage system, verifying that VAAI is enabled on the VMware host, downloading and installing the plug-in on the VMware ESXi host, and ensuring that the installation is successful.

Before you begin

- NFSv3 must be enabled on the storage system.
- VMware vSphere 5.0 or later is required.

For more information about enabling NFS and using VMware vSphere, see the manuals listed at the end of this document.

About this task

- If you are using the Cluster-Mode Element Manager or the VMware ESXi CLI to install the plug-in, start with Step 1.
- If you are using Virtual Storage Console for VMware vSphere (VSC) to install the plug-in, start with Step 3.
  VSC enables VMware vStorage for NFS on the storage controller and enables VAAI on the ESXi host, which are steps 1 through 2 of this procedure.
- Installing the NFS plug-in is a disruptive activity that requires rebooting the ESXi host before the installation is complete.
  To ensure consistent access to the virtual machines residing on the ESXi host on which you are installing the NFS plug-in, it is recommended that you consider virtual machine migrations, or install the NFS plug-in during planned maintenance windows.

  IP address conventions used:

- IP addresses of the form 192.168.42.2xx refer to ESXi server VMkernel ports.
- IP addresses of the form 192.168.42.6x refer to 7-Mode systems.
- IP addresses of the form 192.168.42.8x refer to virtual storage servers (Vservers) on Data ONTAP systems operating in Cluster-Mode.

Steps

1. Enable VMware vStorage for NFS by using one of the following methods:

If you use...	Then...
Cluster-Mode Element Manager	a. Click **Vserver > NFS > Manage**, and then select **Vserver**. b. Under the NFS vStorage Support tab, select **enabled**, and then click **modify**.
Cluster-Mode CLI	Enable VMware vStorage for NFS on a Vserver by using the following command: **vserver nfs modify –vserver *vserver_name* -vstorage enabled** *vserver_name* is the name of a Vserver.
7-Mode CLI	Enable VMware vStorage for NFS on the storage system by using the following command: **options nfs.vstorage.enable on**

If you use...	Then...
7-Mode CLI for vFiler units	Enable VMware vStorage for NFS on the MultiStore vFiler unit hosting VMware NFS datastores by using the following command: `vfiler run vfiler_name options nfs.vstorage.enable on`

2. Verify that VAAI is enabled on each ESXi host.

In VMware vSphere 5.0 and later, VAAI is enabled by default.

If you use...	Then...

VMware ESXi CLI	**a.** Enter the following commands to verify that VAAI is enabled:
	
	`esxcfg-advcfg -g /DataMover/HardwareAcceleratedMove`
	
	`esxcfg-advcfg -g /DataMover/HardwareAcceleratedInit`
	
	If VAAI is enabled, these commands produce the following output:
	
	<pre>~ # esxcfg-advcfg -g /DataMover/HardwareAcceleratedMove
	Value of HardwareAcceleratedMove is 1
	~ # esxcfg-advcfg -g /DataMover/HardwareAcceleratedInit
	Value of HardwareAcceleratedInit is 1</pre>
	b. If VAAI is not enabled, enter the following commands to enable VAAI:
	
	`esxcfg-advcfg -s 1 /DataMover/HardwareAcceleratedInit`
	
	`esxcfg-advcfg -s 1 /DataMover/HardwareAcceleratedMove`
	
	These commands produce the following output:
	
	<pre>~ # esxcfg-advcfg -s 1 /DataMover/HardwareAcceleratedInit
	Value of HardwareAcceleratedInit is 1
	~ # esxcfg-advcfg -s 1 /DataMover/HardwareAcceleratedMove
	Value of HardwareAcceleratedMove is 1</pre>

vSphere Client	**a.** Using the vSphere client, log in to the vCenter server. **b.** For each ESXi server, click the server name. **c.** In the Software section of the Configuration tab, click **Advanced Settings**. **d.** Select **DataMover**, and ensure that the `DataMover.HardwareAcceleratedMove` and `DataMover.HardwareAcceleratedInit` parameters are set to `1`.

3. Download the NetApp NFS Plug-in for VMware VAAI:

   a) Go to the **Software Download** page at *support.netapp.com/NOW/cgi-bin/software*.
   b) Scroll down and click **NetApp NFS Plug-in for VMware VAAI**.
   c) Select the ESXi platform.
   d) Download either the offline bundle (`.zip`) or online bundle (`.vib`) of the most recent plug-in.

4. Install the plug-in on the ESXi host by using one of the following three methods:

To...	Then...
Install the online bundle using the ESXi CLI	Enter the following command: `~ # esxcli software vib install -v http_path` `http_path` is the path to the online bundle (`.vib`), which must be available online.

To...	Then...

Install the offline bundle using the ESXi CLI	**a.** Copy the offline bundle to the ESXi host, or to a common datastore accessible by all ESXi hosts.
	
	b. Enter the following command to list the contents of the offline bundle and verify the plug-in version:
	
	`~ # esxcli software sources vib list –d file:///path_offline_bundle.zip`
	
	In the following output examples, the version and release date of the plug-in are for illustration purposes. The most recent version and release date of the plug-in might be different from what is shown. `path_offline_bundle` is the file name and full path of the offline bundle, and `plugin_name` is the name of the NFS plug-in.
	
	The following output is displayed when you enter this command:
	
	<pre>~ # esxcli software sources vib list -d file:///NetAppNasPlugin.v18.zip
	
	Name Version Vendor Rel Date Acceptance Level
	--------------- ------- ------ ---------- ----------------
	
	NetAppNasPlugin 1.0-018 NetApp 2012-04-29 VMwareAccepted</pre>
	c. Enter the following command to install the plug-in from the offline bundle:
	
	`esxcli software vib install -n plugin_name -d file:///path_offline_bundle.zip`
	
	The following output is displayed when you enter this command:
	
	<pre>~ # esxcli software vib install -n NetAppNasPlugin -d file:///
	NetAppNasPlugin.v18.zip
	
	Message: The update completed successfully, but the system needs to be
	rebooted for the changes to be effective.
	
	   Reboot Required: true VIBs Installed:
	   NetApp_bootbank_NetAppNasPlugin_1.0-018
	   VIBs Removed:
	   VIBs Skipped:
	~ #</pre>

Use VSC to install the plug-in	**a.** Extract the offline bundle in `.zip` format. **b.** Copy the plug-in `.vib` file, `NetAppNasPlugin.vib`, to the VSC installation directory. The path name is `VSC_installation_directory\etc\vsc\web`, where `VSC_installation_directory` is the directory where you installed VSC. The default directory path is `C:\Program Files\NetApp\Virtual Storage Console\`. For example, if you are using the default installation directory, the path to the `NetAppNasPlugin.vib` file is `C:\Program Files\Virtual Storage Console\etc\vsc\web\NetAppNasPlugin.vib`. However, VSC lets you change that directory. **c.** Check that the file name of the `.vib` file that you downloaded matches the predefined name that VSC uses: `NetAppNasPlugin.vib` If the file name does not match the predefined name, rename the `.vib` file. You do not need to restart the VSC client or the NetApp vSphere Plug-in Framework (NVPF) service. **d.** Go to the NFS Plug-in for VMware VAAI section of the Tools panel of Monitoring and Host Configuration, and then click **Install to Host**. **e.** In the pop-up box, specify the ESXi hosts on which you want to install the plug-in. **f.** Click **OK**. The Monitoring and Host Configuration capability automatically installs the plug-in on the hosts that you specified.

5. Reboot the ESXi host to complete the installation.

However, the storage system does not need to be rebooted.

6. Verify that the plug-in was successfully installed on the host by entering the following command at the VMware ESXi command line:

   ~ # esxcli software vib list | more

   The plug-in works automatically following the installation and reboot.

   The following output is displayed when you enter this command:

```
Name               Version   Vendor  Acceptance Level     Install Date
---------------    --------  ------  ------------------   ------------
NetAppNasPlugin    1.0-018   NetApp  VMwareAccepted       2012-04-29
~ # esxcli software vib get|more

NetApp_bootbank_NetAppNasPlugin_1.0-018
   Name: NetAppNasPlugin
   Version: 1.0-018
   Type: bootbank
   Vendor: NetApp
   Acceptance Level: VMwareAccepted
   Summary: NAS VAAI NetApp Plugin
   Description: NetApp NAS VAAI Module for ESX Server
   Release Date: 2012-04-29
   Depends:
   Conflicts:
   Replaces:
   Provides:
   Maintenance Mode Required: False
   Hardware Platforms Required:
   Live Install Allowed: False
   Live Remove Allowed: False
   Overlay: False
   Payloads: NetAppNasPlugin
~ #
```

7. If you are using Data ONTAP operating in Cluster-Mode, either create or modify export policy rules for ESXi servers that use VAAI.

   Skip this step if you are using Data ONTAP operating in 7-Mode.

   You can use export policies to restrict access to volumes to specific clients. NFSv4 is required in the export policy for VAAI copy offloading to work so you might need to modify the export policy rules for datastore volumes on Vservers. If you are using protocols other than NFS on a datastore, verify that setting NFS in the export rule does not remove those other protocols.

If you use...	Then...
Cluster-Mode CLI	Enter the following command to set nfs as the access protocol for each export policy rule for ESXi servers that use VAAI:

   vserver export-policy rule modify -vserver *vserver_name* -policyname *policy* -ruleindex *index* -protocol nfs

   In the following example:

   - **vs1** is the name of the Vserver.
   - **mypolicy** is the name of the export policy.
   - **1** is the index number of the rule.
   - **nfs** includes the NFSv3 and NFSv4 protocols.

```
cluster1::> vserver export-policy rule modify -vserver vs1
-policyname mypolicy -ruleindex 1 -protocol nfs
```

If you use...	Then...
Cluster-Mode Element Manager	a. Click **Vserver > export-policy > rule**. b. Select each export-policy rule from the rule index and select the ESXi server or subnet. c. Enter **nfs** for Access Protocol. d. Click **modify**.
OnCommand System Manager	a. From the **Home** tab, double-click the appropriate cluster. b. Expand the **Vservers** hierarchy in the left navigation pane. c. In the navigation pane, select the Vserver with VAAI-enabled datastores, and then click **Policies > Export Policies**. d. In the Export Policies window, expand the export policy, and then select the rule index. The user interface does not specify that the datastore is VAAI enabled. e. Click **Modify Rule** to display the Modify Export Rule dialog. f. Under **Access Protocols**, select **NFS** to enable all versions of NFS. g. Click **OK.**

If you are starting with a new system, you need to create export policies and rules for the root volume and for each NFS datastore volume. For more information about creating export policy rules, see the *Data ONTAP File Access and Protocols Management Guide for Cluster-Mode* and *Technical Report 4068: VMware vSphere 5 on NetApp Clustered Data ONTAP 8.1*.

8. If you are using Data ONTAP operating in 7-Mode, use the `exportfs` command for exporting volume paths.

   Skip this step if you are using Data ONTAP operating in Cluster-Mode.

   For more information about the `exportfs` command, see the *Data ONTAP File Access and Protocols Management Guide for 7-Mode* or the man pages.

   Example

   When exporting the volume, you can specify a host by name or IP address, a subnet, or a netgroup. You need to specify IP address, subnet, or hosts for both the `rw` and `root` options. For example:

   ```
   sys1> exportfs -p root=192.168.42.227 /vol/VAAI
   ```

   You also can have a list separated by colons. For example:

   ```
   sys1> exportfs -p root=192.168.42.227:192.168.42.228 /vol/VAAI
   ```

   If you export the volume with the actual flag, the export path should have a single component for copy offload to work properly. For example:

   ```
   sys1> exportfs -p actual=/vol/VAAI,root=192.168.42.227 /VAAI-ALIAS
   ```

   Note: Copy offload does not work for multi-component export paths.

9. If you have not already done so, mount the NFS datastore on the ESXi host by performing the following steps:

   a) Enter the following command:

   ```
   ~ # esxcfg-nas -a mount_point_name -o 192.168.42.80 -s /volume_path
   ```

Example

The following example shows the Cluster-Mode command for mounting the datastore and the resulting output:

```
~ # esxcfg-nas -a onc_src -o 192.168.42.80 -s /onc_src
Connecting to NAS volume: onc_src
/onc_src created and connected.
```

For 7-Mode systems, the `/vol` prefix precedes the NFS volume name. The following example shows the 7-Mode command for mounting the datastore and the resulting output:

```
~ # esxcfg-nas -a vms_7m -o 192.168.42.69 -s /vol/vms_7m
Connecting to NAS volume: /vol/vms_7m
/vol/vms_7m created and connected.
```

b) Enter the following command:

~ # esxcfg-nas -l

The following output is displayed:

```
VMS_vol103 is /VMS_vol103 from 192.168.42.81 mounted available
VMS_vol104 is VMS_vol104 from 192.168.42.82 mounted available
dbench1 is /dbench1 from 192.168.42.83 mounted available
dbench2 is /dbench2 from 192.168.42.84 mounted available
onc_src is /onc_src from 192.168.42.80 mounted available
```

Upon completion, the volume is mounted and available in the `/vmfs/volumes` directory.

10. Verify that the mounted datastore supports VAAI by using one of the following methods:

If you use...	Then...

ESXi CLI	Enter the following command:
	
	~ # vmkfstools -Ph /vmfs/volumes/onc_src/
	
	The following output is displayed:
	
	<pre>NFS-1.00 file system spanning 1 partitions.
	File system label (if any):
	onc_src Mode: public Capacity 760 MB, 36.0 MB available,
	file block size 4 KB
	UUID: fb9cccc8-320a99a6-0000-000000000000
	Partitions spanned (on "notDCS"):
	
	nfs:onc_src
	NAS VAAI Supported: YES
	Is Native Snapshot Capable: YES
	~ #</pre>

vSphere client	**a.** Click **ESXi Server > Configuration > Storage**. **b.** Look in the Hardware Acceleration column for an NFS datastore with VAAI enabled.

For more information about VMware vStorage over NFS, see the *Data ONTAP File Access and Protocols Management Guide for Cluster-Mode* or *Data ONTAP File Access and Protocols Management Guide for 7-Mode*.

For details about configuring volumes and space in the volumes, see the *Data ONTAP Logical Storage Management Guide for Cluster-Mode* or *Data ONTAP Storage Management Guide for 7-Mode*.

For information about using VSC to provision NFS datastores and create clones of virtual machines in the VMware environment, see the *Virtual Storage Console for VMware vSphere Installation and Administration Guide*.

For more information about working with NFS datastores and performing cloning operations, see the *VMware vSphere Storage* guide at *pubs.vmware.com/vsphere-50/topic/com.vmware.ICbase/PDF/vsphere-esxi-vcenter-server-50-storage-guide.pdf* and *Technical Report 4068: VMware vSphere 5 on NetApp Clustered Data ONTAP 8.1*.

Note:

11. If you are using Data ONTAP operating in 7-Mode, use the `sis on` command to enable the datastore volume for copy offloading and deduplication.

This step does not apply to Data ONTAP operating in Cluster-Mode. Enabling SIS allows the copy offload operation to perform a fast and space-efficient copy. When you create a volume with VSC, it by default enables SIS on datastore volumes.

After you finish

Use the NFS plug-in space reservation and copy offload features to make routine tasks more efficient:

- Create virtual machines in the thick virtual machine disk (VMDK) format on NetApp traditional or FlexVol volumes and reserve space for the file at the time you create it.
- Clone existing virtual machines within or across NetApp volumes:
    - Datastores that are volumes on the same Cluster-Mode Vserver on the same node.
    - Datastores that are volumes on the same Cluster-Mode Vserver on different nodes.
    - Datastores that are volumes on the same 7-Mode system or vFiler unit.
- Perform cloning operations that finish faster than non-VAAI clone operations because they do not need to go through the ESXi host.