

# HP 3PAR VAAI Plug-in 2.2.0 Software for VMware vSphere 5.0 User's Guide

## Abstract

This guide provides information for installing and using HP 3PAR VAAI Plug-in 2.2.0 Software for VMware vSphere 5.0. This guide is intended for VMware vSphere administrators who are responsible for installing VMware vSphere and overseeing the operation of HP 3PAR Storage Systems.



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### Documentation

For the latest version of this document, go to <http://www.hp.com/go/3par/>, navigate to your product page, click **Support for your product**, and then click **Manuals**.

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# 1 Introduction

This chapter provides an introduction to using this guide, including information on the target audience, related documentation, and typographical conventions.

The HP 3PAR VAAI Plug-in Software for VMware vSphere 5.0 enables SCSI primitives that allow HP 3PAR Storage Systems to take advantage of several VMware virtual machine operations at the meta data level to improve performance.

## Related Documentation

The following documents also provide information related to HP 3PAR Storage Systems and the HP 3PAR InForm Operating System Software:

For information about...	Read the...
HP 3PAR InForm Command Line Interface (CLI) commands and their usage	<i>HP 3PAR InForm OS Command Line Interface Reference</i>
Configuring and managing HP 3PAR Storage Systems and using the Management Console	<i>HP 3PAR InForm OS Management Console Online Help</i>
Configuring and managing HP 3PAR Storage Systems and using the HP 3PAR InForm CLI	<i>HP 3PAR InForm OS CLI Administrator's Guide</i>
Identifying storage system components and alerts	<i>HP 3PAR InForm OS Messages and Operator's Guide</i>
Using HP 3PAR Remote Copy Software	<i>HP 3PAR Remote Copy Software User's Guide</i>
VMware ESXi and its implementation on HP 3PAR Storage Systems	<i>HP 3PAR VMware ESXi 4.1 - 5.0 Implementation Guide</i>

## Typographical Conventions


This guide employs the following typographical conventions :

Typeface	Meaning	Example
<b>ABCDabcd</b>	Used for dialog elements such as titles, button labels, and other screen elements.	When prompted, click <b>Finish</b> to complete the installation.
ABCDabcd	Used for paths, filenames, and screen output.	Open the file <code>\gui\windows\setup.exe</code>


## Advisories

To avoid injury to people or damage to data and equipment, be sure to observe the cautions and warnings in this guide.

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 **WARNING!** Warnings alert you to actions that can cause injury to people or irreversible damage to data or the operating system.

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 **CAUTION:** Cautions alert you to actions that can cause damage to equipment, software, or data.

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**NOTE:** Notes are reminders, tips, or suggestions that supplement the procedures included in this guide.

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## 2 Overview and Features

This chapter provides an overview of the VMware VAAI extensions and describes the benefits provided by HP 3PAR VMware VAAI Plug-in 2.2.0 Software for vSphere 5.0.

### About VMware vStorage APIs for Array Integration (VAAI)

VMware has identified several primitives that will enable an ESXi host to convey virtual machine operations to storage hardware at a meta level instead of at the traditional data level. This reduces operational latency and traffic on the Fibre Channel fabric/iSCSI network. Some of these primitives enable the storage hardware to participate in block allocation and de-allocation functions for virtual machines. These primitives, also known as *hardware offloads*, are typically implemented in-band from ESXi to a disk array. ESXi extensions to make use of these primitives are collectively referred to as vStorage APIs for Array Integration (VAAI).

### About HP 3PAR VAAI Plug-in 2.2.0 Software for VMware vSphere 5.0

To keep up with new advances in cloud computing, enhanced capabilities are required by the SCSI layer stack so that SCSI can meet the demands of emerging virtualized infrastructures. There are currently a number of shortcomings that need to be solved:

- **VMs competing for the same resources.** In cloud computing environments, competition for system resources can limit scalability and performance. While this resource contention is rarely an issue in smaller environments or vSphere servers that can host tens if not hundreds of VMs may run up against these system scalability limits.  
In these situations, the SCSI reservation bit locks a LUN when, for example, VMDK clones are made. This precludes large environments from putting large numbers of VMDKs on a single large LUN since other VMDKs on that LUN are negatively impacted waiting for a SCSI reservation to complete while a clone is made of that VMDK file.
- **Expediting the creation of VMware initiated VMDK clones.** VMware also has the ability to create its own clones. However, this adds extra overhead to the vSphere underlying physical server's CPU, memory, and network resources since the clone has to traverse the storage array, the host, and then go back out to the storage array again.
- **Host overhead associated with zeroing out previously allocated space.** vSphere includes the ability to zero out blocks of data when storage is allocated to a VM. By first zeroing out these blocks of data, it prevents the new VM from accidentally accessing any of the data that may have been stored on that disk by a deleted VM that previously had access to it. However the new problem that results is that the newly created VM has to generate excessive amounts of write I/O and overhead on the physical host and network in order to zero out newly allocated blocks.

It is these storage specific issues that the vStorage APIs for Array Integration (VAAI) for vSphere 5.0 and the latest release of the InForm OS resolve. By adding three new SCSI commands to the standard SCSI command set, VMware and HP provide virtualized data centers a more granular control for scaling virtualized infrastructures. Following are descriptions for these new commands.

## Hardware Assisted Locking (ATS)

Rather than locking the entire LUN, Hardware Assisted Locking (ATS) only locks the blocks on the LUN that are allocated to the VMDK. This enhanced capability is intended to help virtualized data centers in at least two important ways.

- If you are already using or want to use larger size LUNs and place multiple VMDKs on a single LUN, you can now do so and still make clones of individual VMDK files without negatively impacting other VMDKs also located on that LUN.
- HP's implementation of the ATS command was done within the ASIC of its HP 3PAR Storage Systems to expedite processing of this command. While the performance benefits this provides in small environments may be too negligible to notice, large virtualized infrastructures can quickly create large numbers of clones.

HP's unique implementation of Hardware Assisted Locking takes advantage of the HP 3PAR Gen3 ASIC to handle data comparisons in silicon with significantly higher performance and throughput. It facilitates the automatic modification of disk sectors without the use of SCSI reservations so multiple hosts can access LUNs concurrently while reducing the number of commands required to successfully acquire on-disk locks.

## Full Copy (XCOPY)

Full Copy (XCOPY) resolves the host overhead that is associated with VMware initiating and managing cloning operations. It facilitates the cloning of individual VMDKs while keeping the overhead associated with the copy off the host and on the storage array which can significantly improve the performance of host-initiated clones.

Full Copy increases agility by reducing the amount of time required to perform common copy operations like virtual machine cloning and storage workload migrations using VMware Storage vMotion™. This is made possible by allowing the storage hardware to transparently manage large data movements, and by minimizing host, fabric and network I/O activity. With the integration of the HP 3PAR Gen3 ASIC and HP 3PAR Thin Persistence Software, built-in zero-detection capabilities further speed cloning and storage workload migrations while also delivering a capacity savings benefit.

## Block Zeroing (WRITE-SAME)

Block Zeroing (WRITE-SAME) is intended to reduce the host overhead that results when VMware zeros out disk space for Thin and Thick VMDKs and at create time for VMs.

Block Zeroing Increases performance and efficiency by eliminating the writing of zeros as data by the host for the purpose of "cleaning" space for a VMDK. Using the WRITE-SAME command, VMware now transfers the overhead associated with these writes to the storage array by instructing the storage array to assume the burden of writing the zeros on these newly allocated blocks.

HP 3PAR systems then take this WRITE SAME command a step further when the blocks associated with the VM are initialized. HP 3PAR's ASIC and its Thin Persistence software recognize the zeros as they are written by the WRITE SAME command thus reducing system workload.

Since HP tracks which blocks on its array are zeroed out and which ones have data in them, HP only needs to zero out the blocks with data in them. Blocks of data that do contain zeros are unmapped so no write penalty is incurred on the HP 3PAR system.

## Package Contents

You can download the installation package from the following location: <http://www.hp.com/storage/vmware>

## System Requirements

The following components are required:

- VMware ESXi 5.0.
- VMware vSphere Infrastructure Management 5.0 (vCenter, vClient).
- For package installation and deinstallation for ESXi: VMware Update Manager plug-in (VUM) or vSphere CLI (vCLI)

## Supported InForm OS Versions and Features

The following table lists the VMware VAAI features that are supported by the HP 3PAR plug-in for a given InForm OS version.

**Table 1 HP 3PAR VAAI Plug-in 2.2.0 Software for VMware vSphere 5.0 Feature Support for InForm OS Versions**

InForm OS Version	Block Zeroing (WRITE_SAME)	Full Copy (XCOPY)	Hardware Assisted Locking (ATS)
2.3.1 MU2 and later	Yes	Yes	Yes

**NOTE:** For specific platforms and current InForm OS version requirements, refer to the *HP 3PAR InForm Configuration Matrix*. To obtain a copy of this documentation, go to <http://www.hp.com/go/3par/>, navigate to your product page, click **Support for your product**, and then click **Manuals**.

## Special Considerations

- The HP 3PAR VAAI Plug-in 2.2.0 Software for VMware vSphere 5.0 enables the VAAI primitives for HP 3PAR devices only.
- After you upgrade your HP 3PAR Storage System from 2.3.1 to 3.1.1, remove the HP 3PAR VAAI Plug-in 2.2.0 Software from vSphere 5.0. For more information, see “[Deinstalling HP 3PAR VAAI Plug-in 2.2.0 Software for VMware vSphere 5.0](#)” (page 10).

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## 3 Installation and Deinstallation

This chapter describes how to install and verify installation of HP 3PAR VAAI Plug-in 2.2.0 Software for VMware vSphere 5.0. Instructions for deinstalling the software are also provided.

**NOTE:** HP 3PAR VAAI Plug-in 2.2.0 Software is only intended for VMware vSphere 5.0 and does not support any other VMware vSphere releases.

**NOTE:** HP 3PAR VAAI Plug-in 2.2.0 Software for VMware vSphere 5.0 supports InForm OS 2.3.1. InForm OS 3.1.1 is supported by the T10 Plug-in, which is provided with ESXi 5.0.

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### Installing HP 3PAR VAAI Plug-in Software for VMware vSphere 5.0

The following section includes preinstallation and installation instructions for HP 3PAR VAAI Plug-in 2.2.0 Software for VMware vSphere 5.0.

You can either perform the installation using VMware vSphere Update Manager (VUM) or vCLI for ESXi hosts.

**NOTE:** During HP 3PAR VAAI Plug-in Software installation, the ESXi host will enter into maintenance mode. For host maintenance mode behavior, please refer to the VMware knowledge base.

**NOTE:** It is necessary to perform an ESXi host reboot after the HP 3PAR VAAI Plug-In 2.2.0 Software for VMware vSphere 5.0 installation. Refer to the VMware documentation for ESXi host reboot instructions and considerations related to your system configuration.

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### Before You Begin

Before installing HP 3PAR VAAI Plug-in 2.2.0 Software for VMware vSphere 5.0:

- If a VMW\_VAAIP\_T10 plug-in is currently attached to an HP 3PAR device, you need to unload the plug-in from the ESXi host and then reboot the host. Consult the VMware user documentation for specific details on how to unload the VMW\_VAAIP\_T10 plug-in.
- Download HP 3PAR VAAI Plug-in Software package, 3PAR\_vaaip\_InServ-220.zip, from the following location: <http://www.hp.com/storage/vmware>.

### Installing the Plug-in Using VMware Update Manager (VUM)

Refer to the VMware documentation for explicit instructions on how to install the vSphere Client and Update Manager plug-in on a windows server.

**NOTE:** Installing the Plug-in using VMware Update Manager is the recommended method.

**NOTE:** The information in this section is applicable for ESXi servers.

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### Import the HP 3PAR VAAI Plug-in Software Package

1. Copy 3PAR\_vaaip\_InServ-220.zip to the server that has the vSphere Client installed.
2. Double click the **VMware vSphere Client** icon on your server.
3. Log on to the vCenter Server through the vSphere Client with administrator privileges.
4. Click the **Home** icon in the navigation bar.
5. Click the **Update Manager** icon in the **Solutions and Applications** pane.

**NOTE:** If the **Update Manager** icon is not available, check that the Update Manager plug-in is installed and enabled. From the Plug-ins menu, click **Manage Plug-ins** to install the VMware vCenter Update Manager plug-in.

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6. Click the **Path Repository** tab.

7. On the upper right corner, click **Import Patches**.
8. Select `3PAR_vaaip_InServ-220.zip` from your local directory, then click **Next**.
9. From the **Confirm Import** section, choose **Finish**.
10. Click the **Baselines and Groups** tab.
11. In the **Baselines** section, click **Create...**
12. In the **Baseline Name and Description** section, type in a name for your baseline. For example: 3PAR baseline.
13. In the **Baseline Type** section, click **Host Extension** for **Host Baselines**, then click **Next**.
14. In the **Extensions** section, select **HP 3PAR VAAI Plug-in Software for VMware vSphere 5.0** from the extensions list, click the arrow to add the extension, then click **Next**.
15. In the **Ready to Complete** section, click **Finish**. You should see the new 3PAR baseline listed in Baselines table.

## Install HP 3PAR VAAI Plug-in Software Package on the ESXi Host

1. Click the **Home** icon in the navigation bar.
2. Click the **Hosts and Clusters** icon in the Inventory pane.
3. Click the **DataCenter** which has the ESXi host(s) that you want to stage.
4. Click the **Update Manager** tab.
5. Click **Attach...**
6. Select the HP 3PAR baseline entry in the **Extension Baselines** section, then click **Attach**.
7. From the left panel, right click the **DataCenter** and select **Scan for Updates**.

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**NOTE:** If the Compliant section is green, the ESXi hosts already has the package installed. However, the Compliant section does not indicate whether or not a required server reboot has been completed which must be completed before the plug-in is operational.

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8. Click **Stage...**
9. From the **Stage Wizard**, select the hosts for the extension that you want to install, then click **Next**.
10. From the **Ready to Complete** section, click **Finish**.
11. After the staging has completed, click **Remediate...** in the **Update Manager** section.
12. From the **Remediation Selection** section, select the host that you want to remediate, then click **Next**.
13. From the **Patches and Extensions** section, click **Next**.
14. From the **Host Remediation Options** section, fill in the related information, then click **Next**.
15. From the **Ready to Complete** section, click **Finish**.
16. In the **Tasks & Events** section, the tasks **Remediate entry**, **Install**, and **Check** should be in Completed status.
17. If any of these tasks returns any error, check the detail events information by clicking the task.
  - a. For an ESXi host, log onto the ESXi host from vSphere Client by clicking **Home**.
  - b. Under the **Administration** section, click **System logs**.
  - c. Select **System Logs** to view related event messages.
18. Reboot each ESXi host.

After the reboot, the `3PAR_vaaip_InServ` module loads automatically. It is then attached to the 3PAR devices and enabled.

## Installing the Plug-in Software Using the VMware vSphere CLI for ESXi Hosts

1. Install VMware vSphere CLI on a windows machine. (follow the VMware vSphere CLI installation user guide for instructions).
2. Copy `3PAR_vaaip_InServ-220.zip` to the ESXi host local folder (e.g., `/root/temp`).

3. From the vSphere CLI command prompt, issue the following command with appropriate server name:

```
esxcli --server <servername> software vib install -d /root/tmp/3PAR_vaaip_InServ-220.zip
```

4. Place the ESXi server into maintenance mode with the following command:

```
vicfg-hostops.pl --server <servername> -o enter
```

---

**NOTE:** Entering Maintenance Mode may initiate a shutdown, pause, or migration of Virtual Machines in some system environments. Refer to the VMware documentation for the recommended procedure to enter Maintenance Mode for servers in your particular environment.

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5. Reboot the ESXi server with the following command:

```
vicfg-hostops.pl --server <servername> -o reboot -f
```

6. Exit maintenance mode for the ESXi server with the following command:

```
vicfg-hostops.pl --server <servername> -o exit
```

---

**NOTE:** After the reboot, the 3PAR\_vaaip\_InServ module loads automatically. It is then attached to the 3PAR devices and enabled.

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## Verifying the Installation

To verify that the plug-in has been installed successfully, issue the appropriate command using the VMware vSphere CLI as described in the following section.

### Using the VMware vSphere CLI for ESXi hosts

To verify the installation using the VMware vSphere CLI, issue the following command:

```
esxcli --server <servername> storage core claimrule list -c VAAI
```

The output generated by this command should appear as follows:

```
VAAI <rule #> runtime vendor 3PAR_vaaip_InServ vendor=3PARdata model=*
VAAI <rule #> file vendor 3PAR_vaaip_InServ vendor=3PARdata model=*
```

## Deinstalling HP 3PAR VAAI Plug-in 2.2.0 Software for VMware vSphere 5.0

Follow the appropriate instructions to uninstall the HP 3PAR VAAI Plug-in.

### Deinstalling the Plug-in Software Using the vSphere CLI on ESXi Hosts

1. Go to the VMware vSphere CLI command prompt and issue the following command:

```
vihostupdate.pl -B 3PAR_vaaip_InServ-220 --server <servername> --remove
```

2. Reboot the ESXi host with the following command:

```
vicfg-hostops.pl --server <servername> -o reboot -f
```

# 4 Troubleshooting

This chapter lists error messages and provides tips for solving common problems.

## Run Time Error Messages

For run time problems, check the following log file and then consult the description and suggested actions for each message as described in this section:

```
/var/log/vmkernel.log or /var/log/vmkernel.*
```

### MESSAGE

3parvaai:INFO InquiryC0Data (pageCode=0xC0, pageVersion=0x3, tpvvlInfo=0x3d)

#### DESCRIPTION

Provides information derived from the 3PAR device via a SCSI inquiry page C0 command that specifies what VAAI features are supported. This message appears every time the HP 3PAR VAAI plug-in module is loaded, the ESXi host is rebooted, or for each newly arrived HP 3PAR device.

- **pageCode:** This value should always be C0.
- **pageVersion:** Indicates whether or not the HP 3PAR storage device supports the WRITE\_SAME feature:
  - 0x1 = Does not support WRITE\_SAME.
  - 0x2 or greater = Supports WRITE\_SAME.
- **tpvvlInfo:** Indicates whether or not the HP 3PAR storage device supports the XCOPY or ATS features:
  - bit 0 = tpvv.
  - bit 4 = ATS support.
  - bit 5 = XCOPY support.

All other bits can be ignored.

#### SUGGESTED ACTION

None.

### MESSAGE

3parvaai:INFO device((naa.50002ac0006500e8) attribute is set to 0xd

#### DESCRIPTION

Specifies the HP 3PAR VAAI Plug-in 2.2.0 Software for VMware vSphere 5.0 features that are supported by a given 3PAR device.

- bit 0 = WRITE\_SAME support.
- bit 1 = UNMAP support (not implemented in the current release).
- bit 2 = ATS support.
- bit 3 = XCOPY support.

#### SUGGESTED ACTION

None.

### MESSAGE

3parvaai:ERR InquiryC0Data(Error get page C0 data, vmkstatus = %s)

## DESCRIPTION

An inquiry into the customer page C0 data has failed. `vmkstatus` indicates the VMware kernel status.

## SUGGESTED ACTION

Use the information provided by this message in conjunction with any information provided by the following `InquiryC0Data` error message, then check the HP 3PAR Storage System log for related information that might be helpful in resolving this problem.

## MESSAGE

```
3parvaai:ERR InquiryC0Data(ScsiDeviceStatus = %s, ScsiHostStatus = %s, ScsiPlugInStatus = %s)
```

## DESCRIPTION

An inquiry into the customer page C0 data has failed. The `vmk_ScsiDeviceStatus` is the status reported by the target/LUN itself.

- `ScsiDeviceStatus` indicates the device status.
- `vmk_ScsiHostStatus` is a status value from the driver/hba.
- `vmk_ScsiPlugInStatus` is a status value returned from the MP plug-in that was processing the I/O command.

## SUGGESTED ACTION

If `ScsiDeviceStatus` is not set to 0, check the HP 3PAR Storage System log for related information. Otherwise check the `/var/log/vmkernel` log file for additional details that might be useful in resolving this problem.

## MESSAGE

```
3parvaai:INFO Device naa.50002ac0006500e8 (3PARdata:VV)
```

## DESCRIPTION

Shows the device virtual volume World-Wide Name (WWN), product ID, and vendor ID for every loaded storage device.

## SUGGESTED ACTION

None.

## MESSAGE

```
3parvaai:INFO Device %s (%.*s:%.*s) not supported
```

## DESCRIPTION

Indicates that the target device is not an 3PAR device and is not supported by HP 3PAR VAAI Plug-in 2.2.0 Software for VMware vSphere 5.0.

## SUGGESTED ACTION

None. HP 3PAR VAAI Plug-in 2.2.0 Software for VMware vSphere 5.0 only supports 3PAR devices.

## MESSAGE

```
3parvaai:ERR Failed to inquiry page c0, XCOPY/ATS/WRITE_SAME are not supported
```

## DESCRIPTION

An inquiry into the device page C0 data has failed. As a result, the device will be flagged as not supporting the XCOPY, ATS and WRITE\_SAME SCSI commands.

## SUGGESTED ACTION

Check to see what specific XCOPY/ATS/WRITE\_SAME features are supported for a given InForm OS.

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**NOTE:** Consult the HP 3PAR Configuration Matrix for details on what specific XCOPY/ATX/WRITE\_SAME primitives are supported on a given InForm OS. To obtain a copy of this documentation, go to <http://www.hp.com/go/3par/>, navigate to your product page, click **Support for your product**, and then click **Manuals**.

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## MESSAGE

3parvaai:ERR tpd\_claim\_device(Out of memory claiming device %s)

### DESCRIPTION

An out of memory error has occurred while HP 3PAR VAAI Plug-in 2.2.0 Software for VMware vSphere 5.0 was performing a claim device function.

### SUGGESTED ACTION

Check your hardware memory resource setting.

## MESSAGE

3parvaai:ERR tpd\_claim\_device(Inquiry to device %s failed)

### DESCRIPTION

Indicates that a SCSI Inquiry device command error has occurred. The device might not be ready or is not reachable.

### SUGGESTED ACTION

Check the connection between the host and HP 3PAR Storage System. You can also consult the HP 3PAR Storage System log file for additional details that might be useful in solving the problem.

## MESSAGE

3parvaai:ERR init\_module(Failed to register vaaip plugin: %s)

### DESCRIPTION

Failed to register HP 3PAR VAAI Plug-in 2.2.0 Software for VMware vSphere 5.0 with the VMware kernel during loading of the plug-in.

### SUGGESTED ACTION

Remove the HP 3PAR VAAI plug-in module, reboot the ESXi host, and re-install the HP 3PAR VAAI Plug-in 2.2.0 Software for VMware vSphere 5.0 package.

## MESSAGE

3parvaai:ERR Failed to unregister the plugin. The module will be unloaded anyway.

### DESCRIPTION

Indicates that the HP 3PAR VAAI plug-in module was not properly unregistered as part of the cleanup process that occurs when the HP 3PAR VAAI Plug-in is unloaded from the ESXi kernel. Even though the HP 3PAR VAAI plug-in module was not unregistered from VMware kernel, the module had been unloaded from the kernel. After unloading the module, the ESXi host needs to be rebooted.

### SUGGESTED ACTION

None.