

Intel® VMD-enabled NVMe Driver for VMware ESXi

User Guide

November 2019



Revision History

Document Version	Description	Date
001	Initial release.	November 2019

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1 Overview

This document describes the Intel® Volume Management Device (Intel® VMD) enabled NVMe Driver for VMware ESXi. It includes the installation method for adding or upgrading the out-of-box driver to existing VMware ESXi version Operating Systems on Intel® Xeon® Scalable Platforms that have enabled Intel VMD in the BIOS.

At the time of this writing, an inbox driver does not exist, and therefore the Intel VMD-enabled NVMe driver requires manual installation or upgrade into the existing VMware ESXi Operating System solution.

The Intel VMD-enabled NVMe driver is designed to work with Intel VMD hardware logic implemented on the Intel® Xeon® Scalable family. Intel VMD is much like an HBA controller for NVMe SSDs and adds robust management for NVMe SSDs in the Data Center, such as Surprise Hot Plug, LED management, and error handling.

1.1 References

Table 1: Standard Information Referenced in this Document

Date	Title	Location
October 2019	• LED Management for PCI Express SSDs	Intel CCL doc # 567916
October 2019	• Intel® VMD-enabled NVMe Driver	1. VMware (ESXi 6.5) : https://my.vmware.com/en/web/vmware/details?downloadGroup=DT-ESXI65-INTEL-INTEL-NVME-VMD-1801001&productId=614 2. VMware (ESXi 6.7) : https://my.vmware.com/en/web/vmware/details?downloadGroup=DT-ESXI67-INTEL-INTEL-NVME-VMD-1801001&productId=742
October 2019	• Intel® VMD LED Management Tools	Intel Download Link: https://downloadcenter.intel.com/download/28288/Intel-VMD-ESXi-Tools

1.2 Terms and Acronyms

Table 2: Glossary of Terms and Acronyms

Term	Definition
NVMe	Non-Volatile Memory Express
ISO	International Standards Organization
SSD	Solid State Drive



2 Product Requirements

2.1 Platform Requirements

Intel® Xeon® Scalable Platform family with Intel® C620 series chipset family and Intel® C422 series chipset family.
Intel NVMe SSDs in U.2 form factor attached to a Hot Swappable Backplane (HSBP).

LED Management must be implemented with Intel® VMD method using the White Paper located on CDI/IBL:

- **LED Management for PCI Express SSDs**, CCL doc # 567916

2.2 Software Requirements

VMware ESXi Operating system version 6.5 or Newer.

Intel VMD-enabled NVMe Driver kit can be downloaded from:

1. ESXi 6.7) : <https://my.vmware.com/en/web/vmware/details?downloadGroup=DT-ESXI67-INTEL-INTEL-NVME-VMD-1801001&productId=742>
2. (ESXi 6.5) : <https://my.vmware.com/en/web/vmware/details?downloadGroup=DT-ESXI65-INTEL-INTEL-NVME-VMD-1801001&productId=614>

The Intel VMD-enabled NVMe UEFI Drivers listed below are required for NVMe devices attached to Intel VMD enabled PCIe lanes.

These Intel VROC UEFI Drivers version 6.2 drivers can be downloaded from Intel VIP Kit #**133737**.

VMDVROC_1.efi

VMDVROC_2.efi

Intel VMD-enabled NVMe driver for VMware can also be downloaded from VMware Website Link.

For testing capability of Intel VMD LED Management, please download the Intel VMD CLI tool, the VMware LED Framework tool, and KB Article from Intel Validation Internet Portal (VIP)

2.3 Enabling Intel VMD

Intel VMD must be enabled in the BIOS. Please check with your BIOS vendor for instructions on enabling Intel VMD in the BIOS set up menu. Depending on the validation platform of choice Intel VMD must be enabled on the Surprise hot plug capable lanes of the platform.

For LED Management, the NVMe devices should be attached to the HSBP through an internal Retimer Add-in Card (AIC) or switch. If using a retimer card for PCIe NVMe SSDs, a PEM Cable must be attached from the AIC to the motherboard PEM CPU connection.

For Surprise hot plug to work correctly, some platforms allow a jumper to be set to disable ACPI hot plug. PCIe hotplug is required to support Intel VMD.



3 Product Installation/Upgrade

3.1 Suggested Installation and Management Tools

- Putty - www.putty.org
- WinSCP - www.WinSPC.com
- VMware vSphere Client Trial Version available - www.vmware.com/products/vsphere

3.2 VMware Installation with Out-of-box Intel VMD-enabled NVMe Driver

Installing VMware ESXi 6.5 versions and newer on an Intel® Xeon® Scalable platform currently requires the out-of-box Intel VMD-enabled NVMe driver. The suggested method of installation is to install VMware ESXi onto a USB, or an NVMe SSD that is not behind Intel VMD. Once Intel VMD is enabled, without the out-of-box driver, the device will be hidden behind Intel VMD, and will not surface until the out-of-box driver is installed.

To use the management tools for installation of the Intel VMD enabled NVMe driver, the target system must have a network card or built in network with working network cable attached. Mount the ESXi OS onto a fat32 formatted USB device, attached to the target system. With the system in UEFI mode, Boot to this UEFI USB device in order to begin installation.

Accept all License agreements and choose the USB or the Non-Intel VMD-enabled NVMe device to install the VMware ESXi OS on:



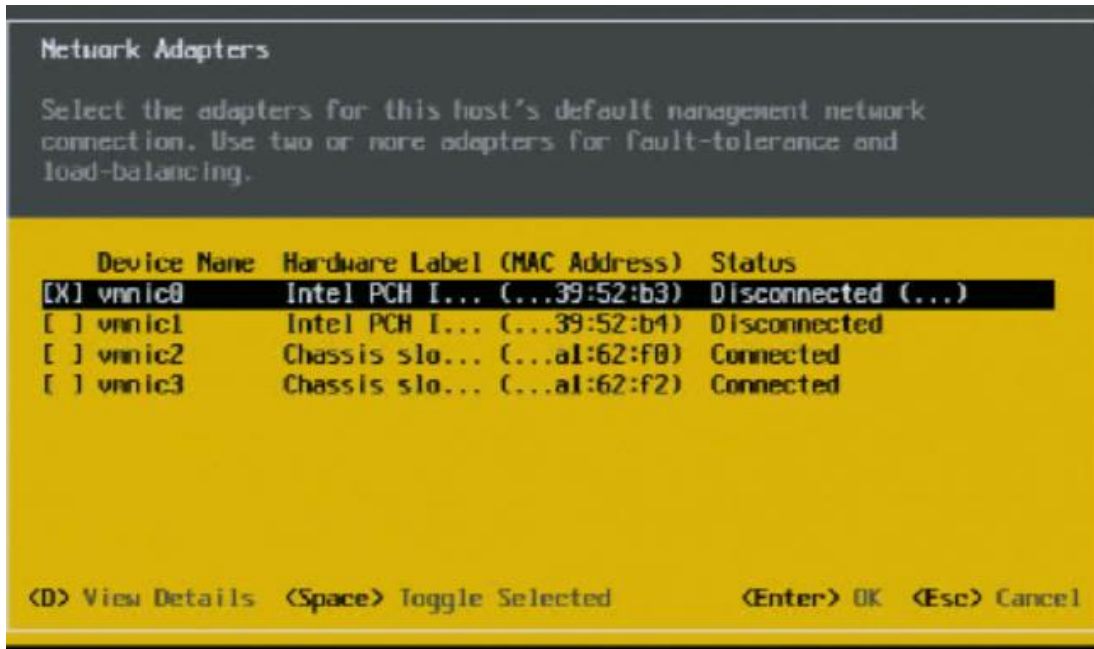
Make note of the IP address for the target system, as you will need it later in the process:

3.3 How to Set Up Network DHCP

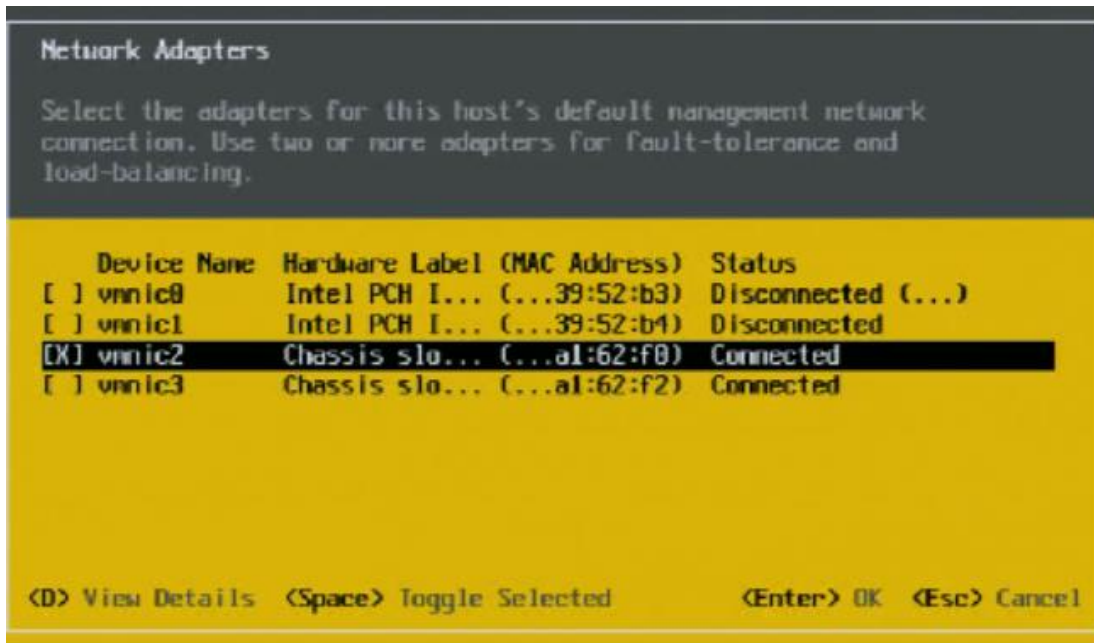
The following message, “waiting for DHCP” and “Warning” may occur when the default internal network is showing, instead of the connected network.

To correct this, press <F2> and select **Configure Management Network > Network Adapters**.

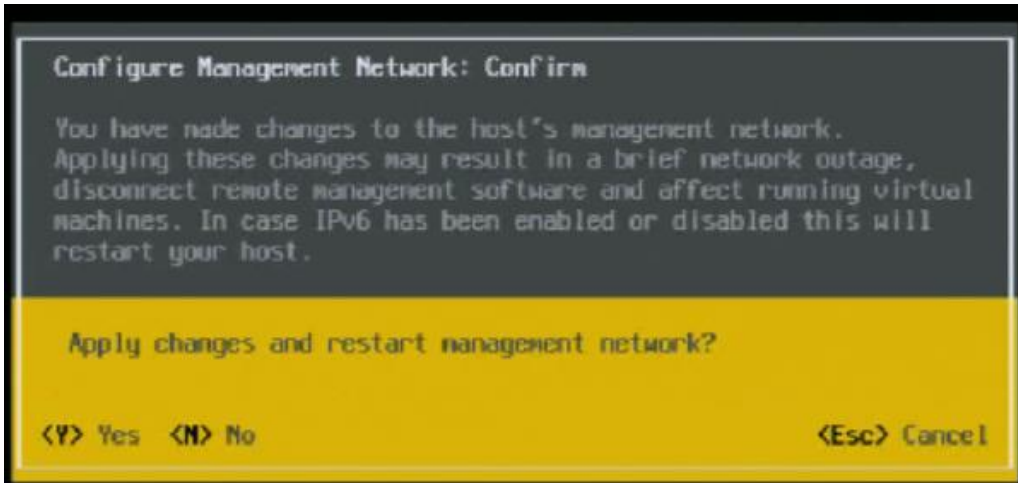
Make sure that the network device selected is connected. The example below shows that the selected network is not connected.



Deselect the Disconnected network adapter by scrolling down and hitting the **<space bar>**. Then select a Connected network adapter.



Press **<Enter>** to select. Press **<Esc>** to go to the previous menu. When the following message appears, select **<Y>** to apply changes and restart management network.



A new refreshed **Configure Management Network** menu will appear with the correct IPv4 Address. Make a note of this address, as you will need it later in the process.

ESXi Main Page should now show up correctly without the warning, as displayed below:





3.4 Set Up System for Remote Console and SSH

If Secure Shell is enabled for the ESXi shell, you can run shell commands by using a Secure Shell client such as SSH or PuTTY.

By default, remote command execution is disabled on an ESXi host, and you cannot log in to the host using a remote shell. You can enable remote command execution from the direct console or from the vSphere Client.

To enable SSH access in the direct console:

1. At the direct console of the ESXi host, press <F2> and provide credentials when prompted.
2. Scroll to Troubleshooting Options and press <Enter>.
3. Choose **Enable SSH** and press <Enter> once.
On the left, **Enable SSH** changes to **Disable SSH**. On the right, **SSH is Disabled** changes to **SSH is Enabled**.
4. Press <Esc> until you return to the main direct console screen.

To enable SSH from the vSphere Client:

1. Select the host and click the **Configuration** tab.
2. Click **Security Profile** in the **Software** panel.
3. In the **Services** section, click **Properties**
4. Select **SSH** and click **Options**
5. Change the SSH options.
To change the startup policy across reboots, click **Start and stop with host** and reboot the host.
To temporarily start or stop the service, click the **Start** or **Stop** button.
6. Click **OK**

To enable the remote ESXi Shell from the vSphere Web Client:

1. Select the host, click the **Manage** tab, and click **Settings**
2. Under **System**, select **Security Profile**
3. In the **Services** panel, click **Edit**
4. Select an **SSH** from the list.
5. Click **Service Details** and select the startup policy **Start and stop manually**.
When you select Start and stop manually, the service does not start when you reboot the host. If you want the service to start when you reboot the host, select **Start and stop with host**.
6. Select **Start** to enable the service.
7. Click **OK**

After you have enabled SSH, log in to the ESXi Shell remotely and run ESXi Shell commands.



Using the ESXi Shell with SSH:

If SSH is enabled on your ESXi host, you can run commands on that shell using an SSH client.

To access the remote ESXi Shell:

1. Open an SSH client.
2. Specify the IP address or domain name of the ESXi host.

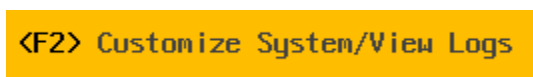
Precise directions vary depending on the SSH client you are using. See vendor documentation and support.

3. Provide credentials when prompted.

- Login to your VMware host locally

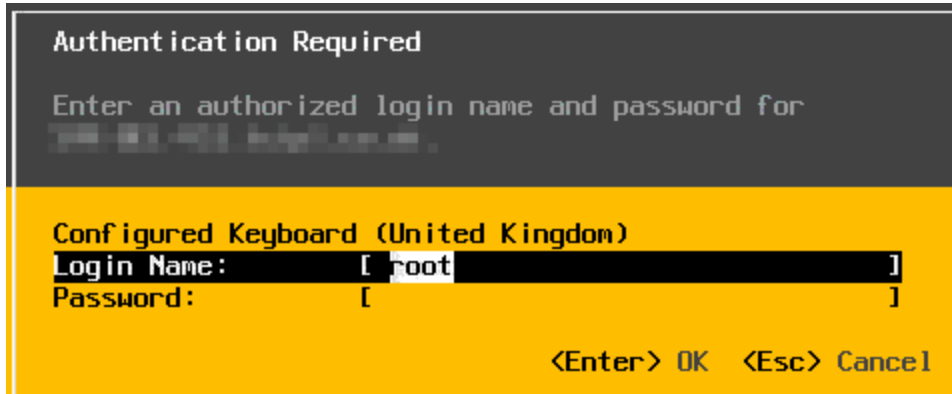


- Press <F2> to Customize System

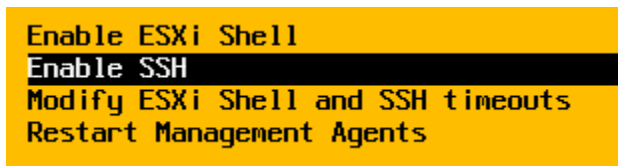




- Provide root password



- Navigate to **Troubleshoot Options > Enable SSH** and press <Enter>



3.5 Use WinSCP to Copy Out-of-box Intel VMD-enabled NVMe Driver to Target System

You should now be able to connect with WinSCP. Don't forget to disable SSH when you finish all file transfers.

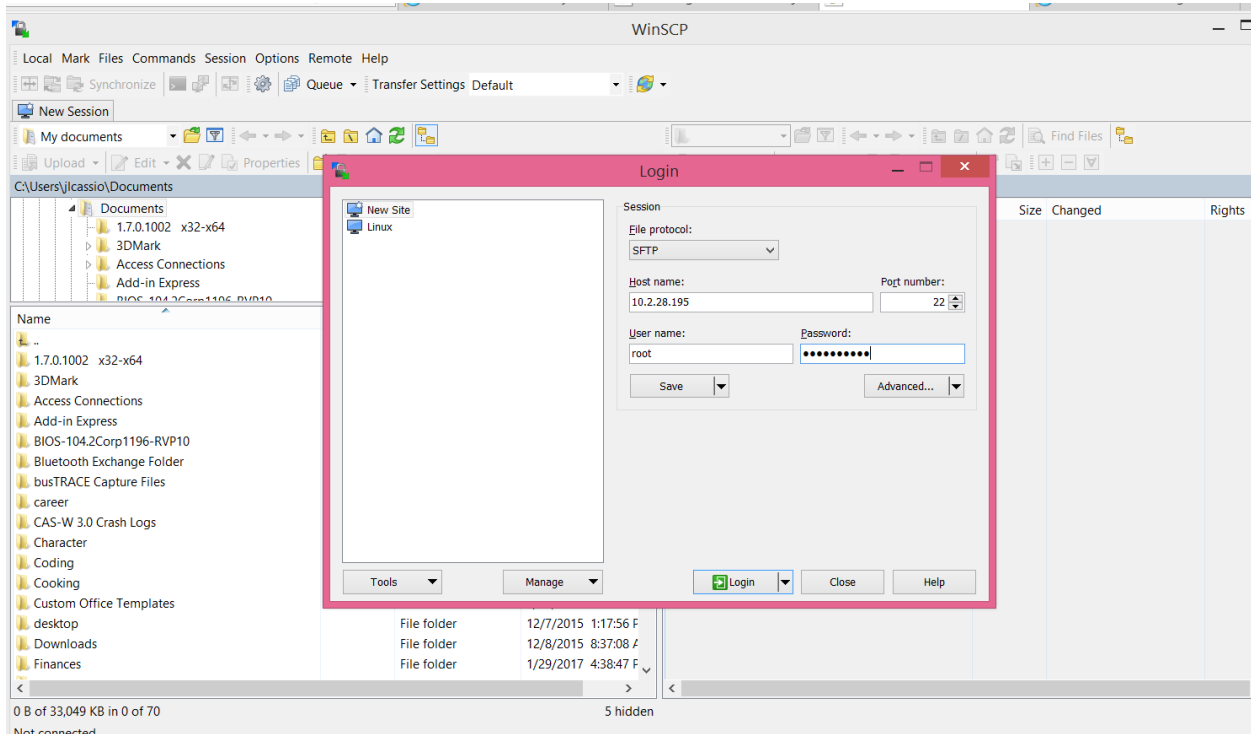
Enter the host name, the port number (if you are a SiteGround client, check the following article for the port and private key setup details).

https://www.siteground.com/kb/How_to_log_in_to_my_account_via_SSH_using_PuTTY/

The user name and the password (if you are a SiteGround client, leave this field blank since we provide a very secure SSH solution through public and private encrypted keys). Pick the preferred protocol. The possible choices are: SFTP (Secure FTP), SCP (Secure Copy) and FTP.



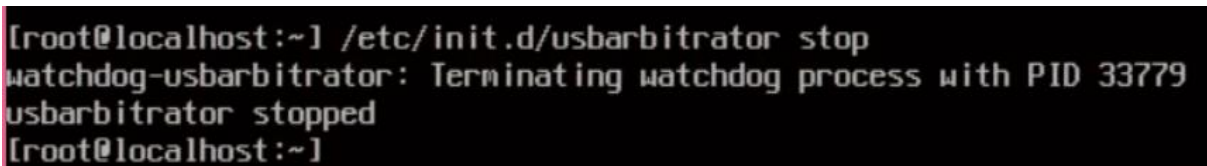
Begin copying VIBs from local system into the /tmp folder on the ESXi target system.



3.6 Option to Copy the Intel VMD VIBs from a USB

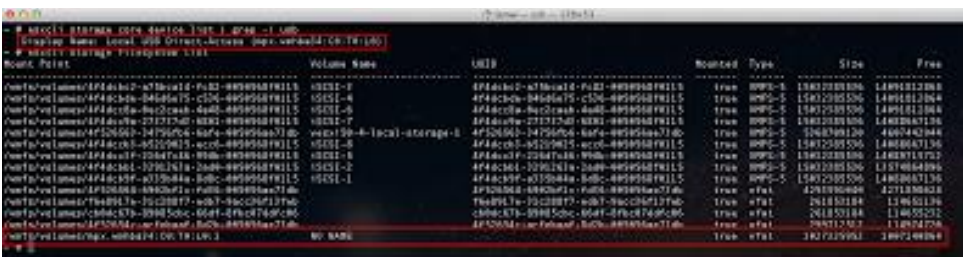
Step 1 - Select <Alt+F1> to enter the direct shell console. From the shell, stop the arbitrator to navigate to a usb file system in the Direct console shell, by sending this command:

```
# /etc/init.d/usbarbitrator stop
```



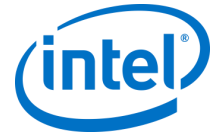
Step 2 - Plug-in your USB device to your ESXi host. Using ESXCLI commands you can:

- Verify the storage device: **# esxcli storage core device list | grep -i usb**
- View the mounted filesystems: **# esxcli storage filesystem list**



Step 3 - Lastly, after you verify the USB device can be seen by the ESXi host, you can browse and access your USB device by looking under **/vmfs/volumes/**

To exit the shell, type <Alt+F2>.



4 Install the Intel VMD Driver and LED Management Command Line Tool

Intel VMD-enabled NVMe driver for VMware out-of-box driver can be installed using the following commands, based on whether it is a signed release, or pre-production release for testing purposes.

If you encounter issues with running the following commands, you can set the system into maintenance mode using the following command:

```
# esxcli system maintenanceMode set --enable true
```

Unsigned releases require the “**--no-sig-check**” syntax in the install command line.

The following sample command assumes the driver vib resides in a directory named “**tmp**”, example command to load an unsigned driver vib in ESXi shell:

```
# esxcli software vib install -v "/tmp/<vibName.vib>" --no-sig-check
```

Signed vib example command line to install:

```
# esxcli software vib install -v "/tmp/<vibName.vib>"
```

Signed offline bundle example command line to install:

```
# esxcli software vib install -d "/tmp/<offlineBundleName.zip>"
```

```
[root@localhost:~] esxcli software vib install -d "/tmp/VMW-ESX-6.7.0-intel-nvme-vmd-1.6.0.1003-offline_bundle-11342064.zip"
```

To exit the ESXi shell press <Alt+F2>

For releases of Intel® VMD NVMe driver, Intel has created a LED Command Line Interface (CLI) tool for validating Intel® VMD LED management with VMware ESXi. Also, VMware has created a VMD LED Management Framework tool. For more details on supporting Intel® VMD LED management, please see CCL/IBL doc # 567916.

The KB Article and signed Intel VMD tools for testing LED Management is available at Intel Download Center:

<https://downloadcenter.intel.com/download/28288/Intel-VMD-ESXi-Tools>



5 Upgrading the VMware ESXi In-Box Intel VMD Driver to Out-of-Box Intel VMD 1.6 and Newer LED Management Tools

5.1 Update Process

The Intel VMD driver is in-box in the VMware ESXi 6.7 Version. The most current version of Intel VMD for ESXi 6.7 in-box is version 1.6.0.1003. By sending the “esxcli software vib list” command you should see the in-box iavmd driver listed as below

```
iavmd 1.2.0.1011-1vmw.670.0.0.7535516 VMW VMw
areCertified 2015-02-19
```

Use the update command to update to the out of box driver. In this example the driver to update to is version 1.3, copied into the “tmp” folder:

```
# esxcli software vib update --maintenance-mode -v "/tmp/<name of vib>
```

You should see the following which shows that the inbox driver has been removed and the out-of-box driver has been installed (example is updating to the 1.3.0.1004 version):

```
[root@localhost:/tmp] esxcli software vib update --no-sig-check --maintenance-mode -v "/tmp/iavmd-1.3.0.1004-1OEM.650.0.0.4598673.x86_64.vib"
Installation Result
  Message: The update completed successfully, but the system needs to be rebooted for the changes to be effective.
  Reboot Required: true
  VIBs Installed: INT_bootbank_iavmd_1.3.0.1004-1OEM.650.0.0.4598673
  VIBs Removed: VMW_bootbank_iavmd_1.2.0.1011-1vmw.670.0.0.7535516
  VIBs Skipped:
```

Reboot the system and send the “esxcli software vib list” command. You should now only see the newly updated iavmd driver version.

Name	Version	Vendor	Acceptance Level	Install Date
iavmd	1.3.0.1004-1OEM.650.0.0.4598673	INT	VMwareCertified	2015-02-20
ata-libata-92	3.00.9.2-16vmw.670.0.0.7535516	VMW	VMwareCertified	2015-02-19
ata-ata-92	3.00.9.2-16vmw.670.0.0.7535516	VMW	VMwareCertified	2015-02-19



5.2 Installing and Using the Intel-vmd-user Tool for LED Management and NVMe Information

Changes in the Intel VMD 1.4 version and newer require a new tool created by Intel to manage NVME LED status on Intel® Xeon® Scalable platforms. This tool is named "intel-vmd-user" and installs on the system with the Intel VMD driver.

1. Download the latest LED tools from Intel Download Site:
<https://downloadcenter.intel.com/download/28288/Intel-VMD-ESXi-Tools>
2. Install command for unsigned intel-vmd-user tool:
esxcli software vib install --no-sig-check -v <path>

Once this tool is installed, a reboot is required. Upon reboot the tool will be found in the /opt/intel/bin directory.

3. Navigate to this directory and run this tool with the following syntax to get the list of all available commands:
./intel-vmd-user --help
4. For help in running the VMD User tool to test LED management, enter the following for help in syntax:
./intel-vmd-user set-led -help

Example to Set the LED State

Options:

[-l <STATE>] -> LED state <off, fault, identify, rebuild>

[-d <NUM>] -> target number of device

5. In order to find the "device" and "target number" you can run the "list" command:
./intel-vmd-user list

In this example this command returned four nvme-adapter(s)

```
[root@localhost:/opt/intel/bin] ./intel-vmd-user list
Returned 4 adapter(s)
Controller:vmhba3-0
Controller:vmhba3-1
Controller:vmhba4-0
Controller:vmhba4-1
```

The number after the "-" is the "disk num" or "target number" ('0' in first line of example). The name before the "-" (vmhba4 in above example) is the "<device>" that controls the LEDs.

Example to Set the LED State

Example to set disk NUM 0 on VMD Adapter device **vmhba2** with led state = fault

```
[root@localhost:/opt/intel/bin] ./intel-vmd-user set-led vmhba2 -d
0 -l fault
Targeting Disk:0 with LED:fault
Set LED completed
```

Next, we can send the "get-led" command to make sure that the Status Register is set correctly to "fault" LED:

./intel-vmd-user get-led vmhba2 -d 0

```
[root@localhost:/opt/intel/bin] ./intel-vmd-user get-led vmhba2 -d 0
Targeting Disk:0
LED state:fault
```



6 Workaround for DataStores Missing After Updating to Intel VMD NVMe Driver

Warning: If installing VMware ESXi 6.7 Hypervisor on an NVMe SSD, datastore1 may be inaccessible after upgrading to Intel VMD/NVMe driver. Please follow the two workarounds listed in this section.

There are two existing issues that may cause a previously created datastore to disappear when updating from VMware inbox NVMe driver to an Intel NVMe driver or to the Intel VMD driver.

Issue #1:

Datastores save SCSI Inquiry VPD 80h (serial number) into their filesystem metadata.

In order to use a datastore, the VPD 80h data needs to match what is stored in the metadata.

The SCSI-to-NVMe translation reference provides 3 possible ways to create a VPD 80h response and Intel VMD driver translation is different than VMware's translation.

Intel always uses a v1.0 translation for VPD 80h. This is compatible with data stores created with drivers that pre-date EUI-64 (all Intel NVMe drivers), and compatible with Intel NVMe drives that have EUI-64 collisions.

However, the Intel VMD driver translation is incompatible with datastores created with a driver using a EUI-64 translation (VMware).

The VMware translation uses EUI-64 if the device supports it, then v1.0 if it does not.

This translation is incompatible with datastores created with drivers that pre-date EUI-64, and incompatible in the presence of drives with EUI-64 collisions.

Issue #1 Workaround:

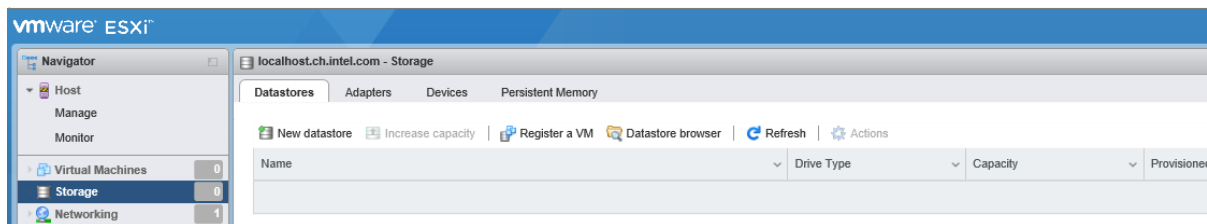
Use Re-Signature Process to locate datastores created previously by VMware ESXi NVMe driver.

Please use the following example for Re-Signature Process. Instructions can be found at the following links from VMware and KB article for Re-Signature Process:

<https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.storage.doc/GUID-EEFEB765-A41F-4B6D-917C-BB9ABB80FC80.html>

<https://kb.vmware.com/s/article/1011387>

Example datastores previously created are missing:





Steps to Re-Signature Process:

1. At the command prompt in the ESXi shell type:

```
# esxcli storage vmfs snapshot list
```

```
[root@localhost:~] esxcli storage vmfs snapshot list
5aac198a-455a5658-cc98-a0369fa162f0
  Volume Name: DataStore2
  VMFS UUID: 5aac198a-455a5658-cc98-a0369fa162f0
  Can mount: true
  Reason for un-mountability:
  Can resignature: true
  Reason for non-resignaturability:
  Unresolved Extent Count: 1
```

```
5aac19e5-acc5004-9605-a0369fa162f0
  Volume Name: DataStore4
  VMFS UUID: 5aac19e5-acc5004-9605-a0369fa162f0
  Can mount: true
  Reason for un-mountability:
  Can resignature: true
  Reason for non-resignaturability:
  Unresolved Extent Count: 1
```

```
5aac2abc-fa70525e-1e1a-a4bf013952b3
  Volume Name: datastore1
  VMFS UUID: 5aac2abc-fa70525e-1e1a-a4bf013952b3
```

```
5aac2abc-fa70525e-1e1a-a4bf013952b3
  Volume Name: datastore1
  VMFS UUID: 5aac2abc-fa70525e-1e1a-a4bf013952b3
  Can mount: true
  Reason for un-mountability:
  Can resignature: true
  Reason for non-resignaturability:
  Unresolved Extent Count: 1
```

Example using the label "datastore1":

2. Re-signature the snapshot/replica LUN by running this command:

```
# esxcli storage vmfs snapshot resignature -l label -u uuid
```

Example using the label "datastore1"

```
# esxcli storage vmfs snapshot resignature -l "datastore1"
```

Output should state, "No unresolved VMFS snapshots with volume label <label> found."

```
[root@localhost:~] esxcli storage vmfs snapshot resignature -l "datastore1"
No unresolved VMFS snapshots with volume label 'datastore1' found.
[root@localhost:~] █
```

3. Rescan the vSphere Web Client to verify that the datastores show up again.



Issue #2:

SCSI Layer Translation for VMware ESXi

VMware ESXi NVMe SCSI layer translation reports a default logical block size for all NVMe devices and stores the physical block size within the filesystem metadata of the datastore. The Intel VMD NVMe driver will report the logical block size from the NVMe device. This incompatibility between the two physical block sizes reported will cause datastore1 to disappear and re-signature process outlined above will not work without the following additional workaround.

Issue #2 Workaround:

Use Module Parameters SNT_COMPAT

In order to correct this issue, the module parameters can be set right after vib installation. Install the Intel VMD driver and reboot. The driver's scsi-to-nvme translation compatibility mode can be set to **off** by running the following commands:

Note: Always set the system into maintenance mode before changing the module parameters command.

```
# esxcli system maintenanceMode set --enable true
```

```
# esxcli system module parameters set -m intel-nvme-vmd -p "SNT_COMPAT=0"
```

Reboot the system after setting this parameter.

Setting to **off** will have the NVMe SCSI layer use VMware's translations and keep compatibility between driver updates.

Note: This is a module-wide parameter; it cannot be used to select the translation on individual drives.



7 Helpful VMware ESXi Commands for Intel VMD-enabled NVMe Driver Management

7.1 Installing Software

```
# esxcli software vib list -> listing drivers
```

```
# esxcli software vib remove -n <driver name> -> removing driver
```

```
# esxcli software vib install --no-sig-check -v <path> - installing soft from VIB unsigned
```

```
# esxcli software vib list | grep iavmd -> check for VMD driver
```

Example for driver installation:

```
# esxcli software vib install --no-sig-check -v /vmfs/volumes/share/VMD_Drivers/Beta/VMware/build-vmd-65-1.3.0.1000/vib/iavmd-1.3.0.1000-1OEM.650.0.0.4598673.x86_64.vib
```

Installing latest ISDCT:

```
# esxcli software vib install --no-sig-check -v /vmfs/volumes/share/tools/isdct/3.0.7/Intel_SSD_Data_Center_Tool_3.0.7_ESXi/intel_ssd_data_center_tool-3.0.7-401.vib
```

7.2 Debugging – Set debug level for kernel log data when issues occur

Use the following command prior to reproducing the issue:

```
# esxcli system module parameters set -m nvme -p "nvme_log_level=5 nvme_dbg=0xfff7"
```

Re-create issue and reboot to collect the kernel log.

7.3 Formatting NVMe Devices

Install the latest Intel SSD Data Center Tool (isdct) from Intel Download Center. Install with no datastores mounted; tool will be installed in /opt/intel/isdct/

For formatting the NVMe *cd* to /opt/intel/isdct and type:

```
# ./isdct start -intelssd 0 -nvmeformat LBAFormat=0 SecureEraseSetting=1 ProtectionInformation=0 MetadataSettings=0
```

```
# LBAFormat=0 -> sector size 512
```

```
# LBAFormat=3 -> sector size 4k (not available anymore)
```

```
# -intelssd x -> disk ID
```

```
# ./isdct show -intelssd -> Lists disks IDs
```



7.4 Change LBA:

```
# /opt/intel/isdct/isdct delete -f -intelssd CVF85474004W1P6BGN-2 -> deleting disk  
# /opt/intel/isdct/isdct set -intelssd CVF85474004W1P6BGN-2 MaximumLBA=100% -> setting proper LBA
```

7.5 Disk Listing

```
# esxcfg-mpath -L -> listing disks  
# ls /vmfs/devices/disks/ | grep NVMe | grep : -vc -> count disks  
# esxcfg-scsidevs -A -> Listing disks with controllers  
# esxcfg-scsidevs -a -> Listing controllers  
# esxcli storage vmfs extent list -> Command to list all datastores present  
# esxcli storage vmfs snapshot list -> If no datastores show up, run this command
```

7.6 Use ISDCT Tool for VMware

```
# /opt/intel/isdct/isdct show -intelssd -> Listing disks managed by ISDCT
```

7.7 Disk Management

```
# /vmfs/volumes/share/VMware/Tools/Nvmecli/nvme-cli intel-nvme0 format 1 -> formatting namespace  
# ls /vmfs/devices/disks/ | grep NVMe | grep : -vc -> number of visible, attached and powered-on disks  
# esxcli storage core device set --state=<on/off> -d [diskID] (e.g.  
t10.NVMe___INTEL_SSDPE2MX450G7_CVPP634600FP450RGN__00000001) -> turn on/off the disk.
```

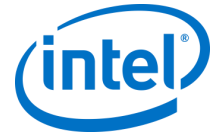
7.8 Performing IO using IOZONE

Create datastore

```
# partedUtil mklabel /vmfs/devices/disks/<diskID> (e.g.  
t10.NVMe___INTEL_SSDPE2MX450G7_CVPP634600FP450RGN__00000001) msdos  
# partedUtil getptbl /vmfs/devices/disks/<diskID>  
# partedUtil set /vmfs/devices/disks/<diskID> "1 2048 209715200 251 0"  
# vmkfstools --createfs vmfs5 --setfsname NvmeVmdDatastore /vmfs/devices/disks/<diskID>:1  
# ls vmfs/volumes/ | grep NvmeVmdDatastore -> Verify if datastore is created
```

7.9 Perform IO

```
# cp -r /vmfs/volumes/share/VMware/Tools/iozone/src/current/  
/vmfs/volumes/NvmeVmdDatastore/iozone -> copy tool to store  
# chmod +x /vmfs/volumes/NvmeVmdDatastore/iozone/iozone  
# cd /vmfs/volumes/NvmeVmdDatastore/iozone
```



7.10 Power management

To shut down a single host:

```
# esxcli system shutdown poweroff --reason <"string reason">
```

You must specify the --reason option and supply a reason for the shutdown. A --delay option allows you to specify a delay interval, in seconds.

To reboot a host:

```
# esxcli system shutdown reboot --reason <"string reason">
```

You must specify the --reason option and supply a reason for the shutdown. A --delay option allows you to specify a delay interval, in seconds.

7.11 Saving Core Dump example

```
# partedUtil setptbl
/vmfs/devices/disks/t10.NVMe___INTEL_SSDPEDMD400G4_CVFT534200N4400BGN__00000001 gpt "1
128 5000000 9D27538040AD11DBBF97000C2911D1B8 0"

# esxcli system coredump partition set --
partition=t10.NVMe___INTEL_SSDPEDMD400G4_CVFT534200N4400BGN__00000001:1

# esxcli system coredump partition set --enable=true

# esxcli system coredump partition list

# vsish -e set /reliability/crashMe/Panic 1

# esxcfg-dumppart --copy --devname
/vmfs/devices/disks/t10.NVMe___INTEL_SSDPECME016T4_CVF85504008C1P6BGN2D100000001:9
```

7.12 Others

```
# esxcli storage nfs add -H 10.91.80.253 -s /share -v share -> mounting share
# vim-cmd /hostsvc/hostsummary -> Host summary. e.g. maintenance mode.
# vim-cmd /hostsvc/maintenance_mode_enter
# vim-cmd /hostsvc/maintenance_mode_exit
# lspci -vvv |grep -i vmd -> lists VMD controllers
```

Ex.

```
[root@gklab-80a-014:~] lspci -vvv |grep -i vmd
0000:17:05.5 RAID bus controller Mass storage controller: Intel Corporation NVM-Express VMD [vmhba2]
0000:5d:05.5 RAID bus controller Mass storage controller: Intel Corporation NVM-Express VMD [vmhba3]
0000:85:05.5 RAID bus controller Mass storage controller: Intel Corporation NVM-Express VMD [vmhba4]
# vdf -> listing ramdisk usage
# esxcli system visorfs ramdisk list -> check ramdisks
```