



Intel[®] Volume Management Device Driver for VMware* ESXi

User Guide

Revision 004

October 2023



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Revision History

Revision	Description	Revision Date
001	Initial Release	November 2022
002	Updated Chapters 3 , 4 , 5 and 6	April 2023
003	Updated Sections 2.2 , 2.3 , 2.4 and 4.1	August 2023
004	Updated Sections 1.2 , 2.2 , 4.1 and 4.2	October 2023

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1 Overview

This document provides guidance for the Intel® Volume Management Device (Intel® VMD) production driver for VMware* ESXi.

The Intel® VMD driver for VMware* ESXi supports ESXi* versions 7.0U3 and 8.0x. This document assumes reader familiarity with the ESXi* Operating System/Hypervisor and does not provide detailed instructions for installing ESXi* or copying drivers to an ESXi* system.

The Intel® VMD driver is designed to work with the Intel® VMD hardware logic implemented on Intel® Xeon® Scalable Processors. Intel® VMD is much like an HBA controller for NVMe* SSDs and adds robust management for NVMe* SSDs in the Data Center such as Hot Plug (referred to as Surprise Hot Plug), LED management, error handling, in addition to being a dependency for Intel® VROC configuration.

VMware* ESXi 6.5 and 6.7 reached their end-of-life, as announced by VMware*. No support is available for these versions, and it is recommended that customers upgrade to ESXi* version 7.0U3d or 8.0x.

1.1 Reference OEM Platform Documentation

Refer to your OEM for a full list of available feature sets. If any of the information in this document conflicts with the support information provided by the platform OEM, the platform documentation and configurations take precedence.

Customers should always contact the place of purchase or system/software manufacturer with support questions about their specific hardware or software configuration.

1.2 Terms and Acronyms

Table 1-1. Glossary of Terms and Acronyms

Term	Definition
NVMe*	Non-Volatile Memory Express
ISO	International Standards Organization
SSD	Solid State Drive
Intel® VMD	Intel® Volume Management Device
IOVP	I/O Vendor Partner
GA	General Availability
vSAN*	Virtual Storage Area Network
LED	Light Emitting Diode

Term	Definition
ESXi	Elastic Sky X integrated
OS	Operating System
Intel® VROC	Intel® Virtual RAID on CPU
HII	Human Interface Infrastructure
PEM	Power Entry Module
BKC	Best Known Configuration

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2 Product Requirements

2.1 Platform and VMD Requirements

Platform and VMD requirements to use Intel® Virtual RAID on CPU (Intel® VROC) RAID volumes:

- 1st, 2nd, 3rd, or 4th Generation Intel® Xeon® Scalable Processor.
- Intel® NVMe* SSDs in U.2 format attached to a Hot Swappable Backplane (HSBP) for Surprise Hot Plug management.
- 48 NVMe* SSDs is the maximum for total devices supported on a platform.
- A licensed Intel® VROC hardware or software key is required on the system to create RAID volumes.
- Intel® VROC UEFI drivers should be integrated with the system BIOS and consist of the following UEFI driver set:
 - VMDVROC_1.efi
 - VMDVROC_2.efi
 - With the above UEFI drivers loaded, the BIOS will display a HII menu within the BIOS setup menu as “Intel® Virtual RAID on CPU”. BIOS menu paths and options may differ depending on BIOS vendor.
- Intel® VMD must be enabled in the BIOS. Check with your BIOS vendor for instructions on enabling Intel® VMD in the BIOS setup menu.
- “Intel® Virtual RAID on CPU” is the BIOS menu option for creating Intel® VROC RAID volumes and associated Intel proprietary metadata for RAID support in the ESXi* Operating System.

2.2 Supported RAID Options

The “Intel® Virtual RAID on CPU” BIOS menu should be used to create the desired RAID volume(s). Currently supported RAID configurations are:

- RAID 1 boot volume.
- RAID 1 data volume.
- Only 1 volume is supported on a given array of drives. Matrix RAID is not supported.
- RAID 0/10/5 are not currently supported.
- Boot device and data device may be attached to the same Intel® VMD Domain if vSAN **IS NOT** implemented. Example If not using VSAN, plug in 4 drives behind one Intel® VMD Domain/Controller. Make two RAID 1 volumes. Install the operating system on one and use the other for data.
- If vSAN **IS** implemented: Boot volume must be on a separate Intel® VMD Domain/Controller from data volume. Example: Boot volume (either a single device or 2-disk RAID 1 volume) is on a dedicated Intel® VMD Domain/Controller.

- Additional scenario clarifications:
 - Multiple RAID 1 volumes are supported for NVMe drives behind Intel® VMD, with a theoretical maximum of twelve (12) RAID 1 volumes per domain/controller. Intel verifies functionality of two volumes per domain/controller. The maximum volume limit has not been tested as of this writing.
 - A disk can only be used in one RAID array. If you only use part of the disk in the RAID array, the rest of the disk cannot be used (i.e.: no Matrix RAID).
 - There can be more than one vSphere configured datastore on a single RAID array, but there cannot be more than one RAID array using the same disks (no Matrix RAID).
 - If vSAN is used, you cannot have both a boot datastore and any other datastore on the same VMD controller. In other words, if you are using vSAN, you cannot have the boot datastore and a “data” datastore on the same RAID 1 array (since that requires use of the same VMD controller).
 - If vSAN is not used, you can have a boot datastore and any other “data” datastores under the same VMD controller (i.e.: you can have multiple datastores on the same RAID 1 array).

2.3 Hot Plug Requirements

Hot plug for a VMD passthrough disk may be performed when the disk is assigned to a VM as a virtual disk and the VM is powered down. In this case, Intel recommends removing the datastore before hot plugging the device.

Intel does not recommend that customers perform hot plug for VMD passthrough disk if the disk is already assigned to a VM as a virtual disk and when VMs are running.

The above guidance complies with VMware’s recommendations that IO to the disk be stopped and the datastore removed or unmounted prior to hot plug actions.

Depending on the validation platform of choice, Intel® VMD must be enabled on the surprise hot plug capable lanes of the platform. For surprise hot plug to work correctly, some platforms allow a jumper to be set to disable ACPI hot plug. PCIe* hot plug is required to support Intel® VMD.

RAID 1 full volume hot plug, where both RAID disks are unplugged, is not a supported scenario.

2.4 RAID Spare Drive and Rebuild Configuration Recommendations

Options for drive replacement and RAID rebuild when using RAID 1 volumes are the following:

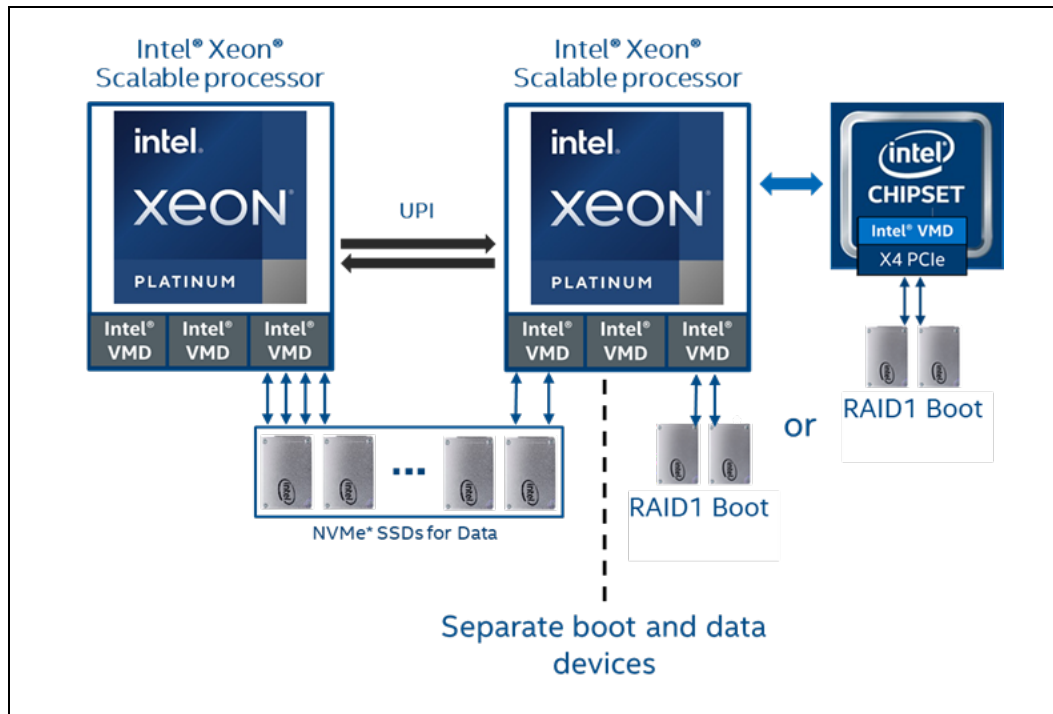
- When configuring the ESXi* boot drive(s) as a RAID 1, Intel recommends a third drive be placed in the system and be designated as an online spare. In case of failure of a RAID 1 member drive, automatic rebuild to the spare drive occurs, making it an active member without further administrator actions.
- If no spare drive has been designated in the system, and a member RAID 1 drive fails, recommended actions are to unplug the failed drive from the system (use Locate LED to assist as needed) and insert a clean drive of capacity at least equal to the RAID volume size.

- The newly inserted drive does not auto rebuild into the RAID 1. It must be manually selected before a rebuild begins, for example: `vmd rebuildstart vmhba0 -v 59 -d 1` (based on volume details provided by the *intel-vmdr-user* tool).

If system slot availability does not allow for a separate slot to insert a spare drive, i.e.: all slots are occupied, another option for auto-rebuild is to provide an external (on the shelf) spare drive. This option may simplify administrative drive replacement if immediate insertion and volume rebuild is needed. Test prior to using in a production environment. Recommended sequence of actions is the following:

1. ESXi* installed and the latest driver/tool installed.
2. Assign a third disk as a spare in BIOS.
3. Boot to ESXi*.
4. With the user tool, confirm and locate the disk that was designated as spare (LED locate).
5. Unplug the designated spare (this disk has been marked in BIOS Intel VROC settings as a spare drive and the slot it occupies is now available for another disk).
6. If a member of the RAID 1 fails, unplug the failed drive, and insert the external spare drive into the vacated slot.
7. Rebuild starts immediately.

Figure 2-1. Graphical Representation of Boot Options



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3 Product Installation/Upgrade

3.1 Intel® VMD Driver Download Instructions and Supported Versions

An inbox Intel® VMD driver is provided with ESXi* releases 7.0x/8.0x. ESXi* version 7.0x inbox driver is a 2.7x level driver. ESXi* version 8.0x inbox driver is a 3.0 level driver. The inbox driver is production quality and fully functional at the time of ESXi* GA release.

If improvements/fixes are identified for the inbox Intel® VMD driver after ESXi* GA release, an outbox or async driver may be provided by Intel upon request. When an outbox/async driver is completed by Intel development, it will follow a standard VMware* IOVP process which includes digital signing and certification. Once all required processes are finalized, Intel will notify OEM customers and assist with installation of the updated driver as required.

Note: The ESXi* 2.7x inbox driver may be upgraded to a 3.0 driver. However, it is not recommended to downgrade a 3.0 inbox driver to a 2.7x driver.

Production Intel® VMD drivers are VMware* certified and can be downloaded from the VMware* website as follows. Non-production or test drivers are released via other means. Contact your Intel representative when non-production drivers may be required for test purposes.

How to download: VMware* Compatibility Guide (VCG) Downloads for Intel® VMD Production IOVP Signed/Certified Drivers

1. Go to the link <https://www.vmware.com/resources/compatibility/detail.php?deviceCategory=io&productid=49722&vcl=true>
2. Select the required VMware* Product Name (ESXi* Version) in the Model Release Details section.
3. Select and expand the preferred driver as listed in the Device Driver(s) column. The driver **Footnotes** entry provides a download link to the certified/signed ESXi* VMD driver.

The matrix below identifies supported ESXi* versions and Intel® VMD driver versions.

- 2.x: Intel® VMD 2.x driver supported.
- 3.x: Intel® VMD 3.x driver supported.

Table 3-1. Supported ESXi* and Intel® VMD Driver Versions

Platform	ESXi* 7.0U3	ESXi* 8.0x
Skylake	Supported	Supported
SKX SP/D <i>iavmd</i> Driver Ver	2.x	3.x

Platform	ESXi* 7.0U3	ESXi* 8.0x
Cascade Lake CLX/SP <i>iavmd</i> Driver Ver	Supported 2.x	Supported 3.x
Cooper Lake CPX6 <i>iavmd</i> Driver Ver	Supported 2.x	Supported 3.x
Ice Lake ICX SP <i>iavmd</i> Driver Ver	Supported 2.x/3.x	Supported 3.x
Ice Lake ICX D <i>iavmd</i> Driver Ver	Planned	Planned
Sapphire Rapids SPR <i>iavmd</i> Driver Ver	Supported 3.x	Supported 3.x

3.2 Intel® VMD Driver Upgrade Procedure

As mentioned previously, VMware* ESXi has an integrated inbox Intel® VMD driver. By sending the `esxcli software vib list` command you will see the inbox *iavmd* driver listed as in the example below:

```
[root@localhost:~] esxcli software vib list | grep vmd
iavmd 3.0.0.1010-5vmw.800.1.0.19956994 VMW VMwareCertified 1998-04-15
lsuv2-intelv2-nvme-vmd-plugin 2.7.2173-2vmw.800.1.0.19956994 VMware VMwareCertified 1998-04-15
[root@localhost:~]
```

3.2.1 Installation of the ESXi* VMD Outbox (async) Driver

To update or install the VMD async driver, VMware* recommends using the following component installation command syntax:

```
# esxcli software component apply -d <path_to_component.zip> --no-sig-check
```

For example:

```
# esxcli software component apply -d /tmp/INT-esx-8.0.0-Intel-Volume-Mgmt-Device-3.5.0.1008-10EM.800.1.0.20613240.zip --no-sig-check
```

Note: As a change to previous VMD driver update practice, it is no longer recommended to perform a VIB file standalone installation for production use. This installation method, which requires a `-f` or `--force` option (starting with ESXi* 8.0), lowers the driver security acceptance level below the ESXi* host level and may introduce vulnerabilities into ESXi* operations:

```
Not recommended for production use: # esxcli software vib install -d /tmp/[xxxxx].vib -f --no-sig-check
```

Product Installation/Upgrade

Note: `--no-sig-check` is used to load an unsigned driver, usually for test purposes. Production drivers, however, are signed/certified and do not require this parameter.

Reboot the host to activate the updated driver. Use the `esxcli software vib list` command to confirm the newly updated `iavmd` driver version.

```
[root@localhost:~] esxcli software vib list | grep vmd
iavmd                 3.0.0.1037-1OEM.800.0.0.19449800    INT    VMwareCertified
lsuv2-intelv2-nvme-vmd-plugin 2.7.2173-2vmw.800.1.0.19956994    VMware VMwareCertified
[root@localhost:~]
```

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4 Intel® VMDR User Tool for RAID Volume and LED Management

As a companion to the Intel® VMD driver, Intel offers a command line utility for both VMD RAID/non-RAID volume administration and LED management. The utility is named *intel-vmdr-cli* (ESXi 8.0x) or *intel-vmdr-user* (ESXi 7.0x), commonly referred to as the user or CLI tool.

The current version of the CLI tool is **3.0.0.2229** and may be downloaded for the respective ESXi* versions at the following links:

- [Intel® VMD/VROC and LED Management Tool for VMware* ESXi 7.x](#)
- [Intel® VMD/VROC and LED Management Tool for VMware* ESXi 8.x](#)

The tool is also included with the production driver package BKC release and may be installed with the command `esxcli software vib install -v <path>` as shown in below example (if installing a pre-production release, add the option `--no-sig-check`):

```
# esxcli software vib install -v /tmp/intel-vmdr-user-8.0.0.2229.vib
```

Note: No reboot is required to activate the tool for ESXi* 7.0. However, reboot is required to activate the tool for ESXi* 8.0.

After installing the *intel-vmdr-cli* (ESXi 8.0x) or *intel-vmdr-user* (ESXi 7.0x) tool, it will be accessible at the following ESXi* host path and CLI name, depending on the ESXi* version used:

- For ESXi* 8.0x: `/opt/intelvmdrcli/bin/intel-vmdr-cli`
- For ESXi* 7.0x: `/opt/intel/bin/intel-vmdr-user`

4.1 Disk and RAID Volume Management

General Usage:

ESXi* 8.0u1 CLI command examples are presented in this user guide.

Syntax:

```
# ./intel-vmdr-cli {command} {adapter name} {options}
```

Note: `./intel-vmdr-cli` as a standalone command will display an extensive list of commands and sample syntax.

```
[root@WIN-303IUHLTVJ1:/opt/intel/vmdrcli/bin] ./intel-vmdr-cli
Management Interface Version: 3000000

Usage:
intel-vmdr-user raidctrllist
intel-vmdr-user vmdctrllist
intel-vmdr-user disklist
intel-vmdr-user volumelist
intel-vmdr-user getlicenseinfo
intel-vmdr-user setled [RAIDCtrlName] -d[TargetID] -l[off, identify]
eg: intel-vmdr-user setled vmhba2 -d 1 -l identify

intel-vmdr-user getled [RAIDCtrlName] -d[TargetID]
eg: intel-vmdr-user getled vmhba2 -d 1

intel-vmdr-user createvol [RAIDCtrlName] -b[StripSize] -d[TargetIDs] -l[RAIDLevel] -n[VolumeName] -s[SourceDiskID (Optional)] -c[VolumeSize]
eg(Volume Creation): intel-vmdr-user createvol vmhba2 -b 64 -d 0,1 -l 1 -n testvolume -c 5120
eg(RAID Migration): intel-vmdr-user createvol vmhba2 -b 64 -d 0,1 -l 1 -n testvolume -s 1 -c 5120

intel-vmdr-user volinitialize [RAIDCtrlName] -v[volumeID]
eg: intel-vmdr-user volinitialize vmhba2 -v 59

intel-vmdr-user deletevol [RAIDCtrlName] -d[TargetID]
eg: intel-vmdr-user deletevol vmhba2 -d 127

intel-vmdr-user verifyvol [RAIDCtrlName] -d[TargetID] -t[VerifyType]
eg: intel-vmdr-user verifyvol vmhba2 -d 59 -t 0

intel-vmdr-user getvolinfo [RAIDCtrlName] -d[TargetID]
eg: intel-vmdr-user getvolinfo vmhba2 -d 59

intel-vmdr-user getdiskinfo [RAIDCtrlName] -d[TargetID]
eg: intel-vmdr-user getdiskinfo vmhba2 -d 1

intel-vmdr-user markpassthrough [RAIDCtrlName] -d[TargetID]
eg: intel-vmdr-user markpassthrough vmhba2 -d 1

intel-vmdr-user rebuildstart [RAIDCtrlName] -v[VolumeID] -d[TargetID]
eg: intel-vmdr-user rebuildstart vmhba2 -v 59 -d 1

intel-vmdr-user markdiskspare [RAIDCtrlName] -s[SpareDiskID]
eg: intel-vmdr-user markdiskspare vmhba2 -s 1

intel-vmdr-user nvmeidctrl [RAIDCtrlName] -d[TargetID]
eg: intel-vmdr-user nvmeidctrl vmhba2 -d 1
```

```

intel-vmdr-user nvmegetlogpage [RAIDCtrlName] -d[TargetID] -i[LogPageId] -l[LogLength] -n[NamespaceID]
eg: intel-vmdr-user nvmegetlogpage vmhba2 -d 1 -i 2 -l 512 -n 4294967295

intel-vmdr-user nvmefwdownload [RAIDCtrlName] -d[TargetID] -f[FirmwarePath]
eg: intel-vmdr-user nvmefwdownload vmhba2 -d 1 -f "/tmp/your_firmware_image.bin"

intel-vmdr-user nvmefwcommit [RAIDCtrlName] -d[TargetID] -s[FirmwareSlot] -a[FirmwareAction]
eg: intel-vmdr-user nvmefwcommit vmhba2 -d 1 -s 1 -a 0

Description:
VMDCtrlName      VMD Controller name = vmhba[X-x]
RAIDCtrlName     RAID Controller name = vmhba[X]
-d              TargetID of Disk/Volume
-b              Strip size in KB
-n              Name of volume
               NVMe namespace Id (for nvmegetlogpage)
-c              Volume size
-v              Volume ID
-l              State of the led[off, identify] (for settled)
               RAID level (for createvol)
               NVMe log page length (for nvmegetlogpage)
-s              Source disk of volume (Applicable only for Migration)
               Spare disk ID (for markdiskspare)
               NVMe SSD firmware slot Id (for nvmefwcommit)
-i              NVMe log page Id (for nvmegetlogpage)
-f              NVMe firmware image path (for nvmefwdownload)
-a              NVMe firmware commit action (for nvmefwcommit)
-t              Type of volume verification (for verifyvol)

```

Note: adapter name can be found by using the command: `esxcfg-scsidevs -A`. The following example returns the disk-attached adapter names: `vmhba1`, `vmhba2` and `vmhba6`.

```

[root@WIN-303IUHLTVJ1:/opt/intelvmdrcli/bin] esxcfg-scsidevs -A
vmhba1    t10.NVMe_____INTEL_SSDPEK1F058GA_____BT0C027407FR058C_____00000001
vmhba3    t10.VMDRAID Intel_Raid_1_VolumeVolume0000000001
vmhba6    t10.NVMe_____INTEL_SSDPE2KE016T8_____BTLN81260ECC1P6AGN_____00000001

```

`./intel-vmdr-cli raidctrllist` returns a complete adapter list:

```

[root@WIN-303IUHLTVJ1:/opt/intelvmdrcli/bin] ./intel-vmdr-cli raidctrllist
Found 5 Controller(s)
VMD Enabled/RAID      Controller: vmhba1
VMD Enabled/RAID      Controller: vmhba4
VMD Enabled/RAID      Controller: vmhba5
VMD Enabled/RAID      Controller: vmhba6
VMD Enabled/RAID      Controller: vmhba3

```

4.2 LED Management

For LED Management, NVMe* devices should be attached to a system-integrated hot swappable backplane or similar backplane attached via an internal retimer Add-in-Card (AIC), switch, or connectors directly to the motherboard. If using a retimer card for PCIe* NVMe* SSDs, a PEM cable must be attached from the Add-in-Card to the motherboard PEM CPU connection.

For help in running the `intel-vmdr-user` tool to test LED management, enter the following for syntax assistance:

```
# ./intel-vmdr-cli settled
```



```
[root@WIN-303IUHLTVJ1:/opt/intelvmldrcli/bin] ./intel-vmldr-cli setled
Usage:
  intel-vmldr-user setled [RAIDCtrlName] -d[TargetID] -l[off, identify]
  eg: intel-vmldr-user setled vmhba2 -d 1 -l identify

Description:
  VMDCtrlName  RAID Controller name = vmhba[X]
  -d           TargetID of Disk
  -l           State of the led[off, identify]
```

Example to set the LED state:

Options:

- [-l <STATE>] - LED state (off, identify)
- [-d <NUM>] - Target disk

Note: The CLI supports *off* and *identify* parameters only.

To find the disk number and target number, the `disklist` command is used:

```
# ./intel-vmldr-cli disklist
```

```
[root@WIN-303IUHLTVJ1:/opt/intelvmldrcli/bin] ./intel-vmldr-cli disklist
Disk Name: "INTEL SSDPEK1F0S"  Controller: vmhba1  TargetId: 0  Serial#: "FTOC027407FR059C  "  State: PASSTHROUGH
Disk Name: "INTEL SSDPE21EQ1"  Controller: vmhba6  TargetId: 0  Serial#: "FTLN01260ECC1P6AGN  "  State: PASSTHROUGH
Disk Name: "INTEL SSDPF2HX07"  Controller: vmhba3  TargetId: 0  Serial#: "PHAB9492001N7P6GGN  "  State: MEMBER
Disk Name: "INTEL SSDPF2HX07"  Controller: vmhba3  TargetId: 1  Serial#: "PHAB949200697P6GGN  "  State: MEMBER
```

The number after the `TargetID` is the disk number or *targetID* (0 in first line of the example above).

In the displays below, syntax is included to set LED *identify* and *off*.

Confirm current LED state (*off*):

```
# ./intel-vmldr-cli getled vmhba3 -d 0
```

```
[root@WIN-303IUHLTVJ1:/opt/intelvmldrcli/bin] ./intel-vmldr-cli getled vmhba3 -d 0
rp_get_led Called
Targeting Disk:0
LED state:off
```

Set LED state to *Identify*:

```
# ./intel-vmldr-cli setled vmhba3 -d 0 -l identify
```

```
[root@WIN-303IUHLTVJ1:/opt/intelvmldrcli/bin] ./intel-vmldr-cli setled vmhba3 -d 0 -l identify
Targeting Disk:0 with LED:identify
Request to Set LED on disk has completed.
```

Return LED state to *Off*:

```
# ./intel-vmldr-cli getled vmhba3 -d 0 -l off
```



```
[root@WIN-303IUHLTVJ1:/opt/intelvmldrcli/bin] ./intel-vmldr-cli setled vmhba3 -d 0 -l off
Targeting Disk:0 with LED:off
Request to Set LED on disk has completed.
```

Alternatively, the VMD controller list command may be used to identify available controllers for LED management:

```
# ./intel-vmldr-cli vmdctrllist
```

The name before the '-', ex. *vmhba3*, is the device that controls the LEDs.

```
[root@WIN-303IUHLTVJ1:/opt/intelvmldrcli/bin] ./intel-vmldr-cli vmdctrllist
Returned 5 vmd-adapter(s)
VMD Controller:vmhba1-0
VMD Controller:vmhba4-1
VMD Controller:vmhba5-2
VMD Controller:vmhba6-3
VMD Controller:vmhba3-4
```

In this example, we will set the LED status on device *vmhba3-4*, disk number 1 to the LED state *off*:

```
# ./intel-vmldr-cli setled vmhba3 -d 1 -l off
```

```
[root@WIN-303IUHLTVJ1:/opt/intelvmldrcli/bin] ./intel-vmldr-cli setled vmhba3 -d 1 -l off
Targeting Disk:1 with LED:off
Request to Set LED on disk has completed.
```

Confirm the status register is correctly set to *off*:

```
# ./intel-vmldr-cli getled vmhba3 -d 1
```

```
[root@WIN-303IUHLTVJ1:/opt/intelvmldrcli/bin] ./intel-vmldr-cli getled vmhba3 -d 1
rp_get_led Called
Targeting Disk:1
LED state:off
```



5 VMware* ESXi Commands for Intel® VMD Driver Management

The following miscellaneous commands are provided for general reference and troubleshooting.

5.1 Installing Software

To list drivers:

```
# esxcli software vib list
```

To remove driver:

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

To install software from VIB:

```
# esxcli software vib install --no-sig-check -v <path>
```

To check for Intel® VMD driver installed:

```
# esxcli software vib list | grep iavmd
```

5.2 Disk Listing

To list disks:

```
# esxcfg-mpath -L
```

To count disks:

```
ls /vmfs/devices/disks/ | grep NVMe* | grep : -vc
```

To list disks with controllers:

```
esxcfg-scsidevs -A
```

To list controllers:

```
esxcfg-scsidevs -a
```

To list all datastores present:

```
esxcli storage vmfs extent list
```

If no datastores show up, run this command:

```
esxcli storage vmfs snapshot list
```

5.3 Disk Management

To remotely turn on/off the disk use the command `esxcli storage core device set -state=<on/off> -d [diskID]`.

Note: The `diskID` typically follows a format like this example:

```
t10.NVMe*___INTEL_SSDPE2MX450G7_CVPF634600FP450RGN__00000001
```

To remotely detach a disk:

```
# esxcli storage core device set --state=off -d
t10.NVMe*___INTEL_SSDPE2KX010T7_____PHLF7516001G1P0GGN__00000001
```

To remotely attach a disk:

```
# esxcli storage core device set --state=on -d
t10.NVMe*___INTEL_SSDPE2KX010T7_____PHLF7516001G1P0GGN__00000001
```

To format namespaces:

```
# /vmfs/volumes/share/VMware/Tools/NVMe*cli/NVMe*-cli intel-NVMe*0 format 1
```

To show the number of visible, attached and powered-on disks:

```
# ls /vmfs/devices/disks/ | grep NVMe* | grep : -vc
```

5.4 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
```

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6 Injecting Outbox Intel® VMD Driver into ESXi* Bootable Image

6.1 Tools Needed

Download the Windows* *VMware.PowerCLI* tool from VMware*:
<https://www.powershellgallery.com/packages/VMware.PowerCLI/11.4.0.14413515>

6.2 Software Needed and Injection Procedure Summary

The VMware* ESXi driver installation package should include a .zip depot file. The following is used for this example:

- **VMware-ESXi-7.0U3d-19482537-depot.zip**
 1. Log in to a vCenter Server or ESX host:


```
Connect-VIServer (may have trust certificate issue)
Connect-VIServer -server 10.2.61.32
```

Note: Do a `Get-PowerCLIConfiguration`. If it says `unset`, do a `Set-PowerCLIConfiguration -InvalidCertificateAction Ignore -Confirm:$false`.

Note: To find out what commands are available, type: `Get-VICommand`.

Note: To show searchable help for all PowerCLI commands, type: `Get-PowerCLIHelp`.

2. Once you have connected, display all virtual machines by typing: `Get-VM`.
3. Run the command: `C:\Program Files (x86)\VMware\Infrastructure\vSphere PowerCLI> Add-EsxSoftwareDepot VMware-ESXi-7.0U3d-19482537-depot.zip`

4. Run the command: `C:\Program Files (x86)\VMware\Infrastructure\vSphere PowerCLI> Get-ESXImageProfile`

Name	Vendor	Last Modified	Acceptance Level
ESXi-7.0U3d-19482537-standard	VMware, Inc.*	3/29/2022	PartnerSupported
ESXi-7.0U3sd-19482531-no-tools	VMware, Inc.*	3/11/2022	PartnerSupported
ESXi-7.0U3sd-19482531-standard	VMware, Inc.*	3/29/2022	PartnerSupported
ESXi-7.0U3d-19482537-no-tools	VMware, Inc.*	3/11/2022	PartnerSupported

5. Run the command: `C:\Program Files (x86)\VMware\Infrastructure\vSphere PowerCLI> New-EsxImageProfile -CloneProfile "ESXi-7.0U3d-19482537-standard" -Name "profile" -Vendor "Intel"`

Name	Vendor	Last Modified	Acceptance Level
profile	Intel	3/29/2022	PartnerSupported

6. Run the command: C:\Program Files (x86)\VMware\Infrastructure\vSphere PowerCLI> Remove-
EsxSoftwarePackage -ImageProfile profile -SoftwarePackage iavmd

Name	Vendor	Last Modified	Acceptance Level
profile	Intel	6/22/2022	PartnerSupported

7. Run the command: C:\Program Files (x86)\VMware\Infrastructure\vSphere PowerCLI> Get-EsxImageProfile
-Name profile | Select-Object -ExpandProperty Viblist | Sort-
Object

Name	Version	Vendor	Creation Date
esxio-combiner	7.0.3-0.35.19482537	VMware*	3/11/2022 2:1...
esx-ui	1.36.0-18403931	VMware*	7/30/2021 6:2...
esx-update	7.0.3-0.35.19482537	VMware*	3/11/2022 2:1...
esx-xserver	7.0.3-0.35.19482537	VMware*	3/11/2022 2:1...
gc	7.0.3-0.35.19482537	VMware*	3/11/2022 2:1...
i40en	1.11.1.31-1vmw.703.0.20.191...	VMware*	1/11/2022 11:...
icen	1.4.1.7-1vmw.703.0.20.19193900	VMware*	1/11/2022 11:...

8. Run the command: C:\Program Files (x86)\VMware\Infrastructure\vSphere PowerCLI> Get-
EsxSoftwarePackage -PackageUrl iavmd-3.0.0.1034-
10EM.700.1.0.15843807.x86_64.vib

Name	Version	Vendor	Creation Date
iavmd	3.0.0.1034-10EM.700.1.0.158	Intel	4/2/2022 4:02...

9. Run the command: C:\Program Files (x86)\VMware\Infrastructure\vSphere PowerCLI> Add-
EsxSoftwarePackage -ImageProfile profile -SoftwarePackage iavmd

Name	Vendor	Last Modified	Acceptance Level
profile	Intel	6/22/2022	PartnerSupported

10. Run the command: C:\Program Files (x86)\VMware\Infrastructure\vSphere PowerCLI> Get-EsxImageProfile
-Name profile | Select-Object -ExpandProperty Viblist | Sort-
Object

Name	Version	Vendor	Creation Date
esxio-combiner	7.0.3-0.35.19482537	VMware*	3/11/2022 2:1...
esx-ui	1.36.0-18403931	VMware*	7/30/2021 6:2...
esx-update	7.0.3-0.35.19482537	VMware*	3/11/2022 2:1...
esx-xserver	7.0.3-0.35.19482537	VMware*	3/11/2022 2:1...
gc	7.0.3-0.35.19482537	VMware*	3/11/2022 2:1...
i40en	1.11.1.31-1vmw.703.0.20.191...	VMware*	1/11/2022 11:...
iavmd	3.0.0.1034-10EM.700.1.0.158...	Intel®	4/2/2022 4:02...
icen	1.4.1.7-1vmw.703.0.20.19193900	VMware*	1/11/2022 11:...

11. Run the command: C:\Program Files (x86)\VMware\Infrastructure\vSphere PowerCLI> Export-
EsxImageProfile -ImageProfile "profile" -ExportToIso -FilePath
ESXI_7.0.u3d_19482537_vmd_3.0.0.1034.iso -NoSignatureCheck

