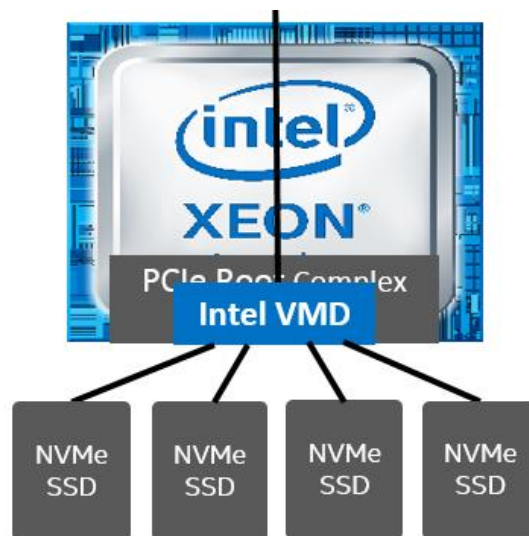


Intel® Volume Management Device LED Management Tool Release Notes and Guide

Purpose

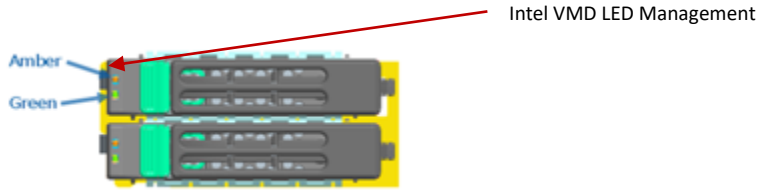
This article provides information about the Intel® Volume Management Device (Intel® VMD) enabled NVMe Driver LED Management Tool for VMware*. This Intel VMD LED Management tool interfaces with the Intel VMD-enabled NVMe driver to drive specific blinking patterns to the backplane on Intel® Xeon® Scalable platforms with PCIe Solid State Drives attached to Intel VMD enabled domains.

Intel VMD is hardware logic inside of the Intel® Xeon® processor. Intel VMD aggregates the NVMe PCIe SSDs attached to its root port and acts much like an HBA today does for SATA and SAS. Intel VMD provides Error management, Surprise Hotplug, and LED Management. This topic will be focusing on the Intel VMD LED Management tools.



PCIe Solid State Drives (SSD) storage lacks a standardized method to blink LEDs visually and represent the status of the device. Locating a drive through a visual indicator is crucial for storage administrators to remove and replace a precise PCIe SSD with a new one in a data center with multiple racks of storage. Without location indicators there is much greater risk of data loss occurring if the wrong drive is removed.

*Green LED below is the activity LED coming directly from the SSD. Amber LED represents the LED coming from the slot on the backplane; this Amber LED is what Intel VMD is responsible for.



Intel VMD LED Management offers the IBPI style of LED management as defined by the SFF-8489 standard. Intel VMD brings a standardized method to PCIe SSD storage to control LED indicators on both direct attached and switch attached PCIe storage. For PCIe register interface technical details necessary to support the Intel VMD method of LED management refer to the references section of this paper.

Intel® Xeon® Scalable platform VPP Bits Used By Enclosure

Bit	Direction	PCIe Signal Name	CPLD Signal Name
0	Output	ATNLED	FAULT
1	Output	PWRLED	LOCATE
2	Output	PWREN#	Not Used Debug Only
3	Input	BUTTON#	Not Used Debug Only
4	Input	PRSNT#	PRSNT_N
5	Input	PWRFLT#	Not Used Debug Only
6	Input	MRL#/EMILS	Not Used Debug Only
7	Output	EMIL	Not Used Debug Only

Repurposing of these VPP bits for PCIe SSD Enclosure Management

Product Overview

This release of the Intel® VMD LED Management Tool includes a simple command line tool to accompany Intel VMD-enabled NVMe Driver version 1.4 and newer on VMware* ESXi* 6.5 and VMware* ESXi* 6.7 operating systems. This tool requires the prior installation of Intel VMD-enabled NVMe driver version 1.4 and newer on the VMware* ESXi* operating system.

Accompanying this tool is a VMware* ESXi* Intel® VMD Framework Plug-in. This framework allows the Intel VMD LED management tool to be used as a vSphere Disk Serviceability Plugin.

Download

This version of Intel VMD LED management tool and VMware* ESXi* LSU Framework Plug-in are available on Intel Download center.

intel.com/download/28288/Intel-VMD-ESXi-Tools

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Known Issues in This Release

Some Switch models are **WRITE ONLY**, therefore, when attempting to send the command to read the slot control registers for LED Status, the tool will not return the LED Status. In this case, manual interpretation by sight viewing the LED Blinking pattern is required to verify the PCIe Slot Control Registers have been correctly configured for the desired blinking pattern.

Installation Details

Intel VMD-enabled NVMe driver, Intel VMD LED management command line tool, and the VMware Framework plug-in are all available with this download collateral from Intel Validation Internet Portal (VIP) as vibs that can be installed in ESXi 6.5 and ESXi 6.7 versions.

Intel VMD-enabled NVMe Driver for Out-of-Box installations:

VMware* ESXi* 6.5

intel-nvme-vmd-1.4.0.1016-1OEM.650.0.0.4598673.x86_64.vib

VMware* ESXi* 6.7

intel-nvme-vmd-1.4.0.1016-1OEM.670.0.0.8169922.x86_64.vib

Intel VMD LED Management command line tool: ***intel-vmd-user.vib***

VMware LSU Framework plug-in: ***lsu-intel-nvme-vmd-plugin-1.0.0-4vmw.680.0.0.00000.i386.vib***

Assuming the vibs has been downloaded to the "tmp" directory, install the vibs using the following syntax:

Esxcli software vib install -v "tmp/<vibName.vib>"

System Requirements

Intel® Xeon® Scalable platform with The Intel VMD enabled on NVMe PCIe SSD connected PCIe lanes.

Intel VMD-enabled NVMe driver is installed.

Intel VMD LED management command line tool is installed on the following VMware* ESXi operating system versions: 6.5 & 6.7

Note: If using VMware* ESXi* 6.7, and replacing the Intel VMD-enabled NVMe inbox driver with the outbox Intel VMD-enabled NVMe driver v. 1.4 or newer, the inbox NVMe LED Management tools should be removed prior to installing the new NVMe LED Management command line tool and the new VMware LSU Framework plug-in for Intel VMD-enabled NVMe driver outbox version 1.4.

Remove the following inbox vibs using the syntax; `esxcli software vib remove -n [driver_name]*`

intel-esx-vmdcli

lsu-intel-vmd-plugin

example:

`esxcli software vib remove -n "intel-esx-vmdcli"`

Note: On ESXi systems, the tool only works on PCIe NVMe drives on Intel VMD enabled domains using the Intel VMD-enabled NVMe driver.

Intel VMD LED Management Tool in VMware* ESXi* environment

For each Intel VMD-enabled domain, the Intel VMD-enabled NVMe driver will enumerate the devices behind the Intel VMD root port. ESXi will assign the HBA Controller ID prefix to the controller, as vmhba# i.e. vmhba0, vmhba3, etc. and also map a SCSI target ID to the NVMe device.

The mapping between SCSI target ID and the device name (t10.NVMe__xxxx) can be found by the command:

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

Below is the example output from this command:

```
vmhba1:C0:T1:L0 state:active t10.NVMe__INTEL_SSDPE2MD016T4_PHFT5462005Q1P6JGN__00000001
vmhba1 0 1 0 NMP active local pscsi.vmhba1 pscsi.0:1
```

vmhba1 = VMD Adapter **Device**

T1 = **Disk NUM** = 1

scsidev = t10.NVMe__INTEL_SSDPE2MD016T4_PHFT5462005Q1P6JGN__00000001

After installing the "intel-vmd-user" vib, the tool will be found in the following directory, and must be ran from this directory:

```
/opt/intel/bin
```

Example to find the list of VMD Adapter Devices:

```
./intel-vmd-user vmd-list
```

```
[root@localhost:~] cd opt/intel/bin
[root@localhost:/opt/intel/bin] ls
intel-vmd-user
[root@localhost:/opt/intel/bin] ./intel-vmd-user vmd-list
Returned 1 vmd-adapter(s)
VMD Controller:vmhba2
```

In order to find the "disk NUM" AND "VMD Adapter device" you can run the "nvme-list" command:

```
./intel-vmd-user nvme-list
```

```
[root@localhost:/opt/intel/bin] ./intel-vmd-user nvme-list
Returned 4 nvme-adapter(s)
NVMe Controller:vmhba2-0
NVMe Controller:vmhba2-1
NVMe Controller:vmhba2-2
NVMe Controller:vmhba2-3
```

The number after the "-" is the "disk NUM" or "target number" ('0' in first line of example). The name before the "-" (vmhba2 in above example) is the "<device>" that controls the LEDs.

Example to Set the LED State

```
./intel-vmd-user set-led <device> -d <disk NUM> -l <off | fault | identify | rebuild>
```

Example to set disk NUM 0 on VMD Adapter 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
```

In this example we will set LED status on disk NUM '1' on device vmhba2 to the LED state of 'identify'

```
./intel-vmd-user set-led vmhba2 -d 1 -l identify
[root@localhost:/opt/intel/bin] ./intel-vmd-user set-led vmhba2 -d 1 -l identify
Targeting Disk:1 with LED:identify
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
```

Command to send **rebuild** blink pattern to NVMe disk NUM 3 on device **vmhba2**:

```
./intel-vmd-user set-led vmhba2 -d 3 -l rebuild
```

Command to turn **off** blinking pattern to disk NUM 3 on device **vmhba2**:

```
./intel-vmd-user set-led vmhba2 -d 3 -l off
```

VMware VMD LED Framework Plug-in in ESXi Environment

The Intel VMD-enabled NVMe driver and Intel VMD-enabled LED Command line interface tool must first be installed on the system.

Install the VMware* ESXi* VMD LED Framework Plug-in according to installation steps above.

The following blinking patterns are supported with the Framework Plug-in:

locator
error
off

Use the following Syntax:

```
Esxcli storage core device set -d <scsidev> -l <blinking pattern>
```

Locator blink example:

```
# esxcli storage core device set -d  
t10.NVMe___INTEL_SSDPE2MD016T4_PHFT5462005Q1P6JGN__00000001 -l locator
```

Off Blink example:

```
# esxcli storage core device set -d  
t10.NVMe___INTEL_SSDPE2MD016T4_PHFT5462005Q1P6JGN__00000001 -l off
```

LED Management with the Framework Plug-in for VMD in VMware vSAN

VMware* ESXi* LED management Framework can be helpful to use in the VMware vSAN environment.

The following blinking patterns are supported:

Locator

Off

Pre-Condition:

The Intel VMD-enabled Driver, Intel VMD LED Command Line Tool, and VMware VMD LED Framework Plug-in are all installed on the system, and Intel VMD is enabled.

Procedure:

Ensure vSphere Disk Serviceability Plugins for test driver is installed.

- **Log in to VCenter Server**
- **Go to Disk Management in vSAN Cluster**

The screenshot displays the VMware vSphere Web Client interface for a vSAN cluster named 'vSanNeonCity'. The left-hand 'Navigator' pane shows the hierarchy: Datacenter > vSanNeonCity > Virtual SAN > Disk Management, with 'Disk Management' highlighted. The main content area is titled 'Disk Groups' and contains a table with the following data:

Disk Group	Disk in Use	State	Virtual SAN ...	Type	Fault Domain	Network Parti...	Disk Form
10.91.80.40	3 of 3	Connected	Healthy	All flash		Group 1	
Disk group (010000000043564654353139323030393134...	3	Mounted	Healthy	All flash		Group 1	3
10.91.80.43	3 of 3	Connected	Healthy	All flash		Group 1	
Disk group (010000000043564654353135363030583632...	3	Mounted	Healthy	All flash		Group 1	3
10.91.80.46	3 of 3	Connected	Healthy	All flash		Group 1	
Disk group (010000000043564654353139333030305734...	3	Mounted	Healthy	All flash		Group 1	3

Below the 'Disk Groups' table, there is a section for '10.91.80.40: Disks' with a sub-table:

Name	Drive Type	Disk Tier	Capacity	Virtual SAN Health Status	State
Local NVMe Disk (t10.NVMe____INTEL_SSDPEDMD40004_CVF...	Flash	Cache	372,61 GB	Healthy	Mounted
Local NVMe Disk (t10.NVMe____INTEL_SSDPE2K020T7_PHL...	Flash	Capacity	1,82 TB	Healthy	Mounted
Local NVMe Disk (t10.NVMe____INTEL_SSDPE2K020T7_PHL...	Flash	Capacity	1,82 TB	Healthy	Mounted

- Turn on LED of capacity drives in every disk group
 - o select disk group

Disk Group	Disks in Use	State	Virtual SAN ...	Type	Fault Domain	Network Parti...	Disk I
10.91.80.40	3 of 3	Connected	Healthy			Group 1	
Disk group (010000000043564654353139323030393134...	3	Mounted	Healthy	All flash			3
10.91.80.43	3 of 3	Connected	Healthy			Group 1	
Disk group (010000000043564654353135363030583632...	3	Mounted	Healthy	All flash			3
10.91.80.46	3 of 3	Connected	Healthy			Group 1	
Disk group (010000000043564654353139333030305734...	3	Mounted	Healthy	All flash			3

- o select drive

Disk group (010000000043564654353139323030393134303042474e2020494e54454c20): Disks

Name	Drive Type	Disk Tier	Capacity	Virtual SAN Health Status	State
Local NVMe Disk (t10.NVMe____INTEL_SSDPEDMD400G4_CVF...	Flash	Cache	372,61 GB	Healthy	Mounted
Local NVMe Disk (t10.NVMe____INTEL_SSDPE2KX020T7_PHL...	Flash	Capacity	1,82 TB	Healthy	Mounted
Local NVMe Disk (t10.NVMe____INTEL_SSDPE2KX020T7_PHL...	Flash	Capacity	1,82 TB	Healthy	Mounted

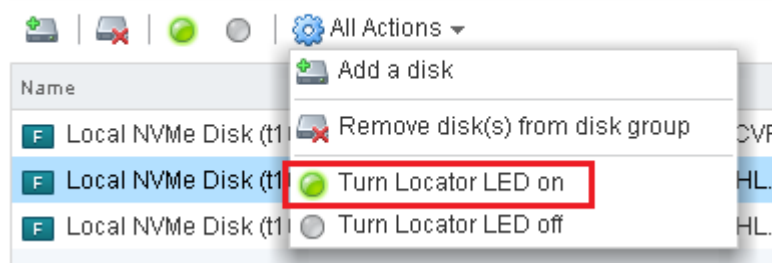
- o turn on locator (amber LED should start blinking)

Disk group (01000000004356465435313932):



- o or click All Actions -> Turn Locator LED on

Disk group (010000000043564654353139323030393134303042474e2020494e54454c20): Disks



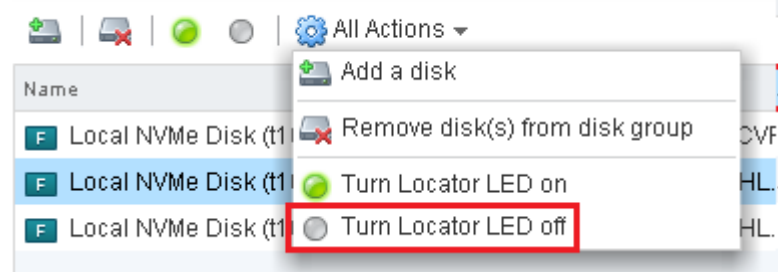
- Turn off LED of capacity drives in every disk group
 - o Select disk group
 - o Select drive
 - o Turn off locator (amber LED should be off)

Disk group (01000000004356465435313932)



- o Or click All Actions -> Turn Locator LED off

Disk group (010000000043564654353139323030393134303042474)



Contact Information

If assistance is needed with the installation, or if problems occur using the tool, issues may be filed through Intel IPS, or directly notify: jay.l.cassio@intel.com