Express Flash NVMe PCIe SSD Monitoring, Inventory and Configuring in Dell PowerEdge 13th Generation Servers

This Dell Technical white paper provides detailed information about Express Flash NVMe PCIe SSD device Monitoring and Inventory using various interfaces such as WS-Man, RACADM and GUI.

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A Dell Technical White Paper

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Executive Summary

This white paper provides information about monitoring, inventory and configuration, using iDRAC interfaces such as WS–Man, RACADM and the GUI. These devices include the Dell Express Flash NVMe PCIe SSD, backplane, extender, and drives.

1 Introduction

This Dell Technical white paper provides detailed information about the capabilities of integrated Dell Remote Access Controller (iDRAC8) for Monitoring , Inventory and Configuring Express Flash NVMe PCIe SSDs on 13th generation servers and later of Dell.

1.1 Existing Solution

The PowerEdge R920 server has sideband support for NVMe PCIe SSD Device discovery. But it does not support the advanced configuration options available in 13G systems.

1.2 Dell Express Flash NVMe PCIe SSD Inventory , Monitoring and Configuration

This Document describes the monitoring , inventory and configuration functionality of Express Flash NVMPCIe SSD s that is implemented in Dell 13th generation server platforms. This feature provides the users to Inventory and remotely monitor the health of PCIe SSD devices in the server.

The PCIe SSD subsystem consists of the Backplane, PCIe Extender card which is attached to the backplane of the system (while 13G Blades will use an extender card that does not physically connect to the backplane (M630 , M830)) and provides PCIe at the front of the connectivity for up to four or eight PCIe SSD (Only in R920 12G)devices chassis and the PCIe SSD devices.

The following are the list of features that are supported by WSMAN , RACADM and GUI as part Express Flash NVMe PCIe SSD in 13G.

- Inventory and Monitoring of Express Flash NVMe PCIe SSD
- Configuring PCIe SSD
    - Blink/UnBlink LED
    - Prepare to remove
    - Secure Erase

1.3 Prerequisites

Make sure that the following prerequisites are met :

- A software license for 13th generation Dell PowerEdge and later servers. For more information about managing licenses using iDRAC Web interface, click **Overview → Server → Licenses.** In the upper-right corner, click **Help** to view the *iDRAC Online Help*.
- All Dell Express Flash NVMe PCIe SSDs are NVMe 1.0c compliant and should have the latest Dell Firmware.
- 13G Platform must be fully enabled for Express Flash NVMe PCIe SSD support.
- iDRAC Service Module (iSM) should be installed in the Operating System for PrepareToRemove Operation.

- For more information about iSM, reference www.delltechcentercom/iDRAC (manuals)

2 PCIe SSD Inventory and Monitoring

Comprehensive view of PCIe SSD Subsystem will be provided by using WSMAN , RACADM and GUI interface layers . Complete monitoring and inventory is available only for the device which has sideband support. PCIeSubsystem consists of following objects.

- PCIe SSD BackPlane
- PCIe Extender card
- PCIe SSD Drive (Each PCIe SSD has its own independent controller)

Hardware Inventory:

- PCIe SSD Ext card.
- PCIe SSD Backplane
- PCIe SSDs 2.5" form factor
- PCIe SSD card form factor

Hardware Monitoring:

- PCIe SSDs 2.5" form factor
- PCIe SSD card form factor

The card form factor devices are PCIe SSDs connected directly to the PCIe slot. The card form factor does not support hot-plug, blink/unblink and prepare to remove operations.

Software Inventory:

- Firmware Version

2.1 PCIe SSD Extenders

2.1.1 Using WS–Man

To get the list of PCIe SSD Extenders , use the below WSMAN command .

winrm e http://schemas.dmtf.org/wbem/wscim/1/cim-schema/2/root/dcim/DCIM_PCIeSSDExtenderView -u:<UserName> -p:<Password> -r:https://<Ip-Address>/wsman -SkipCNcheck -SkipCAcheck -SkipRevocationCheck -encoding:utf-8 -a:basic

Example : Result after running the above command

DCIM_PCIeSSDExtenderView
DeviceDescription = PCIe Extender in PCIe Slot 3
FQDD = PCIeExtender.Slot.3
InstanceID = PCIeExtender.Slot.3
PrimaryStatus = 1
RollupStatus = 1

2.1.2 Using RACADM

To get the list of controllers and PCIe SSD Extenders, run the following command

/admin1-> racadm storage get controllers
RAID.Integrated.1-1
PCIeExtender.Slot.3

To get the properties of PCIe SSD Extender, use the following command format

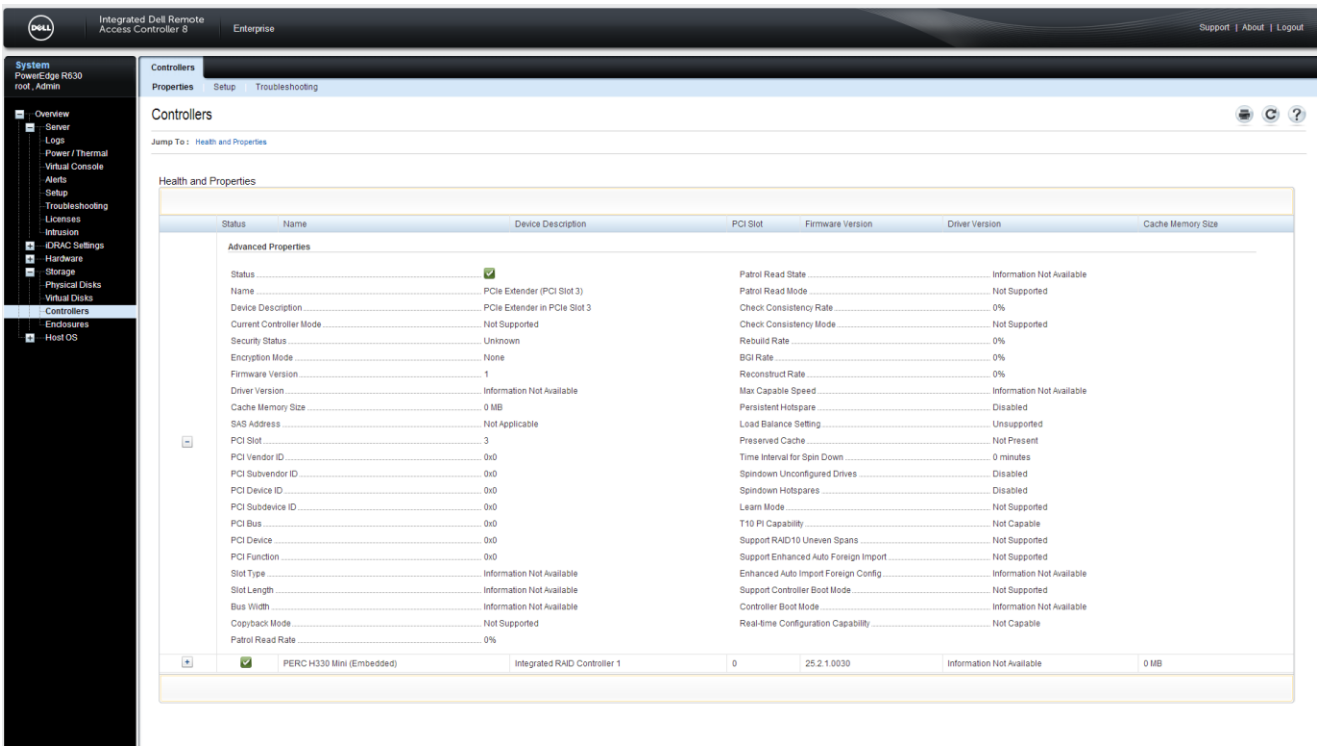
Syntax: racadm storage get controllers:<PcieSSD Extender FQDD>

Example:

/admin1-> racadm storage get controllers:PCIeExtender.Slot.3
PCIeExtender.Slot.3
RollupStatus = Ok
DeviceDescription = PCIe Extender in PCIe Slot 3
Status = Ok
Name = PCIeExtender 3 (PCI Slot 3)

2.1.3 Using GUI

To get the list of Controllers and PCIe SSD Extenders , use the below navigation.



2.2 PCIe SSD Enclosure

2.2.1 Using WS–Man

To get the list of Enclosure , Use the below WSMAN command.

winrm e http://schemas.dmtf.org/wbem/wscim/1/cim-schema/2/root/dcim/DCIM_PCIeSSDBackPlaneView -u:<Username> -p:< Password> -r:https://<IP-Address>/wsman -SkipCNcheck -SkipCAcheck -SkipRevocationCheck -encoding:utf-8 -a:basic

Example : Result after running the above command

DCIM_PCIeSSDBackPlaneView
DeviceDescription = Enclosure.Internal.0-1:PCIeExtender.Slot.3
FQDD = Enclosure.Internal.0-1:PCIeExtender.Slot.3
FirmwareVersion= 0.80
InstanceID = Enclosure.Internal.0-1:PCIeExtender.Slot.3
MediaType = 0
ProductName = PCIe Backplane
RollupStatus = 1

SlotCount = 4

2.2.2 Using RACADM

To get the list of enclosures, run the following command
/admin1-> racadm storage get enclosures
Enclosure.Internal.0-1:RAID.Integrated.1-1
Enclosure.Internal.0-1:PCIeExtender.Slot.3

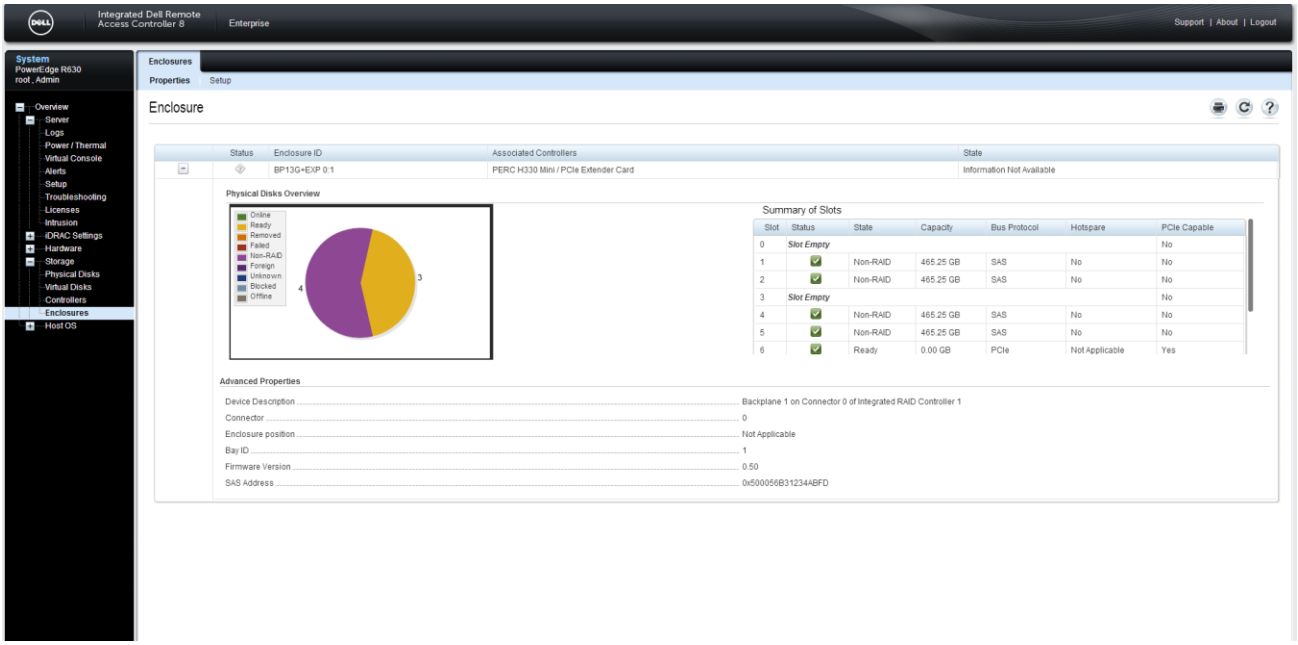
To get the properties of PCIe SSD Enclosure, use the following command format

syntax: racadm storage get enclosures:<PcieSSD Enclosure FQDD>

Example:
/admin1-> racadm storage get enclosures:Enclosure.Internal.0-1:PCIeExtender.Slot.3
Enclosure.Internal.0-1:PCIeExtender.Slot.3
RollupStatus = Ok
DeviceDescription = Enclosure.Internal.0-1:PCIeExtender.Slot.3
Name = PCIe SSD BP 1
SlotCount = 4
FirmwareVersion = 0.80

2.2.3 Using GUI

To get the list of enclosures in GUI , use the below navigation



2.3 PCIe SSD Physical Disks

2.3.1 Using WS–Man

To get the list ofExpress Flash NVMe devices, use the below WSMAN command.

winrm e http://schemas.dmtf.org/wbem/wscim/1/cim-schema/2/DCIM_PCIeSSDView?__cimnamespace=root/dcim -u: <UserName> -p:<Password> -r:https://<Ip Address>/wsman -encoding:utf-8 -a:basic -SkipCNcheck -SkipCAcheck

Example : Result after running the above command.

DCIM_PCIeSSDView
BusProtocol = 7
DeviceDescription = PCIe Solid-State Drive in Slot 6 in Bay 1
DeviceProtocol = NVMe 1.0
DriveFormFactor = 2
FQDD = Disk.Bay.6:Enclosure.Internal.0-1:PCIeExtender.Slot.3
FailurePredicted = NO
InstanceID = Disk.Bay.6:Enclosure.Internal.0-1:PCIeExtender.Slot.3
Manufacturer = SAMSUNG
MaxCapableSpeed = 8 GT/s
MediaType = 1

Model = Dell Express Flash NVMe 800GB
NegotiatedSpeed = 8 GT/s
PCIeCapableLinkWidth = x4
PCIeNegotiatedLinkWidth = x4
PrimaryStatus = 1
ProductID = a820
RemainingRatedWriteEndurance = 100
Revision = IPM0ED35
SerialNumber = S1J1NYAD90018
SizeInBytes = 0
State = 1

2.3.2 Using RACADM

To get the list of physical disks and Express Flash NVMe PCIe SSD devices, run the following command

/admin1-> racadm storage get pdisks
Disk.Bay.0:Enclosure.Internal.0-1:RAID.Integrated.1-1
Disk.Bay.1:Enclosure.Internal.0-1:RAID.Integrated.1-1
Disk.Bay.2:Enclosure.Internal.0-1:RAID.Integrated.1-1
Disk.Bay.3:Enclosure.Internal.0-1:RAID.Integrated.1-1
Disk.Bay.4:Enclosure.Internal.0-1:RAID.Integrated.1-1
Disk.Bay.5:Enclosure.Internal.0-1:RAID.Integrated.1-1
Disk.Bay.8:Enclosure.Internal.0-1:PCIeExtender.Slot.3
Disk.Bay.6:Enclosure.Internal.0-1:PCIeExtender.Slot.3
Disk.Bay.7:Enclosure.Internal.0-1:PCIeExtender.Slot.3
Disk.Bay.9:Enclosure.Internal.0-1:PCIeExtender.Slot.3

To get the properties of Express Flash NVMe PCIe SSD devices, use the following command format

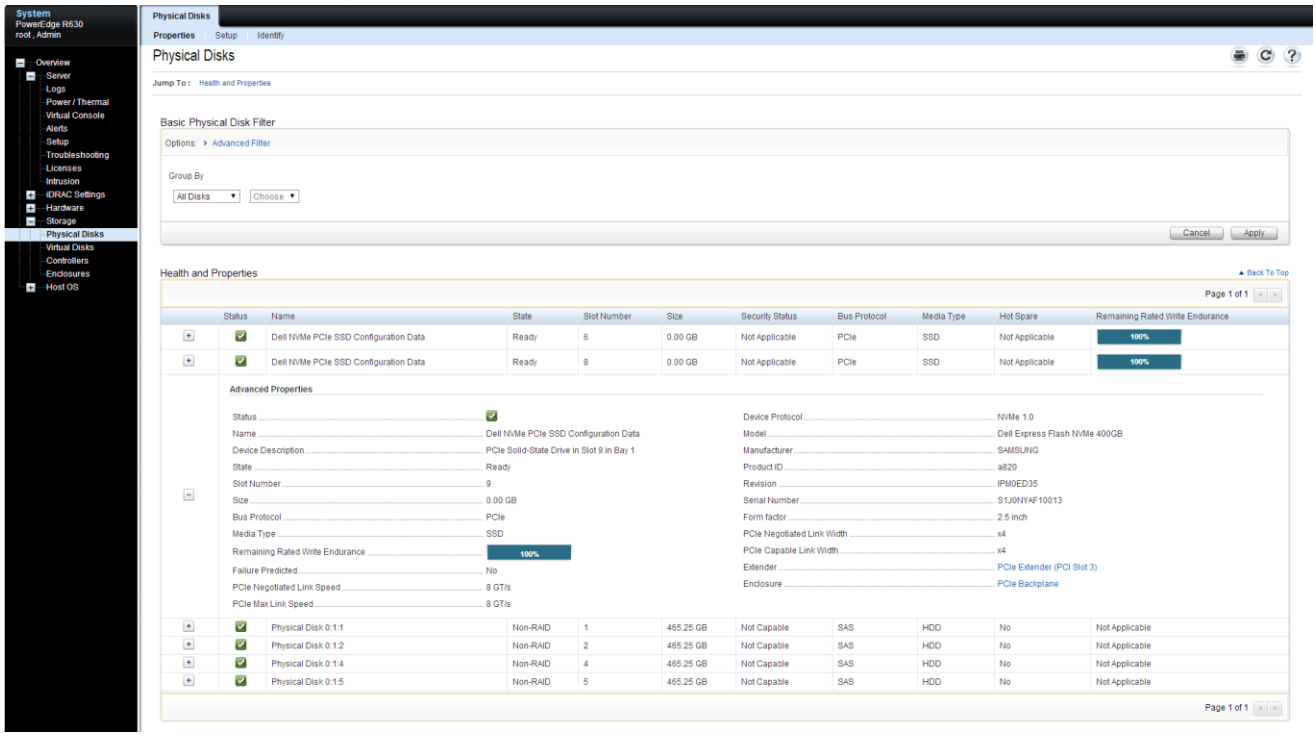
syntax: racadm storage get pdisks:<PcieSSD FQDD>

Example:
/admin1-> racadm storage get pdisks:Disk.Bay.8:Enclosure.Internal.0-1:PCIeExtender.Slot.3
Disk.Bay.8:Enclosure.Internal.0-1:PCIeExtender.Slot.3
Status = Ok
DeviceDescription = PCIe Solid-State Drive in Slot 8 in Bay 1
Name = Physical Device 8
State = Ready
Size = 745.21 GB

BusProtocol = PCIe
MediaType = SSD
Model = Dell Express Flash NVMe 800GB
ProductId = a820
SerialNumber = S1J1NYAD90019
DeviceProtocol = NVMe1.0
Manufacturer = SAMSUNG
PCIeNegotiatedLinkWidth = x4
PCIeCapableLinkWidth = x4
MaxCapableSpeed = 8 GT/s
NegotiatedSpeed = 8 GT/s
FormFactor = 2.5 Inch
Revision = IPM0ED35SAM SAMSUNG MZWEI800HAGM 000D3
RemainingRatedWriteEndurance = 100 %
FailurePredicted = NO

2.3.3 Using GUI

To get the list of physical disks and Express Flash NVMe PCIe SSD devices , use the below navigation



3 PCIe SSD Configuration

Configuration support for Express Flash NVMe PCIe SSD devices Storage Subsystem is introduced in 13Th Generation release onwards. In this case , the configurations do not require a reboot . Configurations can still be done through staged (Scheduled and it requires reboot to see the effect) based on the request from the interface layer.

During a job creation , If a new optional parameter (apply now with out reboot – RealTime , apply now with reboot – Staged) is specified from the interface layer , based on the new parameter , operations (Real or Staged) would be performed.

In order to apply the pending values , one has to create a job which can be real time or staged as mentioned earlier.

If Real time only operation is pending, no staged only operations allowed, but operations that could be done either ways (staged or real time) will be allowed to be set, but done via real time .

If Staged only operation is pending, no real time only operations allowed, but operations that could be done either ways(staged or real time) will be allowed , but done via staged .

3.1 Blink/UnBlink for PCIe SSD

This Blink operation blinks one of the LED in the disk and is performed to locate a disk with in a system. Unblink operation unblinks the LED in the disk. This operation is real time and do not require a job to create. It is an immediate operation.

3.1.1 Using WS–Man

In order to blink the PCIe SSD , use the following WSMAN command.

winrm i BlinkTarget
cimv2/root/dcim/DCIM_RAIDService?SystemCreationClassName=DCIM_ComputerSystem+CreationClassName=DCIM_RAIDService+SystemName=DCIM:ComputerSystem+Name=DCIM:RAIDService -u:<UserName> -p:<Password> -r:https://< IP-Adress>/wsman -SkipCNcheck -SkipCAcheck -encoding:utf-8 -a:basic @{Target=< FQDD of the PCIeSSD>}

Example : After running the above command , output looks like below upon successful .

BlinkTarget_OUTPUT
RebootRequired = NO
ReturnValue = 0

In order to unblink the PCIe SSD , use the following WSMAN command.

winrm i UnBlinkTarget
cimv2/root/dcim/DCIM_RAIDService?SystemCreationClassName=DCIM_ComputerSystem+CreationClass
Name=DCIM_RAIDService+SystemName=DCIM:ComputerSystem+Name=DCIM:RAIDService -
u:<UserName> -p:<Password> -r:https://< IP-Adress>/wsman -SkipCNcheck -SkipCAcheck -
encoding:utf-8 -a:basic @{Target=< FQDD of the PCIeSSD>}

Example : After running the above command , output looks like below upon successful .

UnBlinkTarget_OUTPUT
RebootRequired = NO

ReturnValue = 0

3.1.2 Using RACADM

In order to blink the PCIe SSD, use the below command format

syntax: racadm storage blink:<PCIeSSD FQDD>

Example:

/admin1-> racadm storage blink:Disk.Bay.8:Enclosure.Internal.0-1:PCIeExtender.Slot.3

STOR095 : Storage operation is successfully completed.

In order to unblink the PCIe SSD, use the below command format

syntax: racadm storage unblink:<PCIeSSD FQDD>

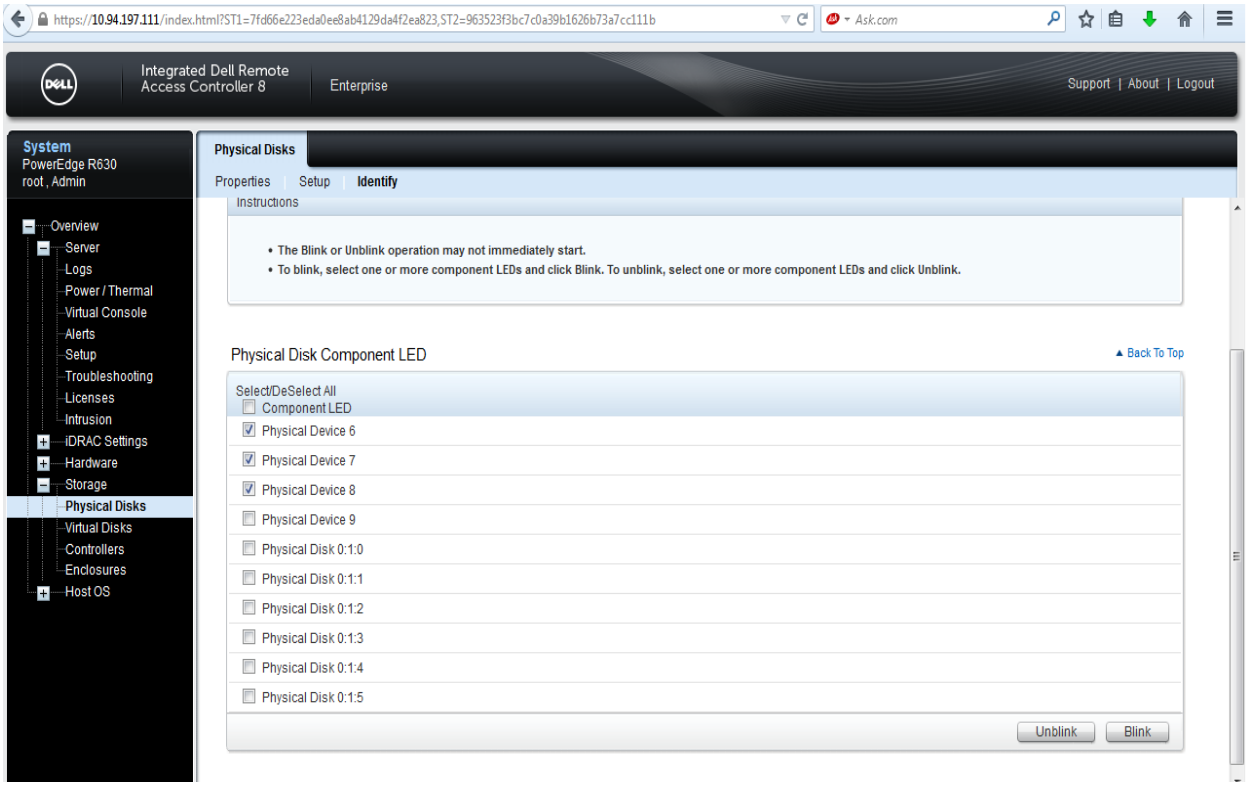
Example:

/admin1-> racadm storage unblink:Disk.Bay.8:Enclosure.Internal.0-1:PCIeExtender.Slot.3

STOR095 : Storage operation is successfully completed

3.1.3 Using GUI

In order to blink/unblink the PCIe SSD , use the below navigation



3.2 Prepare to Remove for PCIe SSD

The Prepare to Remove operation shall be used to safely remove a PCIe SSD drive from the system. This operation stops any background activity and any ongoing I/O activity so that device can be removed safely.

After the drive is removed, it can be replaced by either another PCIe SSD drive or SAS/SATA drive.

This operation causes the status LEDs on the device to blink. The drive can be safely removed from the system under the following conditions after the Prepare to Remove operation:

- The PCIe SSD is blinking the safe to remove LED pattern.
- The PCIe SSD is no longer accessible by the system.

This feature is supported only at run-time. Since there is no support through sideband for this operation currently, the ISM infrastructure will be used for this operation.

NOTE: The Supporting Operating system should have NVMe driver loaded for this operation.

NOTE: If linux fails to boot and prompts for the root password, see below:

A stale volume mount point is still present after a device removal or cryptographic erase. Perform the following steps to recover from this situation:

1. Enter the root password to enter maintenance mode.
2. Remount the root filesystem as read-write using the following command:
    - mount -orw,remount/

Or

Manually edit /etc/fstab to remove the non-existent device entry.

3.2.1 Using WS–Man

To prepare the Express Flash NVMe PCIe SSD devices for removal, use the below WSMAN command

winrm i PrepareToRemove cimv2/root/dcim/DCIM_RAIDService?SystemCreationClassName=DCIM_ComputerSystem+CreationClassName=DCIM_RAIDService+SystemName=DCIM:ComputerSystem+Name=DCIM:RAIDService -u:<UserName> -p:<Password> -r:https://< IP-Adress>/wsman -SkipCNcheck -SkipCAcheck -encoding:utf-8 -a:basic @{Target=< FQDD of the PCIeSSD>}

Job is Created by using DCIM_RAIDService .CreateTargetedConfigJob() method to apply the pending values . To create a RealTime job which does not require reboot use the below WSMAN command.

winrm i CreateTargetedConfigJob http://schemas.dell.com/wbem/wscim/1/cim-schema/2/root/dcim/DCIM_RAIDService?__cimnamespace=root/dcim+SystemCreationClassName=DCIM_ComputerSystem+SystemName=DCIM:ComputerSystem+CreationClassName=DCIM_RAIDService+Name=DCIM:RAIDService -u:<UserName> -p:<Password> -r:https://<ip-address>/wsman -SkipCNcheck -SkipCAcheck -encoding:utf-8 -a:basic @{Target="<PCIeSSD Drive FQDD>";ScheduledStartTime="TIME_NOW";RealTime="1"}

Check the status of the job and wait until Job completes.

Example : After running the PrepareToRemove command , output looks like below upon successful .

SecureErase_OUTPUT
RebootRequired = NO
ReturnValue = 0

3.2.2 Using RACADM

To prepare the Express Flash NVMe PCIe SSD devicefor removal, use the below command format

syntax: racadm storage preparetoremove:<PCIeSSD FQDD>

Example:

/admin->racadm storage preparetoremove: Disk.Bay.8:Enclosure.Internal.0-1:PCIeExtender.Slot.3

STOR089 : Successfully accepted the storage configuration operation.
To apply the configuration operation, create a configuration job with --realtime option.
To create the required commit jobs, run the jobqueue command.
For more information about the jobqueue command, enter the RACADM command "racadm help jobqueue"

/admin->racadm jobqueue create Disk.Bay.8:Enclosure.Internal.0-1:PCIeExtender.Slot.3 --realtime

RAC1024 : Successfully scheduled a job
Verify the job status using "racadm jobqueue view –i JID_xxxxx" command.
Commit JID = JID_996741411337

/admin->racadm jobqueue view -i JID_996741411337

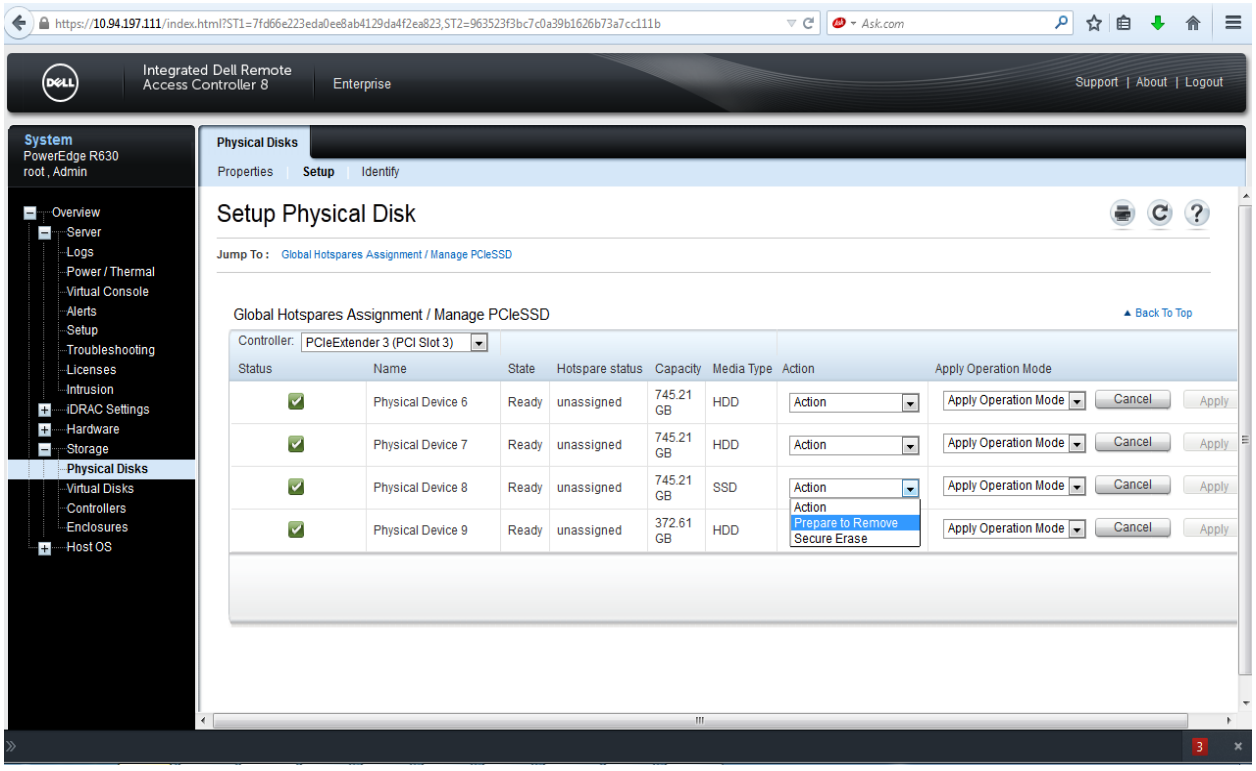
----------JOB----------

[Job ID = JID_996741411337]
Job Name=Configure: Disk.Bay.8:Enclosure.Internal.0-1:PCIeExtender.Slot.3
Status= New
Start Time=[Now]

Expiration Time=[Not Applicable]
Message=[JCP000: New]
Percent Complete=[0]

3.2.3 Using GUI

To prepare the Express Flash NVMe PCIe SSD devicefor removal in GUI ,



3.3 Secure erase for PCIe SSD

Secure erase is instant cryptographic erase of data on PCIe SSD devices and all the data on the PCIe SSD device will be permanently lost.During Secure Erase, the device is not accessible.

While trying from WSMAN , RACADM and GUI interfaces , User should have iDRAC Server control privilege to perform this operation.There is no sideband support for this operation currently.Hence this operation is supported only in staged mode and not run-time.

The device will not execute the command immediately. A host reboot is required for the command to take effect.

3.3.1 Using WS–Man

To Perform the Secure Erase operation on PCIe SSD drive, use the below command.

winrm i SecureErase cimv2/root/dcim/DCIM_RAIDService?SystemCreationClassName=DCIM_ComputerSystem+CreationClassName=DCIM_RAIDService+SystemName=DCIM:ComputerSystem+Name=DCIM:RAIDService -u:<UserName> -p:<Password> -r:https://< IP-Adress>/wsman -SkipCNcheck -SkipCAcheck -encoding:utf-8 -a:basic @{Target=< FQDD of the PCIeSSD DRIVE>}

Example : After running the SecureErase command , output looks like below upon successful .

SecureErase_OUTPUT
RebootRequired = YES
ReturnValue = 0

Job is Created by using DCIM_RAIDService .CreateTargetedConfigJob( ) method to apply the pending values . It supports only staged job. In order to create Staged job , Use the below WSMAN command.

winrm i CreateTargetedConfigJob http://schemas.dell.com/wbem/wscim/1/cim-schema/2/root/dcim/DCIM_RAIDService?__cimnamespace=root/dcim+SystemCreationClassName=DCIM_ComputerSystem+SystemName=DCIM:ComputerSystem+CreationClassName=DCIM_RAIDService+Name=DCIM:RAIDService -u:<UserName> -p:<Password> -r:https://<IP address>/wsman -SkipCNcheck -SkipCAcheck -encoding:utf-8 -a:basic @{Target=" FQDD of the PCIeSSD DRIVE ";RebootJobType="1";ScheduledStartTime="TIME_NOW"}

3.3.2 Using RACADM

To peform a secure erase on PCIe SSD drive, use the below command format

syntax: racadm storage secureerase:<PCIeSSD FQDD DRIVE>

Example:

/admin->racadm storage secureerase: Disk.Bay.8:Enclosure.Internal.0-1:PCIeExtender.Slot.3
RAC1040 : Successfully accepted the storage configuration operation.

To apply the configuration operation, create a configuration job, and then restart the host.
To create the required commit and reboot jobs, run the jobqueue command.
For more information about the jobqueue command, enter the RACADM command "racadm help jobqueue"

/admin->racadm jobqueue create Disk.Bay.8:Enclosure.Internal.0-1:PCIeExtender.Slot.3

RAC1024 : Successfully scheduled a job
Verify the job status using "racadm jobqueue view –i JID_xxxxx" command.
Commit JID = JID_996741414444

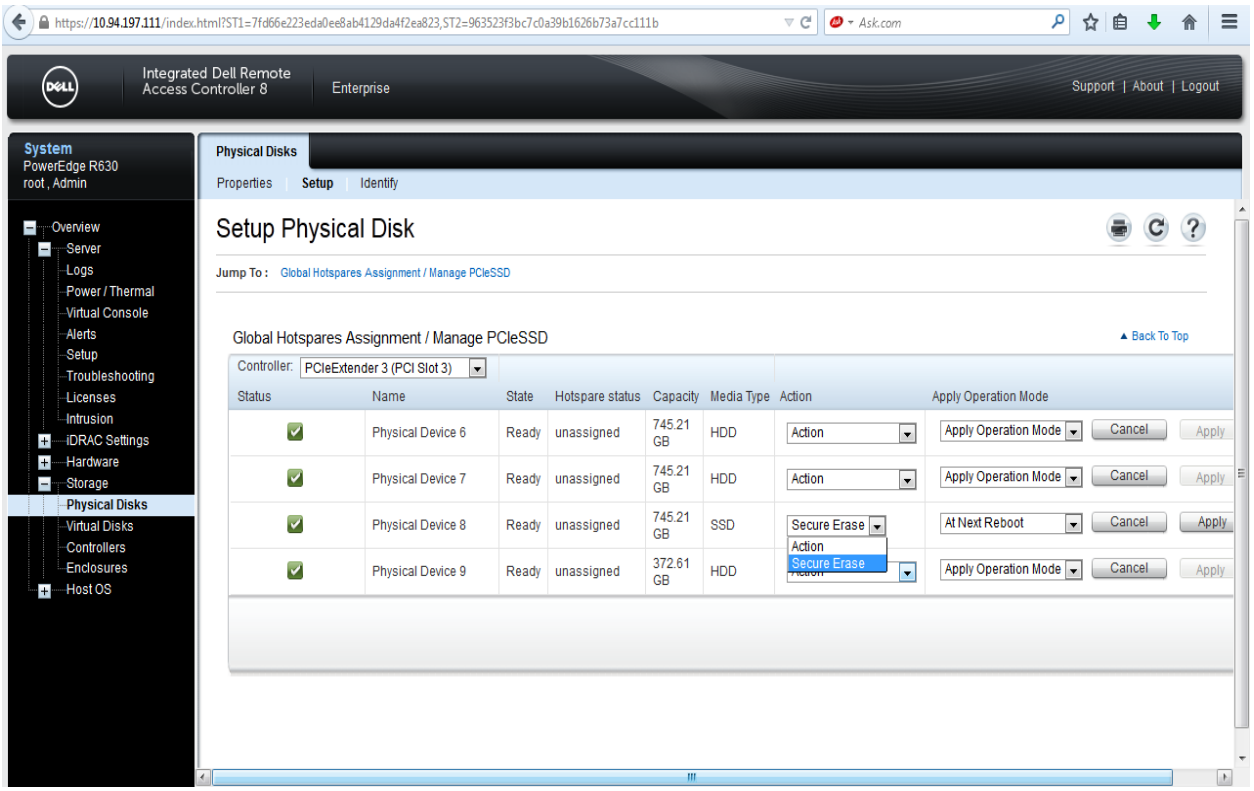
/admin->racadm jobqueue view -i JID_996741414444

----------JOB----------

[Job ID = JID_996741414444]
Job Name=Configure: Disk.Bay.8:Enclosure.Internal.0-1:PCIeExtender.Slot.3
Status= Scheduled
Start Time=[Now]
Expiration Time=[Not Applicable]
Message=[JCP000: Task successfully scheduled.]
Percent Complete=[0]

3.3.3 Using iDRAC GUI

To peform a secure erase on PCIe SSD drive(s) in GUI ,


https://10.94.197.111/index.html?ST1=7fd66e223eda0ee8ab4129da4f2ea823,ST2=963523f3bc7c0a39b1626b73a7cc111b
Integrated Dell Remote Access Controller 8
Enterprise
Support | About | Logout
System
PowerEdge R630
root , Admin
Overview
Server
Logs
Power / Thermal
Virtual Console
Alerts
Setup
Troubleshooting
Licenses
Intrusion
iDRAC Settings
Hardware
Storage
Physical Disks
Virtual Disks
Controllers
Enclosures
Host OS
Physical Disks
Properties
Setup
Identify
Setup Physical Disk
Jump To : Global Hotspares Assignment / Manage PCIeSSD
Global Hotspares Assignment / Manage PCIeSSD
Back To Top
Controller: PCIeExtender 3 (PCI Slot 3)
Status
Name
State
Hotspare status
Capacity
Media Type
Action
Apply Operation Mode
Physical Device 6
Ready
unassigned
745.21 GB
HDD
Action
Apply Operation Mode
Cancel
Apply
Physical Device 7
Ready
unassigned
745.21 GB
HDD
Action
Apply Operation Mode
Cancel
Apply
Physical Device 8
Ready
unassigned
745.21 GB
SSD
Secure Erase
Action
Secure Erase
At Next Reboot
Cancel
Apply
Physical Device 9
Ready
unassigned
372.61 GB
HDD
Apply Operation Mode
Cancel
Apply

4 Error Codes

STOR029: Physical disk not found

STOR072: iDRAC Service Module (ISM) is either not present or not running on the server OS.

STOR073: The iDRAC Service Module version present on the server OS does not support the requested PCIe SSD (NVMe) device operation.

STOR078: The requested operation requires a reboot type that does not match the reboot type required for pending operations

STOR079: The controller does not support this operation or is in a state that does not allow this operation

STOR0103 : No physical disks are displayed. Check if the server has power, physical disks are available, and physical disks are connected to the enclosure or backplane.

5

5 TroubleShooting

Some common problems and possible solutions are mentioned below.

- If Configuration is not successful .
  - Check if LC is disabled .
  - ISM is not installed or Host OS is not up.

- what log files can be helpful for troubleshooting
  - LCLog will have the log details – RAC500 & RAC690

- How to identify a failed component or configuration
  - Check the job queue for Job status.
  - Timeout of a command and error will be logged in LC Log.