Dell Boot Optimized Storage Solution-N1

User's Guide

D∕ELL Technologies

Notes, cautions, and warnings

ⓘ **NOTE:** A NOTE indicates important information that helps you make better use of your product.

⚠ **CAUTION: A CAUTION indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.**

⚠ **WARNING: A WARNING indicates a potential for property damage, personal injury, or death.**

Contents

Dell Boot Optimized Storage Solution-N1

Dell Boot Optimized Storage Solution-N1 (BOSS-N1) is a RAID solution that is designed for booting a server's operating system that supports:

- 80 mm NVMe M.2 Solid-State Drives (SSDs)
- PCIe card with PCIe Gen3 x4 host interface
- Dual NVMe Gen3 x2 device interfaces

(i) **NOTE:** For the safety, regulatory, and ergonomic information associated with these devices, and for more information about the Integrated Dell Remote Access Controller (iDRAC) or Lifecycle Controller (LC) remote management, see your platform documentation.

Topics:

- Hardware components of BOSS-N1 Monolithic controller
- Hardware components of BOSS-N1 Modular Extreme Temperature (ET) controller
- Hardware components of BOSS-N1 Modular controller
- Technical specifications of BOSS-N1 Monolithic, BOSS-N1 Modular ET, and BOSS-N1 Modular controllers
- Supported M.2 drives of BOSS-N1 Monolithic, BOSS-N1 Modular ET, and BOSS-N1 Modular controllers
- Operating systems supported by BOSS-N1 controllers

Hardware components of BOSS-N1 Monolithic controller
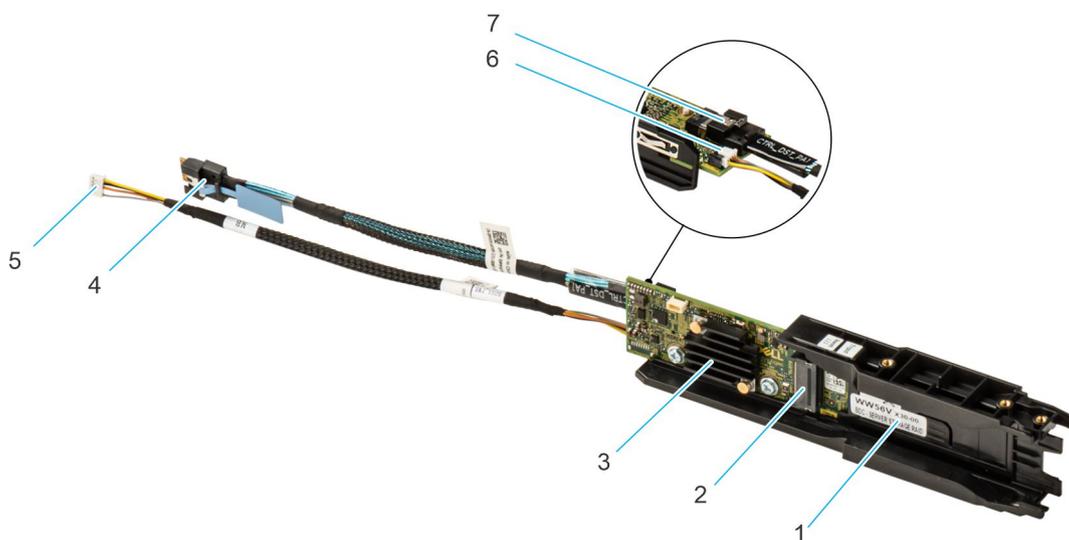
Figure 1. Hardware components of BOSS-N1 Monolithic controller

1. M.2 carrier slot
2. M.2 carrier connector
3. BOSS-N1 controller
4. Signal cable
5. Power cable
6. Power cable connector
7. Signal cable connector

Hardware components of BOSS-N1 Modular Extreme Temperature (ET) controller
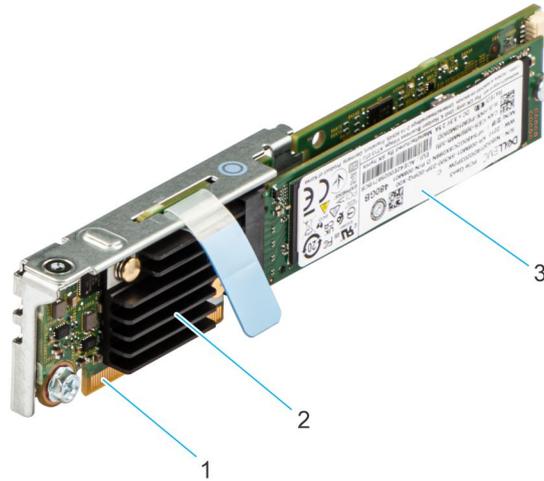
Figure 2. Hardware components of BOSS-N1 Modular Extreme Temperature (ET) controller

1. PCIe connector
2. BOSS-N1 controller
3. M.2 drive

Hardware components of BOSS-N1 Modular controller
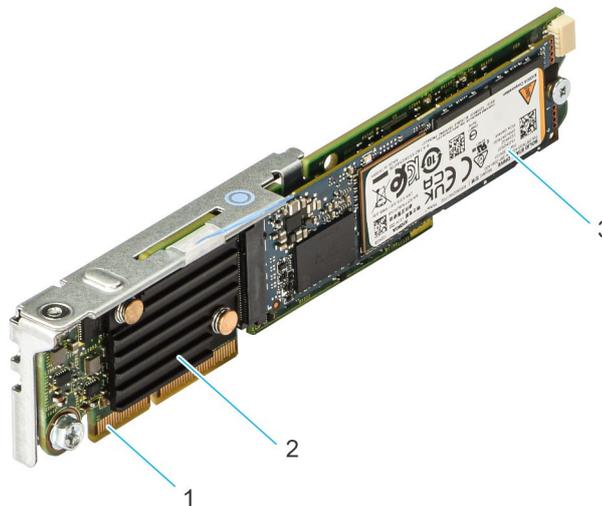
Figure 3. Hardware components of BOSS-N1 Modular controller

1. PCIe connector
2. BOSS-N1 Modular controller
3. M.2 drive

Technical specifications of BOSS-N1 Monolithic, BOSS-N1 Modular ET, and BOSS-N1 Modular controllers

The following table lists the technical specifications of BOSS-N1 Monolithic, BOSS-N1 Modular, and BOSS-N1 Modular ET controllers :

Table 1. Technical specifications of BOSS-N1 Monolithic and BOSS-N1 Modular ET

Function or feature	BOSS-N1 Monolithic	BOSS-N1 Modular ET	BOSS-N1 Modular
Hot−plug of NVMe M.2 drives	Yes	No	No
LED activity of M.2 drives	Yes	No	No
Secure firmware update	Yes	Yes	Yes
RAID levels	Single drive RAID 0 and dual drive RAID 1	Single drive RAID 0 and dual drive RAID 1	Single drive RAID 0 and dual drive RAID 1
Stripe size	Supports default 128 K stripe size only	Supports default 128 K stripe size only	Supports default 128 K stripe size only
Battery backup unit	No	No	No
Non−volatile cache	No	No	No
Virtual disk cache function	Write-through	Write-through	Write-through
Maximum number of virtual disks	1	1	1
Maximum number of drives supported	2	2	2
Support for non−RAID disks	No	No	No
Drive types	M.2 NVMe	M.2 NVMe	M.2 NVMe
PCIe support	Gen 3	Gen 3	Gen 3
Disk cache policy	Drive default	Drive default	Drive default
Configuration (HII)	Yes	Yes	Yes
Full initialization	No	No	No
Fast initialization	Yes ⓘ **NOTE:** By default, fast initialization is performed when you create a virtual disk.	Yes ⓘ **NOTE:** By default, fast initialization is performed when you create a virtual disk.	Yes ⓘ **NOTE:** By default, fast initialization is performed when you create a virtual disk.
Background initialization	No	No	No
RAID 0	Yes (single drive RAID 0)	Yes (single drive RAID 0)	Yes (single drive RAID 0)
RAID 1	Yes	Yes	Yes
Single non−RAID	No	No	No
Dual non−RAID	No	No	No
Foreign import	Yes	Yes	Yes

Table 1. Technical specifications of BOSS-N1 Monolithic and BOSS-N1 Modular ET (continued)

Function or feature	BOSS-N1 Monolithic	BOSS-N1 Modular ET	BOSS-N1 Modular
	ⓘ **NOTE:** iDRAC user interface does not support importing a foreign VD. Use HII or delete the VD.	ⓘ **NOTE:** iDRAC user interface does not support importing a foreign VD. Use HII or delete the VD.	ⓘ **NOTE:** iDRAC user interface does not support importing a foreign VD. Use HII or delete the VD.
Consistency check	No	No	No
Patrol-read	No	No	No
Load balance	N/A	N/A	N/A
Rebuild	Yes	Yes	Yes
Hot-spare	No	No	No
Change rebuild priority/ rate	No	No	No
Virtual disk write-back/ read-ahead cache	No ⓘ **NOTE:** BOSS-N1 does not support controller cache.	No ⓘ **NOTE:** BOSS-N1 does not support controller cache.	No ⓘ **NOTE:** BOSS-N1 does not support controller cache.
Battery support	N/A ⓘ **NOTE:** BOSS-N1 does not support a battery.	N/A ⓘ **NOTE:** BOSS-N1 does not support a battery.	N/A ⓘ **NOTE:** BOSS-N1 does not support a battery.
Non–RAID disk cache policy	Yes ⓘ **NOTE:** Operating system controlled or device defaults.	Yes ⓘ **NOTE:** Operating system controlled or device defaults.	Yes ⓘ **NOTE:** Operating system controlled or device defaults.
SMART Info	Yes ⓘ **NOTE:** Use the BOSS-N1 CLI to retrieve the SMART information from the drives.	Yes ⓘ **NOTE:** Use the BOSS-N1 CLI to retrieve the SMART information from the drives.	Yes ⓘ **NOTE:** Use the BOSS-N1 CLI to retrieve the SMART information from the drives.
Physical disk hot–plug	Yes	No	No
Virtual disk expansion	No	No	No
Virtual disk slicing	No	No	No
Virtual disk migration	Yes ⓘ **NOTE:** On a new controller, virtual disks must be imported from HII before presented to operating system.	Yes ⓘ **NOTE:** On a new controller, virtual disks must be imported from HII before presented to operating system.	Yes ⓘ **NOTE:** On a new controller, virtual disks must be imported from HII before presented to operating system.
Split mirror	No ⓘ **NOTE:** Power off the system and migrate one physical disk to another system and continue rebuild.	No ⓘ **NOTE:** Power off the system and migrate one physical disk to another system and continue rebuild.	No ⓘ **NOTE:** Power off the system and migrate one physical disk to another system and continue rebuild.

Table 1. Technical specifications of BOSS-N1 Monolithic and BOSS-N1 Modular ET (continued)

Function or feature	BOSS-N1 Monolithic	BOSS-N1 Modular ET	BOSS-N1 Modular
Non–RAID migration	Not applicable	Not applicable	Not applicable
Legacy BIOS mode	No	No	No
Add on driver for data path (operating system device driver)	No	No	No
4 K native drive support	No	No	No
TRIM and UNMAP virtual disk	No	No	No
TRIM and UNMAP non–RAID physical disk	No	No	No
Self-Encrypting Drives (SEDs) support	Yes	Yes	Yes
Cryptographic erase (sanitize)	Yes ⓘ **NOTE:** If drive supports Sanitize Crypto Erase. No other encryption support from controller or drive.	Yes ⓘ **NOTE:** If drive supports Sanitize Crypto Erase. No other encryption support from controller or drive.	Yes ⓘ **NOTE:** If drive supports Sanitize Crypto Erase. No other encryption support from controller or drive.

Supported M.2 drives of BOSS-N1 Monolithic, BOSS-N1 Modular ET, and BOSS-N1 Modular controllers

The BOSS-N1 Monolithic and BOSS-N1 Modular ET controllers support M.2 drives.

⚠ **CAUTION: The BOSS-N1 Monolithic, BOSS-N1 Modular ET, and BOSS-N1 Modular controllers are tested and supported only with the M.2 drives that are shipped with the controller.**

Table 2. Supported M.2 drives of BOSS-N1 Monolithic, BOSS-N1 Modular ET, and BOSS-N1 Modular controllers

Drive Model	Capacity
SK Hynix PE8010	480 GB, 960 GB
Micron 7400	480 GB, 960 GB
Micron 7450	480 GB, 960 GB

ⓘ **NOTE:** Dell Technologies recommends that you use the BOSS-N1 Monolithic, BOSS-N1 Modular ET, and BOSS-N1 Modular controllers only as an operating system boot device.

ⓘ **NOTE:** Ensure that M.2 drives have the latest firmware. You can download the latest firmware from the Support site.

Operating systems supported by BOSS-N1 controllers

See Dell Technologies Enterprise operating systems support for a list of supported operating systems by a specific server for the BOSS-N1 controllers.

ⓘ **NOTE:** For the latest list of supported operating systems and driver installation instructions, see the operating system documentation at Operating Systems Manuals. For specific operating system service pack requirements, see the Drivers and Downloads section.

Applications supported by BOSS-N1

BOSS-N1 controller management applications include the UEFI RAID Configuration Utility, Dell OpenManage Storage Management, Command Line Interface (CLI) Utility, Integrated Dell Remote Access Controller (iDRAC), and Lifecycle Controller (LC). They enable you to manage and configure the RAID system, create and manage a disk group, and provide online maintenance.

ⓘ **NOTE:** The Security Key Management on BOSS-N1 controller feature is not supported on the OpenManage Storage Management application.

Topics:

- Unified Extensible Firmware Interface Configuration Utility
- Dell OpenManage Storage Management
- BOSS-N1 Command Line Interface Utility
- Integrated Dell Remote Access Controller and Lifecycle Controller

Unified Extensible Firmware Interface Configuration Utility

UEFI Configuration Utility (HII) is integrated into the system BIOS (F2).

Dell OpenManage Storage Management

Dell OpenManage Storage Management enables you to perform controller and enclosure functions for all supported RAID controllers and enclosures from a single graphical or command line interface. For more information, see the Dell OpenManage Storage Management User's Guide at OpenManage Manuals.

BOSS-N1 Command Line Interface Utility

The BOSS-N1 Command Line Interface (CLI) Utility enables you to check the status of controller, physical disks, and virtual disks while booted to an operating system. The application is also used to check M.2 NVMe SSDs and display controller SMART information. For more information about CLI commands, see Manage BOSS-N1 using CLI commands.

Table 3. BOSS-N1 CLI utility for supported operating systems

Operating system	Utility name
Windows	mnvcli
Linux	mnvcli
ESXi	mnvcli

ⓘ **NOTE:** Administrator privileges on Windows and root user privileges on Linux are required to use the CLI.

Table 4. Instructions to remove mnvcli from the operating systems

Operating system	Instructions to remove mnvcli from the operating systems
Windows	Locate and remove the executable file.
Linux	Locate and remove the executable file.

Operating system	Instructions to remove mnvcli from the operating systems
ESXi	Remove using `vib remove` command.

Integrated Dell Remote Access Controller and Lifecycle Controller

The Integrated Dell Remote Access Controller (iDRAC) and Lifecycle Controller (LC) application enables you to effectively monitor the RAID and network controllers installed on the system using iDRAC and LC without an operating system installed on the system. For more information, see the Integrated Dell Remote Access Controller 9 User's Guide at iDRAC Manuals.

3

Update the BOSS-N1 firmware

BOSS-N1 firmware updates on the controllers can be done using the following methods:
- Operating system Dell Update Packages
  - Windows
  - Linux
- The Integrated Dell Remote Access Controller (iDRAC)
- Lifecycle Controller (LC)
- Mnvcli
  - Windows
  - Linux
  - VMware

Topics:

Update BOSS-N1 firmware using Windows update packages

About this task

To update the BOSS-N1 firmware using Windows update packages, perform the following steps:

ⓘ **NOTE:** Ensure that you have Administrator privileges for Windows.

Steps

1. Download the latest Dell Update Package (DUP) for Windows (**BOSS_Firmware_xxxxx_xxxx_xxxxxx.exe**) from the Support Site.
2. Double-click the .exe file and click **Install**.
   After the inventory collection and firmware validation processes are complete, the installed version and package version are displayed.
   ⓘ **NOTE:** Installed version is the current firmware version of the controller and package version is the DUP version.
3. Click **Yes** to continue.
4. Click **Yes** to reboot the system.
5. Verify the installed firmware version in HII or iDRAC, or mnvcli utility.

Update BOSS-N1 firmware using Linux

About this task

To update the BOSS-N1 firmware using Linux, perform the following steps:

ⓘ **NOTE:** Ensure that you have root or Sudo privileges for Linux.

Steps

1. Download the latest Dell Update Package (DUP) for Linux (**BOSS_Firmware_xxxxx_xxxx_xxx.bin**) from the from the Support Site.
2. Go to the downloaded file path and provide the permissions to run the DUP file.
3. Run the BIN file **./BOSS_Firmware_xxxxx_xxxx_xxx.bin**.
4. When prompted, press **Q** to proceed.
   After the inventory collection and firmware validation processes are complete, the installed version and package version are displayed.
5. To continue, press **Y+Enter** or to cancel, press **N+Enter**.
6. When prompted to reboot the server, press **Y+Enter**.
7. Verify the installed firmware version in HII, iDRAC, or mnvcli utility.

Update BOSS-N1 firmware using iDRAC

Prerequisites

You can update the controller firmware using iDRAC. The controller firmware can be updated using the Dell Update Package (DUP) when booted to an operating system. Ensure that you have installed the latest firmware version available at the Support Site.

About this task

To update the firmware using the iDRAC web interface, perform the following steps:

Steps

1. Download the latest DUP **BOSS_Firmware_xxxxx_xxxx_xxxxxx.exe** from the Support Site.
2. Click **Maintenance** > **System Update** > **Manual Update**.
3. Click **Choose file**. Select the **DUP firmware image**.
4. Click **Upload**.
   The update section displays the firmware DUP details.
5. Select the EXE Dell Update Package (DUP).
6. Upload the file, and then click **Install** > **Reboot**.
   System boots into Lifecycle Controller automatically to perform update operation. Launch **Job Queue** and **Lifecycle Log** page to view and monitor the staged firmware updates.
7. Log in and verify the installed firmware version in HII or iDRAC, or mnvcli.

Update BOSS-N1 firmware using Lifecycle Controller

Prerequisites

You can update controller firmware using Lifecycle Controller (LC). The controller firmware can be updated using the Dell Update Package (DUP) when booted to an operating system. Ensure that you have installed the latest firmware version available at the Support Site.

About this task

To update the firmware using the Lifecycle Controller, perform the following steps:

Steps

1. Download the DUP file from the Support Site and copy the .exe DUP file to a local drive.
   Example of the file name: BOSS_Firmware_xxxxx_xxxx_xxxxxx.exe.
2. Open Virtual Console and boot into Lifecycle Controller by pressing F10 at boot time.
3. Click **Firmware Update** on the dashboard window and click **Launch Firmware Update**.
4. Select any one of these repositories **FTP Server**, **Local Drive (CD/DVD/USB)**, or **Network Share (CIFS, NFS, HTTP, or HTTPS)**. Click **Next**.

5. Select the EXE file and click **Next**.
6. Select the EXE Dell Update Package (DUP) and click **Apply**.
7. After successful installation, reboot and verify the installed firmware version in the HII, iDRAC, or BOSS-N1 CLI.

   (i) **NOTE:** For Information on how to update using the CLI, see Manage BOSS-N1 using CLI commands.

Features of BOSS-N1

Topics:

Hot-plugging M.2 drives in BOSS-N1 Monolithic form factor

The unique controller design of the BOSS-N1 Monolithic carrier card allows you to hot-plug M.2 drives. This feature reduces the possibility of downtime during M.2 replacement.

(i) **NOTE:** The Integrated Dell Remote Access Controller (iDRAC) and Lifecycle Controller (LC) logs for the hot-plug events of M.2 drives are generated.

(i) **NOTE:** It is recommended to maintain a minimum interval of 30 s between hot-removing and hot-inserting a drive.

Identify M.2 drives by using LEDs for BOSS-N1 Monolithic controllers

BOSS-N1 Controller supports Activity and Status LEDs.

(i) **NOTE:** Activity LED actions can be triggered by M.2 drive itself, it will blink Green during rebuild and I/O operations.

- Activity LED—The activity LED is triggered when an activity is initiated in M.2 drives.
- Status LED—The status LED is driven based on the drive status as mentioned in the following table:

Table 5. Status LED state

Status LED state	Description
Green	Drive is online
BLINK - Amber	Drive is failed or has become SMART trip
BLINK - Green	Drive is located or identified (i) **NOTE:** The locate or identify functionality is triggered using iDRAC and OpenManage Server Administrator (OMSA).
OFF	Drive is not present

Security Key Management on BOSS-N1 controller

Security Key Implementation

The BOSS N1 controller supports Self-Encrypting Drives (SEDs) for protection of data against loss or theft of SEDs. Protection is achieved using encryption technology on the drives. The BOSS-N1 controller does not manage any keys but notifies iDRAC about the available SEDs and acts as a media to exchange information between iDRAC and SEDs. You can manage the security key using iDRAC Local Key Management (iLKM) or Secure Enterprise Key Manager(SEKM). iLKM or SEKM configuration requires an iDRAC SEKM license. For more information about configuring iDRAC Local Key Management (iLKM) or Secure Enterprise Key Manager (SEKM), see the *iDRAC User's Guide* available on the support site.

ⓘ **NOTE:** For using the security key management feature, ensure that the BOSS-N1 baseline firmware version is 2.1.13.2017 and iDRAC baseline firmware version is 6.10.80.00.

Secure firmware update

Dell BOSS-N1 controller supports secure firmware update of BOSS-N1 controller firmware images. This means that each of the firmware components is authenticated before being flashed. Authentication requires the use of a public/private asymmetric key pair. If a firmware image is not authentic or any component with the image is not authentic, firmware image will not be flashed.

Foreign import of VDs

ⓘ **NOTE:** iDRAC user interface does not support importing a foreign VD. Use HII or delete the VD.

A virtual disk is considered foreign if it is not native to the adapter.
- A virtual disk is considered native to the adapter if:
  - The virtual disk was created or imported on the adapter.
- A physical disk is considered native to the adapter if:
  - There is no previous virtual disk metadata on the adapter and the physical disks are unconfigured.
  - When the virtual disk corresponding to the physical disks is deleted

The system must be rebooted after performing foreign import.

To check for previous virtual disk metadata, see View controller information. Only a virtual disk or physical disk native to the adapter will be presented to the operating system.

Upon migrating two foreign drives to a controller, you must do either of the following:

- Clear the controller configuration if using unconfigured drives
- Import the virtual disk if using configured drives—Virtual disk import.

Predictive failure analysis using the SMART feature

SMART monitors contain physical aspects of the disk electronics to help detect predictable disk failures. Data on SMART-compliant physical disks can be monitored to identify changes in values and determine whether the values are within the threshold limits. Any electrical failures in the disk can cause degradation in the performance before failure.

A SMART failure is also referred to as a predicted failure. There are numerous factors that predict physical disk failures, such as read error rate and throughput performance. In addition, there are factors that are related to read/write surface failure, such as seek error rate and excessive bad blocks.

ⓘ **NOTE:** The BOSS-N1 CLI displays with smart attributes.

Auto—rebuild a degraded drive

Auto—rebuild is enabled by default, and the rebuild can start automatically if the native virtual disk is degraded and a valid rebuild target is present. A valid rebuild target is any functional drive attached to the BOSS-N1 device which is not part of the native virtual disk and is of equal or greater storage capacity. An auto—rebuild occurs without prompting the user, and any data on the rebuild target is overwritten.

ⓘ **NOTE:** Auto—rebuild is applicable during drive replacement (hot—plug event).

Install and remove a BOSS-N1 controllers

Topics:

Safety instructions

⚠️ **CAUTION: Ensure that two or more people lift the system horizontally from the box and place it on a flat surface, rack lift, or into the rails.**

⚠️ **WARNING: Opening or removing the PowerEdge server cover while the server is powered on may expose you to a risk of electric shock.**

⚠️ **WARNING: Do not operate the server without the cover for a duration exceeding five minutes. Operating the system without the system cover can result in component damage.**

ⓘ **NOTE:** Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that are shipped with your product.

⚠️ **CAUTION: To ensure proper operation and cooling, all system bays and fans must always be populated with a component or a blank.**

ⓘ **NOTE:** It is recommended that you always use an antistatic mat and antistatic strap while working on components inside the server.

ⓘ **NOTE:** To ensure proper operation and cooling, all system bays and fans must always be populated with a component or a blank.

ⓘ **NOTE:** While replacing the hot swappable PSU, after next server boot, the new PSU automatically updates to the same firmware and configuration of the replaced one. For updating to the latest firmware and changing the configuration, see the Lifecycle Controller User's Guide a iDRAC Manuals

Before working inside your system

Prerequisites

Follow the safety guidelines listed in Safety instructions

Steps

1. Power off the system and all attached peripherals.
2. Disconnect the system from the electrical outlet and disconnect the peripherals.

3. If applicable, remove the system from the rack.

   For more information, see the Rail Installation Guide relevant to your rail solutions at PowerEdge Manuals.
4. Remove the system cover.

Remove the BOSS-N1 Monolithic controller

About this task

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ⓘ **NOTE:** The steps may vary based on the platform from where the BOSS-N1 Monolithic controller is removed.

Steps

1. Press and pull the BOSS-N1 Monolithic filler out from the BOSS-N1 Monolithic controller module bay.
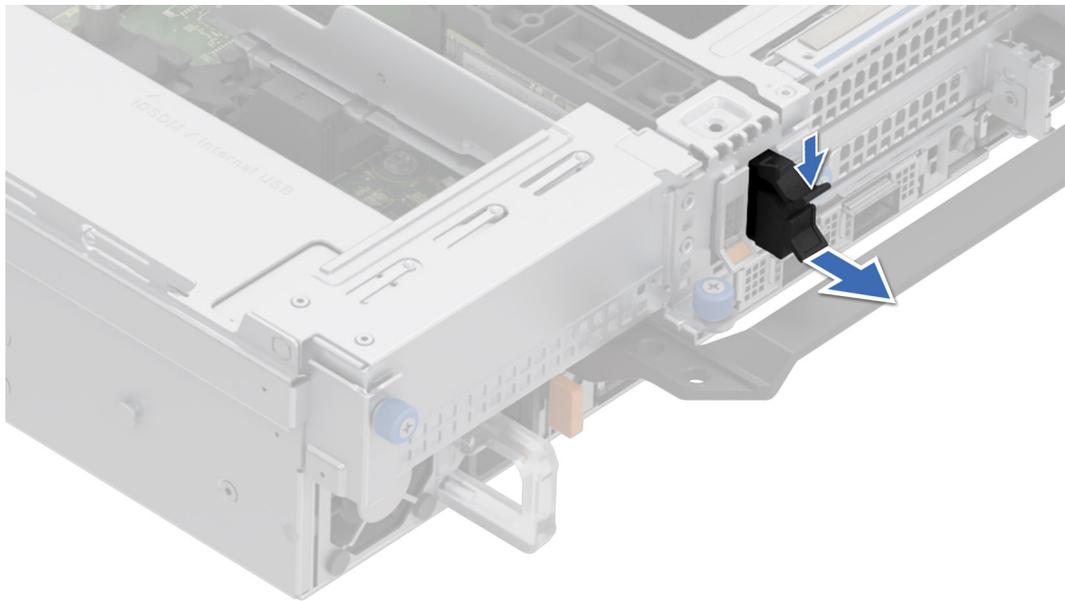
Figure 4. Remove BOSS-N1 Monolithic filler

2. Pull and lift the BOSS-N1 Monolithic controller carrier retention latch to open.
3. Slide the BOSS-N1 Monolithic controller carrier out.

Figure 5. Remove the BOSS-N1 Monolithic controller carrier

4. Using the Phillips #1 screwdriver remove the M2 x 0.4 x 4.2 mm screw that secures the M.2 NVMe SSD carrier to the BOSS-N1 Monolithic controller.
5. Slide the M.2 SSD out and up from the BOSS-N1 Monolithic controller.
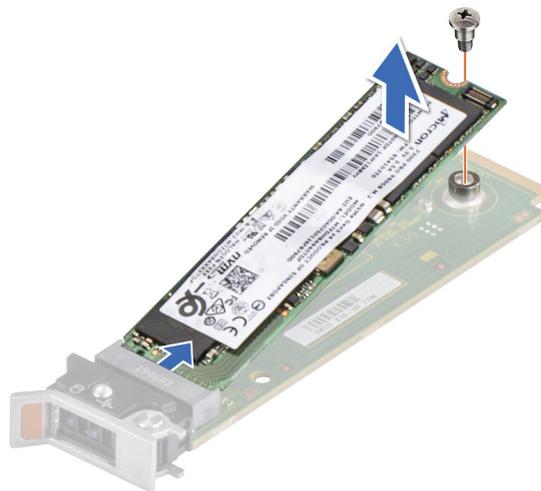
Figure 6. Remove the M.2 SSD

6. Press the latch and disconnect the BOSS N1 power cable and the BOSS signal cable from the BOSS-N1 Monolithic controller module.

   (i) **NOTE:** If BOSS N1 module is installed, ensure to disconnect the BOSS N1 power cable and signal cable before removing the Riser 1 cage.
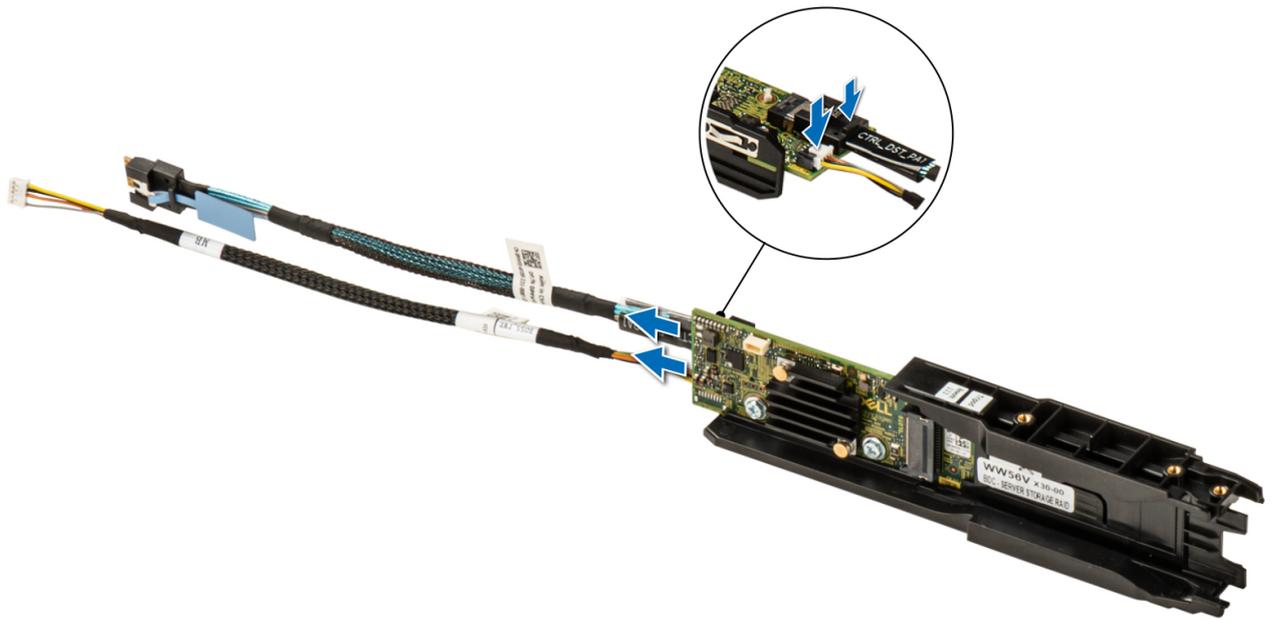
Figure 7. Remove the BOSS power cable and BOSS signal cable from the BOSS-N1 Monolithic controller module

7. Using the Phillips #1 screwdriver remove the M3 x 0.5 x 4.5 mm screw that secures the BOSS-N1 Monolithic controller module on Riser 1. Slide the BOSS-N1 Monolithic controller module towards the front of the chassis and lift the controller module.
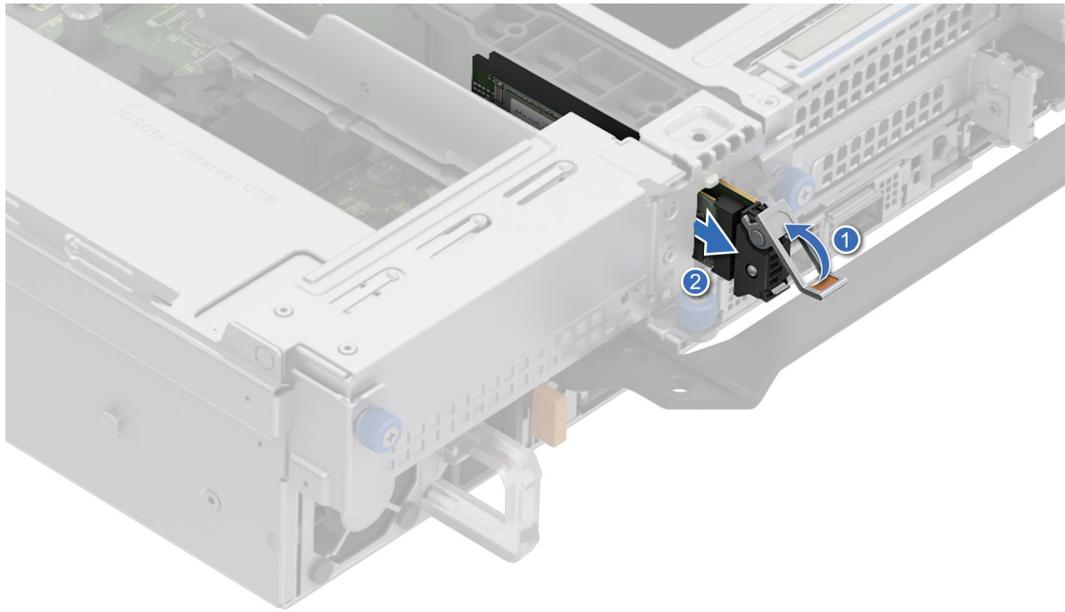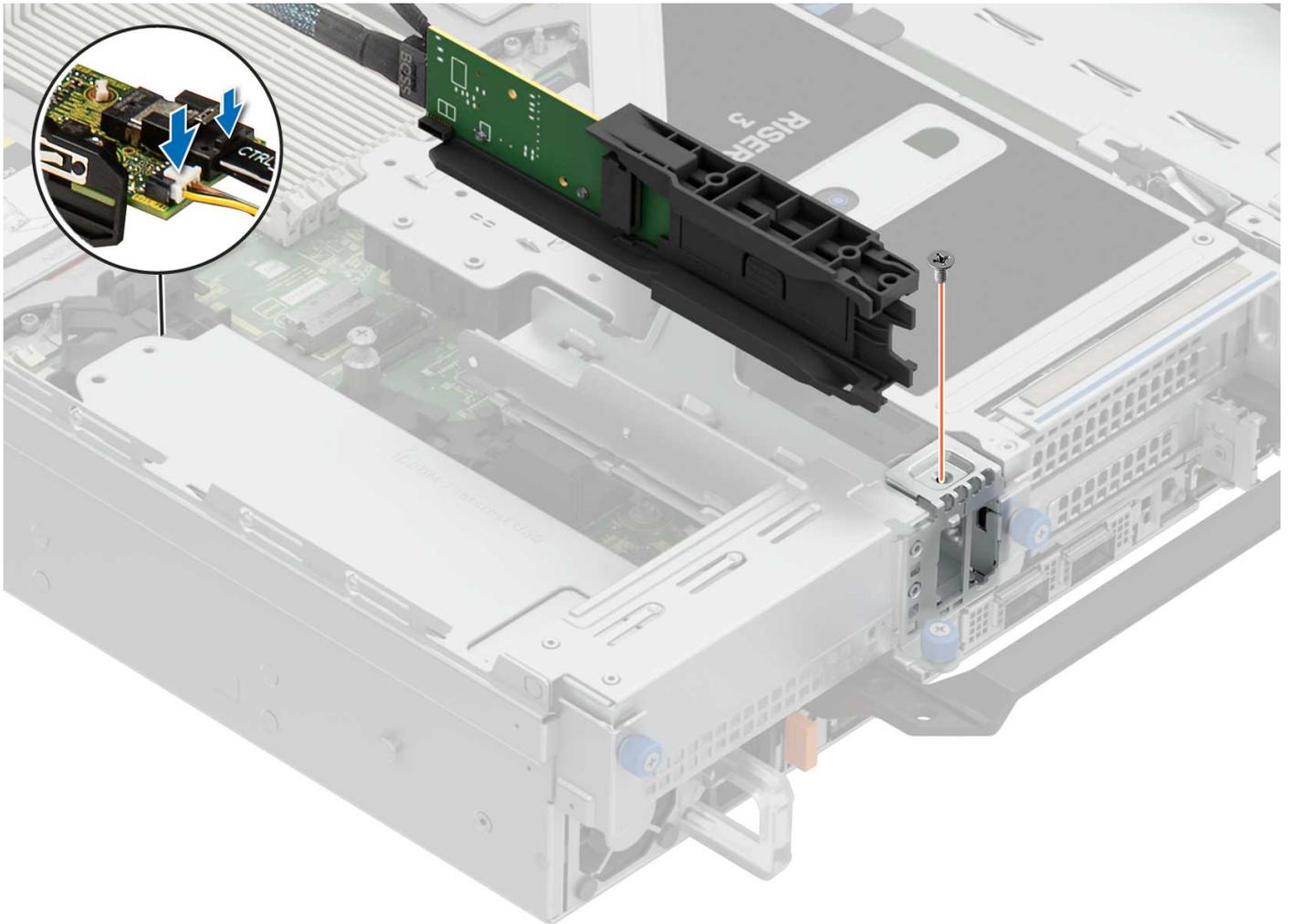
Figure 8. Remove the BOSS-N1 Monolithic controller module

8. Remove the BOSS power cable and BOSS signal cable from the system board.

Install the BOSS-N1 Monolithic controller

About this task

⚠️ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that are shipped with your product.**

ⓘ **NOTE:** The steps vary based on the platform where the BOSS-N1 Monolithic controller is installed.

Steps

1. Connect the BOSS power cable and BOSS signal cable to the BOSS-N1 Monolithic controller module.
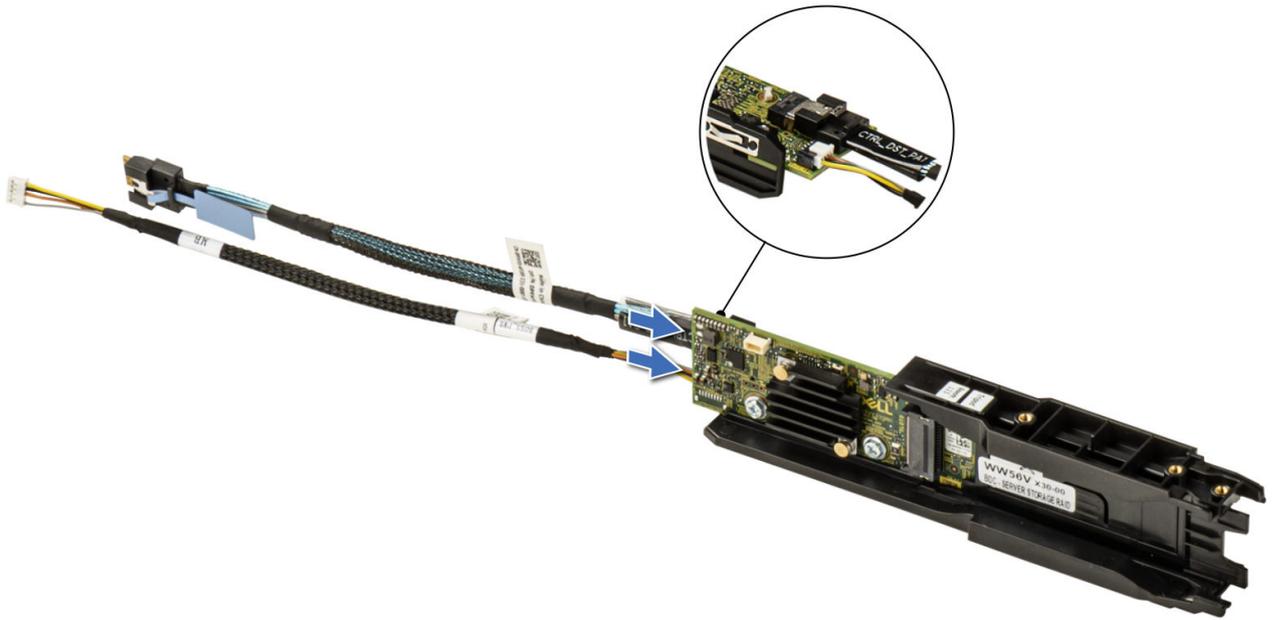
Figure 9. Connect the BOSS power cable and BOSS signal cable to the BOSS-N1 Monolithic controller module

2. Align the BOSS-N1 Monolithic controller module at an angle with the controller module slot.
3. Insert the BOSS-N1 Monolithic controller module and push the controller module towards the back of the chassis until it is secured.
4. Using the Phillips #1 screwdriver secure the BOSS-N1 Monolithic controller module with the M3 x 0.5 x 4.5 mm screw.
5. Connect the BOSS power cable and the BOSS signal cable to the connectors on the system board.
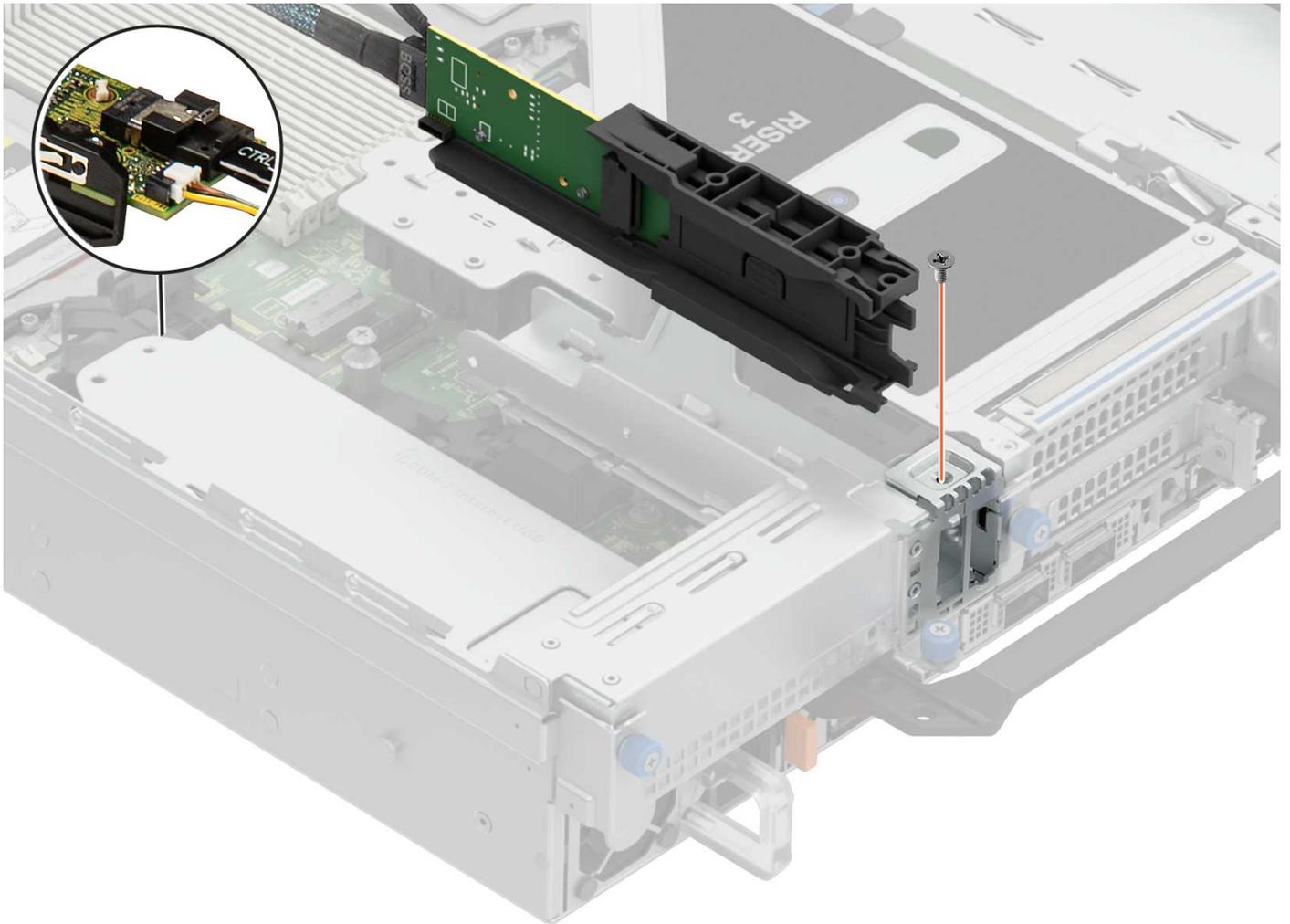
Figure 10. Install the BOSS-N1 Monolithic controller module

6. Align the BOSS-N1 filler with the BOSS-N1 Monolithic controller module bay and push it into the bay until it clicks into place.
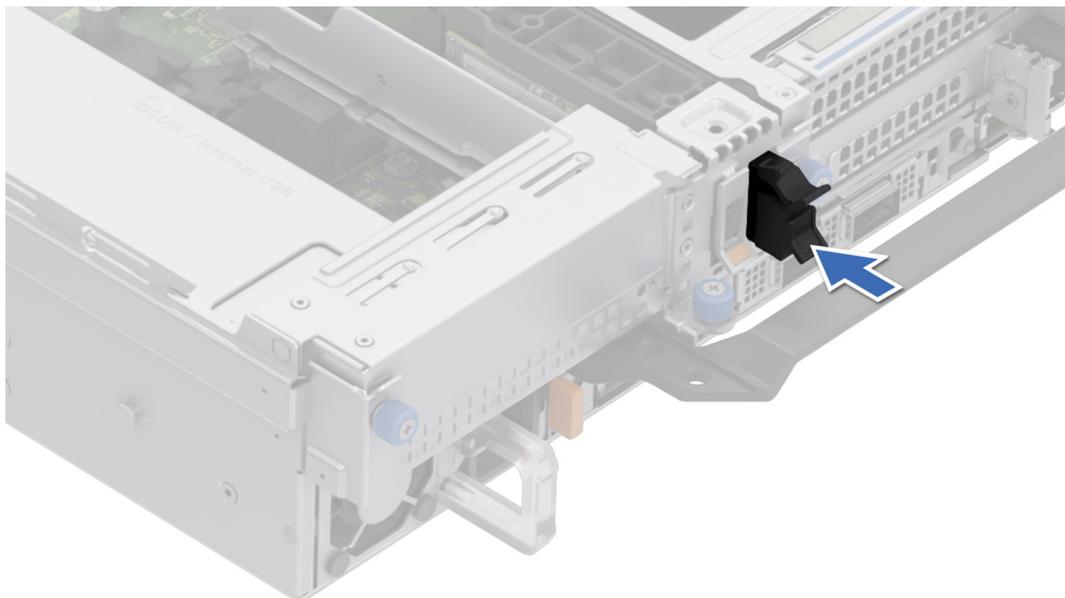
Figure 11. Install the BOSS-N1 Monolithic controller filler

7. Align the M.2 SSD at an angle with the BOSS-N1 Monolithic carrier and insert the M.2 SSD until it is firmly seated in the BOSS-N1 Monolithic carrier.
8. Using the Phillips #1 screwdriver, secure the M.2 SSD on the BOSS-N1 Monolithic carrier with the M2 x 0.4 x 4.2 mm screw.
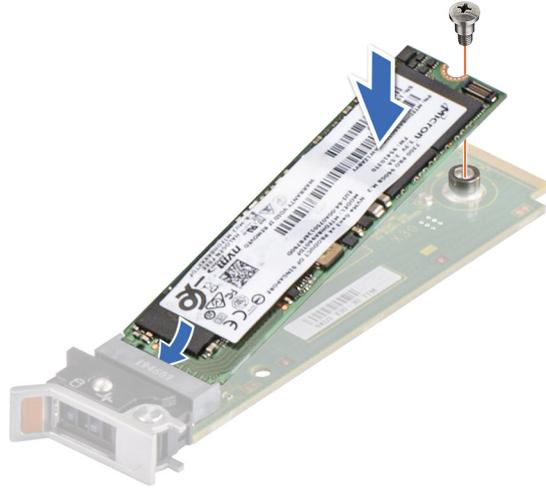
Figure 12. Install the M.2 SSD

9. Slide the BOSS-N1 Monolithic controller into the BOSS-N1 Monolithic module slot.
10. Close the BOSS-N1 Monolithic carrier release latch to lock the carrier in place.
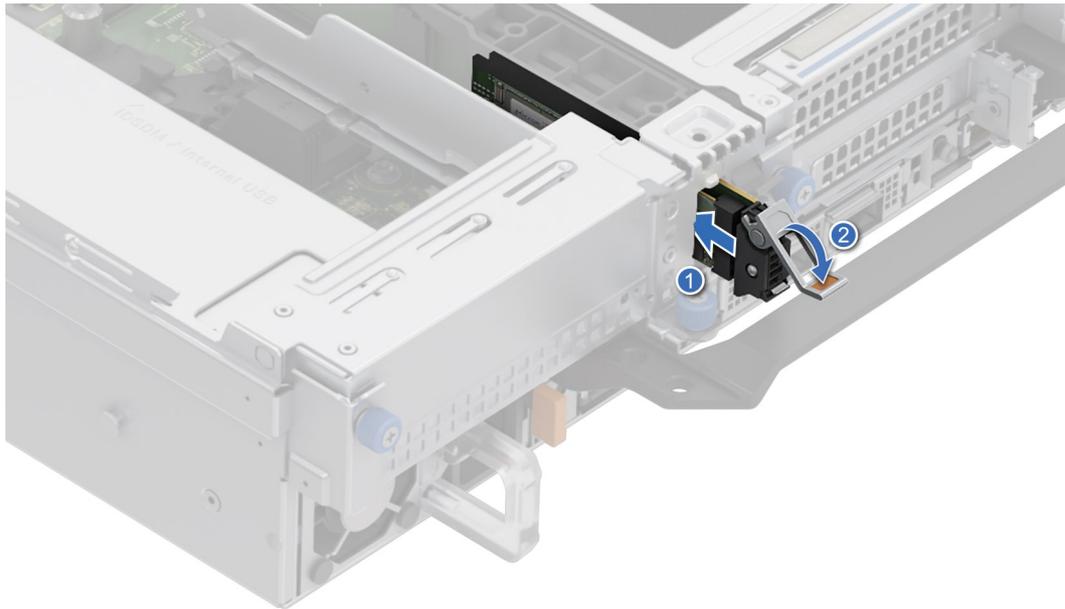
Figure 13. Install the BOSS-N1 Monolithic carrier

Remove the BOSS-N1 Modular ET controller

About this task

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that are shipped with your product.**

(i) **NOTE:** The steps may vary based on the platform from where the BOSS-N1 Modular ET controller is removed.

Steps

1. Using a Phillips 1 screwdriver, loosen the screw that secures the BOSS-N1 Modular ET controller on the system board.

   (i) **NOTE:** The screw is captive and cannot be removed completely.

2. Press and release the plastic holder that secures the BOSS-N1 Modular ET controller.
3. Holding the blue tag, pull the BOSS-N1 card away from the system board connector.

Figure 14. Remove the BOSS-N1 Modular ET controller

Install the BOSS-N1 Modular ET controller

About this task

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that are shipped with your product.**

(i) **NOTE:** Steps vary based on the platform where the BOSS-N1 Modular ET is installed.

Steps

1. Align and insert the BOSS-N1 Modular ET controller with the connector on the system board.
2. Press the BOSS-N1 Modular ET controller firmly until it is fully seated.
3. Using the Phillips 1 screwdriver, tighten the screw to secure the BOSS-N1 Modular ET controller on the system board.

   (i) **NOTE:** The numbers on the image do not depict the exact steps. The numbers are for representation of sequence.
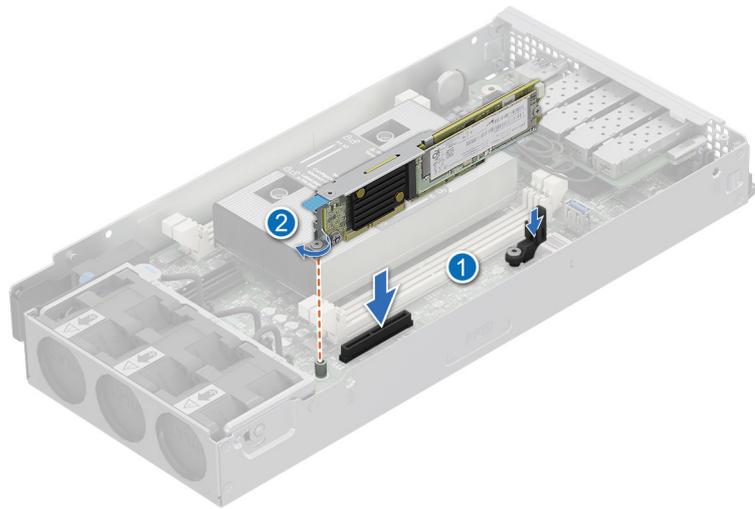
Figure 15. Install the BOSS-N1 Modular ET controller

Remove the BOSS-N1 Modular controller

About this task

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that are shipped with your product.**

ⓘ **NOTE:** The steps may vary based on the platform from where the BOSS-N1 Modular controller is removed.

Steps

1. Using a Phillips 1 screwdriver, remove the screw that secures the riser to the chassis.
2. Holding the blue tag, lift the riser to disengage the riser from the connector on the system board.
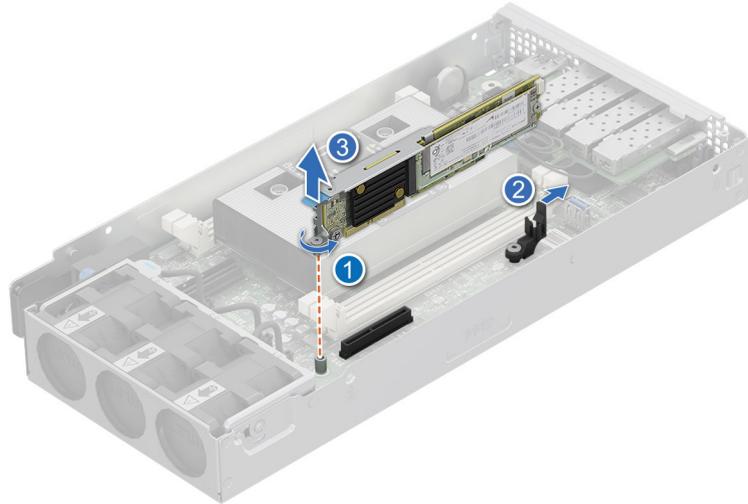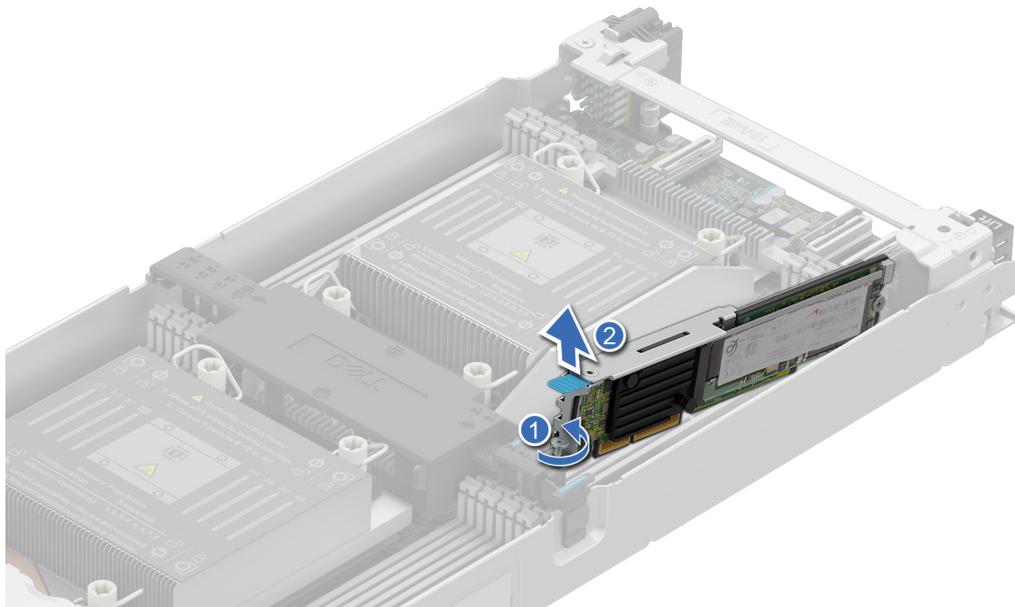
Figure 16. Remove the BOSS-N1 Modular controller

Install the BOSS-N1 Modular controller

About this task

⚠ **CAUTION: Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that are shipped with your product.**

ⓘ **NOTE:** The steps may vary based on the platform from where the BOSS-N1 Modular controller is installed.

Steps

1. Align the M.2 SSD module connectors with the connectors on the card.
2. Tilt the M.2 SSD module downwards until the module is seated firmly on the card.
3. Tighten the screw to secure the M.2 SSD module to the card.

   ⚠ **CAUTION: To avoid damage to the card, ensure that you do not over tighten the screw.**
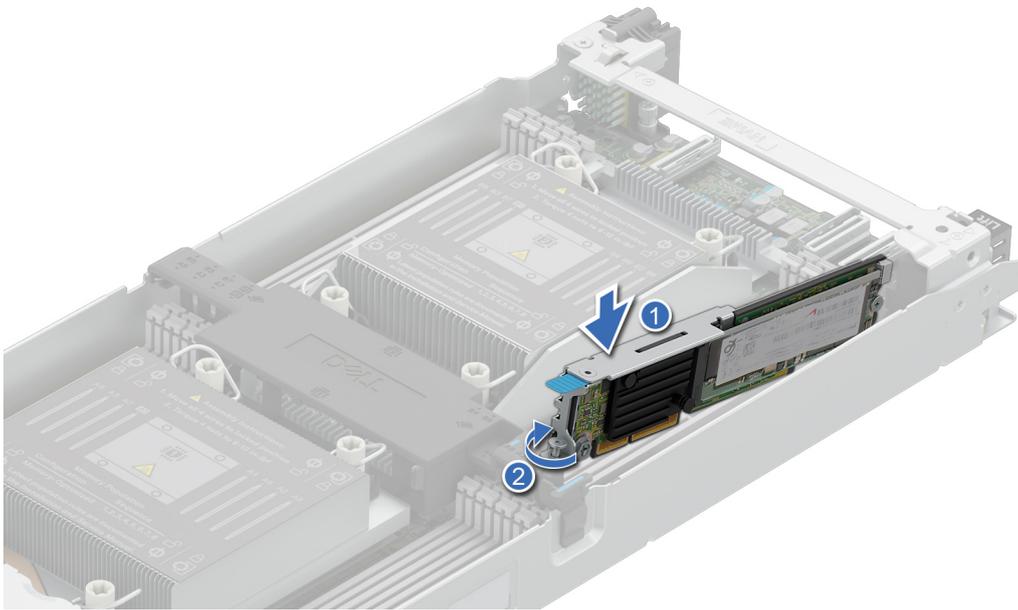
Figure 17. Install the BOSS-N1 Modular controller

Driver support for BOSS-N1

The BOSS-N1 controller leverages the inbox NVMe driver with all the supported operating systems.

Windows driver installation—By default, the native NVMe Inbox driver is used for operating system installation.

Linux driver installation—By default, the native NVMe Inbox driver is used for operating system installation.

ESXi driver installation—By default, the native NVMe inbox driver is used for operating system installation.

BOSS-N1 Configuration Utility

The Unified Extensible Firmware Interface (UEFI) RAID configuration utility is a storage management application integrated into the system BIOS <F2>. It is used to configure and manage RAID disk groups, virtual disks, and physical disks. This utility is independent of the operating system.

The following topics provide information about using the UEFI RAID configuration utility. For more information, see the online help option in the UEFI RAID configuration utility.

(i) **NOTE:** Use the UEFI RAID configuration utility for initial setup and disaster recovery. Certain advanced features are also offered in the utility.

Topics:

*   Enter the BOSS-N1 Configuration Utility
*   Exit the BOSS-N1 Configuration Utility
*   Navigate the BOSS-N1 Configuration Utility
*   Physical and virtual device information
*   Create a virtual disk
*   Delete a virtual disk
*   Recover or rebuild a degraded virtual drive
*   View RAID controller information

Enter the BOSS-N1 Configuration Utility

About this task

To boot to the UEFI configuration utility, perform the following steps:

Steps

1. Turn on the system.
2. While the system is booting, press <F2> to enter **System Setup**.
3. Click **Device Settings**.
    Device Settings lists all the RAID controllers in the system.

    To access the management menu for the controller, use the arrow keys or the mouse.

    (i) **NOTE:** For more information in all the options, click **Help,** available on the top-right corner of the browser screen. Help information for individual option menus can also be viewed by scrolling down on each option.

    (i) **NOTE:** Some of the options within the BOSS-N1 Boot Controller are not present if the controller does not support the corresponding feature. Options may also be disabled if the feature is not supported in the existing configuration.

Exit the BOSS-N1 Configuration Utility

About this task

To exit the UEFI configuration utility, perform the following steps:

Steps

1. Click **Finish** at the bottom-right corner on the **System Setup Main Menu** screen.
    A warning message confirming your choice appears.
2. Click **Yes** to exit the configuration utility.

NOTE: Depending on the device configuration changes, exiting the UEFI configuration utility may prompt for a system reboot.

Navigate the BOSS-N1 Configuration Utility

About this task

To go to UEFI configuration utility, perform the following steps:

Steps

1. Enter the UEFI configuration utility. See Enter the UEFI Configuration Utility.
   The **Device Settings** screen displays a list of NIC ports and the BOSS-N1 Boot Controller.
2. To enter BOSS-N1 Boot Controller, click **BOSS-N1 Boot Controller**.
   The list of **Configuration Options** appears:
   - **Physical Device Information**—view the properties of hard drives.
   - **Virtual Device Information**—view the properties of virtual disks.
   - **Create RAID Configuration**—configure a virtual disk.
   - **Delete RAID Configuration**—delete a virtual disk.
   - **Rebuild RAID Configuration**—rebuild a degraded RAID volume when a peer drive is available.
   - **Controller Information**—view the BOSS-N1 controller information.

Physical and virtual device information

The **Physical Device Information** menu allows you to view physical disk properties. The **Virtual Device Information** menu allows you to view the physical disk properties.

View physical disk information

About this task

To view the physical disk information, perform the following steps:

Steps

1. Enter the **UEFI Configuration Utility**. See Enter the UEFI Configuration Utility.
2. Click **Physical Device Information**.
   All available physical disks are displayed.
3. Select a physical disk to view its information.

View virtual device information

About this task

To view the virtual disk information, perform the following steps:

Steps

1. Enter the **UEFI Configuration Utility**. See Enter the UEFI Configuration Utility.
2. Click **Virtual Device Information**. The **Virtual Device Information** list is displayed.
3. Select the virtual disk. The details of the virtual disk is displayed.

Import and set a foreign virtual disk as BOSS-N1

About this task

The Import operation sets a foreign virtual disk as native to the configuration.

ⓘ **NOTE:** iDRAC user interface does not support importing a foreign VD. Use HII or delete the VD.

Steps

1. Enter the **UEFI Configuration Utility**. See Enter the UEFI Configuration Utility.
2. Click **Virtual disk information**.
3. Select the virtual disk.
4. Select **Yes** for the option **Would you like to import this virtual disk?**.

    ⓘ **NOTE:** This option is only available when the controller detects a foreign disk.

5. Click **OK**, and then click **Import**.
6. Click **Back** untill you return to the screen.
7. Click **Finish**, and then click **Yes** to save the settings.

Create a virtual disk

You can create only one virtual disk.

About this task

To create a virtual disk, perform the following steps:

Steps

1. Enter the **UEFI Configuration Utility**. See Enter the UEFI Configuration Utility.
2. Click **Create RAID Configuration**.
3. Select the hard drives.

    ⓘ **NOTE:** BOSS supports only single drive RAID 0.

4. Click **Go to RAID Configuration**.
5. Select various options based on the user's need and type the **Name** of the virtual disk.

    ⓘ **NOTE:** Adding special characters in the virtual disk name is not supported.

6. Select **Yes** for the option **Would you like to create this virtual disk?** and click **OK**.
7. Click **Accept**.
   A virtual disk is created with quick initialization by default.

Delete a virtual disk

About this task

To delete a virtual disk, perform the following steps:

Steps

1. Enter the **UEFI Configuration Utility**. See Enter the UEFI Configuration Utility.
2. Click **Delete RAID configuration**.
3. Select the virtual disk.
4. Select **Yes** for the option **Are you sure you want to delete the selected Virtual Disk?**.

5. Click **OK**, and click **Accept** to delete the selected virtual disk.

Recover or rebuild a degraded virtual drive

You can manually rebuild a degraded virtual disk. RAID rebuild is available only when a degraded RAID volume is present and there is an available target device. If a foreign virtual disk is in rebuild state, rebuild starts automatically after you import the virtual disk and reboot the server.

View RAID controller information

About this task

The Controller information menu allows you to view the properties of the RAID Controller.

Steps

1. Enter the **UEFI Configuration Utility**. See Enter the UEFI Configuration Utility.
2. Click **Controller information**.

   The RAID controller information is displayed.

Security Key Management on BOSS-N1 controller

Security Key Implementation

The BOSS N1 controller supports Self-Encrypting Drives (SEDs) for protection of data against loss or theft of SEDs. Protection is achieved using encryption technology on the drives. The BOSS-N1 controller does not manage any keys but notifies iDRAC about the available SEDs and acts as a media to exchange information between iDRAC and SEDs. You can manage the security key using iDRAC Local Key Management (iLKM) or Secure Enterprise Key Manager(SEKM). iLKM or SEKM configuration requires an iDRAC SEKM license. For more information about configuring iDRAC Local Key Management (iLKM) or Secure Enterprise Key Manager (SEKM), see the *iDRAC User's Guide* available on the support site.

(i) **NOTE:** For using the security key management feature, ensure that the BOSS-N1 baseline firmware version is 2.1.13.2017 and iDRAC baseline firmware version is 6.10.80.00.

Topics:

- Enable security on a BOSS-N1 controller using iDRAC
- Disable security on a BOSS-N1 controller using iDRAC
- Behavior when a drive is connected to a BOSS-N1 controller

Enable security on a BOSS-N1 controller using iDRAC

About this task

(i) **NOTE:** For enabling the security feature on a BOSS-N1 controller, ensure that all drives are SEDs. Controller security can be enabled if the drives are in configured or unconfigured state.

Steps

1. On the iDRAC **Dashboard** page, click the **Storage** menu.
2. Click **Controllers**.
3. In the **Controllers** section, from the **Actions** drop-down menu, select **Edit**, corresponding to the BOSS-N1 controller on which you want to enable security.
4. In the **BOSS-N1 <Name>** dialog box, from the **Security (Encryption)** drop-down menu, select **Enable Security**.
5. Click **Add to Pending**. iDRAC stages this job and makes it effective only after you restart the server.
6. When prompted, select **Apply at Next Reboot**.
7. Restart the server.
   The security mode is enabled on the controller and drives are secured after the staged operation is completed.

Disable security on a BOSS-N1 controller using iDRAC

About this task

(i) **NOTE:** Before initiating a job to disable the security mode, ensure that the VDs associated with the BOSS-N1 controller are deleted.

Steps

1. On the iDRAC **Dashboard** page, click the **Storage** menu.
2. Click the **Physical Disks** tab.

3. From the **Actions** drop-down menu of the available physical drives, select **Cryptographic Erase**. If prompted to add the erase job to a pending list, click **OK**.

4. Click **Apply Later**. Repeat the procedure for each physical disk associated with the BOSS-N1 controller.

5. Click **Storage** > **Controllers**.

6. In the **Controllers** section, from the **Actions** drop-down menu, select **Edit**, corresponding to the BOSS-N1 controller on which you want to disable security.

7. In the **BOSS-N1 <Name>** dialog box, from the **Security (Encryption)** drop-down menu, select **Disable Security**.

8. Click **Add to Pending**. iDRAC stages this job and makes it effective only after you restart the server.

9. Click **Apply**.

10. Restart the server.
   The security mode is disabled on the controller after the staged operation is completed. The Cryptographic Erase jobs and its associated Security Disable jobs are run together.

Behavior when a drive is connected to a BOSS-N1 controller

Table 6. Behavior when a drive is connected to a BOSS-N1 controller

BOSS-N1 controller security mode	Fresh SED	Migrated SED (drive secured using another server)	Non-SED
Enabled	iDRAC assigns key and secures it.	iDRAC reads the key ID from drive: • If the security configuration matches, iDRAC unlocks the drive. • If the security configuration does not match, the drive stays in locked state.	The BOSS-N1 controller marks the drives as failed.
Disabled	BOSS-N1 can access the SED but will use the drive in an unsecured mode.	Drive stays in the locked state.	The BOSS-N1 controller can access the drive and use it.

(i) **NOTE:** When the controller security mode is enabled, only secure unlocked drives can be used to create a VD.

Manage BOSS-N1 using CLI commands

This section provides information about the methods to use the BOSS-N1 Command Line Interface (CLI) for performing a variety of controller and enclosure specific operations.

The BOSS-N1 CLI utility is supported on the following operating systems:

- Windows
- Linux
- ESXi

Topics:

BOSS-N1 CLI commands supported on PowerEdge servers

The following table lists the supported BOSS-N1 line interface (CLI) commands. For more information about the commands, type **> help**.

ⓘ **NOTE:** The BOSS-N1 CLI utility only supports the following commands:

Table 7. Supported CLI commands

CLI commands	Description	Windows usage	Linux/VMware usage
?	Get brief help for all commands.	mnvcli ?	./mnvcli ?
help	Get brief help for all commands or detail help for one command.	mnvcli help	./mnvcli help
adapter	Get NVMe controller selection options along with supported CLI commands.	mnvcli adapter -list mnvcli adapter -i 0	- ./mnvcli.exe adapter -list - ./mnvcli.exe adapter -i 0
version	Show API, CLI, and support firmware version.	mnvcli version	./mnvcli version
smart	Get SMART info of SSD backend (root complex and slot).	- mnvcli smart -o hba - mnvcli smart -i 0	- ./mnvcli smart -o hba - ./ mnvcli smart -i 0
flash	Update flash image.	- mnvcli flash -o hba -f raw.bin -c 1 -s 1 - mnvcli flash -o pd -i 0-f raw.bin -s 0 -c 3	- ./mnvcli flash -o hba -f raw.bin -c 1 -s 0 - ./mnvcli flash -o pd -i 0-f raw.bin -s 0 -c 3
info	Display information of NVMe Controllers (HBA), virtual disks, physical disks, or Namespace (ns)	- mnvcli info -o hba - mnvcli info -o vd - mnvcli info -o pd	- ./mnvcli info -o hba - ./mnvcli info -o vd - ./mnvcli info -o pd
event	Get event information from NVMe controller.	- mnvcli event -c 0 - mnvcli event -c 20	- ./mnvcli event -c 0 - ./mnvcli event -c 20

(i) **NOTE:** SMART reports the health status of the M.2 disks. See the SMART status after the command is run.

(i) **NOTE:** There might be inconsistency in the events that are listed in BOSS CLI and other management interfaces that include Dell Open Manage Storage Services.

Run BOSS-N1 CLI commands on PowerEdge servers running the Windows operating system

About this task

Follow these procedures to run CLI commands using the Windows operating system:

Steps

1. Download the latest **mnvcli BOSS-N1 utility for Windows** Support Site.
2. Extract the content of the **BOSS-N1_Windows_CLI_xxxx_Axx.zip** file on the system.
3. Browse the directory where you have extracted the content of the **BOSS-N1_Windows_CLI_xxxx_Axx.zip** file and run the **mnvcli.exe** file.
   The CLI window, within which you can run BOSS-N1 CLI commands, is displayed. Run BOSS-N1 CLI commands from this window.

Run BOSS-N1 CLI commands on PowerEdge servers running the Linux operating system

About this task

Follow these procedures to run CLI commands using the Linux operating system:

Steps

1. Download the latest **MNVCLI BOSS-N1 utility for Linux** from the Support Site.
2. Extract the content of the **BOSS-N1_Windows_CLI_xxxx_Axx.zip** file on the system.
3. Browse the directory to which you have extracted the content of the **BOSS-N1_Windows_CLI_xxxx_Axx.zip** file and run the **./mnvcli** files.
   The CLI window, within which you can run BOSS-N1 CLI commands appears.

Run BOSS-N1 CLI commands on PowerEdge servers running the ESXi operating system

About this task

Follow these procedures to run CLI commands using the ESXi operating system:

Steps

1. Install ESXi on a host machine.
2. Use **WinSCP** or **SCP** and copy the attached files into the **/tmp/ directory**.
3. Log in to an **ESXi shell** using putty.
4. Change the directory to **cd /tmp**.
5. Run the command, – esxcli software vib install -d /tmp/DEL_bootbank_BOSSN1-MNV-CLI_X.Y.Z-A00 to install the offline bundle.
   Successful commands are reported at the command line.
6. Enter the directory **cd /opt/dell/boss/** and run the mvcli (BOSS CLI) utility.

(i) **NOTE:** ESXi 7.0 U3 or ESXi 8.0 is the minimum requirement to install the BOSS-N1 CLI utility.

Troubleshooting

To get help with your Dell BOSS-N1, you can contact your Dell Technical Service representative or see the Support Site.
Topics:

- BOSS-N1 supports only single drive RAID 0
- Unwanted 0.0 MB unallocated space entry on BOSS-N1
- BOSS-N1 HII displays Maximum VD supported as 2
- RAID level (between RAID 0 and RAID 1) migration is not supported on BOSS-N1
- BOSS N1 controller may also be detected in the Legacy BIOS mode
- The Enable Security job fails when initiated from iDRAC
- The LED blinks amber when the drive is in Failed state

BOSS-N1 supports only single drive RAID 0

Issue:	BOSS-N1 allows physical connections of two M.2 NVMe drives. However, only one M.2 NVMe drive is used to create RAID 0 volume and the other M.2 NVMe drive is not used.
Corrective Action:	Expected behavior. No action is required.

Unwanted 0.0 MB unallocated space entry on BOSS-N1

Issue:	If no RAID is created on drives connected to BOSS-N1 controller, one unwanted entry of 0.0 MB unallocated space is displayed in the disk selection page during installation of the Windows operating system.
Corrective Action:	Expected behavior. No action is required.

BOSS-N1 HII displays Maximum VD supported as 2

Issue:	BOSS-N1 HII displays **Maximum VD supported** as **2**. Considering one functional VD and one foreign VD, HII displays **Maximum VD supported** as **2**.
Corrective Action:	Expected behavior. No action is required.

RAID level (between RAID 0 and RAID 1) migration is not supported on BOSS-N1

Issue:	BOSS-N1 allows physical connections of two M.2 NVMe drives. Either you can create single drive RAID 0 or two drive RAID 1. After this RAID operation, RAID level migration is not supported.
Corrective Action:	Expected behavior. No action is required.

BOSS N1 controller may also be detected in the Legacy BIOS mode

Issue: BOSS N1 controller may also be detected in the Legacy BIOS mode.

Corrective Action: It is recommended to boot the system on the UEFI mode only. The Legacy BIOS mode is not supported.

The Enable Security job fails when initiated from iDRAC

Issue: When a non-SED is connected and the Enable Security job is initiated from iDRAC, the job fails.

Corrective Action: Remove the non-SED and retry the operation on the controller.

The LED blinks amber when the drive is in Failed state

Issue: The LED blinks amber when the drive is failed.

Corrective Action: Expected behavior when the security mode of a drive and BOSS-N1 controller is not compatible. No action is required.

Getting help

You can get help with your Dell product by contacting Dell, or send feedback on product documentation.

Topics:

- Recycling or End-of-Life service information
- Contacting Dell

Recycling or End-of-Life service information

Take back and recycling services are offered for this product in certain countries. If you want to dispose of system components, visit the How to Recycle page and select the relevant country.

Contacting Dell

Dell provides online and telephone based support and service options. If you do not have an active internet connection, you can find Dell contact information on your purchase invoice, packing slip, bill or Dell product catalog. The availability of services varies depending on the country and product, and some services may not be available in your area. To contact Dell for sales, technical assistance, or customer service issues:

Steps

1. Go to the Support site.
2. Select your country from the drop-down menu on the lower right corner of the page.
3. For customized support:
   a. Enter the system Service Tag in the **Enter a Service Tag, Serial Number, Service Request, Model, or Keyword** field.
   b. Click **Submit**.
      The support page that lists the various support categories is displayed.
4. For general support:
   a. Select your product category.
   b. Select your product segment.
   c. Select your product.
      The support page that lists the various support categories is displayed.
5. For contact details of Dell Global Technical Support:
   a. Click Contact Technical Support.
   b. The **Contact Technical Support** page is displayed with details to call, chat, or e-mail the Dell Global Technical Support team.

Documentation resources

This section provides information about the documentation resources for your system.

To view the document that is listed in the documentation resources table:

- From the Dell support site:
  1. Click the documentation link that is provided in the Location column in the table.
  2. Click the required product or product version.

     (i) **NOTE:** To locate the product name and model, see the front of your system.

  3. On the Product Support page, click **Manuals & documents**.
- Using search engines:
  - Type the name and version of the document in the search box.

Table 8. Additional documentation resources for your system

Task	Document	Location
Setting up your system	For more information about installing and securing the system into a rack, see the Rail Installation Guide included with your rail solution. For information about setting up your system, see the *Getting Started Guide* document that is shipped with your system.	PowerEdge Server Manuals
Configuring your system	For information about the iDRAC features, configuring and logging in to iDRAC, and managing your system remotely, see the Integrated Dell Remote Access Controller User's Guide. For information about understanding Remote Access Controller Admin (RACADM) subcommands and supported RACADM interfaces, see the RACADM CLI Guide for iDRAC. For information about Redfish and its protocol, supported schema, and Redfish Eventing implemented in iDRAC, see the Redfish API Guide. For information about iDRAC property database group and object descriptions, see the Attribute Registry Guide. For information about Intel QuickAssist Technology, see the Integrated Dell Remote Access Controller User's Guide.	PowerEdge Server Manuals
	For information about earlier versions of the iDRAC documents. To identify the version of iDRAC available on your system, on the iDRAC web interface, click	iDRAC Manuals

Table 8. Additional documentation resources for your system (continued)

Task	Document	Location
	? > **About**.	
	For information about updating drivers and firmware, see the Methods to download firmware and drivers section in this document.	Drivers
Managing your system	For information about systems management software offered by Dell, see the Dell OpenManage Systems Management Overview Guide.	OpenManage Documentation
	For information about setting up, using, and troubleshooting OpenManage, see the Dell OpenManage Server Administrator User's Guide.	OpenManage Documentation
	For information about installing, using, and troubleshooting Dell OpenManage Enterprise, see the Dell OpenManage Enterprise User's Guide.	OpenManage Documentation
	For information about partner programs enterprise systems management, see the OpenManage Connections Enterprise Systems Management documents.	OpenManage Connections and Integrations
Understanding event and error messages	For information about the event and error messages generated by the system firmware and agents that monitor system components, go to qrl.dell.com > **Look Up** > **Error Code**, type the error code, and then click **Look it up**.	PowerEdge Server Event and Error Messages