## SupremeRAID™ User Guide for Linux

Oct. 2024



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## **INTRODUCTION**

SupremeRAID<sup>™</sup> is the most powerful, high-speed data protection solution specially designed for NVMe SSDs. SupremeRAID<sup>™</sup> driver installs a virtual NVMe controller onto the operating system and integrates a high-performance, GPU-base PCIe RAID card into the system to manage the RAID operations of the virtual NVMe controller.

This document explains how to install the SupremeRAID<sup>™</sup> software package for Linux and how to manage the RAID components using the command-line interface.

## Software Module Overview

The SupremeRAID<sup>™</sup> Software module has the following major components:

- graidctl The command-line management tool.
- graid\_server The management daemon that handles requests from graidctl to control the driver.
- graid.ko The driver kernel module.
- graid\_core The instance that manages the GPU.
- graid-mgr The management daemon provides the management GUI and API functions.

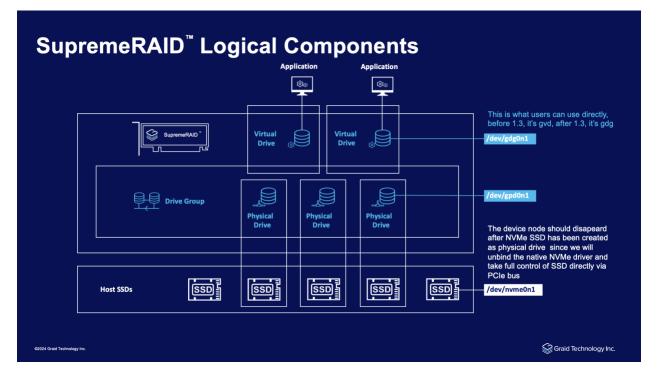
## SupremeRAID<sup>™</sup> Linux Specification

| SupremeRAID™ Linux Driver Specifications              |  |  |
|---|--|--|
| Supported models:                                     | SR-1000, SR-1010, SR-1001  |  |
| Supported RAID levels:                                | RAID 0, 1, 5, 6, 10  |  |
| Recommended minimum drive number for each RAID level: | RAID 0 : at least one drives<br>RAID 1 : at least two drives<br>RAID 5 : at least three drives<br>RAID 6 : at least four drives<br>RAID 10 : at least two drives |  |
| Maximum number of physical drives:                    | 32   |  |
| Maximum number of drive groups:                       | 8  |  |
| Maximum number of virtual drives per drive group:     | 1,023  |  |
| Maximum size of the drive group:                      | Defined by the physical drive sizes  |  |
| Configurable strip size (RAID0, RAID10)               | 4k, 8k, 16k, 32k, 64k,128k   |  |

### **RAID Components**

SupremeRAID<sup>™</sup> has three major RAID logical components:

- Physical Drive (PD)
- Drive Group (DG)
- Virtual Drive (VD)
- Controller (CX)



#### Physical Drive (PD)

Since NVMe drives are not directly attached to the SupremeRAID<sup>™</sup> controller, you must tell the controller which SSDs can be managed. After an SSD is created as a physical drive, the SupremeRAID<sup>™</sup> driver unbinds the SSD from the operating system, meaning the device node (/dev/nvmeX) disappears and is no longer accessible. At the same time, the SupremeRAID<sup>™</sup> driver creates a corresponding device node (/dev/gpdX). You can check the SSD information, such as SSD model or SMART logs, using this device node. To control and access the SSD using /dev/nvmeXn1, you must first delete the corresponding physical drive.

SupremeRAID<sup>™</sup> supports 32 physical drives, regardless of whether the physical drives are created from a native NVMe SSD, a drive connected through NVMe-oF, or a SAS/SATA disk.

### Drive Group (DG)

The main component of RAID logic is a RAID group. When the drive group is created, the SupremeRAID<sup>™</sup> driver initializes the physical drives with the corresponding RAID mode to ensure that the data and parity are synchronized.

There are two types of initialization processes.

- Fast Initialization: When all the physical drives in the drive group (DG) support the de-allocate dataset management command, the SupremeRAID<sup>™</sup> driver performs fast initialization by default, which optimizes the drive group state immediately.
- Background Initialization: Performance is slightly affected by the initialization traffic, but you can still create the virtual drive and access the virtual drive during a background initialization.

SupremeRAID<sup>™</sup> supports eight drive groups, with a maximum of 32 physical drives in one drive group.

#### Virtual Drive (VD)

The virtual drive is equivalent to the RAID volume. You can create multiple virtual drives in the same drive group for multiple applications. The corresponding device node (/dev/gdgXnY) appears on the operating system when you create a virtual drive, and you can make the file system or running application directly on this device node. Currently, the SupremeRAID<sup>™</sup> driver supports a maximum of 1023 virtual drives in each drive group.

#### Controller (CX)

The controller is the core component of the RAID system. It provides detailed hardware information such as GPU serial number, temperature, and fan speed. RAID management relies on the controller, so the controller's state directly affects the underlying drive group operations.

In the Linux driver, users can have dual controllers in the system and manage them separately. By enabling the high-availability function in a drive group, the backup controller will take over drive group management if the primary controller fails or goes missing. Additionally, you can set up drive groups on a specified controller or within the same NUMA node as the controller to minimize negative influences.

Note: If you upgrade from version 1.2.x to version 1.6.x of the SupremeRAID<sup>™</sup> driver, the device path changes from /dev/gvdXn1 to /dev/gdgXnY.

## **Features Overview**

The SupremeRAID<sup>™</sup> presents a range of features that facilitate convenient data storage methods and incorporate diverse protection mechanisms to ensure data integrity. The following will outline key features that contribute to achieving our objectives and fostering a foundational understanding of our services.

#### Ensuring Data Integrity with Consistency Checks

The SupremeRAID<sup>™</sup> is designed to provide high reliability and data integrity levels. A key feature that enables this is the consistency check function.

The consistency check function allows administrators to ensure that the data stored on the SupremeRAID<sup>™</sup> system is intact and uncorrupted. These checks can be performed on a regular schedule or manually initiated as needed. While running the consistency check, the system compares the data on each disk to identify any discrepancies or errors.

Depending on the settings chosen by the administrator, the consistency check function can either automatically fix any errors that are found or stop the check and alert the administrator to any detected errors. This feature provides administrators with flexibility and control over how the system responds to errors.

For detailed information about the commands for managing the consistency check task, please refer to: <u>Using Consistency Checks to Ensure Data Integrity</u>.

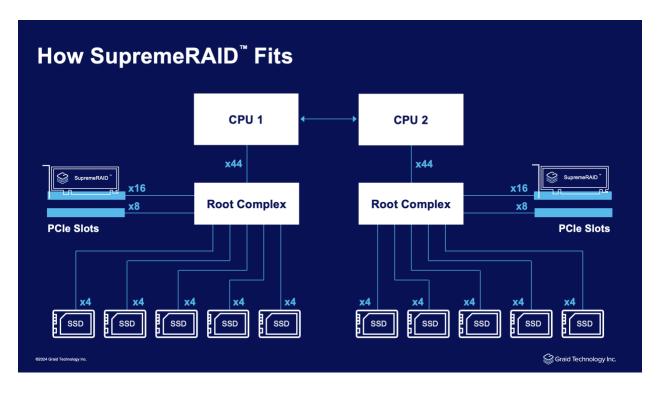
Note: The consistency check function is not supported on SupremeRAID<sup>™</sup> systems configured in RAID0 mode because RAID0 does not provide data redundancy and does not require data consistency checks.

#### Dual-Controller Architecture for Auto-Failover and High-Availability

This feature enables the SupremeRAID<sup>™</sup> system to automatically fail over to another SupremeRAID<sup>™</sup> card when one SupremeRAID<sup>™</sup> card experiences an issue without any interruption in service. This increased reliability and availability ensures that the system remains operational even in the event of a single card failure.

SupremeRAID<sup>™</sup> supports dual-controller configurations in two modes: dual-active and active-passive. This enhances our RAID solution with comprehensive protection and security. Additionally, the high availability (HA) functionality remains unaffected by the root complex. Whether within the same root complex or across different root complexes, we have implemented failover mechanisms to ensure high availability.

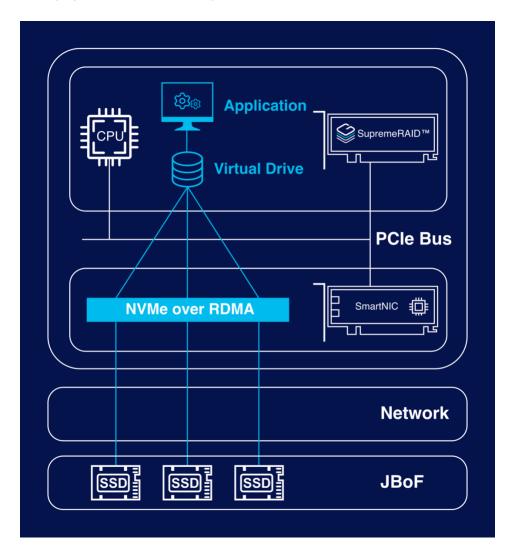
For detailed information about the commands for setup dual-controller, please refer to: <u>Setting Up the</u> <u>Dual-Controller to Enable HA and Auto-Failover</u>.



#### Setting Up the NVMe-oF Initiator Server and Managing Your RAID Components

The SupremeRAID<sup>™</sup> allows you to easily manage a remote target server or storage pool that uses NVMeover-Fabrics (NVMe- oF) technology. Both TCP and RDMA connections are supported, providing flexibility and compatibility with a wide range of systems. With the SupremeRAID<sup>™</sup>, you can create a virtual volume with RAID capabilities without the need for reconfiguration or re-cabling on the host server. This allows you to take advantage of the benefits of NVMe-oF, including increased capacity and improved data protection.

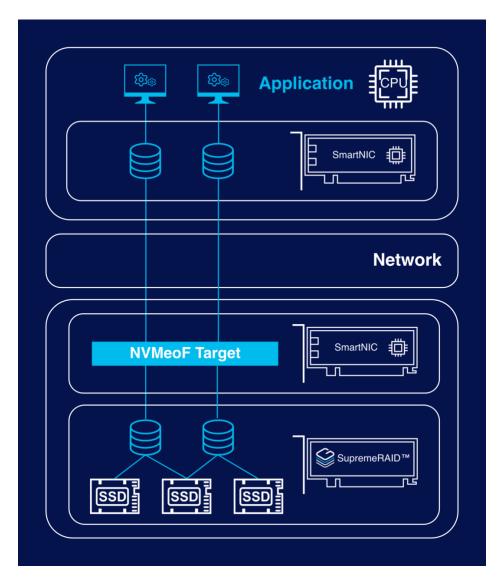
For detailed information about the commands for managing the NVMe-oF initiator, please refer to: <u>Managing Remote NVMe-oF Targets</u>.



# Sharing the SupremeRAID<sup>™</sup> Volume as a NVMe-oF Target Server

The SupremeRAID<sup>™</sup> allows you to easily compose local NVMe devices into a RAID array and share that array as an NVMe- over-Fabrics (NVMe-oF) target server. By using a SmartNIC to accelerate data transfer, you can achieve low latencies and high performance for your remote NVMe-oF clients.

For detailed information about the commands for managing the NVMe-oF target, please refer to: <u>Managing NVMe-oF Export Target</u>.



#### SPDK BDEV Feature of SupremeRAID™

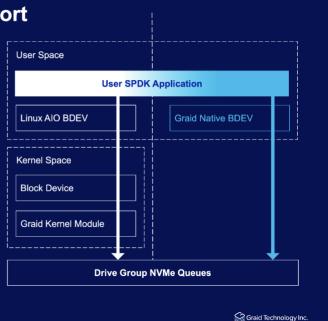
The SupremeRAID<sup>™</sup> software incorporates SPDK (Storage Performance Development Kit) feature, enabling direct access to operate the NVMe queue from user space through the SupremeRAID<sup>™</sup> native BDEV (Block Device) interface. This integration offers significant benefits that enhance the overall performance and efficiency of the system.

The SPDK feature facilitates direct user application access to NVMe queues from user space. This minimizes data access and processing latency, resulting in enhanced system responsiveness through reduced overhead and fewer context switches. Moreover, this direct access eliminates the necessity for data transfers between user space and kernel space, thereby decreasing CPU utilization caused by kernel module activity. This optimization enables the CPU to prioritize crucial tasks, leading to improved overall system performance.

The SPDK feature in SupremeRAID<sup>™</sup> contributes to an optimized storage solution, particularly in highperformance scenarios, where latency reduction and improved CPU utilization are crucial factors. By harnessing the power of SPDK, Graid ensures that users can maximize the potential of their NVMe devices while experiencing enhanced data processing capabilities with minimal overhead.

#### **SPDK BDEV Interface Support**

- The user application has direct access to operate the NVMe queue from user space via Graid native BDEV interface. This:
  - Reduces latency
  - Decreases CPU utilization consumed by the kernel module



#### Double Failure Protection with Distributed Journaling

SupremeRAID<sup>™</sup> incorporates a distributed journaling mechanism specifically designed to safeguard data during abnormal shutdowns in double-failure scenarios. This system ensures data integrity by logging data in a dedicated journaling space before writing it to the storage area, any incomplete I/O operations are replayed upon service restart to maintain data consistency.

This journaling feature is automatically enabled in degraded mode to uphold data integrity. Additionally, users still have the flexibility to bypass journaling space reservation when creating a drive group.

For detailed information about the commands for modifying the journal mode for RAID5 and RAID6 drive group, please refer to: <u>Modifying Journal Mode on a RAID5 Drive Group</u>.

#### SupremeRAID<sup>™</sup> Graphical Management Console

To enhance the SupremeRAID<sup>™</sup> management tool, we offer an intuitive graphical console. Users can effortlessly navigate through the console using the navigation bar, which includes sections for Dashboard, Hosts, RAID Management, Events, and Statistics to display system workloads. Additionally, administrators have access to Licenses, User Management, and Email Notification sections.

The system offers a comprehensive suite of features designed to enhance user experience and system management. The Dashboard and Statistics page provides an overview of system efficiency and health status, allowing users to monitor RAID utility performance and resource utilization. For hands-on management, the Host and RAID Management interface facilitates the conversion of storage devices into RAID resources.

Advanced features cater to administrator needs: the License Management function tracks SupremeRAID<sup>™</sup> license status, while User Management allows for the creation and modification of user accounts with varying permission levels. To ensure timely alerts, administrators can configure SMTP settings in the Email Notification page and enable mail functions for specific users, thereby maintaining a robust notification system for critical events.

For detailed information about the commands for the enabling UI Management console, please refer to: <u>Setup Graphical Management Console</u>.

## Support for the Dataset Management (DSM) deallocate command on virtual drives

With the release of Linux driver 1.6.1, the SupremeRAID<sup>™</sup> driver introduces support for the NVMe DSM deallocate (trim) command on virtual drives, improving the efficiency of unused storage space management on NVMe SSDs. This feature allows filesystems or applications to issue deallocate commands on virtual drives, which are then translated by the driver and sent directly to the SSDs. By enabling the drives to manage deallocated blocks internally, this reduces write amplification, optimizes storage efficiency, and enhances overall performance.

When a discard command is issued to a virtual drive, it triggers a corresponding deallocate command to the underlying NVMe SSDs. The system supports a minimum discard range of 4KB, aligned with the logical block addressing (LBA) size, and can handle a maximum deallocate range of approximately 400 GiB per command. For larger discard operations, the filesystem and block layer handle the process seamlessly.

This feature is automatically enabled on NVMe SSDs that support the deallocate command and guarantee that deallocated blocks return zeros. For SSDs without this guarantee, the system defaults to a "write zeros" command to ensure data consistency. This flexible approach ensures broad compatibility across different SSDs while optimizing their individual capabilities.

To ensure the filesystem can take advantage of this capability and issue discard commands when files are deleted, it must be mounted with the **discard** option.

## INSTALLATION

This section describes how to install the SupremeRAID<sup>™</sup> hardware and software package for Linux operating systems.

## Prerequisites

Before proceeding with the installation, make sure the system meets the following requirements:

- Minimum system requirements
  - CPU: 2 GHz or faster with at least 8 cores
  - RAM: 16 GB
  - Supported operating system: see <u>Drivers & Documentation</u> section on our website.
  - An available PCIe Gen3 or Gen4 x16 slot
- The SupremeRAID<sup>™</sup> card must be installed into a PCIe x16 slot.
- The SupremeRAID<sup>™</sup> software package, which includes the Pre-Installer and Installer, can be downloaded directly from the Graid Technology website. The Pre-Installer configures all necessary dependencies and environment settings automatically prior to installing the SupremeRAID<sup>™</sup> driver. The Installer contains the SupremeRAID<sup>™</sup> driver package and will automatically detect your Linux distributions and install the appropriate files.
- Make sure a SupremeRAID<sup>™</sup>-compatible SSD drive is being used. For a list of compatible drives, see the <u>Drivers & Documentation</u> section on our website.
- [OPTIONAL] The IOMMU function (AMD) or VT-d function (Intel) is recommend disabled in the system BIOS, typically found on the BIOS Advanced page.
- [OPTIONAL] It is highly recommended to disable the UEFI Secure Boot function on the BIOS security page, If UEFI Secure Boot is not applicable in your system, you will need to sign the NVIDIA Kernel Module. For further information and troubleshooting, please refer to the Nvidia website.

Note: To use virtualization services such as ESXi, you must enable the IOMMU (AMD) or VT-d (Intel) function. For more information, see <u>ESXi Virtual Machine Support Using GPU Passthrough</u>.

## Installing the Hardware

#### **ESD** Warning

Electronic components and circuits are sensitive to Electrostatic Discharge (ESD). When handling any circuit board assemblies including Connect Tech carrier assemblies, it is recommended that ESD safety precautions be observed. ESD safe best practices include, but are not limited to:

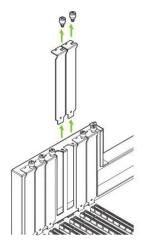
- Leaving circuit boards in their antistatic packaging until they are ready to be installed.
- Using a grounded wrist strap when handling circuit boards, at a minimum you should touch a grounded metal object to dissipate any static charge that may be present on you.
- Only handling circuit boards in ESD safe areas, which may include ESD floor and table mats, wrist strap stations and ESD safe lab coats.
- Avoiding handling circuit boards in carpeted areas.
- Try to handle the board by the edges, avoiding contact with components.

#### Installation Procedure

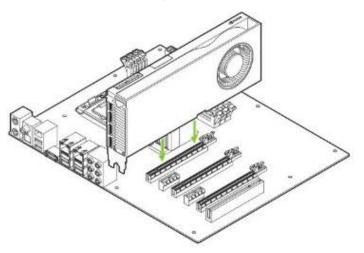
Perform the following procedure to install SupremeRAID<sup>™</sup> into your system.

- Step 1 Power down your system.
- Step 2 Unplug the power cord from the AC power source.
- Step 3 Remove the side panel from your system to gain access to the motherboard.

Step 4 If your system has a PCIe card, remove it. If a retention bar is holding the card in place, remove the screw securing the card. If there is no existing PCIe card, remove the access covers from the primary x16 PCI express slot.



- Note: The SupremeRAID<sup>™</sup> SR-1010 is dual-slot card and requires you to remove two adjacent slot covers. The SupremeRAID<sup>™</sup> SR-1000 and SR-1001 are single slot cards and require only a single-slot.
- Step 5 Install the card into the primary x16 PCI Express slot. Press gently on the card until it is seated securely in the slot and reattach the SupremeRAID<sup>™</sup> card bracket retention mechanism.



- Note: Install the SupremeRAID<sup>™</sup> card into the primary x16 PCI Express slot. The SupremeRAID<sup>™</sup> SR-1010 is dual-slot card and covers the adjacent slot. The SupremeRAID<sup>™</sup> SR-1000 and SupremeRAID<sup>™</sup> SR-1001 are single-slot cards. For more information, see <u>NVIDIA RTX Ampere</u> <u>Architecture-Based Graphics Card User Guide</u>.
- Step 6 Secure the card to the system frame using the screw(s) you removed in step 4.
- Step 7 Install the side panel you removed in step 3.

## Installing the Software Driver

The recommended and quickest way to install the SupremeRAID<sup>™</sup> software by using the pre-installer scripts and installer (described below).

However, if you prefer to install the software manually or your environment lacks Internet access, follow the manual installation procedure to configure the environment settings and install the SupremeRAID<sup>™</sup> driver manually. If you have already installed the software and only wish to upgrade it, please refer to the instructions for the upgrade configuration.

#### Using the Pre-installer and Installer

The SupremeRAID<sup>™</sup> pre-installer is an executable file that contains the required dependencies and a setup script that installs the NVIDIA driver. The script makes it easy to prepare the environment and install the SupremeRAID<sup>™</sup> driver in every supported Linux distribution. Use the following steps to prepare the environment and install the SupremeRAID<sup>™</sup> driver using the pre-installer in supported Linux distributions.

Note: To run the pre-installer, the system must have internet access to download the required dependencies from the official mirror.

Step 1 Go to the Graid Technology website to download the latest version of the pre-installer and make it executable, please download the package in Drivers & Documentation.

\$ sudo chmod +x [Filename]

| iver Packages | 5             |  |
|---------------|---------------|--|
| Product Model | GPU           | x86_64   |
|               |               | grad er installer 1.3.3-000 700-128.nev.2  |
| SR-1000       | NVIDIA T1000  | (MDL 11-albertel) (36-5a/s (1000-a)(6-64))   |
|               |               | grant or metallor 13.0-000.700-128.norc2   |
| SR-1001       | NVIDIA T400   | (MSL1) where the second s |
| SR-1010       | NVIDIA A2000  | grant as installer 1.5.5 (20) 705-128 (un1)  |
| 5K-1010       | INVIDIA A2000 | INTO CONTRACTOR DATASET  |

Step 2 Execute the pre-installer and follow the instructions to complete the pre-installation process, as shown in the following figure.

\$ sudo ./[filename]

| root@graid-demo:/home/graid/driver# ./g  | raid-sr-pre-installer-          | 1 5 0-98-x86 64 run     |          |
|--|---------------------------------|-------------------------|----------|
| Reading package lists Done   |                                 |                         |          |
| Building dependency tree   |                                 |                         |          |
| Reading state information Done   |                                 |                         |          |
| gawk is already the newest version (1:5  | .0.1+dfsg-1ubuntu0.1).          |                         |          |
| mokutil is already the newest version (  | 0.6.0-2~20.04.2).               |                         |          |
| pciutils is already the newest version   | (1:3.6.4-1ubuntu0.20.0          | 4.1).                   |          |
| tar is already the newest version (1.30  |                                 |                         |          |
| 0 upgraded, 0 newly installed, 0 to rem  |                                 |                         |          |
| Extracting installer files, please wait  | a few seconds                   |                         |          |
| DKMS: install completed.   |                                 |                         |          |
| Setting kernel options   |                                 |                         |          |
| Sourcing file `/etc/default/grub'  | lest of al                      |                         |          |
| Sourcing file `/etc/default/grub.d/init-se<br>Generating grub configuration file                                   | Lect.crg                        |                         |          |
| Found linux image: /boot/vmlinuz-5.4.0-163   | -deperic                        |                         |          |
| Found initrd image: /boot/initrd.img-5.4.0   |                                 |                         |          |
| Adding boot menu entry for UEFI Firmware S   |                                 |                         |          |
| done   |                                 |                         |          |
| Setting kernel options done.   |                                 |                         |          |
| Generating new initramfs   |                                 |                         |          |
| update-initramfs: Generating /boot/initrd.   | img-5.4.0-163-generic           |                         |          |
| Generated new initramfs.   |                                 |                         |          |
| Install packages and kernel setting succee   | ded.                            |                         |          |
|  |                                 |                         |          |
| Prepare install NVIDIA driver  |                                 |                         |          |
| Checking Xorg  |                                 |                         |          |
| Checking nouveau<br>Nouveau module has been loaded, graid-prei   | netellen will veleed ve         | HARL FOR MUTDIA desires | install. |
| Unload nouveau module successfully.  | nstaller will unload no         | wedu for widia driver   | Instart  |
| Running install NVIDIA Driver. (This step  | will take a while.)             |                         |          |
| Wed Feb 21 11:27:41 2024   |                                 |                         |          |
| +<br>  NVIDIA-SMI 535.154.05 Driver  | Version: 535.154.05             |                         | +<br>    |
| <br>  GPU Name Persistence-M   |                                 |                         |          |
|  | Bus-Id Disp.A<br>  Memory-Usage |                         |          |
|  |                                 | MIG M.                  |          |
| ·<br>  |                                 |                         |          |
|  | 00000000:01:00.0 Off            |                         |          |
|  | 0MiB / 5754MiB                  |                         |          |
| 1  |                                 | N/A                     |          |
| +  | +                               |                         | +        |
| 1  |                                 |                         |          |
| +   Processes:   |                                 |                         | +<br>I I |
| GPU GI CI PID Type Proce   | ss name                         | GPU Memory              | '<br>I   |
| I ID ID  |                                 | Usage                   |          |
|  |                                 |                         |          |
| <pre>No running processes found +</pre>  |                                 |                         | <br>+    |
|  |                                 |                         |          |
| Install NVIDIA Driver succeeded.   |                                 |                         |          |
|  | atom for an 1                   |                         |          |
| Install NVIDIA Driver succeeded.<br>This graid-preinstaller will reboot the sy<br>Do you want to continue? [Y/n] ∏ | stem for apply previous         | setting!                |          |

Step 3 After running the pre-installation script, type **Y** and press Enter when prompted to reboot the system.



Step 4Go to the Graid Technology website, download the latest version of the installer in Drivers &<br/>Documentation and make it executable.

| S sudo chmod +x [filename]         Driver Packages         Product Model       GPU       x86_64         SR-1000       NVIDIA T1000 | Driver Packages<br>Product Model GPU x86_64      |                |              |  |
|--|--|----------------|--------------|--|
| Product Model GPU x86_64<br>SR-1000 NVIDIA T1000   | Product Model GPU x86_64<br>SR-1000 NVIDIA T1000 | S sudo         | chmod        | 1 +x [filename]                              |
| Product Model GPU x86_64<br>SR-1000 NV/DIA T1000   | Product Model GPU x86_64<br>SR-1000 NVIDIA T1000 |                |              |  |
| SR-1000 NVIDIA T1000   | SR-1000 NVIDIA T1000                             | Driver Package | 5            |  |
| patter invester resolution (10.000 vite)   | patter invester resolution (10.000 vite)         | Product Model  | GPU          | x86_64                                       |
| patter invester resolution (10.000 vite)   | patter invester resolution (10.000 vite)         |                |              | grant-enimataber 13.5-300-708-128 nanci      |
| SR-1001 NV/DIA T400  | SR-1001 NV/DIA T400                              | SR-1000        | NVIDIA T1000 | (MDI: 11-abiantiti110-clade (03334a200454)   |
|  |  | SR-1001        | NVIDIA T400  | grant or metallier 1.3.3-305 705 128 service |
| SR-1010 NVIDIA A2000   |  |                |              | INDE ENVIRONMENT TRADATE CONTRACTORY OF      |

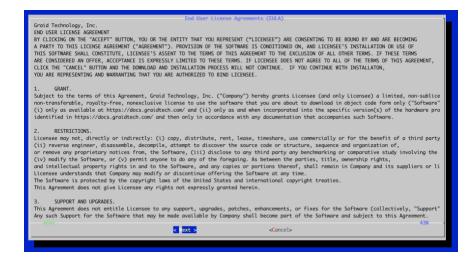
Step 5 Execute the installer and follow the provided steps to complete the installation.

\$ sudo ./[filename]

A At the Welcome page, select Next and press **Enter** to view the end-user license agreement.

| Welcome to the SupremeRAID <sup>™</sup> Driver Installerr   |
|---|
|   |
| Welcome to the SupremeRAID <sup>®</sup> Driver Installer  |
| Copyright © 2021-2023 Graid Technology Inc. All Rights Reserved. SupremeRAID <sup>™</sup> is trademarked by Graid Technology Inc.<br>and/or its affiliates in the United States, certain other countries, and/or the EU. The term (GraidTech refers to Graid Technology Inc.<br>and/or its subsidiaries: For more information, places visit www.graidTech.com, Graid Technology Inc. reserves the right to make changes<br>without further notice to any products or data described herein. Information provided by Graid Technology Inc. is believed to be accurate. |
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| Publication: Aug 1, 2023  |
|   |
|   |
|   |
|   |
|   |
|   |
|   |
| < ext > «Cancel»  |
|   |

B In the end-user license agreement page, use the spacebar to scroll down the content. After you review the license, select **Next** and press Enter.



C Type Accept, click tab, select Next, and press Enter to accept the license agreement.



D Confirm the installation package, and then select Next to continue with the installation.



E Complete the installation, and the installer will reboot the system.



Step 6 To activate the software, apply the SupremeRAID<sup>™</sup> license key.

\$ sudo graidctl apply license [LICENSE\_KEY]

#### Using Installer for Silent Installation

This section is designed for users who require mass deployment and may be designing scripts for installation. However, we strongly recommend using the GUI installation process for the best user experience and comprehensive configuration options.

Step 1 Please follow the steps from the previous section to download the pre-installer and installer, make them executable, and use the pre-installer to install the dependencies required by the SupremeRAID<sup>™</sup> service.

\$ sudo chmod +x [filename]

Step 2 To install pre-installer without interactive mode, add "--yes" while executing the pre-installer.

\$ sudo ./[filename] --yes

Step 3 To install the driver directly with the ULAs license acceptance, simply add the command '-- accept-license' in the end when executing the installer.

\$ sudo ./[filename] --accept-license

| root@graid-demo:~/driver# sudo ./graid-sr-installer-1.5.0-001-659-82-x86_64.runaccept-license<br>Extracting installer files, please wait a few seconds   |
|--|
| Extracting installer files done.   |
| Starting installer<br>systemctl stop graid<br>Creating symlink /var/lib/dkms/grebar/0.1.0/source -> /usr/src/grebar-0.1.0  |
| Kernel preparation unnecessary for this kernel. Skipping   |
| Building module:<br>cleaning build area<br>make -j32 KERNELRELEASE=5.15.0-83-generic<br>Signing module:<br>- /var/lib/dkms/grebar/0.1.0/5.15.0-83-generic/x86_64/module/grebar.ko<br>Secure Boot not enabled on this system.<br>cleaning build area  |
| grebar.ko:<br>Running module version sanity check.<br>- Original module<br>- No original module exists within this kernel<br>- Installation<br>- Installing to /lib/modules/5.15.0-83-generic/updates/dkms/  |
| <pre>depmod Selecting previously unselected package graid-sr. (Reading database 83819 files and directories currently installed.) Preparing to unpack/graid-sr-1.5.0-659.g10e76f72.001.x86_64.deb No need to patch Unpacking graid-sr (1.5.0) Setting up graid-sr (1.5.0) Creating symlink /var/lib/dkms/graid/1.5.0/source -&gt; /usr/src/graid-1.5.0</pre> |
| Kernel preparation unnecessary for this kernel. Skipping   |
| Building module:<br>cleaning build area<br>./build.sh 5.15.0-83-generic /lib/modules/5.15.0-83-generic/build<br>Signing module:<br>- /var/lib/dkms/graid/1.5.0/5.15.0-83-generic/x86_64/module/graid-nvidia.ko<br>- /var/lib/dkms/graid/1.5.0/5.15.0-83-generic/x86_64/module/graid.ko<br>Secure Boot not enabled on this system.<br>cleaning build area     |
| graid.ko:<br>Running module version sanity check.<br>- Original module<br>- No original module exists within this kernel<br>- Installation<br>- Installing to /lib/modules/5.15.0-83-generic/updates/dkms/   |
| graid-nvidia.ko:<br>Running module version sanity check.<br>- No original module exists within this kernel<br>- Installation<br>- Installing to /lib/modules/5.15.0-83-generic/updates/dkms/   |
| depmod<br>Processing triggers for man-db (2.10.2-1)<br>Suggestion!! This installer will reboot the system for apply previous kernel module grebar setting!<br>Do you want to continue? [Y/n]   |

Step 4 To activate the software, apply the SupremeRAID<sup>™</sup> license key.

```
$ sudo graidctl apply license [LICENSE_KEY]
```

#### Manual Installation

The following procedure describes how to manually install the SupremeRAID<sup>™</sup> software on various operating systems. The reference for packages and dependencies for each operating system is provided below.

- For CentOS, Rocky Linux, AlmaLinux, and RHEL operating systems.
- For <u>Ubuntu operating systems</u>.
- For openSUSE operating systems.
- For <u>SLES operating systems</u>,.
- Note: For systems without internet access, download required dependencies from official repositories. See the distribution section below for details. Only perform manual installation if necessary or if the pre-installer fails. For most cases, check Supported Operating Systems on our website and use the automated pre-installer script to install the SupremeRAID<sup>™</sup> software.

#### Dependency Table for Manual Installation

Here is the dependency tree for manual installation and the comparison table for each operating system.

| RHEL     | CentOS/Rocky/<br>Almalinux/Oracle | SLES     | Debian/Ubuntu |
|----------|-----------------------------------|----------|---------------|
| automake | automake                          | automake | automake      |
| dialog   | dialog                            | dialog   | dialog        |
| dkms     | dkms                              | dkms     | dkms          |
| gcc      | gcc                               | gcc      | gcc           |
| ipmitool | ipmitool                          | ipmitool | ipmitool      |
| make     | make                              | make     | make          |
| mdadm    | mdadm                             | mdadm    | mdadm         |

| mokutil                               | mokutil                               | mokutil   | mokutil                              |
|---------------------------------------|---------------------------------------|---|--------------------------------------|
| pciutils                              | pciutils                              | pciutils  | pciutils                             |
| tar                                   | tar                                   | tar   | tar                                  |
| vim                                   | vim                                   | vim   | vim                                  |
| wget                                  | wget                                  | wget  | wget                                 |
| sg3_utils                             | sg3_utils                             | libsgutils-devel  | libsgutils2-2                        |
|                                       |                                       | libpci3   | libpci3                              |
|                                       |                                       | libpci3   | libpci3                              |
| sqlite-libs                           | sqlite-libs                           | sqlite3   | sqlite3                              |
|                                       |                                       | libudev-devel   |                                      |
|                                       |                                       |   | initramfs-tools                      |
|                                       |                                       |   | gawk                                 |
| gcc-c++-\$(VERSION_ID)                | gcc-c++                               | g++   | g++                                  |
| gcc-\$(VERSION_ID)                    |                                       |   |                                      |
| kernel-devel-<br>\$(kernel_version)   | kernel-devel-<br>\$(kernel_version)   |   |                                      |
| kernel-headers-<br>\$(kernel_version) | kernel-headers-<br>\$(kernel_version) | -C kernel-default-<br>devel=\$(kernel_version_sus<br>e) | linux-headers-<br>\$(kernel_version) |

Note: To determine the kernel version for RHEL, you can use the command **uname -r**. For SUSE, extract the kernel version using **uname -r | awk -F"-default" '{print \$1}'.** Additionally, please using **awk -F'=' '/VERSION\_ID/{ gsub(/"/,""); print \$2}' /etc/os-release** to retrieve the version ID.

## Manual Installation on a CentOS, Rocky Linux, AlmaLinux, and RHEL Operating Systems

Graid Technology, Inc. recommends referring to <u>Supported Operating Systems</u> on our website and using the pre-installer to configure the environmental settings.

- Step 1 Install the package dependencies and build for Dynamic Kernel Module Support (DKMS) based on your operating system.
  - For CentOS, Rocky Linux, and AlmaLinux: issue the following commands.

\$ sudo yum install --enablerepo=extras epel-release

\$ sudo yum install vim wget make automake gcc gcc-c++ kernel-devel kernel-headers kernel dkms ipmitool tar mdadm sg3\_utils sqlite-libs automake dialog

• For RHEL8, issue the following commands:

\$ sudo yum install https://dl.fedoraproject.org/pub/epel/epelrelease-latest-8.noarch.rpm

\$ sudo yum install vim wget make automake kernel-devel-\$(uname -r)
kernel-headers-\$(uname -r) dkms gcc gcc-c++ ipmitool tar mdadm
sg3 utils sqlite-libs automake dialog

• For RHEL7.9: issue the following commands.

\$ sudo yum install https://dl.fedoraproject.org/pub/epel/epelrelease-latest-7.noarch.rpm

```
$ sudo yum install gcc-$(awk -F'=' '/VERSION_ID/{ gsub(/"/,"");
print $2}' /etc/os-release) gcc-c++-$(awk -F'=' '/VERSION_ID/{
gsub(/"/,""); print $2}' /etc/os-release)
```

```
$ sudo yum install vim wget make automake kernel-devel-$(uname -r)
kernel-headers-$(uname -r) dkms ipmitool tar mdadm sg3_utils sqlite-
libs automake dialog
```

Step 2 Add the kernel option. This step prevents the Nouveau driver from loading during installation and disables IOMMU in the system BIOS.

\$ sudo vim /etc/default/grub



Step 5

- Step 3 Append the command line parameters and then update the grub configuration based on your operating system.
  - For RHEL8, append iommu=pt and 'nvme\_core.multipath=Y' to GRUB\_CMDLINE\_LINUX\_DEFAULT.
  - For RHEL7.9, append iommu=pt to 'GRUB\_CMDLINE\_LINUX\_DEFAULT'.

```
$ sudo grub2-mkconfig -o /boot/grub2/grub.cfg
```

Step 4 Append blacklist nouveau and options nouveau modeset=0 to the end of the /etc/modprobe.d/graid- blacklist.conf file to disable the Nouveau driver and update initramfs.

```
$ sudo update-initramfs -u
```

```
root@graid-demo:/etc/modprobe.d# cat graid-blacklist.conf
blacklist nouveau
options nouveau modeset=0
```

• For CentOS, Rocky Linux, and AlmaLinux: Find the latest version of the kernel and assign it to -kver.

```
$ sudo dracut -f --kver `rpm -qa | grep kernel-headers | awk -
F'kernel-headers-' {'print $2'}`
```

• For RHEL: issue the following command.

```
$ sudo dracut -f
```

- Step 6 Reboot the system and make sure the grub configuration was applied. You can check /proc/cmdline for the grub configuration in use. For example:
  - For RHEL8:

| [root@localhost ~]# cat /proc/cmdline<br>BOOT_IMAGE=(hd9,gpt2)/vmlinuz-4.18.0-553.5.1.el8_10.x86_64 root=/dev/mapper/rl-root ro crashkernel=auto<br>resume=/dev/mapper/rl-swap rd.lvm.lv=rl/root rd.lvm.lv=rl/swap rhgb quiet iommu=pt nvme_core.multipath=Y |  |
|--|--|
| For RHEL7:   |  |
|  |  |

| [root@localhost ~]# cat /proc/cmdline  |
|--|
| BOOT_IMAGE=(hd9,gpt2)/vmlinuz-4.18.0-553.5.1.el7_9.x86_64 root=/dev/mapper/rl-root ro crashkernel=auto         |
| resume=/dev/mapper/rl-swap rd.lvm.lv=rl/root rd.lvm.lv=rl/swap rhgb quiet rd.driver.blacklist=nouveau iommu=pt |

Step 7 Install the NVIDIA driver.

\$ wget https://us.download.nvidia.com/XFree86/Linuxx86 64/550.67/NVIDIA-Linux-x86 64-550.67.run

- \$ chmod +x ./NVIDIA-Linux-x86 64-550.67.run
- For CentOS: Use the latest version of kernel-headers to install the NVIDIA driver.

```
$ sudo ./NVIDIA-Linux-x86_64-550.67.run -s --no-systemd --no-opengl-
files --no-nvidia-modprobe --dkms -k `rpm -qa | grep kernel-headers
| awk -F'kernel-headers-' {'print $2'}`
```

• For RHEL:

```
$ sudo ./NVIDIA-Linux-x86_64-550.67.run -s --no-systemd --no-opengl-
files --no-nvidia-modprobe --dkms -k `rpm -qa | grep kernel-headers
| awk -F'kernel-headers-' {'print $2'}`
```

Step 8 The Nouveau driver is now disabled. Reboot and install the NVIDIA driver before proceeding with the installation.

\$ sudo reboot

Step 9 Use the **nvidia-smi** command to confirm that the NVIDIA GPU is working. The following figure shows an output example of a successful installation.

|        |           | 550.67<br> |     |         |        |           |                  |                     | CUDA Versio                | on: 12.4                            |
|--------|-----------|------------|-----|---------|--------|-----------|------------------|---------------------|----------------------------|-------------------------------------|
| GPU I  | Name      | Perf       | Pe  | ersiste | nce-M  | Bus-Id    | Memo             | Disp.A<br>ory-Usage | Volatile<br>  GPU-Util<br> | Uncorr. ECC<br>Compute M.<br>MIG M. |
|        | 75C       |            |     | N/A /   | 31W    | 1271      | 000:01:<br>MiB / | 00.0 Off<br>4096MiB | <br>  100%                 | N/A<br>E. Process<br>N/A            |
| Proces | <br>sses: |            |     |         |        |           |                  |                     | +                          |                                     |
| <br>0  | N/A       | N/A        | 720 | <br>С   | /usr/t | oin/graid | _core            |                     |                            | 1260MiB                             |

Step 10 From the Graid Technology website, download the latest version of the installer and make it executable.

\$ sudo chmod +x [filename]

Step 11 Proceed to Executing the Installer and Completing the Installation to execute the installer and to complete the installation.



#### Manual Installation on an Ubuntu Operating System

- Step 1 Graid Technology, Inc. recommends referring to <u>Supported Operating Systems</u> on our website and using the pre-installer to configure the environmental settings.
- Step 2 Install the package dependencies and build for DKMS.

```
$ sudo apt-get update
```

```
$ sudo apt-get install make automake gcc g++ linux-headers-$(uname -r)
dkms ipmitool initramfs-tools tar mdadm libsgutils2-2 libudev-dev
libpci3 sqlite automake dialog
```

Step 3 Disable Ubuntu daily upgrade.

```
$ sed -i '/Unattended-Upgrade "1"/ s/"1"/"0"/'
/etc/apt/apt.conf.d/20auto-upgrades
$ sed -i '/Update-Package-Lists "1"/ s/"1"/"0"/'
/etc/apt/apt.conf.d/20auto-upgrades
```

Step 4 Add the kernel option. This step prevents the Nouveau driver from loading during installation and disables IOMMU in the system BIOS.

\$ sudo vim /etc/default/grub

Step 5 Append **iommu=pt** and **nvme\_core.multipath=Y** to GRUB\_CMDLINE\_LINUX\_DEFAULT, and then update the grub configuration.

\$ sudo update-grub

Step 6 Append blacklist nouveau and options nouveau modeset=0 to the end of the /etc/modprobe.d/graid-blacklist.conf file to disable the Nouveau driver and update initramfs.

\$ sudo update-initramfs -u

```
root@graid-demo:/etc/modprobe.d# cat graid-blacklist.conf
blacklist nouveau
options nouveau modeset=0
```

Note: You might need to manually create the /etc/modprobe.d/graid-blacklist.conf file and append blacklist nouveau and options nouveau modeset=0.

Step 7 Reboot the system and make sure the grub configuration was applied. You can check **/proc/cmdline** for the grub configuration in use. For example:

root@graid-demo:/etc/modprobe.d# cat /proc/cmdline BOOT\_IMAGE=/boot/vmlinuz-5.15.0-46-generic root=UUID=32b02b62-7173-4f3b-a723-8aa1e2fbf60a ro text iommu=pt nvme\_core.multipath=Y

Step 8 Install the NVIDIA driver.

\$ wget https://us.download.nvidia.com/XFree86/Linuxx86\_64/550.67/NVIDIA-Linux-x86\_64-550.67.run \$ sudo chmod +x ./NVIDIA-Linux-x86\_64-550.67.run \$ sudo ./NVIDIA-Linux-x86\_64-550.67.run -s --no-systemd --no-openglfiles --no-nvidia-modprobe --dkms --disable-nouveau

Step 9 The Nouveau driver is now disabled. Reboot and install the NVIDIA driver before proceeding with the installation.

\$ sudo reboot

Step 10 Use the **nvidia-smi** command to confirm that the NVIDIA GPU is working. The following figure shows an output example of a successful installation.

| root@graid:~#<br>Ved Feb 21 02 |           |          |       |                                     |                            |                           |
|--------------------------------|-----------|----------|-------|-------------------------------------|----------------------------|---------------------------|
|                                |           |          |       | Version: 535.154.05                 |                            |                           |
| GPU Name<br>Fan Temp           |           | Persiste | nce-M | Bus-Id Disp.A<br>  Memory-Usage<br> | Volatile<br>  GPU-Util<br> | Uncorr. ECC               |
| 46% 46C                        | P0        | N/A /    | 31W   |                                     | I<br>I 0%<br>I             | N/A  <br>Default  <br>N/A |
| Processes:<br>GPU GI<br>ID     |           | PID Type |       | ss name                             |                            | GPU Memory I<br>Usage     |
| No running                     | processes |          |       |                                     |                            | <br> <br> <br> +          |

Step 11 Go to the Graid Technology website to download the latest version of the pre-installer and make it executable, please download the package in <u>Drivers & Documentation</u>.



Step 12 Proceed to Executing the Installer and Completing the Installation to execute the installer and to complete the installation.

#### Manual Installation on an openSUSE Operating System

Graid Technology, Inc. recommends referring to <u>Supported Operating Systems</u> on our website and using the pre-installer to configure the environmental settings.

- Step 1 Install openSUSE and select all online repositories.
- Step 2 Install the package dependencies and build for DKMS.

\$ sudo zypper addrepo -f https://download.opensuse.org/distribution/leap/15.3/repo/oss/ leap-15.3 \$ sudo zypper --gpg-auto-import-keys refresh \$ sudo zypper install sudo vim wget libpci3 dkms ipmitool tar mdadm libsgutils-devel libudev-devel sqlite3 automake dialog \$ sudo zypper install -C kernel-default-devel=\$(uname -r | awk -F"default" '{print \$1}')

Step 3 Add the kernel option. This step prevents the Nouveau driver from loading during installation and disables IOMMU in the system BIOS.

\$ sudo vim /etc/default/grub

Step 4 Append iommu=pt and 'nvme\_core.multipath=Y' to GRUB\_CMDLINE\_LINUX\_DEFAULT, and then update the grub configuration.

\$ sudo grub2-mkconfig -o /boot/grub2/grub.cfg

Step 5 Append 'blacklist nouveau' to the end of the /etc/modprobe.d/graid-blacklist.conf file to disable the Nouveau driver. You might need to manually create the /etc/modprobe.d/graid-blacklist.conf file and append blacklist nouveau and options nouveau modeset=0.

```
root@graid-demo:/etc/modprobe.d# cat graid-blacklist.conf
blacklist nouveau
options nouveau modeset=0
```

Step 6 Set the **allow\_unsupported\_modules** option to **1** in the /etc/modprobe.d/10-unsupported-modules.conf file and update initrd.

\$ sudo mkinitrd

Step 7 Reboot the system and make sure the grub configuration was applied. You can check **/proc/cmdline** for the grub configuration in use. For example:



Step 8 Install the NVIDIA driver.

```
$ wget https://us.download.nvidia.com/XFree86/Linux-
x86_64/550.67/NVIDIA-Linux-x86_64-550.67.run
$ sudo chmod +x ./NVIDIA-Linux-x86_64-550.67.run
$ sudo ./NVIDIA-Linux-x86_64-550.67.run -s --no-systemd --no-opengl-
files --no-nvidia-modprobe --dkms --disable-nouveau
```

Step 9 The Nouveau driver is now disabled. Reboot and install the NVIDIA driver before proceeding with the installation.

\$ sudo reboot

Step 10 Use the **nvidia-smi** command to confirm that the NVIDIA GPU is working. The following figure shows an output example of a successful installation.

| VIDI |             |    |                 | Version: 515.86.01                     |          |                     |
|------|-------------|----|-----------------|--|----------|---------------------|
|      | Name        |    | Persistence-MI  | Bus-Id Disp.A<br>Memory-Usage          | Volatile | Uncorr. ECC         |
|      |             | P2 | 24W / 70W  <br> | 00000000:22:00.0 Off<br>0MiB / 5754MiB | 2%       | N/A                 |
|      | sses:<br>GI |    | PID Typ         | e Process name                         |          | GPU Memory<br>Usaae |

Step 11 Go to the Graid Technology website to download the latest version of the pre-installer and make it executable, please download the package in <u>Drivers & Documentation</u>.

| \$ | sudo          | chmod        | +x               | [Filename]   |
|----|---------------|--------------|------------------|--|
| Dr | iver Packages |              |                  |  |
|    | Product Model | GPU          | x86_64           |  |
| 5  | 6R-1000       | NVIDIA T1000 | praid or install | er 1.5.2-000-700-528 nunct                                 |
| 5  | 6R-1001       | NVIDIA T400  | part or ment     | ar 13.0-000-700-128.nav11                                  |
| 5  | 6R-1010       | NVIDIA A2000 | paint or install | er 13.0-000 700-100 var.)<br>allot 18.0-000 100004-0004744 |

Step 12 Proceed to Executing the Installer and Completing the Installation to execute the installer and to complete the installation.

#### Manual Installation on a SLES Operating System

Graid Technology, Inc. recommends referring to <u>Supported Operating Systems</u> on our website and using the pre-installer to configure the environmental settings.

Step 1 Install SLES with the following extensions and modules:

- SUSE Package Hub 15 SP3 x86\_64
- Desktop Applications Module 15 SP3 x86\_64
- Development Tools Module 15 SP3 x86\_64
- Step 2 Install the package dependencies and build for DKMS.

```
$ sudo zypper addrepo -f
https://download.opensuse.org/distribution/leap/15.3/repo/oss/ leap-
15.3
$ sudo zypper --gpg-auto-import-keys refresh
$ sudo zypper install sudo vim wget libpci3 dkms ipmitool tar mdadm
libsgutils-devel libudev-devel sqlite3 automake dialog
$ sudo zypper install -C kernel-default-devel=$(uname -r | awk -F"-
default" `{print $1}')
```

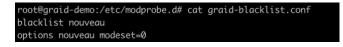
Step 3 Add the kernel option. This step prevents the Nouveau driver from loading during installation and disables IOMMU in the system BIOS.

\$ sudo vim /etc/default/grub

Step 4 Append iommu=pt and nvme\_core.multipath=Y to GRUB\_CMDLINE\_LINUX\_DEFAULT, and then update the grub configuration:

\$ sudo grub2-mkconfig -o /boot/grub2/grub.cfg

Step 5 Append blacklist nouveau to the end of the /etc/modprobe.d/graid-blacklist.conf file to disable the Nouveau driver. You might need to manually modify the configuration file.



Step 6 Set the **allow\_unsupported\_modules** option to 1 in the /etc/modprobe.d/10-unsupported-modules.conf file and update initrd.

\$ sudo mkinitrd

Step 7 Reboot the system and make sure the grub configuration was applied. You can check **/proc/cmdline** for the grub configuration in use. For example:

outgoraid:~ # cat /proc/cmdline
B00T\_TMAGE=/boot/vmlinuz-5.3.18-59.5-default root=UUID=7560fe42-0275-4618-b8a0-0785765610c9 modprobe.blacklist=nouveau iommu=pt splash=silent quiet
mitigations=auto nvme\_core.multipath=Y

Step 8 Install the NVIDIA driver.

```
$ wget https://us.download.nvidia.com/XFree86/Linux-
x86_64/550.67/NVIDIA-Linux-x86_64-550.67.run
$ sudo chmod +x ./NVIDIA-Linux-x86_64-550.67.run
$ sudo ./NVIDIA-Linux-x86_64-550.67.run -s --no-systemd --no-opengl-
files --no-nvidia-modprobe --dkms --disable-nouveau
$ sudo reboot
```

Step 9 The Nouveau driver is now disabled. Reboot and install the NVIDIA driver before proceeding with the installation.

\$ sudo reboot

Step 10 Use the **nvidia-smi** command to confirm that the NVIDIA GPU is working. The following figure shows an output example of a successful installation.

|                   |                 | 550.67          |        |                    |                   | Version:              |                 |                      | CUDA Versio                | on: 12.4                            |
|-------------------|-----------------|-----------------|--------|--------------------|-------------------|-----------------------|-----------------|----------------------|----------------------------|-------------------------------------|
| GPU I             | Name            | Perf            | P<br>P | ersiste<br>wr:Usag | nce-M<br>e/Cap    | Bus-Id                | Memo            | Disp.A<br>Dry-Usage  | Volatile<br>  GPU-Util<br> | Uncorr. ECC<br>Compute M.<br>MIG M. |
|                   |                 | T400 4GB<br>P0  |        | N/A /              | 0n<br>31W         | 00000<br>1271         | 000:01<br>MiB / | :00.0 Off<br>4096MiB | <br>  100%<br>             | N/A<br>E. Process<br>N/A            |
| <br>Proces<br>GPU |                 |                 |        |                    |                   |                       |                 |                      | <br>+                      |                                     |
|                   | GI<br>ID        | CI<br>ID        | PID    | Туре               | Proces            | s name                |                 |                      |                            | GPU Memory<br>Usage                 |
| =====<br>0        | ======<br>N / Δ | ========<br>N/A | 720    | <br>C              | =======<br>/usr/l | ========<br>oin/graid | core            |                      |                            | <br>1260MiB                         |



Step 11 Go to the Graid Technology website to download the latest version of the pre-installer and make it executable, please download the package in <u>Drivers & Documentation</u>.

| \$ | sudo          | chmod        | +X  | [Filename]                       |  |  |  |
|----|---------------|--------------|---|----------------------------------|--|--|--|
|    | iver Packages | GPU          | x86 64  |                                  |  |  |  |
|    | Product model | GPU          | x00_04  |                                  |  |  |  |
| s  | SR-1000       | NVIDIA T1000 | part or result                                    | e-1.3.3-006-706-128.ver.0        |  |  |  |
|    |               |              | (MDI: 11-allianeli211-28-charles-12222-4-28947-4) |                                  |  |  |  |
|    |               |              | past or trends                                    | ar 1.5.5-000-700-128.cum         |  |  |  |
| 5  | SR-1001       | NVIDIA T400  | (MCS 11-484)                                      | 4001 (McGala (000044/00404)      |  |  |  |
|    |               |              | print or mature                                   | No. 1, 5, 3-0005-7005-728, no. 1 |  |  |  |
| 5  | 5R-1010       | NVIDIA A2000 | (M23 11-80)                                       | 0001106-000101104-000104-0004    |  |  |  |
|    |               |              |   |                                  |  |  |  |

Step 12 Proceed to next part of <u>Executing the Installer and Completing the Installation</u> to execute the installer and to complete the installation.

### Executing the Installer and Completing the Installation

Step 1 Execute the installer and follow the provided steps to complete the installation.

```
$ sudo ./[filename]
```

Step 2 At the Welcome page select **Next** and click **Enter** to view the end-user license agreement.

| Welcome to the SupremeRAID® Driver Installerr  |  |  |  |  |
|--|--|--|--|--|
|  |  |  |  |  |
|  |  |  |  |  |
| Welcome to the SupremeRAID <sup>®</sup> Driver Installer   |  |  |  |  |
| Copyright © 2021-2023 Graid Technology Inc. All Rights Reserved. SupremeRAID™ is trademarked by Graid Technology Inc.<br>and/or its affiliates in the United States, certain other countries, and/or the EU. The term GraidTech refers to Graid Technology Inc.<br>and/or its subsidiaries. For more information, please visit www.graidtech.com. Graid Technology Inc. reserves the right to make changes<br>without further notice to any products or data described herein. Information provided by Graid Technology Inc. is believed to be accurate. |  |  |  |  |
| However, Graid Technology Inc. does not assume any liability arising from the use of any application or product described herein, neither does it convey any license under its patent rights nor the rights of others.   |  |  |  |  |
| Publication: Aug 1, 2023   |  |  |  |  |
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Step 3 In the end-user license agreement, use the spacebar to scroll through the content. When you complete your review, select **Next** and click **Enter** to proceed.

| End User License Agreements (EBLA)<br>End User License Agreements (EBLA)<br>END USER LICENSE AGREEMENT<br>BY CLICKING ON THE "ACCEPT" BUITON, YOU OR THE ENTITY THAT YOU REPRESENT ("LICENSEE") ARE CONSENTING TO BE BOUND BY AND ARE BECOMING<br>A PARTY TO THIS LICENSE AGREEMENT"), PROVISION OF THE SOFTWARE IS CONDITIONED ON, AND LICENSEE'S INSTALLATION OR USE OF<br>THIS SOFTWARE SHALL CONSTITUTE, LICENSEE'S ASSENT TO THE TERMS OF THE SOFTWARE IS CONDITIONED ON, AND LICENSEE'S INSTALLATION OR USE OF<br>ARE CONSIDERED AN OFFER, ACCEPTANCE IS EXPRESSLY LIDITED TO THESE TERMS. IF LICENSEE DOES NOT AGREE TO ALL OF THE TERMS OF THIS AGREEMENT,<br>CLICK THE "CANCEL" BUITON AND THE DOMINADA AND INSTALLATION PROCESS MULL NOT CONTINUE. IF YOU CONTINUE WITH INSTALLATON,<br>YOU ARE REPRESENTING AND WARRANTING THAT YOU ARE AUTHORIZED TO BIND LICENSEE.  |
|--|
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| 3. SUPPORT AND UPGRADES.<br>This Agreement does not entitle Licensee to any support, upgrades, patches, enhancements, or fixes for the Software (collectively, "Support"<br>Any such Support for the Software that may be made available by Company shall become part of the Software and subject to this Agreement.   |
| - (t) (ancel>  |

Step 4 Type accept, click tab, select Next, and click Enter to accept the license agreement.



Step 5 Complete the installation, and the installer will reboot the system.

| Confirm reboot for grebar   |
|---|
| Suggestion!! This installer will reboot the system for apply previous kernel module grebar setting! |
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Step 6 To activate the software, apply the SupremeRAID<sup>™</sup> license key.

\$ sudo graidctl apply license [LICENSE KEY]

# USING THE SUPREMERAID<sup>™</sup> DRIVER

This section describes how to use the basic functions of SupremeRAID<sup>™</sup>. It consists of step- by-step examples and command instructions that guide you to accessing all SupremeRAID<sup>™</sup> features.

- To activate the SupremeRAID<sup>™</sup> service, see <u>Activating the SupremeRAID<sup>™</sup> Driver and Managing the</u> <u>License(s)</u>.
- To set up a local volume (Virtual Drive), see <u>Creating a RAID5 Virtual Drive with Five NVMe SSDs</u>.
- To create drive group without journaling space, see <u>Creating a RAID6 Drive Group without Journaling</u> <u>Space</u>.
- To edit journal mode of a drive group, see <u>Modifying Journal Mode on a RAID5 Drive Group</u>.
- To set up an Initiator server, see <u>Creating a Physical Drive from the Remote NVMe-oF Targets</u>.
- To replace the physical drive, see <u>Replace the Nearly Worn-out or Broken SSD</u>.
- To set up a Target server, see <u>Exporting the Virtual Drive as an NVMe-oF Target Drive Using RDMA to</u> <u>the Initiator</u>.
- To set up the high availability (HA) feature in one server, see <u>Setting Up the Dual-Controller to Enable</u> <u>HA and Auto-Failover</u>.

# Activating the SupremeRAID<sup>™</sup> Driver and Managing the License(s)

When you install the SupremeRAID<sup>™</sup> driver, you must activate the SupremeRAID<sup>™</sup> service by applying a specific license key prior to use the SupremeRAID<sup>™</sup> service, and the license key you could get from your vendor. Once this is done, you can perform activities such as creating drive groups and virtual drives to use the SupremeRAID<sup>™</sup>.

• To check the SupremeRAID™ driver version, issue:

\$ sudo graidctl version

• To activate the SupremeRAID<sup>™</sup> software, issue:

```
$ sudo graidctl apply license [LICENSE_KEY]
```

• To check the license information, issue:

```
$ sudo graidctl describe license
```

• To check the controller status, issue:

```
$ sudo graidctl list controller
```

• To replace a new controller with the same model of the controller when the old controller is failure or missing, issue:

```
$ sudo graidctl disable controller [Controller ID]
```

- \$ sudo graidctl replace controller [Controller\_ID] [LICENSE\_KEY]
- To delete the old controller that failed, missing, or disabled, issue:

```
$ sudo graidctl delete controller [Controller_ID]
```



#### Output example:

|        |                      |                                | licens      | e XXXXXXXX | x-xxxxxxxx-xxxxxxx-xxxxxxx |
|--------|----------------------|--------------------------------|-------------|------------|----------------------------|
|        | y license successfu  |                                |             |            |                            |
|        | d@graid demo~]\$ sud |                                | ibe lic     | ense       |                            |
|        | ribe license succes  |                                |             |            |                            |
|        | se State: APPL       | IED                            |             |            |                            |
| Contro | oller 0:             |                                |             |            |                            |
|        |                      | : SR-1000                      |             |            |                            |
|        |                      | al Number: 1xxxx               |             | 0          |                            |
|        |                      | nse State: APPLI               |             |            |                            |
|        |                      | nse Key: XXXXXXX               | x-xxxxx     | XXX-XXXXX  | XXX-XXXXXXXX               |
|        |                      | nse Type: Full                 |             |            |                            |
|        |                      | ration Days: Unl               |             | 20         |                            |
|        |                      | / NVMe-oF PD Nur               | nber: 3     | 2          |                            |
| Contro | oller 1:             |                                |             |            |                            |
|        |                      | : SR-1000                      |             |            |                            |
|        |                      | al Number: 1xxxx               |             | 1          |                            |
|        |                      | nse State: APPLI               |             |            |                            |
|        |                      | nse Key: XXXXXXX               | K-XXXXX     | XXX-XXXXX  | XXX-XXXXXXXX               |
|        |                      | nse Type: Full                 |             |            |                            |
|        |                      | ration Days: Unl               |             |            |                            |
|        |                      | / NVMe-oF PD Nur               | nber: 3     | 2          |                            |
| Featur |                      |                                |             |            |                            |
|        |                      | / NVMe-oF PD Nur               | nber: 3     | 2          |                            |
|        |                      | 5: true                        |             |            |                            |
|        |                      | 6: true                        |             |            |                            |
|        |                      | rt VD via NVMe-o               |             |            |                            |
|        |                      | iple Controller !              |             |            |                            |
|        | d@graid demo~]\$ sud |                                | control     | ler        |                            |
| List   | controller success   | fully.                         |             |            |                            |
| 1000   |                      | Contractor de la contractor de | · · · · · · |            |                            |
| ID     | CONTROLLER MODEL     | SERIAL NUMBER                  | NUMA        | STATE      | DG                         |
|        |                      |                                |             |            |                            |
| 0      | SR-1000              | 1xxxxxxxxxx0                   |             | ONLINE     | 0,1                        |
| 1      | SR-1000              | 1xxxxxxxxxx1                   | 1           | ONLINE     | 2,3                        |
|        |                      |                                |             |            |                            |
|        | d@graid demo~]\$sudo |                                | e contr     | oller 1    |                            |
|        | ble controller succ  |                                |             |            |                            |
|        | ble controller Cont  |                                |             |            |                            |
|        | d@graid demo~]\$ sud |                                | le cont     | roller 1   |                            |
|        | ble controller succ  |                                |             |            |                            |
|        | ble controller Cont  |                                |             |            |                            |
|        |                      |                                | ce cont     | roller 1 ; | *****                      |
|        | ace controller succ  |                                | 4.33        |            |                            |
| Кері   | ace controller Cont  | rotter 1 success               | rully.      |            |                            |
|        |                      |                                |             |            |                            |

Note: To apply the license, you might need to provide the NVIDIA GPU serial number to Graid Technology Technical Support. Use either of the following commands to obtain the serial number for all NVIDIA cards in your environment: \$ sudo nvidia-smi --query-gpu=name, index, serial --format=csv OR

```
$ sudo nvidia-smi -q | grep -i serial
```

Note: If two controllers are activated in the graid.conf system configuration file, the SupremeRAID<sup>™</sup> service prevents you from activating any additional controllers until one of the existing controllers is removed. This safeguard prevents conflicts and ensures proper system operation. Exercise caution and consult the software documentation or seek professional assistance if needed.

# Creating a RAID5 Virtual Drive with Five NVMe SSDs

To create a RAID5 virtual drive with 5 NVMe SSDs:

Step 1 Create a physical drive.

\$ sudo graidctl create physical\_drive /dev/nvme0-4

Step 2 Create a drive group.

\$ sudo graidctl create drive\_group raid5 0-4

Step 3 Create a virtual drive with a 5TB volume size.

\$ sudo graidctl create virtual\_drive 0 5T

Step 4 Check the device path of the new virtual drive.

\$ sudo graidctl list virtual\_drive --dg-id=0

Output example:

| •••  |   |               |              |                         |  |  |  |  |
|--|---|---------------|--------------|-------------------------|--|--|--|--|
| [graid@graid demo~]\$ sudo graidctl create physical_drive /dev/nvme0-4<br>✔Create physical drive successfully. |   |               |              |                         |  |  |  |  |
| ✓Create physical of  | <pre>✓Create physical drive PD0 (/dev/nvme0: nqn.2019-08.org.qemu:NVME0002) successfully.</pre> |               |              |                         |  |  |  |  |
|  | <pre></pre>   |               |              |                         |  |  |  |  |
|  | <pre>/Create physical drive PD3 (/dev/nvme3: nqn.2019-08.org.qemu:NVME0003) successfully.</pre> |               |              |                         |  |  |  |  |
|  |   |               |              | NVME0005) successfully. |  |  |  |  |
| - 5 - 5  | ]\$ sudo graidctl cr  | eate drive_gr | oup raid5 0- | -4                      |  |  |  |  |
| ✓Create drive grou   |   |               |              |                         |  |  |  |  |
|  | up DG0 successfully.  |               |              |                         |  |  |  |  |
| [graid@graid demo~   | /]\$ sudo graidctl cr   | eate virtual_ | drive 0 5T   |                         |  |  |  |  |
| ✓Create virtual dr   | ✓Create virtual drive successfully.   |               |              |                         |  |  |  |  |
| Create virtual drive DG0/VD0 successfully.   |   |               |              |                         |  |  |  |  |
| [graid@graid demo~]\$ sudo graidctl list virtual_drivedg-id=0  |   |               |              |                         |  |  |  |  |
| ✓List virtual driv   | ve successfully.  |               |              |                         |  |  |  |  |
|  |   |               |              |                         |  |  |  |  |
| VD ID DG ID  | SIZE DEVICE PA  | TH STATE      | EXPORTED     |                         |  |  |  |  |
| 0 0  | 4.7 TiB /dev/gdg0   | n1 OPTIMAL    | No           |                         |  |  |  |  |
| -  |   |               |              |                         |  |  |  |  |

# Creating a RAID6 Drive Group without Journal Space

To create a RAID6 drive group without journal space.

Step 1 Create physical drives.

\$ sudo graidctl create physical\_drive /dev/nvme0-4

Step 2 Create a RAID6 drive group without journal space.

\$ sudo graidctl create drive\_group raid6 0-4 --no-journal

Step 3 List the drive group configuration, the journal section should show 'No Journal Space'.

```
$ sudo graidctl describe drive group [DG ID]
```

Output example:

| • • •               |  |  |  |  |  |  |  |
|---------------------|--|--|--|--|--|--|--|
|                     |  |  |  |  |  |  |  |
| root@graid:~# sudo  | root@graid:~# sudo graidctl create drive_group raid6 0-4no-journal |  |  |  |  |  |  |
| ✓Create drive group | Create drive group successfully.                                   |  |  |  |  |  |  |
| ✓Create drive group | DG0 successfully.  |  |  |  |  |  |  |
| root@graid:~# sudo  | graidctl describe drive_group 0                                    |  |  |  |  |  |  |
| ✓Describe drive gro | up successfully.   |  |  |  |  |  |  |
| DG ID:              | 0  |  |  |  |  |  |  |
| NQN:                | nqn.2020-05.com.graidtech:GRAID-SR6889EAED7B8F8E64                 |  |  |  |  |  |  |
| Model:              | GRAID-SR   |  |  |  |  |  |  |
| Serial:             | 6889EAED7B8F8E64   |  |  |  |  |  |  |
| Firmware:           | 1.6.0-rc1  |  |  |  |  |  |  |
| Mode:               | RAID6  |  |  |  |  |  |  |
| Capacity:           | 30 GiB (32007782400 B)   |  |  |  |  |  |  |
| Free Space:         |  |  |  |  |  |  |  |
| Used Space:         | 0 B  |  |  |  |  |  |  |
| Strip Size:         | 4096   |  |  |  |  |  |  |
| State:              | OPTIMAL  |  |  |  |  |  |  |
| PD IDs:             | [0 1 2 3 4]  |  |  |  |  |  |  |
| Number of VDs:      | 0  |  |  |  |  |  |  |
| Prefer Controller:  |  |  |  |  |  |  |  |
| Running Controller: | 0  |  |  |  |  |  |  |
| Volatile Cache:     | Disabled   |  |  |  |  |  |  |
| PD Volatile Cache:  | Enabled  |  |  |  |  |  |  |
| Journal:            | No Journal Space   |  |  |  |  |  |  |
| Attributes:         |  |  |  |  |  |  |  |
|                     | spdk_bdev = DISABLE  |  |  |  |  |  |  |
|                     | cc_speed = high  |  |  |  |  |  |  |
|                     | rebuild_speed = high   |  |  |  |  |  |  |
|                     | auto_failover = ENABLE   |  |  |  |  |  |  |
|                     | init_speed = high  |  |  |  |  |  |  |
|                     | resync_speed = high  |  |  |  |  |  |  |
|                     |  |  |  |  |  |  |  |

Note: Once the drive group is set up, the journal space cannot be recreated. Without journal space, you cannot edit journal mode.

# Modifying Journal Mode on a RAID5 Drive Group

To edit the journal mode of a RAID5 drive group.

Step 1 List current drive group configuration.

\$ sudo graidctl describe drive group

- Step 2 Modify the journal mode.
  - \$ sudo graidctl edit drive\_group [DG\_ID] journal [JOURNAL\_MODE]

Output example:

| •••                 |   |  |  |  |  |  |  |
|---------------------|---|--|--|--|--|--|--|
| ✓Edit drive group s | root@graid:~# graidctl edit drive_group 0 journal always_on<br>√Edit drive group successfully.<br>root@graid:~# graidctl describe drive_group 0 |  |  |  |  |  |  |
| ✓Describe drive gro |   |  |  |  |  |  |  |
| DG ID:              | 0   |  |  |  |  |  |  |
| NON :               | ngn.2020-05.com.graidtech:GRAID-SR2D2DF2D826D71D62  |  |  |  |  |  |  |
| Model:              | GRAID-SR  |  |  |  |  |  |  |
| Serial:             | 2D2DF2D826D71D62  |  |  |  |  |  |  |
| Firmware:           | 1.6.0-beta  |  |  |  |  |  |  |
| Mode:               | RAID5   |  |  |  |  |  |  |
| Capacity:           | 59 GiB (63172509696 B)  |  |  |  |  |  |  |
| Free Space:         | 0 B   |  |  |  |  |  |  |
| Used Space:         | 59 GiB (63172509696 B)  |  |  |  |  |  |  |
| Strip Size:         | 4096  |  |  |  |  |  |  |
| State:              | OPTIMAL   |  |  |  |  |  |  |
| PD IDs:             | [3 1 2]   |  |  |  |  |  |  |
| Number of VDs:      | 1   |  |  |  |  |  |  |
| Prefer Controller:  | 0   |  |  |  |  |  |  |
| Running Controller: | 0   |  |  |  |  |  |  |
| Volatile Cache:     | Disabled  |  |  |  |  |  |  |
| PD Volatile Cache:  |   |  |  |  |  |  |  |
| Journal:            | Always On   |  |  |  |  |  |  |
| Attributes:         |   |  |  |  |  |  |  |
|                     | init_speed = high   |  |  |  |  |  |  |
|                     | resync_speed = high   |  |  |  |  |  |  |
|                     | rebuild_speed = high  |  |  |  |  |  |  |
|                     | spdk_bdev = DISABLE   |  |  |  |  |  |  |
|                     | cc_speed = high   |  |  |  |  |  |  |
|                     | auto_failover = ENABLE  |  |  |  |  |  |  |

Note: Only RAID5/6 can enable the journal function. If the user bypasses the creation of the journal space, it cannot be recreated.

# Creating a Physical Drive from the Remote NVMe-oF Targets

To create a physical drive from the Remote NVMe-oF targets:

Step 1 Connect to the remote NVMe-oF target.

```
$ sudo graidctl connect remote_target [tcp|rdma|fc] [addr] [address
family] [service id]
```

Step 2 Check the NVMe drives from the remote NVMe-oF target.

\$ sudo graidctl list nvme\_drive

Step 3 Create the physical drives.

\$ sudo graidctl create physical\_drive [nqn or devpath]...

Step 4 Create a RAID5 drive group with four physical drives.

\$ sudo graidctl create drive\_group [Mode] [PD\_ID]... [flags]

Output example:

| and the second se |   |  |                              |   |  |
|---|---|--|------------------------------|---|--|
| •••   |   |  |                              |   |  |
| /Connect remote ta<br>/Connect remote ta  | rget suc<br>rget Tar<br>]\$ sudo  | rget 0 successfully.<br>graidctl list nvme_drive   | 11.81 i                      | pv4 4420                                |  |
| DEVICE PATH (4)   | MODEL   | NQN/WWID   | NSID                         | CAPACITY                                | ADDRESS                                |
| /dev/nvme0n1  | <br>  Linux   | uuid.b951d877-76af-4dfe-84ee-a45164554fe2  | 1                            | 22 GB                                   | <br>  traddr=172.16.11.81,trsvcid=4420 |
| /dev/nvmeln1  | Linux   | uuid.6f21ec8f-00ee-4a30-a9b8-413447b8f138  | 1                            | 22 GB                                   | traddr=172.16.11.81,trsvcid=4420       |
| /dev/nvme2n1  | Linux   | uuid.34d1d6aa-41fc-4c02-a660-f75429d7d74b  | 1                            | 22 GB                                   | traddr=172.16.11.81,trsvcid=4420       |
| /dev/nvme3n1  | Linux   | uuid.d846f451-31af-49ae-b3db-8ca90f454c3b  | 1                            | 22 GB                                   | traddr=172.16.11.81,trsvcid=4420       |
| 75429d7d74b<br>/Create physical c<br>/Create physical c<br>/Create physical c<br>/Create physical c<br>/Create physical c   | Irive suc<br>Irive PDO<br>Irive PD1<br>Irive PD2<br>Irive PD3<br>]\$ sudo | <pre>) (uuid.b951d877-76af-4dfe-84ee-a45164554fe2)<br/>(/dev/nvme1: uuid.6f21ec8f-00ee-4a30-a9b8-4<br/>(/dev/nvme3: uuid.d846f451-31af-49ae-b3db-8<br/>(uuid.34d1d6aa-41fc-4c02-a660-f75429d7d74b)<br/>graidctl create drive_group raid5 0-3</pre> | succes<br>13447b8<br>ca90f45 | sfully.<br>8f138) succe<br>64c3b) succe | essfully.                              |

## Replace the Nearly Worn-out or Broken SSD.

To replace the SSD that is nearly worn-out or broken:

Step 1Check the status of the physical drive. If the drive is already displaying as MISSING or another<br/>abnormal status, you can skip step 2 and go directly to step 3.

\$ sudo graidctl list pd

Step 2 If the physical drive status is "online", mark the physical drive as BAD.

\$ sudo graidctl edit pd [OLD\_PD\_ID] marker bad

- Step 3 Replace the NVMe SSD. The state of the previous physical drive will indicate FAILED.
- Step 4 Check the NQN of the new SSD.
  \$ sudo graidctl list nvme drive
- Step 5 Replace the physical drive.

\$ sudo graidctl replace physical\_drive [OLD\_PD\_ID]
[DEVICE PATH|NQN|WWID]



#### Output example:

|   |  | sudo graidctl<br>successfully.<br>-  | list phys   | ical_driv  | ve   |  |  | ı  | 11                      | 1  |
|---|--|--|---|--|--|--|--|--|-------------------------|--|
|   |  | DEVICE PATH  | NQN/WWID  |  |  |  |  | CAPACITY   | SLOT ID                 |  |
| 0<br>1<br>2<br>3<br>4   | 0  | /dev/gpd0<br>/dev/gpd1<br>/dev/gpd2<br>/dev/gpd3<br>/dev/gpd4  | nqn.2019<br>  nqn.2019<br>  nqn.2019  | -10.com.<br>-10.com.<br>-10.com.   | kioxia:KCM61VUL<br>kioxia:KCM61VUL<br>kioxia:KCM61VUL  | .3720:2010A004T1L8<br>.3720:2060A006T1L8<br>.3720:2010A001T1L8<br>.3720:2080A04HT1L8<br>.3720:2080A04HT1L8 | KCM61VUL3T20<br>KCM61VUL3T20<br>KCM61VUL3T20<br>KCM61VUL3T20<br>KCM61VUL3T20 | 3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB | 15<br>9<br>8<br>11<br>3 | FAILED<br>ONLINE<br>ONLINE<br>ONLINE<br>ONLINE |
| graid@graid<br>List nvme (  |  | sudo graidctl<br>cessfully.  | 'list nvme <sub>.</sub>   | _drive   |  |  |  |  |                         | · · · ·  |
| DEVICE PAT  | rH (1)   | NQN  |   |  |  | MODEL  | CAPACITY   |  |                         |  |
|   |  | 2010 10 0  | om kiovia-l   | KCM61VIII 3  | 3T20:Z050A002T1  | LL8 KCM61VUL3T20   | 3.2 TB   |  |                         |  |
| Replace phy<br>raid@graid   | i demo ~]s<br>ysical dr<br>i demo ~]s  |  | replace pl<br>y.  | hysical_d  | drive 0 /dev/nv  | —i——   | ii   |  |                         |  |
| raid@graid<br>Replace phy<br>raid@graid<br>_ist physid  | i demo ~]s<br>ysical dr<br>i demo ~]s  | sudo graidctl<br>ive successfull<br>sudo graidctl  | replace pl<br>y.<br>list phys   | hysical_c<br>ical_driv   | drive 0 /dev/nv  | —i——   | MODEL  |  | SLOT ID                 | STATE  |
| raid@graid<br>Replace phy<br>raid@graid<br>ist physid<br>PD ID (5)<br>1   | i demo ~]4<br>ysical dr<br>i demo ~]4<br>cal drive<br> <br>  DG ID<br>  0  | sudo graidctl<br>ive successfull;<br>sudo graidctl<br>successfully.<br>DEVICE PATH<br>/ dev/gpd1   | replace pl<br>y.<br>list phys<br>NQN/WWID   | hysical_d<br>ical_driv<br>-10.com.k  | drive 0 /dev/nvr<br>ve<br>kioxia:KCM61VUL:   | .3T20: Z060A006T1L8  | KCM61VUL3T20   | 3.2 TB   | 15                      | ONLINE   |
| raid@graid<br>Replace phy<br>raid@graid<br>ist physic<br>PD ID (5)<br>1<br>2<br>3   | i demo ~]<br>ysical dr<br>i demo ~]<br>cal drive<br>  DG ID<br>  | sudo graidctl<br>ive successfull<br>successfully.<br>uccessfully.<br>DEVICE PATH   | replace pl<br>y.<br>list phys:<br>NQN/WWID<br>nqn.2019<br>nqn.2019  | hysical_d<br>ical_driv<br>-10.com.H<br>-10.com.H   | drive 0 /dev/nvn<br>ve<br>kioxia:KCM61VUL<br>kioxia:KCM61VUL   | /me5   |  | 3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB                               | 15<br>9<br>8            | ONLINE<br>ONLINE<br>ONLINE                     |
| raid@graid<br>Replace phy<br>iraid@graid<br>.ist physic<br>PD ID (5)<br>1<br>2<br>3<br>4  | d demo ~]<br>ysical dr<br>d demo ~]<br>cal drive<br>  DG ID<br>  0<br>  0  | sudo graidctl<br>ive successfully<br>sudo graidctl<br>successfully.<br>DEVICE PATH<br>/dev/gpd1<br>/dev/gpd2<br>/dev/gpd3<br>/dev/gpd4   | replace pl<br>y.<br>list phys<br> <br>  NQN/WWID<br> <br>  nqn.2019-<br>  nqn.2019-<br>  nqn.2019-<br>  nqn.2019-<br>  nqn.2019-    | hysical_d<br>ical_driv<br>-10.com.k<br>-10.com.k<br>-10.com.k<br>-10.com.k   | drive 0 /dev/nvr<br>ve<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:   |  | KCM61VUL3T20<br>KCM61VUL3T20   | 3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB           | 15<br>9                 | ONLINE<br>ONLINE<br>ONLINE<br>ONLINE           |
| raid@graid<br>keplace phy<br>raid@graid<br>ist physic<br>PD ID (5)<br>1<br>2<br>3<br>4<br>5<br>5  | i demo ~]4<br>ysical dri<br>i demo ~]4<br>cal drive<br>  DG ID<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0               | sudo graidctl<br>successfully.<br>DEVICE PATH<br>/dev/gpd1<br>/dev/gpd2<br>/dev/gpd3   | replace pl<br>y.<br>list phys:<br>  | hysical_d<br>ical_driv<br>-10.com.k<br>-10.com.k<br>-10.com.k<br>-10.com.k<br>-10.com.k  | drive 0 /dev/nvr<br>ve<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:   | /me5<br>.3720:2060A006T1L8<br>.3720:2010A001T1L8<br>.3720:2010A001T1L8                                     | KCM61VUL3T20<br>KCM61VUL3T20<br>KCM61VUL3T20<br>KCM61VUL3T20                 | 3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB                               | 15<br>9<br>8<br>11      | ONLINE<br>ONLINE<br>ONLINE<br>ONLINE           |
| raid@graid<br>Replace phy<br>raid@graid<br>.ist physio<br>PD ID (5)<br>1<br>2<br>3<br>4<br>5<br>raid@graid<br>.ist drive<br>  | 1 demo ~]4<br>ysical dr<br>d demo ~]4<br>cal drive<br>  DG ID<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0  | sudo graidctl<br>ive successfully.<br>sudo graidctl<br>successfully.<br>DEVICE PATH<br>/dev/gpd1<br>/dev/gpd2<br>/dev/gpd4<br>/dev/gpd5<br>sudo graidctl   | replace pl<br>y.<br>list phys'<br>NQN/WID<br>nqn.2019<br>nqn.2019<br>nqn.2019<br>nqn.2019<br>nqn.2019<br>list drive                 | hysical_d<br>ical_driv<br>-10.com.k<br>-10.com.k<br>-10.com.k<br>-10.com.k<br>-10.com.k  | drive 0 /dev/nvr<br>ve<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:   |  | KCM61VUL3T20<br>KCM61VUL3T20<br>KCM61VUL3T20<br>KCM61VUL3T20                 | 3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB           | 15<br>9<br>8<br>11      | ONLINE<br>ONLINE<br>ONLINE<br>ONLINE           |
| raid@graid<br>keptace physic<br>raid@graid<br>ist physic<br>PD ID (5)<br>1<br>2<br>3<br>4<br>5<br>raid@graid<br>List drive  | 1 demo ~]4<br>ysical dr<br>d demo ~]4<br>cal drive<br>  DG ID<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0  | s sudo graidctl<br>s sudo graidctl<br>s successfully.<br>DEVICE PATH<br>/dev/gpd1<br>/dev/gpd3<br>/dev/gpd3<br>/dev/gpd5<br>s sudo graidctl<br>ccessfully.   | replace pl<br>y.<br>list phys<br>non.2019<br>non.2019<br>non.2019<br>non.2019<br>list drive<br>free                                 | hysical_c<br>ical_driv<br>-10.com.H<br>-10.com.H<br>-10.com.H<br>-10.com.H<br>-10.com.H<br>e_group   | drive 0 /dev/nvr<br>ve<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:   |  | KCM61VUL3T20<br>KCM61VUL3T20<br>KCM61VUL3T20<br>KCM61VUL3T20                 | 3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB           | 15<br>9<br>8<br>11      | ONLINE<br>ONLINE<br>ONLINE                     |
| raid@graid<br>teplace physic<br>raid@graid<br>(ist physic<br>PD ID (5)<br>1<br>2<br>3<br>4<br>5<br>7<br>aid@graid<br>(ist drive<br>DG ID   MC<br>0   RA<br>raid@graid | i demo ~]4<br>i demo ~]4<br>i demo ~]4<br>cal drive<br>  DG ID<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0 | s sudo graidctl<br>twe successfully.<br>DEVICE PATH<br>/dev/gpd1<br>/dev/gpd3<br>/dev/gpd3<br>/dev/gpd3<br>/dev/gpd5<br>s sudo graidctl<br>ccessfully.   | replace pl<br>y.<br>list phys:<br>nqn.2019<br>nqn.2019<br>nqn.2019<br>nqn.2019<br>nqn.2019<br>list drive<br>- FREE<br>FREE<br>12 TB | hysical_c<br>ical_driv<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>e_group<br>USED<br>1.0 TB  | drive @ /dev/nvr<br>ve<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>Kioxia:KCM61VUL:<br>Kioxia:KCM61VUL: |  | KCM61VUL3T20<br>KCM61VUL3T20<br>KCM61VUL3T20<br>KCM61VUL3T20                 | 3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB           | 15<br>9<br>8<br>11      | ONLINE<br>ONLINE<br>ONLINE<br>ONLINE           |
| raid@graid<br>teplace physic<br>PD ID (5)<br>1<br>2<br>3<br>4<br>5<br>5<br>0G ID MC<br>0 RA<br>raid@graid<br>.ist drive<br>0 RA<br>raid@graid                         | i demo ~]4<br>i demo ~]4<br>i demo ~]4<br>cal drive<br>  DG ID<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0<br>  0 | s sudo graidctl<br>twe successfully.<br>DEVICE PATH<br>/dev/gpd1<br>/dev/gpd2<br>/dev/gpd3<br>/dev/gpd3<br>/dev/gpd5<br>s sudo graidctl<br>xuccessfully.<br>NUM CAPACITY<br>1 13 TB<br>is sudo graidctl<br>successfully. | replace pl<br>y.<br>list phys:<br>ngn.2019<br>ngn.2019<br>ngn.2019<br>ngn.2019<br>list drive<br>FREE<br>FREE<br>list virte          | hysical_driv<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com.<br>-10.com. | drive @ /dev/nvr<br>ve<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>kioxia:KCM61VUL:<br>Kioxia:KCM61VUL:<br>Kioxia:KCM61VUL: |  | KCM61VUL3T20<br>KCM61VUL3T20<br>KCM61VUL3T20<br>KCM61VUL3T20                 | 3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB           | 15<br>9<br>8<br>11      | ONLINE<br>ONLINE<br>ONLINE<br>ONLINE           |

Note: Make sure that the system or other applications are not utilizing the physical drive before initiating the creation or replacement process.

## Exporting the Virtual Drive as an NVMe-oF Target Drive Using RDMA to the Initiator

To export the virtual drive as an NVMe-oF target drive using RDMA to the initiator:

Step 1 Create the RDMA/TCP NVMe-of export target port services.

\$ sudo graidctl create export\_target [tcp|rdma] [interface] [address
family] [srvcid] [flags]

Step 2 Export a virtual drive as an NVMe-of target.

\$ sudo graidctl export virtual drive [DG ID] [VD ID]... [flags]

Step 3 List all NVMe-oF export targets.

\$ sudo graidctl list export\_target [flags]

Step 4 Describe the detailed information for an NVMe-of export target.

```
$ sudo graidctl describe export_target [PORT_ID] [flags]
```

Output example:

| •••                    |   |  |   |                                  |                         |       |         |             |  |
|------------------------|---|--|---|----------------------------------|-------------------------|-------|---------|-------------|--|
| - 5 - 5                |   | o ~]\$ sudo<br>ive succes  | o graidctl list<br>ssfully.   | t virtual_<br>I                  | drive                   | I     |         |             |  |
| VD ID                  | DG ID   | SIZE   | DEVICE PATH   | STATE                            | EXPORTED                |       |         |             |  |
| 0                      | 0<br>0  | 93 GiB<br>93 GiB   | /dev/gdg0n1<br>/dev/gdg0n2  | OPTIMAL<br>OPTIMAL               | No<br>No                |       |         |             |  |
| <pre> Create e</pre>   | export ta<br>export ta<br>raid-demo<br>virtual o<br>virtual o | arget succ<br>arget Targ<br>o ~]\$ sudc<br>drive succ<br>drive VD0 | graidctl crea<br>cessfully.<br>get 0 successfo<br>graidctl expo<br>cessfully.<br>into Target 0<br>graidctl deso | ully.<br>ort virtua<br>successfu | <br>l_drive 0 0<br>lly. |       | ∨4 4420 |             |  |
| ✓Describe Id:          | e export  | target su  | uccessfully.  |                                  |                         |       |         |             |  |
| Port:                  |   | 0  |   |                                  |                         |       |         |             |  |
| Transport              | Туре:   | tcp  |   |                                  |                         |       |         |             |  |
| Address:               |   | 172.17   | 7.2.20  |                                  |                         |       |         |             |  |
| Interface              |   | eno1   |   |                                  |                         |       |         |             |  |
| AddressFa<br>ServiceIo |   | ipv4<br>4420   |   |                                  |                         |       |         |             |  |
|                        |   | 4420   |   |                                  |                         |       |         |             |  |
|                        | Subsystems:   |  |   |                                  |                         |       |         |             |  |
| NAME                   |   |  |   |                                  |                         | DG ID | VD ID   | DEVICE PATH |  |
| nqn.202                | 20-05.com   | n.graidted   | ch:GRAID-SR185  | 1EC569B688                       | 8A5:dg0vd0              | 0     | 0       | /dev/gdg0n1 |  |
|                        |   |  |   |                                  |                         |       |         |             |  |

# Setting Up the Dual-Controller to Enable HA and Auto-Failover

To activate the HA feature, you need two SupremeRAID<sup>™</sup> cards installed in your server model and have the service activated. The total drive group count is four, with at least one drive group allocated to each controller. However, the number of drive groups assigned to each controller does not need to be equal.

If one controller fails and the auto-failover function is turned on (it is enabled by default), the drive group under the failed controller fails over immediately to the functioning controller. To ensure data integrity, the drive group statuses that failover switch to Resync mode.

| Step 1 | Activate two cards to enable the HA feature.                                       |
|--------|--|
|        | <pre>\$ sudo graidctl apply license [LICENSE_KEY]</pre>                            |
| Step 2 | Check the controller status.   |
|        | \$ sudo graidctl list controller   |
| Step 3 | Check the NVMe devices' NUMA location.   |
|        | \$ sudo graidctl list nvme_drive -n [NUMA_ID]                                      |
| Step 4 | Create physical drives.  |
|        | <pre>\$ sudo graidctl create physical_drive [DEVICE_PATH NQN WWID]</pre>           |
| Step 5 | Create two drive groups with specific controllers.                                 |
|        | \$ sudo graidctl create drive_group [RAID_MODE] [PD_IDs] -c<br>[Controller_ID]     |
| Step 6 | Create a specific virtual drive with a different drive group.                      |
|        | <pre>\$ sudo graidctl create virtual_drive [DG_ID] [VD_SIZE]</pre>                 |
| Step 7 | The drive group can optionally be assigned to a specific controller by editing it. |
|        | <pre>\$ sudo graidctl edit [DG_ID] controller [Controller_ID]</pre>                |

Note: Typically, there is no need to set the controller manually while creating a drive group because SupremeRAID<sup>™</sup> selects the optimal controller automatically based on the chosen physical drive. However, it is possible to adjust the controller manually for the drive group by making edits to it.



#### Output example:

| Apply Transmit  | 🛢 🥌 🔵<br>[graid@gi  | raid demo  | o∼]\$ sud  | lo graidctl :   | apply licen  | se XXXX   | xxxx-xxx                                     | 00000-000000   | 000-0000000  |   |                                 |  |  |                                 |                               |   |  |
|--|---|--|--|---|--|---|--|--|--|---|---------------------------------|--|--|---------------------------------|-------------------------------|---|--|
| In         Continuity much         Marking much         Mark         State           1         State   | graid@g<br>Apply l<br>graid@g<br>Apply l<br>graid@g           | raid demo<br>icense f<br>raid demo<br>icense s<br>raid demo                                    | p∼]\$ sud<br>ailed: M<br>p~]\$ sud<br>uccessfi<br>p~]\$ sud                          | lo graidctl a<br>New license<br>No graidctl a<br>ully.<br>No graidctl                       | PD number 1<br>apply licen   | 2 is le<br>se YYYY                                  | ess than o                                   | old license  | PD number 3  |   |                                 |  |  |                                 |                               |   |  |
| θ         9-100         1000000000000000000000000000000000000  |   |  |  |   |  |   |  |  |  |   |                                 |  |  |                                 |                               |   |  |
| 1         0.100         1000000000000000000000000000000000000  |   |  | A HODEE  | i   | —i—  | -i  | —i—  |  |  |   |                                 |  |  |                                 |                               |   |  |
| Litt me drive successfully.         NOTE         NOTE <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>   |   |  |  |   |  |   |  |  |  |   |                                 |  |  |                                 |                               |   |  |
| /dev/waddi       KCW2VULTB       mp.2019-18.com.ktoxis.KCW2VULTB   |   |  |  |   | list nvme_d  | rive -n   | 0  |  |  |   |                                 |  |  |                                 |                               |   |  |
| /dev/nee2h1 KKBUULT29 np.289-10-co.kiokik/KKBUULT29:278494391114 1 30 618 0 0 0082:23:08.0<br>pridgrid demo-15 subs pridet1<br>Lit nwe drive successfully.<br>DeVICE MAR (1) MODEL NUMARD PRIDE NO. 2009 1 1 1 0 0 618 1 0 0082:23:08.0<br>pridgrid demo-15 subs pridet1<br>Lit nwe drive successfully.<br>DeVICE MAR (1) MODEL NUMARD PRIDE NO. 2009 1 1 0 0082:23:08.0<br>Pridgrid demo-15 subs pridet1<br>Lit nwe drive successfully.<br>DeVICE MAR (1) MODEL NUMARD PRIDE NO. 2009 1 1 0 0082:23:08.0<br>Pridgrid demo-15 subs pridet1<br>Lit nwe drive successfully.<br>Create psystal drive base pridet1<br>Lit need for the B1 (dev/need: np.289-10.com.kiokis/KKBUULT29:2884089114 1 1 0 0 618 1 0 0082:23:08.0<br>Treate psystal drive base pridet1<br>Create psystal drive base pridet1<br>Create psystal drive base pridet1<br>Lit need for the B1 (dev/need: np.289-10.com.kiokis/KKBUULT29:2884089114 )<br>Successfully.<br>Create psystal drive base pridet1<br>Lit need for the B1 (dev/need: np.289-10.com.kiokis/KKBUULT29:2884089114 )<br>Successfully.<br>Create psystal drive base pridet1<br>Lit need for the B1 (dev/need: np.289-10.com.kiokis/KKBUULT29:2884089114 )<br>Successfully.<br>Create psystal drive base pridet1<br>Lit need for the B1 (dev/need: np.289-10.com.kiokis/KKBUULT29:2884089114 )<br>Successfully.<br>Create psystal drive base pridet1<br>Lit need for the B1 (dev/need: np.289-10.com.kiokis/KKBUULT29:2884089114 )<br>Successfully.<br>Create psystal drive base pridet1<br>Lit need for the B1 (dev/need: np.289-10.com.kiokis/KKBUULT29:2884089114 )<br>Successfully.<br>Create psystal drive base pridet1<br>Lit drive base pridet1<br>Lit need for the B1 (dev/need: np.289-10.com.kiokis/KKBUULT29:2884089114 )<br>Successfully.<br>Create psystal drive base pridet1<br>Lit drive base pridet1<br>Lit drive base pridet1<br>Lit drive base pridet1<br>Lit drive prop successfully.<br>Dive drive for the B1 (dev/need for the B1 (dev/need) in psi29-10.com.kiokis/KGBUULT29:2884089114 )<br>Successfully.<br>Dive drive prop successfully.<br>Dive drive prop successfully.<br>Dive drive prop successfully.<br>Dive drive prop successfully.<br>Dive drive prop succes   | DEVICE  | PATH (3  | ) MOD  | EL  | NQN/WWID   |   |  |  |  | NSID  | D                               | CAPACITY   | NUMA NODE                                      | E ADDRES                        | s                             |   |  |
| List immed rive successfully.           OPVICE PAIR (1)         MODE         MODE/ADD         MODE // ADD  | /dev/n  | vme2n1   | і ксм  | 161VUL3T20  | nqn.2019-1   | 0.com.k   | ioxia:KCM                                    | 161VUL3T20:  | Z0F0A031T1L8   | 1   | 1                               | 50 GiB   | 0  | 0000:2                          | 3:00.0                        |   |  |
| //dev/nveining         KK65/UUL370<br>(mgn.2819-18.com.ktoxiarKK66/UUL372:2206406057118)         1         9         6         1         0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>0000222:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>000022:00.0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>00002:0<br>000002:0<br>00002:0<br>000002:0<br>000002:0<br>000002:0<br>000002:0<br>000002:0<br>000002:0<br>000002:0<br>000002:0<br>000002:0<br>00000000   |   |  |  |   | list nvme_d  | rive -n   | 1  |  |  | -1  | 1.                              |  | 1  | -1                              | ı                             |   |  |
| /dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/nueshi<br>/dev/ | DEVICE  | РАТН (З  | ) MOD  | DEL   | NQN/WWID   |   |  |  |  | NSID  | D                               | CAPACITY   | NUMA NODE                                      | E ADDRES                        | s                             |   |  |
| (freate physical drive B0 (/dev/wwB2: ngn.2819-18.com.ktotaixCM01VUL3728:28840841114)         successfully.         (freate physical drive P0 (/dev/wwB2: ngn.2819-18.com.ktotaixCM01VUL3728:2884085114)         successfully.         (freate physical drive P0 (/dev/wwB2: ngn.2819-18.com.ktotaixCM01VUL378:2884085114)         successfully.         (freate physical drive P0 (/dev/wwB2: ngn.2819-18.com.ktotaixCM01VUL378:2884085114)         successfully.         (freate physical drive P0 (/dev/wwB2: ngn.2819-18.com.ktotaixCM01VUL378:2884085114)         successfully.         (freate physical drive P1 (/dev/wB2: ngn.2819-18.com.ktotaixCM01VUL378:2884085114)         successfully.         (freate physical drive successfully.         (freate successfully.         (freate physical drive successfully.         (freate physical drive successfully.         (freate physical drive successfully.         (freate successfully.         (freate physical mon.2819-18.com.ktotaixCM01VUL378:28840851114         KM02VUL378         S 6 (18 NA          0 UNCONFIGURED.GOOD         1   | /dev/nv   | vme3n1   | і ксм  | 161VUL3T20  | nqn.2019-1   | 0.com.k   | ioxia:KCM                                    | 161VUL3T20:  | Z080A058T1L8   | 1   | 1                               | 50 GiB   |  | 0000:2                          | 3:00.0                        |   |  |
| 0         N/A         /dev/gpd0         ngn.2019-10.com.ktox1a:KCM61VUL3720:2868A04HT118         KCM61VUL3720         50         618         N/A         0         UNCONFIGURED_COOD           1         N/A         /dev/gpd1         ngn.2019-10.com.ktox1a:KCM61VUL3720:2868A04HT118         KCM61VUL3720         50         618         N/A         0         UNCONFIGURED_COOD           2         N/A         /dev/gpd1         ngn.2019-10.com.ktox1a:KCM61VUL3720:2868A065118         KCM61VUL3720         50         618         N/A         0         UNCONFIGURED_COOD           3         N/A         /dev/gpd1         ngn.2019-10.com.ktox1a:KCM61VUL3720:2866A0857118         KCM61VUL3720         50         618         N/A         0         UNCONFIGURED_COOD           4         N/A         /dev/gpd1         ngn.2019-10.com.ktox1a:KCM61VUL3720:2010A08957118         KCM61VUL3720         50         618         N/A         1         UNCONFIGURED_COOD           5         N/A         /dev/gpd1         ngn.2019-10.com.ktox1a:KCM61VUL3720:2010A08957118         KCM61VUL3720         50         618         N/A         1         UNCONFIGURED_COOD           5         V/A         /dev/gpd1         ngn.2019-10.com.ktox1a:KCM61VUL3720:2010A08957118         KCM61VUL3720         50         618         N/A         1   | /Create<br>/Create<br>[graid@gu<br>/List ph                   | physical<br>physical<br>raid demo<br>ysical d<br> -  | drive  <br>drive  <br>p~]\$ sud<br>rive sud<br>————————————————————————————————————  | PD4 (/dev/nv<br>PD5 (/dev/nv<br>lo graidctl<br>ccessfully.                                  | me3: nqn.20<br>me4: nqn.20<br>list physic<br>-                                 | 019-10.0<br>019-10.0<br>al_driv                     | com.kioxi                                    | a:KCM61VUL3  |  | T1L8) :<br>T1L8) :<br>——                            | suc                             | cessfully.   |  |                                 |                               |   |  |
| Cfcreate drive group DG® successfully.         Cfcreate drive group successfully.         Titst drive group successfully.         DG ID       MODE       VD NUM         CAPACITY       FREE       USED       CONTROLLER       STATE         0       RAID5       0       100 G1B       100 G1B       0       B       running: 0 prefer: 0       OPTIMAL         graid@graid       graiddlyraid       demo->15 sudo       graiddlyraid       graiddlyraid       graid@graid         graid@graid       demo->16 sudo       sudo       graid@graid       graid@graid       graid@graid         graid@graid       demo->16 sudo       graid@graid       loo G1B       100 G1B       0       B       running: 0       prefer: 0       OPTIMAL         graid@graid       demo->16 sudo       graid@graid       loo G1B       100 G1B       0       ID       nunning: 0       prefer: 0       OPTIMAL         0       RAID5       0       100 G1B       100 G1B       0       B       running: 1       prefer: 1       0       OPTIMAL         1       RAID5       0       100 G1B       100 G1B       0       B       running: 1       prefer: 1       0       OPTIMAL         1  | 0<br>1<br>2<br>3<br>4   | <br>   | N/A  <br>N/A  <br>N/A  <br>N/A  <br>N/A  | /dev/gpd0<br>/dev/gpd1<br>/dev/gpd2<br>/dev/gpd3<br>/dev/gpd4                               | nqn.2019<br>  nqn.2019<br>  nqn.2019<br>  nqn.2019<br>  nqn.2019<br>  nqn.2019 | -10.com<br>-10.com<br>-10.com<br>-10.com<br>-10.com | .kioxia:<br>.kioxia:<br>.kioxia:<br>.kioxia: | CM61VUL3T20<br>CM61VUL3T20<br>CM61VUL3T20<br>CM61VUL3T20 | 0:20F0A031T1<br>0:2080A058T1<br>0:2060A006T1<br>0:2080A058T1 | L8   KC<br>L8   KC<br>L8   KC<br>L8   KC<br>L8   KC | CM6<br>CM6<br>CM6<br>CM6<br>CM6 | <br>1VUL3T20  <br>1VUL3T20  <br>1VUL3T20  <br>1VUL3T20  <br>1VUL3T20 | 50 GiB<br>50 GiB<br>50 GiB<br>50 GiB<br>50 GiB | N/A<br>N/A<br>N/A<br>N/A<br>N/A | 0<br>  0<br>  0<br>  1<br>  1 | UNCONFIGURED_GOOD<br>UNCONFIGURED_GOOD<br>UNCONFIGURED_GOOD<br>UNCONFIGURED_GOOD<br>UNCONFIGURED_GOOD |  |
| Cfreate drive group b01 successfully.         graid@graid       Gemo>l\$ sudo graidctl list drive_group         List drive group successfully.       Image: Controller         DG ID       MODE       VD NUM       CAPACITY         FREE       USED       CONTROLLER       STATE         0       RAIDS       0       100 GlB       100 GlB       0 B         1       RAIDS       0       100 GlB       100 GlB       0 B       running: 0 prefer: 0       OPTIMAL         1       RAIDS       0       100 GlB       100 GlB       0 B       running: 1 prefer: 1       OPTIMAL         graid@graid       demo-) \$ sudo graidctl edit drive_group 1 controller 0       Feit drive group successfully.       graid@graid demo-) \$ sudo graidctl list drive_group         4List drive group successfully.       The state drive group successfully.       State       State         0       RAIDS       0       100 GlB       0 B       CONTROLLER       State         0       RAIDS       0       100 GlB       0 B       running: 0 prefer: 0       OPTIMAL   | <pre>'Create 'Create graid@gu 'List dr DG ID 0 graid@gu</pre> | drive gr<br>drive gr<br>raid demo<br>ive grou<br> <br>  MODE<br> <br>  RAID5<br> <br>raid demo | oup suce<br>oup DG0<br>p~]\$ sud<br>p succes<br>  VD NUM<br>  0<br>  0<br>  0<br>  0 | cessfully.<br>successfull<br>o graidctl<br>ssfully.<br>  CAPACITY<br>  100 GiB<br>  100 GiB | y.<br>list drive_<br>  FREE<br>  100 GiB<br>  -                                | group<br>   | <br>  CONTROL<br>  running                   | LER<br>1: 0 prefer                                       |  |   |                                 |  |  |                                 |                               |   |  |
| 0       RAID5       0       100 GiB       100 GiB       0 B       running: 0 prefer: 0       OPTIMAL         1       RAID5       0       100 GiB       0 B       running: 1 prefer: 1       OPTIMAL         graid@graid demo~]\$ sudo graidct1 deit drive_group 1 controller 0       redit drive group successfully.       running: 1 prefer: 1       OPTIMAL         graid@graid demo~]\$ sudo graidct1 list drive_group 1       controller 0       redit drive group successfully.         graid@graid demo~]\$ sudo graidct1 list drive_group 1       controller 0         /List drive group successfully.       graid@graid demo~]\$ sudo graidct1 list drive_group 1         0 F ID       MODE       VD NUM       CAPACITY       FREE       USED       CONTROLLER         0       RAID5       0       100 GiB       0 B       running: 0 prefer: 0       OPTIMAL  | /Create<br>graid@g  | drive gr<br>raid demo  | oup <mark>DG1</mark><br>p~]\$ sud  | successfull<br>o graidctl   |  | group   |  |  |  |   |                                 |  |  |                                 |                               |   |  |
| 1       RAIDS       0       100 GiB       100 GiB       0 B       running: 1 prefer: 1       OPTIMAL         graid@graid       demo>J\$ sudo       graidct       edit       drive_group       1 controller 0         'Edit       drive       group       successfully.       graid@graid       demo>J\$ sudo       graid@graid         graid@graid       demo>J\$ successfully.       graid@raid       graid@raid       graid@raid         List       drive       group       successfully.       group       controller         DG       IMODE       VD       NUM       CAPACITY       FREE       USED       CONTROLLER       STATE         0       RAIDS       0       100 GiB       0 B       running: 0 prefer: 0       OPTIMAL  | DG ID   | MODE   | VD NUM   | 1 CAPACITY  | FREE   | USED  | CONTROL                                      | LER  | STATE  |   |                                 |  |  |                                 |                               |   |  |
| Edit drive group successfully.<br>graid@graid demo~]\$ sudo graidtl list drive_group<br>List drive group successfully.<br>DG_ID  |   |  |  |   |  |   |  |  |  |   |                                 |  |  |                                 |                               |   |  |
| 0 RAID5 0 100 GiB 100 GiB 0 B running: 0 prefer: 0 0PTIMAL   | Edit dr<br>graid@gr   | ive grou<br>raid demo  | p succes<br>o~]\$ sud  | ssfully.<br>No graidctl   |  |   | controll                                     | er O   |  |   |                                 |  |  |                                 |                               |   |  |
|  | DG ID   | MODE   | VD NUM   |   | FREE   | USED  | CONTROL                                      | LER  | STATE  |   |                                 |  |  |                                 |                               |   |  |
|  |   |  |  |   |  |   |  |  |  |   |                                 |  |  |                                 |                               |   |  |
| graidd@graid demo~]\$ sudo graidctl edit drive_group 1 controller 1<br>Fait drive group successfully.<br>orgaidd@graid.demo~)Ssudw orgaidctl create virtual drive @  | Edit dr   | ive grou   | p succes   | ssfully.  |  |   |  | er 1   |  |   |                                 |  |  |                                 |                               |   |  |

# Upgrading the Software

To upgrade the Linux Driver, we offer two methods: silent upgrade and manual setup. Please follow the steps below for your preferred method. Perform the following procedure exactly as described. If you encounter any abnormal failure messages during the driver upgrade, please <u>collect the logs</u> and contact Graid Technical Support team.

## Silent Upgrade

In the SupremeRAID<sup>™</sup> Linux Driver, if you have already installed the SupremeRAID<sup>™</sup> driver, there's no need to uninstall it. Simply run the pre-installer and installer then include '--accept-license' in the upgrade command to automatically apply the license key to the new software.

- Step 1 Stop all applications running on the virtual drive.
- Step 2 Stop the management service. If you have already enabled the graphical management console, please ensure to disable it as well.

\$ sudo systemctl stop graid

\$ sudo systemctl stop graid-mgr.service

- Step 3 Download the upgrade driver package and make it executable.
- Step 4 Run the pre-installer directly, it will automatically check the required dependencies.
  \$ sudo ./[filename] --yes
- Step 5 Run the installer and add 'accept-license' to automatically apply the license key.
  \$ sudo ./[filename] --accept-license
- Step 6 Check the driver version to ensure the upgrade is successful.

\$ sudo graidctl version

Step 7 Use nvidia-smi to check the serial number of the SupremeRAID<sup>™</sup> Card.

\$ nvidia-smi -q

Step 8 Find the matching license key for the serial number, and then apply the license.

\$ sudo graidctl apply license [LICENSE\_KEY]

## Manual Upgrade

If you need to perform a manual upgrade, please follow the steps below to upgrade the software.

- Step 1 Stop all applications running on the virtual drive.
- Step 2 Stop the management service. If you have already enabled the graphical management console, please ensure to disable it as well.

\$ sudo systemctl stop graid

\$ sudo systemctl stop graid-mgr.service

Step 3 Make sure the SupremeRAID<sup>™</sup> kernel module is unloaded.

\$ sudo rmmod graid\_nvidia graid

Step 4 Check the NVIDIA driver DKMS status.

\$ sudo dkms status nvidia

- Step 5 The version of the NVIDIA driver installed in the kernel must match the SupremeRAID<sup>™</sup> driver version. If they do not match, perform the following steps to uninstall the NVIDIA driver.
  - A Dracut the initramfs (Centos, Rocky Linux, AlmaLinux, and RHEL).

\$ sudo dracut --omit-drivers "nvidia graid" -f

- B Uninstall the NVIDIA driver.
  - \$ sudo ./usr/bin/nvidia-uninstall
- C Install the new NVIDIA driver.

\$ sudo ./NVIDIA-Linux-x86\_64-550.67.run -s --no-systemd --no-openglfiles --no-nvidia-modprobe --dkms --disable-nouveau

- D Reboot the server.
- Step 6 Uninstall the package using the command appropriate for your operating system.
  - For Centos, Rocky Linux, AlmaLinux, RHEL, openSUSE, and SLES:

\$ sudo rpm -e graid-sr

- For Ubuntu:
  - \$ sudo dpkg -r graid-sr

Step 7 Confirm that the SupremeRAID<sup>™</sup> module is unloaded. There should not be any output.

\$ sudo lsmod | grep graid

- Step 8 Confirm that the SupremeRAID<sup>™</sup> package is uninstalled using the command appropriate for your operating system, the output should be empty.
  - For Centos, Rocky Linux, AlmaLinux, RHEL, openSUSE, and SLES:

```
$ sudo rpm -qa | grep graid
```

• For Ubuntu:

```
$ sudo dpkg -1 | grep graid
```

Step 9 Go to the Graid Technology website to download the latest version of the pre-installer and make it executable, please download the package in <u>Drivers & Documentation</u>.

\$ sudo chmod +x [Filename]

#### **Driver Packages**

| Product Model | GPU          | x86_64   |
|---------------|--------------|--|
| SR-1000       | NVIDIA T1000 | paid an installar 13.5-005-705-528 sect<br>(MDR: Invaluantity Obstacle (00004208454) |
| SR-1001       | NVIDIA T400  | part or resulter 1.8.5-000-705-128.vor.1<br>(MSR-11-Measure-1000-4-000-4-000-4-00)   |
| SR-1010       | NVIDIA A2000 | grant an installant 5.5-2000 700-528 name?<br>(MDR: 11-MinuteDDF/DeclarkerDDF/AR)    |

Step 10 Proceed to Executing the Installer and Completing the Installation to execute the installer and to complete the installation.

Step 11 Start the SupremeRAID<sup>™</sup> service.

- \$ sudo systemctl enable graid
- \$ sudo systemctl start graid

OR

\$ sudo systemctl --now enable graid

Note: If you upgrade from version 1.2.x to version 1.6.x of the SupremeRAID<sup>™</sup> driver, the device path changes from /dev/gvdXn1 to /dev/gdgXnY.

# Replacing a SupremeRAID<sup>™</sup> Card Stop all applications running on the virtual drive.

Step 1 Stop the management service. If you have already enabled the graphical management console, please ensure to disable it as well.

\$ sudo systemctl stop graid

\$ sudo systemctl stop graid-mgr.service

Step 2 Back up the configuration file.

\$ sudo cp /etc/graid.conf graid.conf.bak

Step 3 Make sure the SupremeRAID<sup>™</sup> kernel module is unloaded.

\$ sudo rmmod graid\_nvidia graid

Step 4 Check the NVIDIA driver DKMS status.

\$ sudo dkms status nvidia

- Note: The NVIDIA driver version installed in the kernel must match the SupremeRAID<sup>™</sup> driver version. Perform step 5 if the versions do not match.
- Step 5 Uninstall the package using the command appropriate for your operating system:
  - For Centos, Rocky Linux, AlmaLinux, RHEL, openSUSE, and SLES:
    - \$ sudo rpm -e graid-sr
  - For Ubuntu:
    - \$ sudo dpkg -r graid-sr
- Step 6 Confirm that the SupremeRAID<sup>™</sup> module is unloaded, the output should be empty.

\$ sudo lsmod | grep graid

- Step 7 Confirm that the SupremeRAID<sup>™</sup> package is uninstalled using the command appropriate for your operating system, the output should be empty.
  - Centos, Rocky Linux, AlmaLinux, RHEL, openSUSE, and SLES:

\$ sudo rpm -qa | grep graid

• Ubuntu:

```
$ sudo dpkg -1 | grep graid
```

- Step 8 Power-off the server, and then install the new card into the server.
- Step 9 Power-on the server.
- Step 10 Go to the Graid Technology website to download the latest version of the pre-installer and make it executable, please download the package in <u>Drivers & Documentation</u>.

\$ sudo chmod +x [Filename]

#### **Driver Packages**

| Product Model | GPU          | x86_64  |
|---------------|--------------|---|
| SR-1000       | NVIDIA T1000 | grant er manifer 1,5,5,000 700 428 navn?<br>(MDS: Er allssanttit "Distanter (1000Au/104454) |
| SR-1001       | NVIDIA T400  | gold an examine 13.0-000 700-120.sec.(<br>(MDS_01-absorber) 20.0-absorber)                  |
| SR-1010       | NVIDIA A2000 | grant or matalane 1.5.5 (20) 705-128 (unit)<br>2015, Distance of Distance (2015)            |

- Step 11 Proceed to Executing the Installer and Completing the Installation to execute the installer and to complete the installation.
- Step 12 When the installer finishes, restart the SupremeRAID<sup>™</sup> service.

\$ sudo systemctl restart graid

If the settings do not return properly after restarting SupremeRAID™ service, see

Manually Migrating the RAID Configuration Between Hosts.

Note: If you are replacing a card in the system, deleting any inactive or invalid licenses associated with the old card is essential. Failing to do so may prevent other cards from becoming active, which is key for multi-controller systems.

# COMMANDS AND SHORTCUTS

# Syntax

Use the following syntax to run graidctl commands from the terminal window:

```
$ sudo graidctl [command] [OBJECT_TYPE] [OBJECT_ID] [flags]
where command, OBJECT_TYPE, OBJECT_ID, and flags are:
```

- **command**: Specifies the operation to perform on one or more resources (for example create, list, describe, and delete.
- **OBJECT\_TYPE**: Specifies the object type. Object types are case-sensitive (for example license, physical\_drive, and drive\_group).
- **OBJECT\_ID**: Specifies the object ID. Some commands support simultaneous operations on multiple objects. You can specify the OBJECT\_ID individually or use a dash to describe an OBJECT\_ID range. For example, to delete physical drives 1, 3, 4, and 5 simultaneously, issue the command:

 $\$  sudo graidctl delete physical\_drive 1 3-5

- flags: Specifies optional flags. For example:
  - -force forces the deletion of a physical drive.

```
\ sudo graidctl delete physical_drive 0 -force
```

- -json prints output in JSON format. This flag can also assist with API implementation.

```
$ sudo graidctl list virtual_drive --format json
```

For help, run graidctl help from the terminal window.

## Command and Subcommand Quick Reference

### General

| Category | Commands | Alias | Sub-Commands | alias |
|----------|----------|-------|--------------|-------|
| Common   | version  |       |              |       |
| License  | apply    |       | license      | lic   |
|          | describe | desc  | license      | lic   |

### Resources

| Category       | Commands | Alias          | Sub-Commands   | alias |
|----------------|----------|----------------|----------------|-------|
| NVMe Drive     | list     | I, Is          | nvme_drive     | nd    |
| SCSi Drive     | list     | I, Is          | scsi_drive     | sd    |
| Physical Drive | create   | c, cre, crt    | physical_drive | pd    |
|                | icreate  | ic, icre, icrt | physical_drive | pd    |
|                | delete   | d, del         | physical_drive | pd    |
|                | describe | desc           | physical_drive | pd    |
|                | edit     | е              | physical_drive | pd    |
|                | list     | l, ls          | physical_drive | pd    |
|                | replace  | en             | physical_drive | pd    |



| Category      | Commands | Alias          | Sub-Commands  | alias |
|---------------|----------|----------------|---------------|-------|
| Drive Group   | create   | c, cre, crt    | drive_group   | dg    |
|               | icreate  | ic, icre, icrt | drive_group   | dg    |
|               | delete   | d, del         | drive_group   | dg    |
|               | describe | desc           | drive_group   | dg    |
|               | edit     | e              | drive_group   | dg    |
|               | list     | I, Is          | drive_group   | dg    |
| Virtual Drive | create   | c, cre, crt    | virtual_drive | vd    |
|               | icreate  | ic, icre, icrt | virtual_drive | vd    |
|               | delete   | d, del         | virtual_drive | vd    |
|               | describe | desc           | virtual_drive | vd    |
|               | edit     | e              | virtual_drive | vd    |
|               | list     | I, Is          | virtual_drive | vd    |
| Controller    | enable   |                | controller    | сх    |
|               | disable  |                | controller    | сх    |
|               | delete   | d, del         | controller    | сх    |
|               | list     | I, Is          | controller    | сх    |
|               | replace  | en             | controller    | сх    |
| MD Boot Drive | import   | im, imp        | md_drive      | md    |
|               | replace  | en             | md_drive      | md    |



| Category | Commands | Alias  | Sub-Commands | alias |
|----------|----------|--------|--------------|-------|
| Config   | describe | desc   | config       | conf  |
|          | edit     | e      | config       | conf  |
|          | delete   | d, del | config       | conf  |
|          | restore  | Re     | Config       | conf  |
| Event    | delete   | d, del | event        | ev    |
|          | list     | I, Is  | event        | ev    |

### Features

| Category          | Commands | Alias       | Sub-Commands      | alias |
|-------------------|----------|-------------|-------------------|-------|
| Consistency Check | describe | desc        | consistency_check | сс    |
|                   | set      |             | consistency_check | сс    |
|                   | start    |             | consistency_check | сс    |
|                   | stop     |             | consistency_check | сс    |
| Export NVMe-oF    | create   | c, cre, crt | nvmeof_target     | nt    |
|                   | describe | desc        | nvmeof_target     | nt    |
|                   | delete   | d, del      | nvmeof_target     | nt    |
|                   | list     | I, Is       | nvmeof_target     | nt    |
|                   | export   | ex, exp     | virtual_drive     | vd    |
|                   | unexport | unex, unexp | virtual_drive     | vd    |

| Category       | Commands   | Alias        | Sub-Commands  | alias |
|----------------|------------|--------------|---------------|-------|
| Import NVMe-oF | connect    | conn         | remote_target | rt    |
|                | disconnect | dis, disconn | remote_target | rt    |
|                | list       | I, Is        | remote_target | rt    |

## **Managing Licenses**

You can apply the license and check license information.

## Applying the License

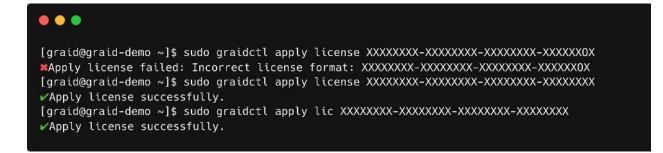
To apply the license and complete the installation, issue the following command:

\$ sudo graidctl apply license [LICENSE KEY] [flags]

OR

```
$ sudo graidctl apply lic [LICENSE KEY] [flags]
```

Output example: for invalid and valid licenses is shown below:



Note: When applying the license, you must provide the serial number of the NVIDIA GPU to Graid Technology Technical Support.

To obtain NVIDIA GPU serial number, issue the following command:

```
$ sudo nvidia-smi --query-gpu=name,index,serial --format=csv
```

OR

\$ sudo nvidia-smi -q | grep -i serial

This command lists all NVIDIA cards in your environment and their serial number.

## **Checking License Information**

To obtain the license information, issue the following command:

```
$ sudo graidctl describe license [flags]
```

OR

```
$ sudo graidctl desc lic [flags]
```

Output example:

| •••   |  |
|---|--|
| [graid@graid-demo<br>✔Describe license<br>Controller 0: | ~]\$ sudo graidctl describe license<br>successfully. |
|   | Name: SR-1000  |
|   | Serial Number: 1352424094196                         |
|   | License State: APPLIED                               |
|   | License Key: XXXXXXXX-XXXXXXXX-XXXXXXXXXXXXXXXXXXX   |
|   | License Type: Full                                   |
|   | Expiration Days: Unlimited                           |
|   | NVMe / NVMe-oF PD Number: 32                         |
| Controller 1:   |  |
|   | Name: SR-1000  |
|   | Serial Number: 1320439569794                         |
|   | License State: APPLIED                               |
|   | License Key: XXXXXXXX-XXXXXXXX-XXXXXXXXXXXXXXXXXXX   |
|   | License Type: Full                                   |
|   | Expiration Days: Unlimited                           |
|   | NVMe / NVMe-oF PD Number: 32                         |
| Features:   |  |
|   | NVMe / NVMe-oF PD Number: 32                         |
|   | RAID5: true  |
|   | RAID6: true  |
|   | Export VD via NVMe-oF: true                          |
|   | Multiple Controller Support: true                    |
|   |  |

#### Output content:

| Field         | Description                             |
|---------------|---|
| Name          | Product SKU                             |
| Serial Number | Applied controller's serial number      |
| License State | License state (see the following table) |
| License Key   | Applied license key                     |

| Field                    | Description   |
|--------------------------|---|
| License Type             | License type (Full or Essential)                                  |
| Expiration Days          | Expiration date of the license key                                |
| NVMe / NVMe-oF PD Number | This license allows for a maximum number of PDs for NVMe/NVMe-oF. |

#### License state:

| State     | Description  |
|-----------|--|
| UNAPPLIED | License was not applied.   |
| APPLIED   | A valid license was applied.   |
| INVALID   | A valid license was applied, but a valid RAID card cannot be detected. |

#### Feature support:

| Features                    | Description                                  | Value   |
|-----------------------------|--|---------|
| NVMe / NVMe-oF PD Number    | Accept total create maximum amount of the PD | Integer |
| RAID5                       | Support RAID5 function                       | Boolean |
| RAID6                       | Support RAID6 function                       | Boolean |
| Export VD via NVMe-oF       | Support Export NVMe-of function              | Boolean |
| Multiple Controller Support | Support Multiple Controller function         | Boolean |

## Checking the SupremeRAID<sup>™</sup> Driver Version

You can prompt the version command to check SupremeRAID<sup>™</sup> service information.

To obtain the SupremeRAID<sup>™</sup> service version information, issue the following command:

\$ sudo graidctl version [flags]

Output example:



## **Viewing Host Drive Information**

### Listing NVMe Drives

To list all the directly attached NVMe drives or NVMe-oF target drives that can be used to create physical drives, issue the following command:

\$ sudo graidctl list nvme drive [flags]

OR

```
$ sudo graidctl ls nd [flags]
```

Related command flags:

| Flag         | Description                                |
|--------------|--|
| -h,help      | Help for the list nvme_drive command       |
| -n,numa-node | [int32] Filter by numa node<br>Default: -1 |



#### Output example:

|   |                  | Contraction and Contraction of Contr |      | "Terra and terrate and the | ina ana ana ang ang ang ang ang ang ang a | 12 CLORENCE STREET |
|---|------------------|--|------|----------------------------|---|--------------------|
| DEVICE PATH(4)  | MODEL            | NQN/WWID   | NSID | CAPACITY                   | NUMA NODE                                 | ADDRESS            |
| /dev/nvme0  | KCM61VUL3T20     | nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A064T1L8   | 1    | 3.2 TB                     | 1   | 0000:e4:00.0       |
| /dev/nvme1  | KCM61VUL3T20     | nqn.2019-10.com.kioxia:KCM61VUL3T20:Z050A002T1L8   | 1    | 3.2 TB                     | 0   | 0000:01:00.0       |
| /dev/nvme2  | KCM61VUL3T20     | nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A05KT1L8   | 1    | 3.2 TB                     | 1   | 0000:e1:00.0       |
| /dev/nvme3  | KCM61VUL3T20     | nqn.2019-10.com.kioxia:KCM61VUL3T20:X0N0A015T1L8   | 1    | 3.2 TB                     | 0   | 0000:43:00.0       |
| /dev/nvme0  | KCM61VUL3T20     |  | 1    | 3.2 TB                     | 1   | 0000:e4:00.0       |
|   |                  | -  |      |                            |   | 4                  |
| /dev/nvmel  | KCM61VUL3T20     | ngn.2019-10.com.ktoxta:KCM61VUL3T20:2050A0041126   | 1    | 3.2 TB                     |   | 0000:01:00.0       |
|   |                  |  | 1    | 3.2 TB                     | 1   | 0000:e1:00.0       |
|   | KCM61VUL3T20     |  |      |                            |   |                    |
| /dev/nvme1<br>/dev/nvme2<br>/dev/nvme3                          | KCM61VUL3T20     | nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A05KT1L8<br>nqn.2019-10.com.kioxia:KCM61VUL3T20:X0N0A015T1L8   | 1    | 3.2 TB                     | 0   | 0000:43:00.0       |
| /dev/nvme2  | KCM61VUL3T20<br> | nqn.2019-10.com.kioxia:KCM61VUL3T20:X0N0A015T1L8   |      | 3.2 TB<br>                 |   | 0000:43:00.0<br>   |
| /dev/nvme2<br>/dev/nvme3<br>graid@graid-demo                    | KCM61VUL3T20<br> | nqn.2019-10.com.kioxia:KCM61VUL3T20:X0N0A015T1L8   |      | 3.2 TB                     | NUMA NODE                                 | 0000:43:00.0       |
| /dev/nvme2<br>/dev/nvme3<br>graid@graid-demo<br>List nvme drive | KCM61VUL3T20<br> | nqn.2019-10.com.kioxia:KCM61VUL3T20:X0N0A015T1L8<br>   |      | <br>                       | <br>                                      | <br>               |

#### Output content:

| Field       | Description                      |
|-------------|----------------------------------|
| DEVICE PATH | Block device path of the drive   |
| NQN         | NVMe Qualified Name of the drive |
| MODEL       | Model number of the drive        |
| CAPACITY    | Capacity of the drive            |
| NUMA NODE   | NUMA NODE of the drive           |

### Listing SAS/SATA Drives

To list all SAS/SATA drives that can be used as physical drives, issue the following command:

\$ sudo graidctl list scsi\_drive

OR

\$ sudo ls sd

Output example:

| • • •                |  |                                      |                  |
|----------------------|--|--------------------------------------|------------------|
|                      | emo ~]\$ sudo graidctl list scsi_drive<br>ve successfully.                                       |                                      |                  |
| DEVICE PATH          | WWID   | MODEL                                | CAPACITY         |
| /dev/sda<br>/dev/sdb | t10.ATA INTEL SSDSC2KB240G7 BTYS83010GKS240AGN<br>t10.ATA INTEL SSDSC2KB240G8 BTYF052107VH240AGN | INTEL SSDSC2KB24<br>INTEL SSDSC2KB24 | 240 GB<br>240 GB |
|                      |  |                                      | <br>             |
| DEVICE PATH          | WWID   | MODEL                                | CAPACITY         |
| /dev/sda<br>/dev/sdb | t10.ATA INTEL SSDSC2KB240G7 BTYS83010GKS240AGN<br>t10.ATA INTEL SSDSC2KB240G8 BTYF052107VH240AGN | INTEL SSDSC2KB24<br>INTEL SSDSC2KB24 | 240 GB<br>240 GB |
|                      |  |                                      |                  |

Output content:

| Field       | Description                           |
|-------------|---------------------------------------|
| DEVICE PATH | Block device path of the drive        |
| WWID        | Worldwide Identification of the drive |
| MODEL       | Model number of the drive             |
| CAPACITY    | Capacity of the drive                 |

# Managing Physical Drives

## **Creating a Physical Drive**

To create a physical drive, issue the following command:

\$ sudo create physical\_drive [DEVICE\_PATH|NQN|WWID] [flag]

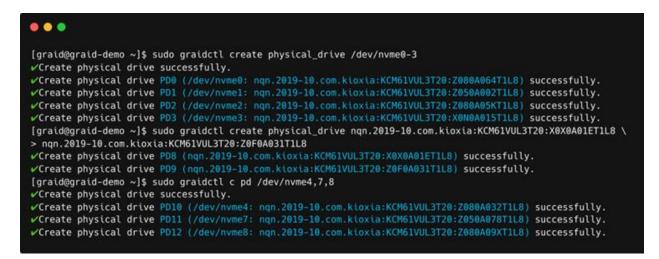
OR

\$ sudo graidctl c pd [DEVICE\_PATH|NQN|WWID] [flag]

Related command flags:

| Flag      | Description                              |
|-----------|--|
| -h,help   | Help for the list physical_drive command |
| -f,dblfwd | Door Bell Forwarding                     |

The following figure shows an output example when creating multiple physical drives simultaneously with the device path and NQN.



Note: Be sure the system or other applications are not on the physical drive before creating or replacing the drive.

# Listing the Physical Drives

To list all the physical drives, issue the following command:

\$ sudo graidctl list physical\_drive [flag]

OR

\$ sudo graidctl ls pd [flag]

Related command flags:

| Flag         | Description  |
|--------------|--|
| -h,help      | Help for the list physical_drive command               |
| -d,dg-id     | [int32] Filter result by drive group ID<br>Default: -1 |
| -f,free      | List unused PDs  |
| -l,locating  | List locating PDs                                      |
| -n,numa-node | [int32] Filter by NUMA node<br>Default: -1             |



#### Output example:

|  | -  | successfully.                             |  | I                  | I                  | I       | - I       | I                 |
|--|--|---|--|--------------------|--------------------|---------|-----------|-------------------|
|  | DG ID                                      | DEVICE PATH                               | NQN/WYID   | MODEL              | CAPACITY           | SLOT ID | NUMA NODE | STATE             |
|  | N/A  | /dev/gpd0                                 | <pre></pre>                                      | KCM61VUL3T20       | 3.2 TB             | 0       | 1         | UNCONFIGURED_GOOD |
|  | N/A  | /dev/gpd1                                 | ngn.2019-10.com.kioxia:KCM61VUL3T20:Z080A060T1L8 | KCM61VUL3T20       | 3.2 TB             | 1       | 0         | UNCONFIGURED_GOOD |
|  | N/A  | /dev/gpd2                                 | ngn.2019-10.com.kioxia:KCM61VUL3T20:Z080A04WT1L8 | KCM61VUL3T20       | 3.2 TB             | i z     | i 1       | UNCONFIGURED GOOD |
|  | NZA -                                      | /dev/gpd3                                 | ngn.2019-10.com.kioxia:KCM61VUL3T20:Z050A002T1L8 | KCM61VUL3T20       | 3.2 TB             | 3       | İÐ        | UNCONFIGURED_GOOD |
|  | N/A  | /dev/gpd4                                 | ngn.2019-10.com.kioxia:KCM61VUL3T20:Z010A003T1L8 | KCM61VUL3T20       | 3.2 TB             | 4       | 1         | UNCONFIGURED GOOD |
|  | N/A  | /dev/gpd5                                 | ngn.2019-10.com.kioxia:KCM61VUL3T20:Z060A005T1L8 | KCM61VUL3T20       | 3.2 TB             | 5       | 8         | UNCONFIGURED_GOOD |
|  | N/A  | /dev/gpd6                                 | ngn.2019-10.com.kioxia:KCM61VUL3T20:Z0F0A031T1L0 | KCM61VUL3T20       | 3.2 TB             | 6       | i i       | UNCONFIGURED_GOOD |
|  | N/A  | /dev/gpd7                                 | ngn,2019-10.com,kioxia:KCM61VUL3T20:Z010A002T1L8 | KCM61VUL3T20       | 3.2 TB             | 7       | 10        | UNCONFIGURED_GOOD |
| 2  | 4  | /dev/nyme0n1                              | ngn.2019-10.com.kioxia:KCM61VUL3T20:Z080A04HT1L8 | KCM61VUL3T20       | 3.2 TB             | N/A     | i i       | ONLINE            |
| 3  | 4  | /dev/nvmein1                              | nqn.2019-10.com.kioxia:KCM61VUL3T20:Z010A001T1L8 | KCM61VUL3T20       |                    | N/A     | 1         | ONLINE            |
| D ID (10)  | DG ID                                      | DEVICE PATH                               | NQN/WWID   | MODEL              | CAPACITY           | SLOT ID | NUMA NODE | STATE             |
|  | N/A  | /dev/gpd0                                 | <pre></pre>                                      | KCM61VUL3T20       | 3.2 TB             | 0       | 1         | UNCONFIGURED_GOOD |
|  | N/A  | /dev/gpd1                                 | ngn.2019-10.com.kioxia:KCM61VUL3T20:Z080A06QT1L8 | KCM61VUL3T20       | 3.2 TB             |         | 9         | UNCONFIGURED_GOOL |
|  | N/A  | /dev/gpd2                                 | nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A04WT1L8 | KCM61VUL3T20       | 3.2 TB             | 2       | 11        | UNCONFIGURED_GOOD |
|  | N/A  | /dev/gpd3                                 | nqn.2019-10.com.kioxia:KCM61VUL3T20;Z050A002T1L8 | KCM61VUL3T20       | 3.2 TB             | 3       | 0         | UNCONFIGURED_GOOD |
|  | N/A  | /dev/gpd4                                 | nqn.2019-10.com.kioxia:KCM61VUL3T20:Z010A003T1L8 |                    | 3.2 TB             |         | 1         | UNCONFIGURED_GOOD |
|  | N/A  | /dev/gpd5                                 | nqn.2019-10.com.kioxia:KCM61VUL3T20:Z060A805T1L8 | KCM61VUL3T20       | 3.2 TB             |         | 8         | UNCONFIGURED_GOOD |
|  | N/A  | /dev/gpd6                                 | nqn.2019-10.com.kioxia:KCM61VUL3T20:Z0F0A031T1L8 | KCM61VUL3T20       | 3.2 TB             | 6       | 1         | UNCONFIGURED_GOOD |
|  | N/A  | /dev/gpd7                                 | nqn.2019-10.com.kioxia:KCM61VUL3T20:Z010A002T1L8 | KCM61VUL3T20       | 3.2 TB             |         | 8         | UNCONFIGURED_GOOD |
|  | 4  | /dev/nvme0n1                              | nqn.2019-10.com.kioxia:KCM61VUL3T20:Z000A04HT1L0 | KCM61VUL3T20       | 3.2 TB             | N/A     | 1         | ONLINE            |
| 2  |  | /dev/nvmelnl                              | nqn.2019-10.com.kioxia:KCM61VUL3T20:Z010A001T1L8 | KCM61VUL3T20       | 3.2 TB             | N/A     | 1 1       | ONLINE            |
| 2  | 4  |   |  | ·                  |                    |         | -         |                   |
| 2<br>3<br>aid@graid-                               | demo ~]\$                                  | sudo graidctl ls<br>successfully.         | . pa -n u  |                    |                    |         |           |                   |
| 3<br>aid@graid-<br>st physic:<br>                  | demo ~]\$                                  |   | s pa -n u  | MODEL              | CAPACITY           | SLOT ID | NUMA NODE |                   |
| 2<br>3<br>aid@graid-<br>st physics<br><br>D ID (4) | demo ~]\$<br>al drive<br>                  | successfully.                             | -  | MODEL KCMG1VUL3T20 | CAPACITY<br>3.2 TB | SLOT ID | NUMA NODE | STATE             |
| 2<br>3<br>aid@graid-<br>st physics<br><br>D ID (4) | demo ~]\$<br>al drive<br><br>DG ID  <br>   | successfully,<br>DEVICE PATH              | NQN/MWID   | i                  | ———i               |         | ———i      |                   |
|  | demo ~]9<br>al drive<br><br>DG ID  <br>N/A | SUCCESSFULLY.<br>DEVICE PATH<br>/dev/gpdl | -<br>  | KCMG1VUL3T20       | 3.2 TB             | 1       | 0         | UNCONFIGURED_GOOD |

#### Output content:

| Field    | Description  |
|----------|--|
| SLOT ID  | Slot ID of the corresponding NVMe/SAS/SATA drive. The PD ID is not related to the SLOT ID. To set the physical drives, use the PD ID.  |
| DG ID    | Drive group ID of the physical drive   |
| PD ID    | PD ID. The PD ID is a unique ID provided by the SupremeRAID <sup>™</sup> driver when the physical drive is created. It is not related to any SSD information such as slot ID or NQN. The PD ID is used for all further operations. |
| NQN/WWID | NQN or WWID of corresponding NVMe/SAS/SATA drive   |
| MODEL    | Model number of the corresponding NVMe/SAS/SATA drive  |

| Field    | Description  |
|----------|--|
| CAPACITY | Capacity of corresponding NVMe/SAS/SATA drive          |
| NODE     | NUMA NODE of the corresponding NVMe/SAS/SATA drive     |
| STATE    | State of the physical drive (see the following table). |

Physical drive state:

| State             | Description  |
|-------------------|--|
| ONLINE            | Physical drive was added to a drive group and is ready to work.          |
| HOTSPARE          | Physical drive is configured as a hot spare drive.                       |
| FAILED            | Physical drive is detected, but it is not operating normally.            |
| OFFLINE           | Physical drive is marked as offline.                                     |
| REBUILD           | Physical drive is being rebuilt.   |
| MISSING           | Physical drive cannot be detected.                                       |
| UNCONFIGURED_GOOD | Physical drive did not join a drive group.                               |
| UNCONFIGURED_BAD  | Physical drive did not join a drive group and is not operating normally. |

## Deleting a Physical Drive

To delete a physical drive, issue the following command:

```
$ sudo graidctl delete physical drive [PD ID]
```

OR

\$ sudo graidctl del pd [PD\_ID]

The following figure shows an output example for deleting multiple physical drives simultaneously.



The output shows that a physical drive cannot be deleted when it is part of a drive group.

### Describing a Physical Drive

To view detailed information for a physical drive, issue the following command:

```
$ sudo graidctl describe physical_drive [PD_ID]
```

#### OR

\$ sudo graidctl desc pd [PD\_ID]

Output example:

| Actl describe physical_drive 1                      |
|---|
| drive successfully.                                 |
|   |
| 0   |
| 10  |
| nqn.2019-10. com. kioxia: KCM61VUL3T20:2080A038T1L8 |
| KCM61VUL3T20  |
| 2.9 TiB   |
| ONLINE  |
| /dev/gpd6   |
| 0   |
| Enabled   |
| 0%  |
|   |
| No warning.   |
|   |
| locating = false                                    |
| hotspare =  |
| dctl desc pd 4                                      |
| drive successfully.                                 |
|   |
| 0   |
| 9   |
| nqn.2019-10. com. kioxia: KCM61VUL3T20:Z080IP38T1L8 |
| KCM61VUL3T20  |
| 2.9 TiB   |
| ONLINE  |
| /dev/gpd3   |
| 0   |
| Enabled   |
| 0%  |
|   |
| No warning.   |
|   |
| locating = false                                    |
| hotspare =  |
|   |

#### Locating a Physical Drive

To locate a physical drive, issue the following command:

\$ sudo graidctl edit physical\_drive [PD\_ID] locating start

To stop locating a physical drive, issue the following command:

\$ sudo graidctl edit physical\_drive [PD\_ID] locating stop

### Marking a Physical Drive Online or Offline

To mark a physical drive as online or offline, issue the following command:

\$ sudo graidctl edit physical drive [PD ID] marker [offline|online]

Note: Marking a physical drive as offline, even briefly, puts the physical drive in the **REBUILD** state.

#### Assigning a Hot Spare Drive

To assign a physical drive as global hot spare, issue the following command:

```
$ sudo graidctl edit physical drive [PD ID] hotspare global
```

To assign a physical drive as the hot spare for a specific drive group, issue the following command:

\$ sudo graidctl edit physical drive [PD ID] hotspare [DG ID]

To assign a physical drive as a hot spare for multiple drive groups, use a comma (,) to separate the drive group IDs.

### Replacing a Nearly Worn-Out or Broken SSD

Note: Make sure the system or other applications are not on the physical drive before creating or replacing the drive.

To replace a nearly worn-out or broken SSD:

Step 1 If the physical drive is in the MISSING or other abnormal state, skip this step. Otherwise, issue the following command to mark the physical drive as bad:

\$ sudo graidctl edit pd [OLD PD ID] marker bad

- Step 2 Replace the NVMe SSD. The state of the prior physical drive indicates FAILED.
- Step 3 Check the NQN of the new SSD.

\$ sudo graidctl list nvme\_drive

Step 4 Replace the physical drive.

```
$ sudo graidctl replace physical_drive [OLD_PD_ID]
[DEVICE_PATH|NQN|WWID]
```



|   |                                   |   |  |  |          |                              |  |                                 |   |  |       |   | _ |
|---|-----------------------------------|---|--|--|----------|------------------------------|--|---------------------------------|---|--|-------|---|---|
| •••   |                                   |   |  |  |          |                              |  |                                 |   |  |       |   |   |
| ✓Edit physica ✓Edit physica [graid@graid  | ıl drive<br>ıl drive<br>demo ~]\$ | sudo graidctl<br>successfully.<br>PD0 successfu<br>sudo graidctl<br>successfully. | lly.   |  |          | oad                          |  |                                 |   |  |       |   |   |
| PD ID (5)   | DG ID                             | DEVICE PATH   | NQN/WWI  | D  |          |                              |  | MODEL                           | CAPACITY  | SLOT ID  | STATE |   |   |
| 0<br>1<br>2<br>3<br>4   |                                   | /dev/gpd0<br>/dev/gpd1<br>/dev/gpd2<br>/dev/gpd3<br>/dev/gpd4                     | nqn.201<br>  nqn.201<br>  nqn.201  | ngn.2019-10.com.kioxia:KCM61VUL3T20:2010A004T118<br>ngn.2019-10.com.kioxia:KCM61VUL3T20:2060A006T118<br>ngn.2019-10.com.kioxia:KCM61VUL3T20:2010A006T118<br>ngn.2019-10.com.kioxia:KCM61VUL3T20:2080A04HT118<br>ngn.2019-10.com.kioxia:KCM61VUL3T20:2080A05KT118 |          |                              | KCM61VUL3T20<br>KCM61VUL3T20<br>KCM61VUL3T20<br>KCM61VUL3T20<br>KCM61VUL3T20<br>KCM61VUL3T20 |                                 | 15<br>  9<br>  8<br>  11<br>  3                       | FAILED<br>ONLINE<br>ONLINE<br>ONLINE<br>ONLINE<br>ONLINE |       |   |   |
| [graid@graid<br>✓List nvme dr   |                                   | ˈsudo graidctl<br>essfully.   | ˈlist nvm  | e_drive  |          |                              |  |                                 |   |  |       |   |   |
| DEVICE PATH   | (1)                               | NQN   |  |  |          |                              | MODEL  | CAPACITY                        |   |  |       |   |   |
| /dev/nvme5 nqn.2019-10.com.kioxia:KCM61VUL3T20:Z050A002T1L8 KCM61VUL3T20 3.2 TB |                                   |   |  |  |          |                              |  |                                 |   |  |       |   |   |
| [graid@graid  | demo ~]\$                         | ve successfull<br>sudo graidctl<br>successfully.<br>DEVICE PATH                   |  |  | ve       |                              |  | MODEL                           | CAPACITY  | SLOT ID  | STATE |   |   |
| 1<br>  2<br>  3<br>  4<br>  5   | 0<br>  0<br>  0<br>  0<br>  0     | /dev/gpd1<br>/dev/gpd2<br>/dev/gpd3<br>/dev/gpd4<br>/dev/gpd5                     | nqn.2019-10.com.kioxia:KCM61VUL3T20:Z060A006T1L8<br>nqn.2019-10.com.kioxia:KCM61VUL3T20:Z060A006T1L8<br>nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A04HT1L8<br>nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A04HT1L8<br>nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A042T1L8 |  |          | KCM61VUL3T20<br>KCM61VUL3T20 | 3.2 TB<br>  3.2 TB   | 15<br>  9<br>  8<br>  11<br>  3 | ONLINE<br>ONLINE<br>ONLINE<br>ONLINE<br>REBUILD (12.6 | 9%, 54 mins remaining)                                   |       |   |   |
| [graid@graid<br>✓List drive g   |                                   |   | list dri   | ve_group   |          |                              |  |                                 |   |  |       | I |   |
| DG ID MOD   | e VD                              | NUM CAPACITY  | FREE   | USED   | STATE    |                              |  |                                 |   |  |       |   |   |
| 0 RAI   | D5                                | 1 13 TB   | 12 TB  | 1.0 TB   | RECOVERY |                              |  |                                 |   |  |       |   |   |
| [graid@graid<br>✓List virtual   |                                   | sudo graidctl<br>uccessfully.   | list vir   | ,<br>tual_driv<br>I  | e        |                              |  |                                 |   |  |       |   |   |
| VD ID DG  | ID SIZ                            | E DEVICE P  | ATH STA  | TE   |          |                              |  |                                 |   |  |       |   |   |
|   | 0   1.0                           | TB /dev/gdg   | 0n1   REC  | OVERY  |          |                              |  |                                 |   |  |       |   |   |
|   |                                   |   |  |  |          |                              |  |                                 |   |  |       |   |   |

# Managing Drive Groups

# Creating Drive Groups

To create a drive group or groups, issue the following command:

\$ sudo graidctl create drive\_group [RAID\_MODE] [PD\_IDs] [flag]

OR

\$ sudo graidctl c dg [RAID\_MODE] [PD\_IDs] [flag]

Related command flags:

| Flag               | Description  |
|--------------------|--|
| -h,help            | Help for the create drive_group command                                  |
| -b,background-init | Background initialization  |
| -c,controller      | [int32] Specific controller id<br>Default: -1                            |
| -f,force-clean     | Ignore initialization (Danger)   |
| -z,foreground-init | Foreground initialization (Write Zeros)                                  |
| -s,strip-size      | [uint32] Strip Size (KiB)<br>Values: 4, 8, 16, 32, 64, 128<br>Default: 4 |





#### Required parameters:

| Option    | Description   |
|-----------|---|
| RAID_MODE | RAID mode of the drive group. Entries must be all uppercase or all lowercase. For example, RAID6 or raid6 are both correct. |
| PD_IDs    | ID of the physical drive joining the drive group.   |

#### Optional parameters:

| Option                      | Description  | Behavior   |
|-----------------------------|--|--|
| background<br>- init,<br>-b | Default option.<br>Use standard methods to initialize the drive group.<br>When all the physical drives in the drive group<br>support the de-allocate dataset management<br>command, it is used to synchronize the data, or<br>parity, between the physical drives during the<br>creation of the drive group. | An I/O-capable device path similar to<br>/dev/gdg0n1 is created.   |
| foreground<br>- init,<br>-z | Foreground initialization. This method writes zeros to the entire drive.   | The virtual drive appears in the system<br>after initialization is complete. Use the<br>following command to check the<br>initialization progress:<br>\$ sudo graidctl list<br>drive_group |
| force<br>- clean,<br>-f     | Force bypass initialization, assuming that all drives are clean.   | The drive group STATE immediately becomes OPTIMAL, indicating that the drive group is available for use.   |
| controller,<br>-c           | Specific controller to control this drive_group.<br>Default: -1, [Int32]   | The drive group control by specific controller.  |
| no-journal                  | Bypass the creation of journal space in the drive group.   | The drive group will not create journal space.   |

| Option            | Description  | Behavior  |
|-------------------|--|---|
| strip-size,<br>-s | Strip size of the drive_group.<br>[RAID0, RAID10]<br>Values: 4, 8, 16, 32, 64, 128 | Adjust RAID0/RAID10 strip size to a<br>specific size: (4k, 8k, 16k, 32k, 64k, or<br>128k) |
|                   | Default: 4, [Int32]  |   |

Wait for the drive group initialization to complete. DO NOT power-off or reboot the system when the drive\_group state is INIT, RESYNC, or RECOVERY. To check the drive\_group state, issue the following command:

```
$ sudo graidctl list drive_group
```

OR

\$ sudo graidctl ls dg

Output content:

| Flag       | Description                                       |
|------------|---|
| DG ID      | Drive group ID                                    |
| MODE       | Drive group RAID mode                             |
| VD NUM     | Number of virtual drives in the drive group       |
| CAPACITY   | Total usable capacity of the drive group          |
| FREE       | Unused space of the drive group                   |
| USED       | Used space of the drive group                     |
| CONTROLLER | Drive group controlled by the specific controller |
| STATE      | Drive group state (see the following table)       |

Drive group state:



| State              | Description  |  |  |  |
|--------------------|--|--|--|--|
| OFFLINE            | Drive group is not working properly. This condition usually occurs when the number of damaged physical drives exceeds the limit.   |  |  |  |
| OPTIMAL            | Drive group is in optimal state.   |  |  |  |
| OPTIMAL (!)        | Drive group is in optimal state but found inconsistency data.  |  |  |  |
| OPTIMAL (cc)       | Drive group is in optimal state and the consistency check task is ongoing.   |  |  |  |
| OPTIMAL (cc!)      | Drive group is in optimal state and the consistency check task is ongoing but found inconsistent data.   |  |  |  |
| DEGRADED           | Drive group is available and ready, but the number of missing or failed physical drives has reached the limit.   |  |  |  |
| PARTIALLY_DEGRADED | Drive group is available and ready for use, but some physical drives are missing or failed.  |  |  |  |
| RECOVERY           | Drive group is recovering  |  |  |  |
| FAILED             | Drive group is not working normally.   |  |  |  |
| INIT               | Drive group is initializing.   |  |  |  |
| RESYNC             | Drive group is resynchronizing. This condition usually occurs when the system encounters an abnormal crash. Do not replace the physical drive in this state until the resynchronization process completes. |  |  |  |
| RESCUE             | Drive group is in rescue mode.   |  |  |  |

## **Deleting Drive Groups**

To delete a drive group, issue the following command:

Note: You cannot delete a drive group that contains a virtual drive.

```
$ sudo graidctl delete drive_group [DG_ID] [flag]
```

OR

```
$ sudo graidctl del dg [DG_ID] [flag]
```

In this example, drive group 1 was not deleted because it contains a virtual drive. Drive groups 0 and 2 were deleted successfully.



# **Displaying Drive Group Information**

To display detailed information about a drive group, issue the following command:

```
$ sudo graidctl describe drive group [DG ID] [flag]
```

OR

```
$ sudo graidctl desc dg [DG_ID] [flag]
```



| •••                                       |   |
|---|---|
| root@graid:∼# sudo<br>√Describe drive gro | graidctl describe drive_group 0<br>up successfullv. |
| DG ID:                                    | 0   |
| NQN:                                      | ngn.2020-05.com.graidtech:GRAID-SR2D2DF2D826D71D62  |
| Model:                                    | GRAID-SR  |
| Serial:                                   | 2D2DF2D826D71D62                                    |
| Firmware:                                 | 1.6.0-beta  |
| Mode:                                     | RAID5   |
| Capacity:                                 | 59 GiB (63172509696 B)                              |
| Free Space:                               | 0 B   |
| Used Space:                               | 59 GiB (63172509696 B)                              |
| Strip Size:                               | 4096  |
| State:                                    | OPTIMAL   |
| PD IDs:                                   | [3 1 2]   |
| Number of VDs:                            | 1   |
| Prefer Controller:                        | 0   |
| Running Controller:                       | 0   |
| Volatile Cache:                           | Disabled  |
|   | Enabled   |
| Journal:                                  | Degrade Only  |
| Attributes:                               |   |
|   | spdk_bdev = DISABLE                                 |
|   | rebuild_speed = high                                |
|   | auto_failover = ENABLE                              |
|   | $cc_speed = high$                                   |
|   | resync_speed = high                                 |
|   | init_speed = high                                   |
| root@graid:~# graid                       | ctl desc dg 0                                       |
| ✓Describe drive gro                       |   |
| DG ID:                                    | 0   |
| NQN:                                      | nqn.2020-05.com.graidtech:GRAID-SR2D2DF2D826D71D62  |
| Model:                                    | GRAID-SR  |
| Serial:                                   | 2D2DF2D826D71D62                                    |
| Firmware:                                 | 1.6.0-beta  |
| Mode:                                     | RAID5   |
| Capacity:                                 | 59 GiB (63172509696 B)                              |
| Free Space:                               | 0 B   |
| Used Space:                               | 59 GiB (63172509696 B)                              |
| Strip Size:                               | 4096  |
| State:                                    | OPTIMAL   |
| PD IDs:                                   | [3 1 2]   |
| Number of VDs:                            | 1   |
| Prefer Controller:                        | 0   |
| Running Controller:                       | 0   |
| Volatile Cache:                           | Disabled  |
| PD Volatile Cache:                        | Enabled   |
| Journal:                                  | Degrade Only  |
| Attributes:                               |   |
|   | init_speed = high                                   |
|   | <pre>spdk_bdev = DISABLE</pre>                      |
|   | rebuild_speed = high                                |
|   | <pre>resync_speed = high</pre>                      |
|   | auto_failover = ENABLE                              |
|   | cc_speed = high                                     |
|   |   |



Output content:

| Flag               | Description                                 |
|--------------------|---|
| DG ID              | Drive group ID                              |
| NQN                | Drive group NQN                             |
| Model              | Model number of the drive group             |
| Serial             | Serial number of the drive group            |
| Firmware           | Firmware version of the drive group         |
| Mode               | RAID mode of the drive group                |
| Capacity           | Capacity of the drive                       |
| Free Space         | Remaining space on the drive                |
| Used Space         | Used space of the drive                     |
| Strip Size         | Strip size (B) of the drive                 |
| PD IDs             | All PDs of the drive                        |
| Number of VDs      | Number of VDs of the drive<br>Maximum: 1023 |
| Prefer Controller  | Preferred controller of the drive           |
| Running Controller | Running controller number of the drive      |
| Volatile Cache     | VMC status for drive group                  |
| PD Volatile Cache  | VMC status for physical drive               |
| Journal            | Journal mode of the drive group             |
| Attributes         | Status of all attributes of the drive       |

### Selecting the Controller for a Drive Group

To set the controller to control a drive group, issue the following command:

```
$ sudo graidctl edit drive_group [DG_ID] controller [CX_ID]
```

Output example:

|                 | @graid demo<br>drive grou |                              | graidctl lis<br>ully.     | st drive_q       | group              | I  | 11                           |
|-----------------|---------------------------|------------------------------|---------------------------|------------------|--------------------|--|------------------------------|
| DG I            | D MODE                    | VD NUM                       | CAPACITY                  | FREE             | USED               | CONTROLLER                                   | STATE                        |
|                 | RAID1                     | 1<br>35                      | 3.5 TiB<br>  10 TiB       | 0 B<br>10 TiB    | 3.5 TiB<br>0 B     | running: 0 prefer: 0<br>running: 1 prefer: 1 | OPTIMAL  <br>OPTIMAL         |
|                 | @graid demo<br>controller |                              | graidctl li<br>ully.      | st contro        | ller               | II   |                              |
| ID              | CONTROLLER                | R MODEL                      | SERIAL NUMB               | ER NUMA          | STATE              | DG   |                              |
|                 |                           | 1xxxxxxxxxxx<br>1xxxxxxxxxxx |                           | ONLINE<br>ONLINE |                    |  |                              |
| ✓Edit<br>[graid | drive grou                | p successt<br>p~]\$ sudo     | graidctl lis              | 5                |                    | <br>0  |                              |
| DG I            | D MODE                    | VD NUM                       | CAPACITY                  | FREE             | USED               | CONTROLLER                                   | STATE                        |
| <br>  0<br>  1  | RAID1                     | 1 35                         | <br>  3.5 TiB<br>  10 TiB | 0 B<br>10 TiB    | <br>3.5 ТіВ<br>0 В |  | <br>  OPTIMAL  <br>  OPTIMAL |

#### Assigning a Controller to a Drive Group

To assign a controller to control a drive group, issue the following command:

```
$ sudo graidctl create drive_group [RAID_Type] [PD_IDs] -c [CX_ID]
```



## Managing Background Task Speed

To set the background task speed for a drive group, issue the following command:

\$ sudo graidctl edit drive\_group [DG\_ID] rebuild\_speed {low|normal|high}

#### Locating the Physical Drives in the Drive Group

To locate all the physical drives in a drive group, issue the following command:

\$ sudo graidctl edit drive\_group [DG\_ID] locating start

To stop locating all the physical drives in a drive group, issue the following command:

```
$ sudo graidctl edit drive_group [DG_ID] locating stop
```

#### Degradation and Recovery

If multiple drive groups require simultaneous recovery, the drive groups recover individually. If multiple physical drives in the same drive group require rebuilding, the physical drives are rebuilt simultaneously.

#### **Rescue Mode**

If a damaged drive group is initialized or a recovering drive group encounters an abnormal system crash, the data integrity of the drive group is affected. In this event, the drive group is forced offline to prevent data from being written to the drive group. To read the data for the drive group, force the drive group to go online using Rescue mode.

Note: A drive group in Rescue mode is read-only. Rescue mode cannot be disabled.

To enter rescue mode, issue the following command:

```
$ sudo graidctl edit drive group [DG ID] rescue mode on
```

# Managing Virtual Drives

# Creating a Virtual Drive

To create a virtual drive, issue the following command:

\$ sudo graidctl create virtual\_drive [DG\_ID] [VD\_SIZE] [flags]

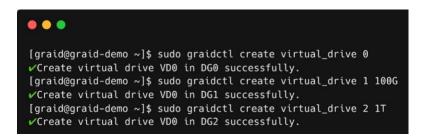
OR

\$ sudo graidctl c vd [DG\_ID] [VD\_SIZE] [flags]

Related command flags:

| Flag      | Description                               |  |
|-----------|---|--|
| -h,help   | Help for the create virtual_drive command |  |
| -s,serial | [string] Use user-specified serial ID     |  |

Output example:



Note: See

Setting Up the Auto-mount File Systems on Linux Using the SupremeRAID<sup>™</sup> Driver. It is critically important to follow these instructions to guarantee that the RAID group mounts automatically during system boot and to avoid any improper or unclear shutdown processes that could cause the RAID group to enter resync mode.

# **Listing Virtual Drives**

To list virtual drives, issue the following command:

```
$ sudo graidctl list virtual_drive [flag]
```

OR

\$ sudo graidctl ls vd [flag]

Related command flags:

| Flag     | Description                             |
|----------|---|
| -h,help  | Help for the list virtual_drive command |
| -d,dg-id | [string] List VDs of a certain DG ID    |
| -v,vd-id | [string] List certain VD IDs            |

| root®graid:/home/graid# graidctl list virtual_drive<br>√List virtual drive successfully. |      |       |         |             |         |          |
|--|------|-------|---------|-------------|---------|----------|
| VI   | ) ID | DG ID | SIZE    | DEVICE PATH | STATE   | EXPORTED |
| 0  |      | 0     | 959 MiB | /dev/gdg0n1 | OPTIMAL | No       |
|  |      |       |         |             |         |          |



#### Output content:

| Flag        | Description  |
|-------------|--|
| DG ID       | Drive group ID   |
| VD ID       | Virtual drive ID   |
| SIZE        | Usable size of the virtual drive   |
| DEVICE PATH | Device path of the virtual drive   |
| NQN         | NQN of the virtual drive   |
| STATE       | Virtual drive state - identical to the drive group state (see the following table) |
| EXPORTED    | Shows whether the virtual drive was exported using NVMe-oF or iSCSI                |

# Note: Do not perform I/O before the virtual drive is initialized and the device path (for example, /dev/gdgXnY) is created.

#### Virtual drive state:

| State              | Description   |
|--------------------|---|
| OFFLINE            | Drive group is not working normally. This condition is usually caused when the number of damaged physical drives exceeds the limit. |
| OPTIMAL            | Drive group is in the optimal state.  |
| PARTIALLY_DEGRADED | Drive group is available and ready for use, but some physical drives are missing or failed.   |
| RECOVERY           | Drive group is recovering.  |
| FAILED             | Drive group is not working normally.  |
| INIT               | Drive group is initializing.  |



| State  | Description  |
|--------|--|
| RESYNC | Drive group is resynchronizing. This condition usually occurs when the system<br>encounters an abnormal crash. Do not replace the physical drive in this state until<br>the resynchronization process completes. |
| RESCUE | Drive group is in rescue mode.   |

#### Stripe-cache state:

| State   | Description  |
|---------|--|
| OFFLINE | Stripe cache drive group is OFFLINE.                 |
| CLEAN   | Stripe cache write-back has finished.                |
| PURGE   | Stripe cache is writing data into the virtual drive. |
| ACTIVE  | Stripe cache is in optimal state.                    |

## **Deleting Virtual Drives**

To delete virtual drives, issue the following command:

\$ sudo graidctl delete virtual\_drive [DG\_ID] [VD\_ID] [flags]

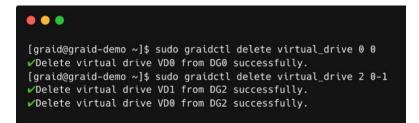
OR

\$ sudo graidctl del vd [DG\_ID] [VD\_ID] [flags]

Related command flags:

| Flag     | Description                               |
|----------|---|
| -h,help  | Help for the delete virtual_drive command |
| -f,force | Delete VD forcibly                        |

The following example shows that a virtual drive being used by the application cannot be deleted without adding the force flag.



## **Displaying Virtual Drive Information**

To display detailed information about a virtual drive, issue the following command:

```
$ sudo graidctl describe virtual drive [DG ID] [VD ID] [flags]
```

OR

\$ sudo graidctl desc vd [DG\_ID] [VD\_ID] [flags]

Output example:

| •••  |                                       |  |              |                |            |
|------|---------------------------------------|--|--------------|----------------|------------|
|      | ath: /dev/<br>4.3 C<br>OPTIM<br>tion: | successfully.<br>C79373ED375F<br>(gdg0n1<br>5B | cribe virtua | l_drive 0 4    |            |
| PORT | TRANSPORT TYPE                        | ADDRESS  | INTERFACE    | ADDRESS FAMILY | SERVICE ID |
| 0    | tcp                                   | 172.16.11.64                                   | ens192       | ipv4           | 4420       |

### Setting Up a Stripe Cache

Setting up a stripe cache improves HDD RAID 5 and RAID 6 sequential write performance. To set up a stripe cache:

Step 1 Create a stripe cache with a 4GB virtual drive.

\$ sudo graidctl create virtual\_drive 0 4GB

Note: For best practices, use a 4GB stripe whenever possible.

Step 2 Assign a 4GB virtual disk as the stripe cache.

\$ sudo graidctl edit virtual drive 0 0 stripecache 1 0

Step 3 Check the stripe cache.

\$ sudo graidctl list virtual\_drive

Step 4 To flush the stripe cache, issue the following command.

\$ sudo graidctl edit vd 0 0 stripecache none

The following output is assigned virtual drive is listed as = **Stripe Cache** = in the DEVICE PATH column.

| ∕Create virtua<br>∕Create virtua                                   | al drive<br>al drive<br>ake ~]\$ s                   | successfu<br>DO/VDO su<br>sudo graio                   | ccessfully.<br>dctl create virtual_                          |                                |          |
|--|--|--|--|--------------------------------|----------|
| [graid@graid-s<br>∕Edit virtual<br>[graid@graid-s                  | ake ~]\$ s<br>drive su<br>ake ~]\$ s                 | sudo graio<br>ccessfull<br>sudo graio                  | dctl edit virtual_dr<br>y.<br>dctl list virtual_dr           | ive 0 0 stripecache 0 1<br>ive | 1        |
| Edit virtual   | ake ~]\$ s<br>drive su<br>ake ~]\$ s                 | sudo graio<br>ccessfull<br>sudo graio                  | dctl edit virtual_dr<br>y.<br>dctl list virtual_dr           |                                | EXPORTED |
| [graid@graid-s<br>/Edit virtual<br>[graid@graid-s<br>/List virtual | ake ~]\$ s<br>drive su<br>ake ~]\$ s<br>drive su<br> | sudo graio<br>ccessfull<br>sudo graio<br>ccessfull<br> | dctl edit virtual_dr<br>y.<br>dctl list virtual_dr<br>y.<br> | ive<br>-                       | EXPORTED |

# Managing Controllers

## Activating a Controller

To enable a controller, issue the following command:

\$ sudo graidctl enable controller [Controller\_ID] [flags]

OR

\$ sudo graidctl enable cx [Controller\_ID] [flags]

Output example:



[graid@graid demo~]\$ sudo graidctl enable controller 0
//Enable controller successfully.
//Enable controller Controller 0 successfully.
[graid@graid demo~]\$ sudo graidctl enable cx 1
//Enable controller failed: Not found controller 1

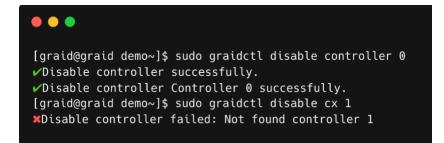
### Deactivating a Controller

To disable a controller, issue the following command:

\$ sudo graidctl disable controller [Controller ID] [flags]

OR

\$ sudo graidctl disable cx [Controller ID] [flags]



### **Listing Controllers**

To list controllers, issue the following command:

\$ sudo graidctl list controller [flag]

OR

\$ sudo graidctl ls cx [flag]

Output example:

| ••  |   |               |         |          |     |  |  |  |  |  |  |  |
|-----|---|---------------|---------|----------|-----|--|--|--|--|--|--|--|
| - 2 | l@graid demo~]\$ sudo<br>controller success | 2             | control | ler      |     |  |  |  |  |  |  |  |
| ID  | CONTROLLER MODEL                            | SERIAL NUMBER | NUMA    | STATE    | DG  |  |  |  |  |  |  |  |
|     | SR-1000                                     | 1xxxxxxxxxxx0 | 0       | ONLINE   | 0,1 |  |  |  |  |  |  |  |
| 1   | SR-1000                                     | 1xxxxxxxxxxx1 | 1       | OFFLINE  | 2,3 |  |  |  |  |  |  |  |
| - 5 |   |               |         |          |     |  |  |  |  |  |  |  |
| ID  | CONTROLLER MODEL                            | SERIAL NUMBER | NUMA    | STATE    | DG  |  |  |  |  |  |  |  |
| 0   | SR-1000                                     | 1xxxxxxxxxxx0 | 0       | ONLINE   | 0,1 |  |  |  |  |  |  |  |
| 1   | SR-1000                                     | 1xxxxxxxxxxx1 | 1       | OFFLINE  | 2,3 |  |  |  |  |  |  |  |
|     |   |               |         | <u> </u> |     |  |  |  |  |  |  |  |

### **Display Controller Information**

To display the controller information, issue the following command:

\$ sudo graidctl describe controller [Controller\_ID] [flag]

OR

```
$ sudo graidctl desc cx [Controller ID] [flag]
```



#### Output example:

| •••               |  |
|-------------------|--|
| [root@localhost   | ~]# sudo graidctl describe controller 0  |
| ✓Describe control | oller successfully.                      |
| Fullname:         | SR-1001                                  |
| Serial:           | 1420422030438                            |
| UUID:             | 489333294714454403                       |
| GPU UUID:         | GPU-2d17547a-1d8e-2f43-9999-37ecf249f5ca |
| State:            | ONLINE                                   |
| Numa Node:        | -1                                       |
| Running Dgs:      | 0, 1, 2                                  |
| Temperature:      | 72 C                                     |
| Fan Speed:        | 59 %                                     |

#### **Deleting a Controller**

To delete a controller, issue the following command:

```
$ sudo graidctl delete controller [Controller_ID] [flag]
```

OR

```
$ sudo graidctl del cx [Controller ID] [flag]
```

Note: You must disable the SupremeRAID<sup>™</sup> controller before you can delete it. Disabling the controller prevents further access to it and its associated drives, allowing you to delete the controller safely without affecting the system's operation.



## Replacing a Controller License Key

To replace a controller's license key, issue the following command:

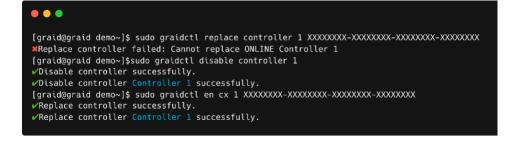
```
$ sudo graidctl replace controller [Controller_ID] [License_Key] [flags]
```

OR

```
$ sudo graidctl en cx [Controller_ID] [License_Key] [flags]
```

Follow these guidelines when replacing a controller license key:

- Disable the Controller: Before replacing the license key for a controller in SupremeRAID<sup>™</sup>, disable the controller to ensure it is not in use. This prevents access to the controller and its associated drives, allowing the license key to be replaced safely without affecting system operation.
- Ensure Compatibility: You cannot replace a license key with one that has a different architecture or supported features. Use the same license key or a compatible replacement to avoid replacement issues.
- Delete Inactive or Invalid Licenses: If you are replacing a card in the system, delete any inactive or invalid licenses associated with the old card. Failing to do so may prevent other cards from becoming active, which is especially important in multi-controller systems.



# Importing and Controlling MD Bootable NVMe RAIDs

After installing the SupremeRAID<sup>™</sup> driver and the graidctl utility, SupremeRAID<sup>™</sup> can import and control an MD bootable NVMe RAID. This feature makes it easy to swap drives if a bootable drive malfunctions.

Note: You must disable the SupremeRAID<sup>™</sup> controller before you can delete it. Disabling the controller prevents further access to it and its associated drives, allowing you to delete the controller safely without affecting the system's operation. For instructions on setting up the MD bootable NVMe RAID, see <u>Configuring Boot-Drive Devices</u>.

# Importing an MD Bootable NVMe RAID

Note: You can import only MD bootable NVMe RAID1.

To import an MD bootable NVMe RAID, issue the following command:

\$ sudo graidctl import md\_drive [DEVICE\_PATH\_0] [DEVICE\_PATH\_1] [flags]

OR

\$ sudo graidctl imp md [DEVICE\_PATH\_0] [DEVICE\_PATH\_1] [flags]

| 32       4       ngn.2014-08.org.nvmexpress:uuid:52797061-8f0f-27b3-fb2f-8462d3c8f972       VMware Virtual NVMe Disk       27 GB       N/A       OMLT         graid@graid ~)5 sudo graidctl ls dg       List drive group successfully.       STATE       Image: State of the s | PD ID | DG ID | NON/WWII  | D                                      |      |       |   | MODEL | CAPACITY | SLOT ID | STATE            |
|--|-------|-------|-----------|--|------|-------|---|-------|----------|---------|------------------|
| graid@graid ~]5 sudo graidctl ls vd<br>List drive group successfully.<br>DG ID MODE VD NUM CAPACITY FREE USED STATE<br>4 RAIDI 3 27 GB 0 B 27 GB 0PTINAL<br>graid@graid@n/15 sudo graidctl ls vd<br>List virtual drive successfully.   |       | 4     | ngn.2014  | 4-08.org.nvn                           |      |       |   |       | 27 GB    | N/A     | ONLINE<br>ONLINE |
| [graid@graid ~]5 sudo graidcti Is vd<br>/ List virtual drive successfully.   |       |       |           | İ————————————————————————————————————— |      | i     | - |       |          |         |                  |
| VD TR DG TR STZE DEVICE PATH STATE   |       |       |           |  |      |       |   |       |          |         |                  |
|  | VD ID | DG ID | SIZE      |  | H ST | ATE   |   |       |          |         |                  |
| 9 4 11 GB /dev/md127 OPTIMAL   | <br>0 | 4     | <br>11 GB | /dev/md127                             | — [  |       |   |       |          |         |                  |
| 0         4         11         GB         /dev/md127         OPTIMAL           1         4         5.4         GB         /dev/md125         OPTIMAL           2         4         5.4         GB         /dev/md126         OPTIMAL   |       | 4     | 5.4 GB    | /dev/md125                             | OP   | TIMAL |   |       |          |         |                  |

## Replacing an MD Bootable NVMe RAID1

Note: You can replace only MD bootable NVMe RAID1.

To replace an MD bootable NVMe RAID 1, replace the old NVMe SSD with the new one. The old physical drive state should indicate **MISSING**.

\$ sudo graidctl replace md\_drive [OLD\_MD)PD\_ID] [NEW\_DEVICE\_PATH] [flags]

OR

\$ sudo graidctl en md [OLD\_MD)PD\_ID] [NEW\_DEVICE\_PATH] [flags]

Related command flags:

| Flag     | Description                           |
|----------|---------------------------------------|
| -h,help  | Help for the replace md_drive command |
| -f,force | Replace ONLINE MD forcibly            |

The following example shows an MD missing.

|           |   |           | idctl ls pd<br>cessfully,  |      |        |       |  |  |                |                    |                   |
|-----------|---|-----------|--|------|--------|-------|--|--|----------------|--------------------|-------------------|
| PD ID     | DG ID   | NQN/WWII  | )  |      |        |       |  | MODEL  | CAPACITY       | SLOT ID            | STATE             |
| 32        | 4 4   |           | ngn.2014-08.org.nvmexpress:uuid:527970f1-8f0f-27b3-fb2f-8462d3c8f972<br>ngn.2014-08.org.nvmexpress:uuid:5218a65c-e259-6392-ff5c-35759b31b537 |      |        |       |  | - VMware Virtual NVMe Disk<br>VMware Virtual NVMe Disk | 27 GB<br>27 GB | <br>  N/A<br>  N/A | ONLINE<br>MISSING |
| ii        | i   |           | · · · · · · · · · · · · · · · · · · ·  |      |        |       |  | -  |                |                    |                   |
|           | [graid@graid ~]\$ sudo graidctl ls dg<br>✓ List drive group successfully. |           |  |      |        |       |  |  |                |                    |                   |
| DG ID     | MODE  | VD NUM    | CAPACITY   | FREE | USED   | STATE |  |  |                |                    |                   |
| 4         | RAID1   | 3         | 3 27 GB 0 B 27 GB DEGRADED   |      |        |       |  |  |                |                    |                   |
|           |   |           | idctl ls vd  |      |        |       |  |  |                |                    |                   |
| ✓ List vi | irtual d<br>  | rive succ | essfully.<br>  | I    | I      |       |  |  |                |                    |                   |
| VD ID     | DG ID   | SIZE      | SIZE DEVICE PATH STATE   |      |        |       |  |  |                |                    |                   |
| 0         | 4   | 11 GB     | /dev/md12:   | 7 DE | GRADED |       |  |  |                |                    |                   |
| 1         | 4   | 5.4 GB    | /dev/md125   |      | GRADED |       |  |  |                |                    |                   |
|           |   | 5.4 GB    | /dev/md126   |      | GRADED |       |  |  |                |                    |                   |



The following example shows a replaced drive. The bootable RAID group rebuilds immediately after replacing the drive.

|      | nqn.2014<br>sudo grai |   |   |               |   |  |  | !   | I   | ۱ <b></b>  |
|------|-----------------------|---|---|---------------|---|--|--|---|---|--|
|      |                       | dctl ls dg  |   |               | 2324/29-3d  | 0f-27b3-fb2f-8462d3c8f972<br>31-13e7-a316-f6e765e16ec8 | VMware Virtual NVMe Disk<br>  VMware Virtual NVMe Disk   |   | N/A<br>  N/A  | ONLINE<br>  REBUILD  |
| IODE | VD NUM                | CAPACITY<br>27 GB   | FREE<br>0 B   | USED<br>27 GB | STATE<br>REBUILD  |  |  |   |   |  |
|      |                       |   |   |               |   |  |  |   |   |  |
| G ID | SIZE                  | DEVICE PAT  | н ст  | ATE           |   |  |  |   |   |  |
| 4    | 11 GB<br>5.4 GB       |   |   |               |   |  |  |   |   |  |
| t    | ~]\$<br>ual dr        | U ~]\$ sudo grai<br>ual drive succe<br>ID SIZE<br>4   11 GB | Image: solution of the second seco |               | a)     b)     b)       a)     a)     c)     b)       a)     drive successfully.       b)     b)     b)       c)     D)     SIZE       d)     DEVICE PATH     STATE       4     11     GB     /dev/md127       4     5.4     GB     /dev/md125 |  | Image: Sudo graidctl ls vd       Jal drive successfully.       Image: Size       DEVICE PATH       STATE       4       11 GB       /dev/mdl27       REBUILD (pending)       4       5.4 GB       /dev/mdl25       REBUILD (82.52%) | ad     ad     ad     ad       ad     bit     bit     bit       bit     bit     bit     bit       constraint     bit     bit     bit       dir     bit     bit     bit | Image: Sudo graidatt ls vd       Image: Sudo graidatt ls vd       Jal drive successfully.       Image: Size device path       Size device pat | Image: Sudo graidatt ls vd       Image: |

#### Dismissing an Imported MD Bootable NVMe RAID1

Note: You can dismiss only MD bootable NVMe RAID1.

To dismiss an imported MD bootable NVMe RAID 1, issue the following command:

```
$ sudo graidctl delete drive_group [DG_ID] [flags]
```

OR

```
$ sudo graidctl del dg [DG_ID] [flags]
```

| • | •   |       |        |                           |        |       |         |  |  |  |  |  |
|---|---|-------|--------|---------------------------|--------|-------|---------|--|--|--|--|--|
|   | [graid@graid ~]\$ sudo graidctl ls dg<br>✔ List drive group successfully. |       |        |                           |        |       |         |  |  |  |  |  |
|   | DG ID   | MODE  | VD NUM | CAPACITY                  | FREE   | USED  | STATE   |  |  |  |  |  |
|   | 4   | RAID1 | 3      | 27 GB                     | 0 B    | 27 GB | OPTIMAL |  |  |  |  |  |
|   | - 5 - 5   |       | -      | idctl delete<br>essfully. | e dg 4 |       |         |  |  |  |  |  |

# Adjusting or Updating Configuration Settings for the SupremeRAID<sup>™</sup> Add-on

The add-on for SupremeRAID<sup>™</sup> provides enhanced configuration options and allows you to fine-tune system settings to meet your specific needs. Follow these steps to ensure that the add-on is configured optimally for maximum system performance.

# **Editing Configuration Settings**

To edit the configuration, issue the following command:

```
$ sudo graidctl edit config [config_name] [value] [flags]
```

OR

```
$ sudo graidctl e conf [config_name] [value] [flags]
```

Configuration options:

| Field   | Description                            |
|---------|--|
| SED_KEY | Add single SED key for specific device |

Output example:

| [graid@graid demo~]\$ sudo graidctl edit config sed_key nqn.2019-08.org.qemu:<br>Enter Key: ~Edit config successfully. | NVME0002 |
|--|----------|

# **Describing Configuration Settings**

To describe the configuration, issue the following command:

```
$ sudo graidctl describe config [config_name] [flags]
```

OR

```
$ sudo graidctl desc conf [config_name] [flags]
```



Configuration options:

| Field | Description                                 |
|-------|---|
| LED   | Obtain the imported LED configuration files |
| SED   | Obtain the SED key information              |

Output example:



# **Deleting Configuration Settings**

To delete the configuration, issue the following command:

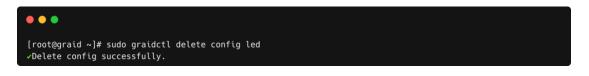
```
$ sudo graidctl delete config [config_name] [flags]
```

OR

```
$ sudo graidctl del conf [config_name] [flags]
```

Configuration options:

| Field | Description                                 |
|-------|---|
| LED   | Obtain the imported LED configuration files |
| SED   | Obtain the SED key information              |



## Restoring SupremeRAID<sup>™</sup> Configuration Settings

To scan all NVMe and SCSI drives and restore the latest SupremeRAID<sup>™</sup> configuration, issue the following command:

\$ sudo graidctl restore config [flags]

OR

```
$ sudo graidctl re conf [flags]
```

Related command flags:

| Flag    | Description                                  |
|---------|--|
| -h,help | Help for the restore config command          |
| -a,auto | Selects the last configuration automatically |

| [graid@graid demo~]\$ sudo graidctl restore config<br>#Restore config failed: Please stop the graid service before restoring the config, and restart the graid service after restored the config.<br>[graid@graid demo~]\$ sudo graidctl re conf<br>Skip /dev/sda: no config found  |
|---|
| Found the following configs:<br>0: Device /dev/nvme0n1, UUID 00200000-0000-0000-4d02-000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST<br>1: Device /dev/nvme1n1, UUID 00200000-0000-0000-4d02-00000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST<br>2: Device /dev/nvme2n1, UUID 00200000-0000-0000-4d02-00000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST |
| 3: Device /dev/nvme3n1, UUID 00200000-0000-4002-000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST<br>Please select one config to restore (0-3): 0<br>Restore to /etc/graid.conf (y/N)?: y<br>#Restore config graid.conf successfully.  |
| WRestore config graid.conf successfully.  |

# Managing Events

## Listing Events

To check detailed information from record, issue the following command:

\$ sudo graidctl list event [flags]

OR

\$ sudo graidctl ls event [flags]

Related command flags:

| Flag           | Description                                 |
|----------------|---|
| -h,help        | Help for the list event command             |
| -c,component   | [string] Filter events by component         |
| -n,max_entries | [int32] Limit the number of events returned |
| -o,output      | [string] Output to a file                   |
| -s,severity    | [string] Filter events by severity          |

| [graid@graid-demo ~]\$ sudo graidctl list event -n 10 -s INFO -c DG<br>✔List event successfully.  |
|---|
| [2022-06-22 22:06:29 +0800 CST][INF0][DG][0] State transitted from UNKNOWN to OFFLINE.<br>[2022-06-22 22:20:07 +0800 CST][INF0][DG][0] Drive group deleted. |
| [2022-06-22 22:21:13 +0800 CST][INF0][DG][0] State transitted from UNKNOWN to OPTIMAL.  |
| [2022-06-22 22:21:13 +0800 CST][INF0][DG][0] Drive group created.<br>[2022-06-22 22:28:02 +0800 CST][INF0][DG][0] Drive group deleted.                      |
| [2022-06-22 22:28:20 +0800 CST][INF0][DG][0] State transitted from UNKNOWN to OPTIMAL.<br>[2022-06-22 22:28:20 +0800 CST][INF0][DG][0] Drive group created. |
| [2022-06-22 22:30:15 +0800 CST][INF0][DG][0] Drive group created.<br>[2022-06-22 22:30:15 +0800 CST][INF0][DG][0] CC has started.                           |
| [2022-06-22 23:26:57 +0800 CST][INF0][DG][0] CC has completed.<br>[2022-06-22 23:26:57 +0800 CST][INF0][DG][0] CC has started.                              |
|   |



### **Deleting Events**

To delete events, issue the following command:

\$ sudo graidctl delete event [flags]

OR

\$ sudo graidctl del event [flags]

Related command flags:

| Flag       | Description  |
|------------|--|
| -h,help    | Help for the delete event command                    |
| -d,date    | [string] Delete event entries before the date        |
| -e,entries | int32] Keep the latest number of entries Default: -1 |

# Managing NVMe-oF Remote Targets

Before you can create physical drives from remote NVMe-oF devices, you must connect to the NVMe-oF remote target.

#### Connecting to a NVMe-oF Remote Target

To connect to a remote NVMe-oF target, issue the following command:

```
$ sudo graidctl connect remote_target [transport type] [addr] [address
family] [port service id]
```

OR

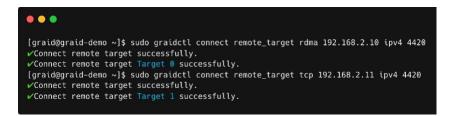
\$ sudo graidctl con rt [transport type] [addr] [address family] [port service id]



Required parameters:

| Option         | Description  |
|----------------|--|
| transport type | <ul> <li>Network fabric used for a NVMe-over-Fabrics network. Current string values include:</li> <li>RDMA = network fabric is an RDMA network (RoCE, iWARP, InfiniBand, basic RDMA, etc.)</li> <li>TCP = network fabric is a TCP/IP network.</li> </ul> |
| ip address     | Network address of the controller  |
| address family | Network address protocol. Current string values include ipv4/ipv6.   |
| port service   | Transport service ID   |

Output example:



### Listing Connected NVMe-oF Remote Targets

To list all the connected NVMe-oF remote targets, issue the following command:

```
$ sudo graidctl list remote_target
```

OR

```
$ sudo graidctl ls rt
```



Output example:

|         |      | ~]\$ sudo gra<br>et successfu          | aidctl list nvm<br>lly. | eof_target     | Ĩ.         |                           |
|---------|------|--|-------------------------|----------------|------------|---------------------------|
| PORT ID | TYPE | INTERFACE                              | ADDRESS                 | ADDRESS FAMILY | SERVICE ID | SUBSYSTEMS                |
| 0       | tcp  | ens160                                 | 172.16.11.81            | ipv4           | 4420       | DG0/VD0, DG0/VD1          |
| 1       | tcp  | ens160                                 | 172.16.11.81            | ipv4           | 4421       | DG0/VD0, DG0/VD1, DG0/VD3 |
|         |      | <br>~]\$ sudo gra<br> et successfu<br> |                         |                | j          | 1                         |
| PORT ID | TYPE | INTERFACE                              | ADDRESS                 | ADDRESS FAMILY | SERVICE ID | SUBSYSTEMS                |
| 0       | tcp  | <br>  ens160                           | 172.16.11.81            | <br>  ipv4     | 4420       | DG0/VD0, DG0/VD1          |
|         | tcp  | ens161                                 | 172.16.11.82            | ipv4           | 4420       | DG0/VD0, DG0/VD1, DG0/VD3 |

#### Disconnecting from NVMe-oF Remote Targets

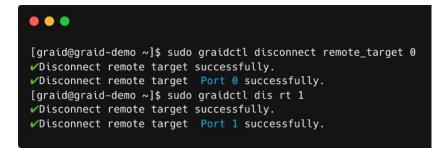
Note: You cannot delete the target when there are physical drives created from the target.

To disconnect from an NVMe-oF remote target, issue the following command:

\$ sudo graidctl disconnect remote target [target id]

OR

```
$ sudo graidctl dis rt [target id]
```



## Managing NVMe-oF Export Target

You can export the virtual drive via the NVMe-oF export target to other initiators.

## Creating the NVMe-oF Export Target Port Service

To create the NVMe-oF export target port service, issue the following command:

```
$ sudo graidctl create export_target [tcp|rdma] [interface] [address family]
[srvcid] [flags]
```

OR

```
$ sudo graidctl c et [tcp|rdma] [interface] [address family] [srvcid] [flags]
```

| •••   |  |           |             |                |            |            |
|---|--|-----------|-------------|----------------|------------|------------|
| <pre>[graid@graid-demo ~]\$ sudo graidctl create export_target tcp enol ipv4 4420</pre> |  |           |             |                |            |            |
| ✓List   | <pre>~List export target successfully.</pre> |           |             |                |            |            |
| ID  | TYPE   | INTERFACE | ADDRESS     | ADDRESS FAMILY | SERVICE ID | SUBSYSTEMS |
| 0   | tcp  | eno1      | 172.17.2.20 | ipv4           | 4420       |            |
| 1   | tcp  | enol      | 172.17.2.20 | ipv4           | ipv4 4421  |            |
| =   |  |           |             |                |            |            |

### Exporting the Virtual Drive via NVMe-oF Export Targets

To export the virtual drive via NVMe-oF export targets using the service port you created, use the following command:

\$ sudo graidctl export virtual\_drive [DG\_ID] [VD\_ID] [flags]

OR

\$ sudo graidctl exp vd [DG\_ID] [VD\_ID] [flags]

Related command flags:

| Flag        | Description                                 |
|-------------|---|
| -h,help     | Help for the export NVMe-oF targets command |
| -a,all      | Export all NVMe-oF target into all ports    |
| -p,port-ids | Port IDs [Int32]                            |

| •••  |  |
|--|--|
| <ul> <li>Export virtual drive</li> <li>Export virtual drive</li> <li>Export virtual drive</li> <li>Export virtual drive</li> </ul>   | <pre>sudo graidctl export virtual_drive 0 0-1all successfully. VD0 into Target 0 successfully. VD0 into Target 1 successfully. VD1 into Target 0 successfully. VD1 into Target 1 successfully.</pre> |
| [graid@graid-demo ~]\$<br><pre> <export <pre="" drive="" virtual=""> <export <pre="" [graid@graid-demo="" drive="" virtual="" ~]\$=""> <pre> <pre> </pre> </pre></export></export></pre> | <pre>sudo graidctl export virtual_drive 0 2ids=1 successfully. VD2 into Target 1 successfully. sudo graidctl export virtual_drive 0 3 -i 0</pre>   |

### Listing Created NVMe-oF Export Targets

To list all created NVMe-oF export target devices, issue the following command:

```
$ sudo graidctl list export_target
```

OR

\$ sudo graidctl ls et

| •• | •••  |                                |             |                  |            |                           |  |  |
|----|------|--------------------------------|-------------|------------------|------------|---------------------------|--|--|
|    |      | -demo ~]\$ suc<br>target succe |             | st export_target | 1          |                           |  |  |
| ID | TYPE | INTERFACE                      | ADDRESS     | ADDRESS FAMILY   | SERVICE ID | SUBSYSTEMS                |  |  |
| 0  | tcp  | enol                           | 172.17.2.20 | ipv4             | 4420       | DG0/VD0, DG0/VD1, DG0/VD3 |  |  |
| 1  | tcp  | eno1                           | 172.17.2.20 | ipv4             | 4421       | DG0/VD0, DG0/VD1, DG0/VD2 |  |  |
|    |      |                                |             |                  |            |                           |  |  |
| ID | TYPE | INTERFACE                      | ADDRESS     | ADDRESS FAMILY   | SERVICE ID | SUBSYSTEMS                |  |  |
| 0  | tcp  | enol                           | 172.17.2.20 | ipv4             | 4420       | DG0/VD0, DG0/VD1, DG0/VD3 |  |  |
| 1  | tcp  | eno1                           | 172.17.2.20 | ipv4             | 4421       | DG0/VD0, DG0/VD1, DG0/VD2 |  |  |
|    |      |                                |             |                  |            |                           |  |  |

### Deleting the NVMe-oF Export Target Port Service

To delete the NVMe-oF export target port service, issue the following command:

```
$ sudo graidctl delete export_target [PORT_ID] [flags]
```

```
OR
```

\$ sudo graidctl del et [PORT\_ID] [flags]

Related command flags:

| Flag     | Description                               |
|----------|---|
| -h,help  | Help for the delete export_target command |
| -f,force | Force delete ports                        |

Output example:

#### Unexporting the Virtual Drives form NVMe-oF export Targets

To unexport a virtual drive from an NVMe-oF export target, issue the following command:

```
$ sudo graidctl unexport virtual_drive [DG_ID] [VD_ID] [flags]
```

OR

\$ sudo graidctl unexp vd [DG\_ID] [VD\_ID] [flags]



Output example:

| <pre>[graid@graid-demo ~]\$ sudo graidctl unexport virtual_drive 0 0 -<br/>~Unexport virtual drive successfully.<br/>~Unexport virtual drive VD0 from target 0 successfully.</pre> | -all |
|--|------|
| <pre>~Unexport virtual drive VD0 from target 1 successfully. [graid@graid-demo ~]\$ sudo graidctl unexport virtual_drive 0 1 -</pre>   | i1   |
| ✓Unexport virtual drive successfully. ✓Unexport virtual drive VD1 from target 1 successfully.  |      |

# Using Consistency Checks to Ensure Data Integrity

The consistency check operation verifies that the data is correct in DGs that use RAID levels 1, 5, 6, and 10. In a system with parity, for example, checking consistency calculates the data on one drive and compares the results to the contents of the parity drive.

Note: You cannot perform a consistency check on RAID 0 because it does not provide data redundancy. Additionally, a consistency check can only run when the DG is in OPTIMAL or PARTIALLY\_DEGRADED state.

The consistency check function records all events to the event database, and graidctl provides commands to retrieve the events. The maximum number of event entries is 1,000. The system deletes event entries periodically. You can also delete entries manually.

## Starting Consistency Checks Manually

To start a consistency check manually, issue the following command:

```
$ sudo graidctl start consistency check manual task [flags]
```

OR

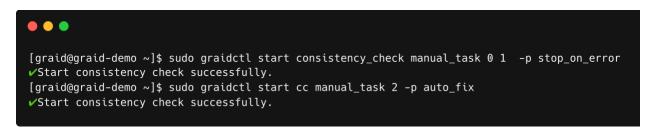
\$ sudo graidctl start cc [flags]

Related command flags:

| Flag      | Description   |
|-----------|---|
| -h,help   | Help for the start consistency_check manual command |
| -p,policy | [string] Specify CC policy [stop_on_error/auto_fix] |

DG state for consistency check: Enabling a consistency check task will add the following annotations beside the output string of the DG state.

| DG State      | Description                                       |
|---------------|---|
| OPTIMAL       | Normal state without enabling consistency check   |
| OPTIMAL (!)   | Inconsistency found                               |
| OPTIMAL (cc)  | Consistency check ongoing                         |
| OPTIMAL (cc!) | Consistency check ongoing and inconsistency found |



## Stopping Consistency Check

To stop a consistency check task, issue the following command:

```
$ sudo graidctl stop consistency check current task [flags]
```

OR

\$ sudo graidctl stop cc current\_task [flags]

Output example:



## Scheduling Consistency Checks

To schedule a consistency check task, issue the following command:

```
$ sudo graidctl set consistency_check schedule_mode
[off|continuously|hourly|daily|weekly|monthly][yyyy/mm/dd] [hh] [flags]
```

OR

```
$ sudo graidctl set cc schedule_mode
[off|continuously|hourly|daily|weekly|monthly] [yyyy/mm/dd] [hh] [flags]
```

DG State: Enabling a consistency check task adds the following annotations beside the output string of the DG state.

| DG State      | Description                                       |
|---------------|---|
| OPTIMAL       | Normal state without enabling consistency check   |
| OPTIMAL (!)   | Inconsistency found                               |
| OPTIMAL (cc)  | Consistency check ongoing                         |
| OPTIMAL (cc!) | Consistency check ongoing and inconsistency found |



#### Output example:



#### Viewing Consistency Check Information

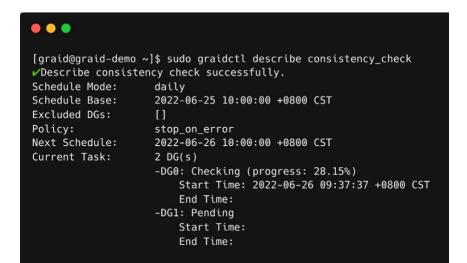
To view detailed consistency check information, issue the following command:

```
$ sudo graidctl describe consistency check [flags]
```

OR

```
$ sudo graidctl desc consistency check [flags]
```

Output example:



#### Setting the Consistency Check Policy

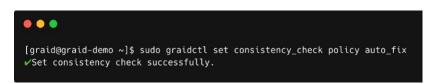
To set a consistency check policy, issue the following command.

Note: By default, the consistency check runs on all drive\_groups. To exclude drive groups, run the xcluded\_dgs command.

\$ sudo graidctl set consistency\_check policy [auto\_fix|stop\_on\_error] [flags]



Output example:



### Excluding Drive Groups from the Consistency Check Policy

To exclude some drive groups from a consistency check policy, issue the following command:

\$ sudo graidctl set consistency\_check excluded\_dgs [DG\_IDs]

OR

```
$ sudo graidctl set cc excluded dgs [DG IDs]
```



# ADDITIONAL FUNCTIONS

This chapter describes the following additional tasks you can perform with SupremeRAID™.

- Configuring Boot-Drive Devices
- Manually Migrating the RAID Configuration Between Hosts
- Restarting the SupremeRAID<sup>™</sup> Service After Upgrading the System Kernel
- Obtaining SMART Information from Devices
- Monitoring System Input/Output Statistics for Devices Using iostat
- Setting Up the Auto-mount File Systems on Linux Using the SupremeRAID™ Driver
- ESXi Virtual Machine Support Using GPU Passthrough
- Using Self-Encrypting Drives

# Configuring Boot-Drive Devices

You can configure two NVMe SSDs as RAID1 boot devices and control them using SupremeRAID<sup>™</sup>. The procedure you use depends on the operating system.

- For CentOS, see Procedure for CentOS.
- For Ubuntu, see Procedure for Ubuntu.
- For SLES 15 SP2 and SP3, see Procedure for SLES 15 SP2, and SP3.
- Note: Please note, these procedures are provided for reference only. Your actual steps may vary depending on your Linux distribution and version. For complete and up-to-date information, please refer to your Linux distro's documentation or contact the distro's support team for further information. You cannot configure boot-drive devices across multiple operating systems.

## Procedure for CentOS

#### Assigning RAID1 Boot Devices Manually

You assign RAID1 boot devices when you install CentOS. If the CentOS GUI does not prompt you to assign the boot devices, you can assign them manually.

Step 1 From the INSTALLATION SUMMARY page, select **SYSTEM > Installation Destination**.

| CentOS | INSTALLATION SUMMARY                        |                  | CENTOS     | LINUX 8 INSTALLATION                     |
|--------|---|------------------|------------|--|
| Centos |   |                  | 🖽 us       | Help!                                    |
| 1      | LOCALIZATION                                | SOFTWARE         |            | SYSTEM                                   |
|        | English (US)                                | Installation Sou | rce        | Installation Desti                       |
|        | Language Support<br>English (United States) | Software Select  | tion       | KDUMP<br>Kdump is enabled                |
|        | O Time & Date<br>Asia/Taipei timezone       |                  |            | Network & Host<br>Wired (ens192) connect |
|        | USER SETTINGS                               |                  |            | Security Policy                          |
|        | Root Password<br>Root account is disabled.  |                  |            |  |
|        |   |                  | Quit       | Begin Installation                       |
|        |   | We won't touch   | vour disks | until you click 'Begin Installation      |

Step 2 From the INSTALLATION DESTINATION page, select the two NVMe SSDs that you want to set as RAID1 boot devices.

| INSTALLATION DESTINATION Done   | CENTOS LINUX 8 INSTALLATION  |
|---|--|
| Device Selection<br>Select the device(s) you'd like to install to. They will be left untouch  | ed until you click on the main menu's "Begin Installation" button. |
| Local Standard Disks  |  |
| 10 GiB  | 10 GiB   |
| # <b>#</b>  | <b></b>  |
| re Virtual NVMe Disk i.6b4f27116183325d000c296a891bb4a3   | VMware Virtual NVMe Disk i.1c65d3900abf288f000c296788e2902a        |
| nvmeOn1 / 10 GiB free   | nvme0n2 / 10 GiB free  |
| Specialized & Network Disks   | Disks left unselected here will not be touched                     |
| Storage Configuration  Automatic Custom  I would live to make additional space available.  Bercyption  Encrypt my data. You'll set a passphrase next. | Disks left unselected here will not be touche                      |
| II disk summary and boot loader   | 2 disks selected: 20 GB capacity; 20 GB free <u>Batre</u>          |

Note: To select multiple devices, use the Ctrl key.

#### Step 3 For Storage Configuration, select Custom.

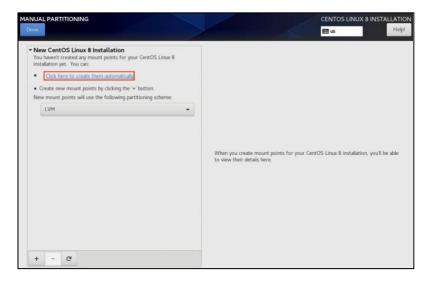
| Done<br>Device Selection | on                   |               |                                    |                                   | 🕮 us          | Helpl                       |
|--------------------------|----------------------|---------------|------------------------------------|-----------------------------------|---------------|-----------------------------|
| elect the devi           | ce(s) you'd like     | to install to | . They will be left untouched unti | l you click on the main menu's "B | egin Insta    | allation" button.           |
| ocal Standard D          | Disks                |               |                                    |                                   |               |                             |
|                          |                      | 10 GiB        |                                    |                                   | 10 GiB        |                             |
|                          |                      |               |                                    |                                   |               |                             |
| VMware Virt              | ual NVMe Disk        | i.6b4f2711    | L6183325d000c296a891bb4a3          | VMware Virtual NVMe Disk          | i.1c65d39     | 900abf288f000c29678         |
|                          | nvme0n1              | 1             | 10 GiB free                        | nvme0n2                           | 1             | 10 GiB free                 |
| ecialized & Ne           |                      |               |                                    |                                   |               |                             |
| itorage Confi            | guration<br>© Custon | n             |                                    | Disk                              | s left unsele | cted here will not be touch |

Step 4 Click Done.

#### **Creating Storage Partitions Manually**

You manually create the storage partitions on CentOS systems. Each partition function as a software RAID.

- Step 1 From the MANUAL PARTITIONING page, select New CentOS Linux 8 Installation.
- Step 2 Click here to create them automatically to create the mount points.





Step 3 Set Device Type to RAID and set RAID LEVEL to RAID 1.

Step 4 Click Update Settings. Each partition function as a software RAID.

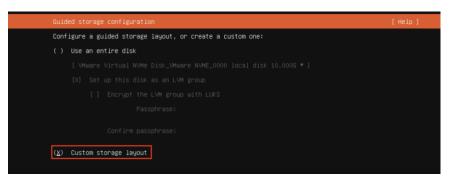
| MANUAL PARTITIONING   |   |   | CENTOS LINUX 8 INSTALLATION  |
|---|---|---|--|
| New CentOS Linux 8 Installation<br>SYSTEM<br>// croat<br>//boot/efi<br>nmmt0nlp1<br>/boot<br>nmmt0nlp2<br>Swap<br>cl-swap | 16.41 GiB<br>600 MiB<br>1024 MiB<br>2 GiB | cl-root<br>Mount Point:<br>/<br>Desired Capacity:<br>16.41 G/B<br>Device Type:<br>RAID<br>File System:<br>file System:<br>file System:<br>file System:<br>Start Point:<br>File System:<br>Start Point:<br>File System:<br>Start Point:<br>File System:<br>Start Point:<br>File System:<br>Start Point:<br>File System:<br>Start Point:<br>Start Point:<br>S | Devketg):<br>VMaxe Virtual NVMe Disk I.<br>654727115183325000022964891b64a<br>3 (nmme0n] and 1 other<br>Modify   |
| + - G   |   | Label:<br>Note: 1<br>be app   | Name:<br>root<br>Update Settings<br>The settings you make on this screen will not<br>lead until you click on the main menu's Begin<br>Installation button. |

### Procedure for Ubuntu

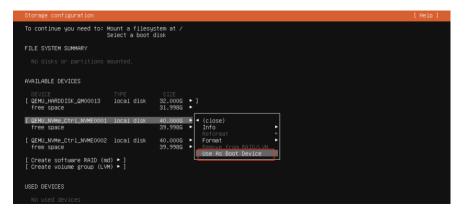
#### Creating and Configuring Storage Partitions

Storage partitions must be created and configured during the Ubuntu Server 20.04 installation. The partitions are required for mounting /boot, swap, and root/. Each partition functions as a software RAID.

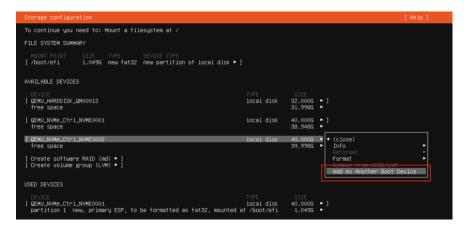
Step 1 From the Guided storage configuration page, select **Custom storage layout**.



Step 2 From the Storage configuration page, select the first disk and choose Use As Boot Device.



Step 3 From the Storage Configuration page, select the second disk and Use As Another Device.



Step 4 Devices used for the MD bootable RAID will be listed as **USED DEVICES** in the interface.

| Storage configuration  |                                    |                                | [ Help ] | ) |
|--|------------------------------------|--------------------------------|----------|---|
| To continue you need to: Mount a filesystem at /   |                                    |                                |          |   |
| FILE SYSTEM SUMMARY  |                                    |                                |          |   |
| HOUNT POINT SIZE TYPE DEVICE TYPE<br>[/boot/efi 1:049G new fat32 new partition of local disk ►         | u                                  |                                |          |   |
| AVAILABLE DEVICES  |                                    |                                |          |   |
| DEVICE<br>[ QEMJ_HARDDISK_QM00013<br>free space  | TYPE<br>local disk                 | SIZE<br>32.000G ►<br>31.998G ► |          |   |
| [ QEMU_NVMe_Ctrl_NVME0001<br>free space  | local disk                         | 40.000G ►<br>38.948G ►         |          |   |
| [ QEMU_NVMe_Ctrl_NVME0002<br>free space  | local disk                         | 40.000G ►<br>38.948G ►         |          |   |
| [Create software RAID (md) ⊨ ]<br>[Create volume group (LVH) ► ]                                       |                                    |                                |          |   |
| USED DEVICES   |                                    |                                |          |   |
| DEVICE<br>[ QEMU_NVMe_Ctrl_NVWE0001<br>partition 1 new, primary ESP, to be formatted as fat32, mounted | TYPE<br>local disk<br>at ∕boot∕efi | SIZE<br>40.000G ►<br>1.049G ►  |          |   |
| [ QEMU_NVMe_Ctrl_NVME0002<br>partition 1 new, backup ESP, to be formatted as fat32                     | local disk                         | 40.000G ►<br>1.049G ►          |          |   |

- Step 5 From the Disk menu, select **free space** and choose **Add GPT Partition**. Leave both disks unformatted.
  - A Select first drive and select Add GPT Partition.

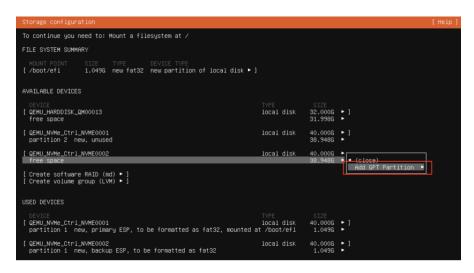


| To continue you need to: Mount a filesystem at /  |                                    |                            |                     |   |
|---|------------------------------------|----------------------------|---------------------|---|
| FILE SYSTEM SUMMARY   |                                    |                            |                     |   |
| HOUNT POINT SIZE TYPE DEVICE TYPE<br>[/boot/efi 1.049G new fat32 new partition of local disk ►        |                                    |                            |                     |   |
| AVAILABLE DEVICES   |                                    |                            |                     |   |
| DEVICE<br>[ QEMU_HARDDISK_QM00013<br>free space   | ⊤YPE<br>local disk                 | SIZE<br>32.000G<br>31.998G |                     |   |
| [ QEMU_NVMe_Ctrl_NVME0001<br>free space   | local disk                         | 40.000G<br>38.948G         |                     | 4 |
| [ QEMU_NVMe_Ctrl_NVME0002<br>free space   | local disk                         | 40.000G<br>38.948G         | Add GPT Partition • |   |
| [ Create software RAID (md) ► ]<br>[ Create volume group (LVM) ► ]                                    |                                    |                            |                     |   |
| USED DEVICES  |                                    |                            |                     |   |
| DEVICE<br>[QEMU_NVMe_Ctrl_NVME0001<br>partition 1 new, primary ESP, to be formatted as fat32, mounted | ⊺YPE<br>local disk<br>at ∕boot/efi | SIZE<br>40.000G<br>1.049G  |                     |   |
| [ QEMU_NVMe_Ctrl_NVME0002<br>partition 1 new, backup ESP, to be formatted as fat32                    | local disk                         | 40.000G<br>1.049G          |                     |   |

B Leave the drive unformatted.

| Adding GP<br>Size (max 38.948G): | partition to QE⊬     | U_NVMe_Ctrl_NVME0001 |  |
|----------------------------------|----------------------|----------------------|--|
| Format:                          | Leave unformatt      | ed ▼ ]               |  |
|                                  |                      |                      |  |
|                                  | [ Create<br>[ Cancel | 1                    |  |

C Select another drive for OS bootable RAID.





D Leave the drive also unformatted.



Note: You must use [Leave unformatted]. DO NOT mount the partition. Setting RAID1 and mounting partitions on multiple drives (MD) occurs later in this procedure.

#### Creating a Software RAID for Multiple Devices (MD)

To create the software RAID on multiple devices, from the Storage configuration page, select **Create software RAID (md)**.

Step 1 Select Create Software RAID (md) for the previously configured disks.

| To continue you need to: Mount a filesystem at /  |                                 |  |
|---|---------------------------------|--|
| FILE SYSTEM SUMMARY   |                                 |  |
| HOUNT POINT SIZE TYPE DEVICE TYPE<br>[/boot/efi 1.0496 new fat32 new partition of local disk • ]                  |                                 |  |
| AVAILABLE DEVICES   |                                 |  |
|   | SIZE<br>32.0006 ►]<br>31.9986 ► |  |
| [QEMU_NVMe_Ctrl_NVMED001 local disk<br>partition 2 new, unused  | 40.000G • ]<br>38.948G •        |  |
| [ QEMU_NVMe_Ctrl_NVME0002 local disk<br>partition 2 new, unused   | 40.000G • ]<br>38.948G •        |  |
| [ Create software RAID (md) ► ]<br>( Create volume group (LVH) ► ]  |                                 |  |
| USED DEVICES  |                                 |  |
| פריער<br>[QEMU_AVMe_Ctrl_NVME0001<br>partition i new, primary ESP, to be formatted as fat32, mounted at /Boot/efi | SIZE<br>40.000G ►]<br>1.049G ►  |  |
| [QEMLJNVMe_Ctrl_NVME0002 local disk<br>partition 1 new, backup ESP, to be formatted as fat32                      | 40.000G ►]<br>1.049G ►          |  |

Step 2 Select the configured partitions on both disks, then create the Software RAID (md).



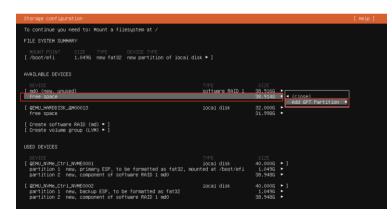
|  | Create software RAID ("M   | D") disk ———                               |   |      |
|--|--|--|---|------|
| Name:  | md0  |  |   |      |
| RAID Level:  | [ 1 (mirrored) 🔻 ]   |  |   |      |
|  |  |  |   |      |
| Devices:   | [] QEMU_HARDDISK_QM00013<br>[ active ♥ ]<br>unused local disk                        | 32.000G                                    |   |      |
|  |  | 40.000G                                    |   |      |
|  |  | 38.948G                                    |   |      |
|  | QEMU_NVMe_Ctrl_NVME0002  | al disk<br>40.000G                         |   |      |
|  |  | 38.948G                                    |   |      |
|  | unused partition of loc  |  |   |      |
|  |  |  |   |      |
|  |  |  |   |      |
|  | [ <u>C</u> reate]<br>[Cancel]]   |  |   |      |
|  |  |  |   |      |
|  |  |  |   | -    |
| Storage configurati  | nn   |  |   | [ He |
|  | d to: Mount a filesystem at /  |  |   |      |
| FILE SYSTEM SUMMARY  |  |  |   |      |
|  | HIZE TYPE DEVICE TYPE<br>.049G new fat32 new partition of loca!                      | l disk ⊨ ]                                 |   |      |
| AVAILABLE DEVICES  |  |  |   |      |
| DEVICE<br>[ md0 (new, unused)<br>free space                          |  | TYPE<br>software RAID 1                    | SIZE<br>38.916G ►]<br>38.914G ►             |      |
| [ QEMU_HARDDISK_QM0<br>free space                                    | 0013   | local disk                                 | 32.000G ►]<br>31.998G ►                     |      |
| [ Create software R<br>[ Create volume gro                           |  |  |   |      |
| USED DEVICES   |  |  |   |      |
| DEVICE<br>[QEMU_NVMe_Ctrl_NV<br>partition 1 new,<br>partition 2 new, | ME0001<br>primary ESP, to be formatted as fat32,<br>component of software RAID 1 md0 | TVPE<br>local disk<br>mounted at ∕boot/efi | SIZE<br>40.000G ►]<br>1.049G ►<br>38.948G ► |      |
| [ QEMU_NVMe_Ctrl_NV<br>partition 1 new,<br>partition 2 new,          | MEOOO2<br>backup ESP, to be formatted as fat32<br>component of software RAID 1 md0   | local disk                                 | 40.000G ►]<br>1.049G ►<br>38.948G ►         |      |

#### Configuring the Boot Partition for MD

The following procedure describes how to configure the /boot, swap, and root/ partitions on both disks

To set MD as the mounting point:

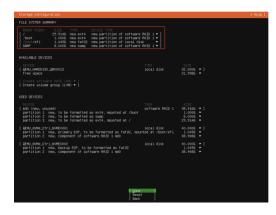
Step 1 Select the **free space** option in the md, then Choose **Add GPT Partition**.



Step 2 Set the size of the EFI System Partition (ESP). Allocate sufficient capacity for each partition based on anticipated usage.

|                     | Adding GPT parti             | tion to mdO |
|---------------------|------------------------------|-------------|
| Size (max 38.914G): | 1G                           |             |
| Format:             | [ ext4                       | • 1         |
| Mount:              | [/boot                       | • ]         |
|                     | [ <u>C</u> reate<br>[ Cancel | 1           |
|                     |                              |             |
|                     | Adding GPT parti             | tion to mdO |
| Size (max 37.914G): | 8G                           |             |
| Format:             | [ swap                       | • ]         |
| Mount:              |                              | * ]         |
|                     | [ <u>C</u> reate<br>[ Cancel | 1           |
|                     |                              |             |
|                     | - Adding GPT parti           | tion to mdO |
| Size (max 29.914G): |                              |             |
| Format:             | [ ext4                       | ▼ ]         |
| Mount:              |                              | • 1         |
|                     | [ <u>C</u> reate<br>[ Cancel | ]           |

Step 3 After creating the partitions, the md configuration should display the following information.



Step 4 From the Confirm destructive action popup, select **Continue**. The partition settings are now in effect.



## Procedure for SLES 15 SP2, and SP3

When installing SLES 15 SP2 or SP3, you must manually create RAID1 and configure the partitions. To manually create RAID1 and configure the partitions:

Step 1 From the SUSE Suggested Partitioning page, select **Expert Partitioner > Next**.

| SUSE                   |   |                 |
|------------------------|---|-----------------|
| Suggested Partitioning | Initial layout proposed after adjusting the Guided Setup settings:<br>- 4 not propose a separate /home<br>Changes to partitioning:<br>- 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 |                 |
|                        | Guided Satup<br>Expert Partitioner -  |                 |
| Help Rolease Notes     |   | Abort Back Next |

#### Step 2 From the SUSE Add menu, select Add > RAID.

| SUSE   |                    |                                    |     |   |       |  |             |
|--|--------------------|------------------------------------|-----|---|-------|--|-------------|
| System 641 Sector Yow<br>SAG<br>BAG<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Barta<br>Bart | Device             | 16.00 GIB<br>8.00 MiB<br>14.72 GIB | Enc | Type<br>Profile Service | Label | Mourit Point<br>/<br>Acostopub2/086.pc<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086.pt<br>Acostopub2/086. |             |
| Help Rejease Notes   | Edit Add Partition |                                    |     |   |       | Çancel   | Back Accept |

Step 3 From the SUSE Add RAID page, select RAID 1 (Mirroring) for the RAID Type.

| 🗩 SUSE   |                        |                             |
|--|------------------------|-----------------------------|
| Add RAID /dev/md0<br>RAO Type<br>0 A00 g (Rompa)<br>0 A00 g (Rompa)<br>0 A00 g (Null Hedundard Stoppa)<br>0 A | Adr                    | Top<br>Up<br>Down<br>Bottom |
| Total size: 84.00 GiB<br>Help Release Notes  | Resulting size: 0.00 B | Next                        |

Step 4 From the Selected Devices list, select two NVMe disks and click Add.

| < SUSE   |  |                             |
|--|--|-----------------------------|
| Add RAID / dev/md0<br>RAD Type<br>O RAD ((tripps))<br>O RAD ((tripps)) | Selected Devices :<br>Device Size Enc Type<br>Add<br>Add All<br>Remove<br>Remove All | Iop<br>Up<br>Down<br>Bottom |
| Total size: 84.00 GiB<br>Help Rejease Notes  | Resulting size: 0.00 B   | Next                        |

Step 5 Click **Next** to continue with the installation.

| 🗩 SUSE   |  |                             |
|--|--|-----------------------------|
| Add RAID /dev/md0<br>RAD Type<br>0 RAD (Integra)<br>0 RAD (Devrore)<br>0 RAD (Devrore)<br>0 RAD (Devrore)<br>0 RAD (Devrore)<br>0 RAD (Devrore)<br>Available Devrore)<br>Available Devrore:<br>Composed State (Stated Withware, Doc. Withware Dask<br>/devromendor2 16.00.08<br>Composed Stated Withware, Doc. Withware Dask | Device       Size       Enc.       Type         Jdev/mmatini       10.00 GB       Type         Jdev/mmatini       10.00 GB       Type         Apd All -       -       Remove         -       Remove       H         -       Remove       H | Jop<br>Jy<br>Dyam<br>Bottug |
| Total size: 22.00 G/B  | Resulting size: 9.87 GB  | ack <u>N</u> ext            |

# Manually Migrating the RAID Configuration Between Hosts

The following procedure describes how to migrate the RAID configuration manually between hosts.

## Restoring a RAID Configuration from a Backup Configuration File

To restore a RAID configuration from a backup configuration file:

- Step 1 Periodically back up the configuration file /etc/graid.conf from the original host. Use cp or scp to move the configuration file to another system.
- Step 2 Set up the target host and ensure that the SupremeRAID<sup>™</sup> service is stopped.
- Note: If the target host already contains an installed and running SupremeRAID<sup>™</sup> card, stop the service and copy the graid.conf file from the original system. On the original system, stop any running applications or unmount the mountpoint before starting the SupremeRAID<sup>™</sup> service.
- Step 3 Move all the SSDs from the original host to the new host.
- Step 4 Install the SupremeRAID<sup>™</sup> driver on the new server. Stop the SupremeRAID<sup>™</sup> service before copying the configuration backup file to the new host using the same path (/etc/graid.conf). If you have already enabled the graphical management console, please ensure to disable it as well.

\$ sudo systemctl stop graid

\$ sudo systemctl stop graid-mgr.service

Step 5 Copy the configuration file.

\$ sudo cp graid.conf /etc/graid.conf

- Step 6 If the original card also moved to the new host, start the SupremeRAID™ service directly.
  \$ sudo systemct1 start graid
- Step 7 (Optional) If the card changed, you must apply the new license.
   \$ sudo graidctl apply license [LICENSE\_KEY]

#### Restoring a RAID Configuration from SSD Metadata

The SupremeRAID<sup>™</sup> system provides robust support for restoring RAID configurations from SSD metadata. This feature allows you to recover a RAID configuration quickly and easily in case of a failure or other issues. Perform the following procedure to restore the RAID configuration and get the SupremeRAID<sup>™</sup> system back online.

To restore a RAID configuration from an SSD's metadata:

- Step 1 Set up the target host and make sure that the SupremeRAID<sup>™</sup> service is stopped.
- Note: If the target host already contains an installed and running SupremeRAID<sup>™</sup> card, stop the service the SupremeRAID<sup>™</sup> service before restoring the configuration. On the original system, stop any running applications or unmount the mountpoint before starting the SupremeRAID<sup>™</sup> service.
- Step 2 Move all the SSDs from the original host to the new host.
- Step 3 Install the SupremeRAID<sup>™</sup> driver on the new server and stop the SupremeRAID<sup>™</sup> service before restoring the configuration file. If you have already enabled the graphical management console, please ensure to disable it as well.
  - \$ sudo systemctl stop graid
  - \$ sudo systemctl stop graid-mgr.service
- Step 4 Run the restore command and restore the configuration file from SSD's metadata.

\$ sudo graidctl restore config

| [graid@graid demo~]\$ sudo graidctl restore config<br>#Restore config failed: Please stop the graid service before restoring the config, and restart the graid service after restored the config.<br>[graid@graid demo~]\$ sudo graidctl re conf<br>Skip /dev/sda: no config found<br>Found the following configs:  |
|---|
| 0: Device /dev/nvme0n1, UUID 00200000-0000-0000-4002-000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST<br>1: Device /dev/nvme1n1, UUID 00200000-0000-4002-000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST<br>2: Device /dev/nvme3n1, UUID 00200000-00000-0000-4002-00000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST<br>3: Device /dev/nvme3n1, UUID 00200000-00000-0000-4002-00000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST<br>Please select one config to restore (0-3): 0<br>Restore to /etc/graid.conf (y/N)?: y<br> |

Step 5 If the original card also moved to the new host, start the SupremeRAID<sup>™</sup> service directly.

\$ sudo systemctl start graid

Step 6 (Optional) If the card changed, you must apply the new license.

```
$ sudo graidctl apply license [LICENSE_KEY]
```

# Restarting the SupremeRAID<sup>™</sup> Service After Upgrading the System Kernel

If the SupremeRAID<sup>™</sup> service does not start properly after upgrading the kernel, reinstall the SupremeRAID<sup>™</sup> pre-installer and the installer to ensure that they are configured properly for the new kernel environment.

To reinstall the SupremeRAID<sup>™</sup> pre-installer and installer on new kernel, follow these steps:

Step 1 Go to the Graid Technology website to download the latest version of the pre-installer and make it executable, please download the package in <u>Drivers & Documentation</u>.

 \$ sudo chmod +x [Filename]

 Driver Packages

 Product Model
 GPU
 x86\_64

 SR-1001
 NVIDIA T400

 SR-1001
 NVIDIA 7400

- Step 2 Open a terminal window and log in to the system as a user with root privileges.
- Step 3 Use the cd command to navigate to the directory where the downloaded installer files are located.
- Step 4 Run the graid-sr-pre-installer and follow the on-screen instructions to complete the preinstallation process.
- Step 5 Run the graid-sr-installer and follow the on-screen instructions to complete the installation process.
- Step 6 After installing the SupremeRAID<sup>™</sup> pre-installer and installer, restart the SupremeRAID<sup>™</sup> service and verify it is running correctly in the new kernel environment.

sudo systemctl restart graid

# Obtaining SMART Information from Devices

Self-Monitoring, Analysis and Reporting Technology (SMART) data is a set of metrics and parameters that SSDs collect and monitor to assess their health and performance. Although the specific information included in the SMART data varies by manufacturer and drive model, it typically reports on the temperature, available spare capacity, power-on hours, error rates, and other details that are used to monitor the health of the SSD and predict its future performance.

By monitoring the SMART data for an SSD, you can identify a potential issue or degradation of the drive before it becomes a serious problem.

To check the SMART information for the gpd device using the NVMe smart-log or smartctl command, follow these steps:

- Step 1 Open a terminal window and log in to the system with administrative privileges.
- Step 2 Use the list physical drives command to identify the device name for the gpd device, such as /dev/gpdx.

\$ sudo graidctl list physical\_drive

Step 3 Use the **nvme** command to display the SMART data for the gpd device:

\$ sudo nvme smart-log /dev/gpd[#]

- Alternatively, you can use the smartctl command to display the SMART data for the gpd device:
- \$ sudo smartctl -d nvme -a /dev/gpd[#]

A detailed report of the SMART data for the gpd device, including the temperature, available spare capacity, and other details, appears. Use this information to monitor the health and performance of the device and to diagnose any potential issues.

Note: The specific steps and commands used to display SMART data may vary, depending on your system and the version of the nvme or smartctl command in use. Be sure to use the correct device name for the gpd device in the command.



The following figure shows an output example using nvme smart-log.

| PD ID (8)  | DG ID                | DEVICE PATH                | NQN/WWID  | MODEL          | CAPACITY | SLOT ID   | NUMA NODE | WEAROUT    | STATE             |
|--|----------------------|----------------------------|---|----------------|----------|-----------|-----------|------------|-------------------|
| 0  | <br>  N/A            | /dev/gpd0                  | ngn.2019-08.org.gemu:NVME0001                                   | OEMU NVMe Ctrl |          | <br>  N/A | 0         | <u> </u>   | UNCONFIGURED GOOD |
| 1  | N/A                  | /dev/gpd1                  | ngn.2019-08.org.gemu:NVME0002                                   | QEMU NVMe Ctrl | 30 GiB   | N/A       | 0         | 0%         | UNCONFIGURED_GOOD |
| 2  | N/A                  | /dev/gpd2                  | ngn.2019-08.org.gemu:NVME0003                                   | QEMU NVMe Ctrl | 30 GiB   | N/A       | 0         | <b>0</b> % | UNCONFIGURED_GOOD |
| 3  | N/A                  | /dev/gpd3                  | ngn.2019-08.org.gemu:NVME0004                                   | 0EMU NVMe Ctrl | 30 GiB   | N/A       | 0         | 0%         | UNCONFIGURED GOOD |
| 4  | N/A                  | /dev/gpd5                  | ngn.2019-08.org.gemu:NVME0005                                   | QEMU NVMe Ctrl | 30 GiB   | N/A       | 0         | 0%         | UNCONFIGURED_GOOD |
| 5  | N/A                  | /dev/gpd4                  | ngn.2019-08.org.gemu:NVME0006                                   | QEMU NVMe Ctrl | 30 GiB   | N/A       | 0         | <b>0</b> % | UNCONFIGURED_GOOD |
| 6  | N/A                  | /dev/gpd7                  | nqn.2019-08.org.qemu:NVME0007                                   | QEMU NVMe Ctrl | 30 GiB   | N/A       | 0         | 0%         | UNCONFIGURED_GOOD |
|  | N/A                  | /dev/gpd6                  | ngn.2019-08.org.gemu:NVME0008                                   | QEMU NVMe Ctrl | 30 GiB   | N/A       | 0         | 0%         | UNCONFIGURED_GOOD |
| ndurance gro<br>ata_units_re<br>ata_units_wr<br>ost_read_com<br>ost_write_co | ad<br>itten<br>mands | cal warning sur            | nmary: 0<br>: 139,489<br>: 74,819<br>: 2,492,356<br>: 1,881,814 |                |          |           |           |            |                   |
| ontroller_bu   |                      |                            | : 0   |                |          |           |           |            |                   |
| ower_cycles  |                      |                            | : 0   |                |          |           |           |            |                   |
| ower_on_hour   | s                    |                            | : 126   |                |          |           |           |            |                   |
| nsafe_shutdo   | wns                  |                            | : 0   |                |          |           |           |            |                   |
| edia_errors  |                      |                            | : 0   |                |          |           |           |            |                   |
| um_err_log_e   |                      |                            | : 0   |                |          |           |           |            |                   |
| arning Tempe   |                      |                            | : 0   |                |          |           |           |            |                   |
|  | ocito Tor            | nperature Time             | : 0   |                |          |           |           |            |                   |
|  | ostre le             |                            |   |                |          |           |           |            |                   |
| ritical Comp<br>nermal Manag   | ement T1             | Trans Count                | : 0   |                |          |           |           |            |                   |
| ritical Comp<br>nermal Manag   | ement T1             |                            | : 0<br>: 0  |                |          |           |           |            |                   |
| itical Comp<br>nermal Manag  | ement T1<br>ement T2 | Trans Count<br>Trans Count |   |                |          |           |           |            |                   |



The following figure shows an output example using smartctl.

| ot@graid:~#<br>.ist physical   |                                    | uccessfully.                   |  |                    | I                  |            | I         | 1          |  |
|--------------------------------|------------------------------------|--------------------------------|--|--------------------|--------------------|------------|-----------|------------|--|
| PD ID (8)                      | DG ID                              | DEVICE PATH                    | NQN/WWID   | MODEL              | CAPACITY           | SLOT ID    | NUMA NODE | WEAROUT    | STATE                                      |
| 0                              | N/A                                | /dev/gpd0                      | nqn.2019-08.org.qemu:NVME0001  |                    | 30 GiB             | N/A        | 0         | 0%         | UNCONFIGURED_GOOD                          |
| 1                              | N/A                                | /dev/gpd1                      | nqn.2019-08.org.qemu:NVME0002  |                    | 30 GiB             | N/A        | 0         | 0%         | UNCONFIGURED_GOOD                          |
| 2                              | N/A                                | /dev/gpd2                      | nqn.2019-08.org.qemu:NVME0003  |                    | 30 GiB             | N/A        | 0         | 0%         | UNCONFIGURED_GOOD                          |
| 3  <br>4                       | N/A  <br>N/A                       | /dev/gpd3                      | nqn.2019-08.org.qemu:NVME0004  |                    | 30 GiB<br>  30 GiB | N/A<br>N/A | 0<br>  0  | 0%<br>  0% | UNCONFIGURED_GOOD  <br>  UNCONFIGURED GOOD |
| 5                              | N/A<br>N/A                         | /dev/gpd5<br>/dev/gpd4         | nqn.2019-08.org.qemu:NVME0005<br>nqn.2019-08.org.qemu:NVME0006   |                    | 30 GIB             | N/A<br>N/A | 0         | 0%         | UNCONFIGURED_GOOD                          |
| 6 1                            | N/A                                | /dev/gpd4                      | nqn.2019-08.org.qemu:NVME0007  |                    | 30 GiB             | N/A        | 0         | 0%         | UNCONFIGURED_GOOD                          |
| 7                              | N/A                                | /dev/gpd6                      | nqn.2019-08.org.qemu:NVME0008  |                    | 30 GiB             | N/A        | 0         | 0%         | UNCONFIGURED_GOOD                          |
| nartctl 7.2 2<br>opyright (C)  | 2020-12-3<br>2002-20,<br>INFORMATI | 0 r5155 [x86_                  | -a /dev/gpd0<br>54-linux-5.15.0-78-generic] (lo<br>Christian Franke, www.smartmon<br>=<br>QEMU NVMe Ctrl<br>NVME0001 |                    |                    |            |           |            |  |
| irmware Versi                  |                                    |                                | 7.2.2  |                    |                    |            |           |            |  |
| CI Vendor ID:                  |                                    |                                | 0x1b36   |                    |                    |            |           |            |  |
| CI Vendor Sub                  |                                    | D:                             | 0xlaf4   |                    |                    |            |           |            |  |
| EEE OUI Ident                  |                                    |                                | 0×525400   |                    |                    |            |           |            |  |
| ontroller ID:                  |                                    |                                | 0<br>1.4   |                    |                    |            |           |            |  |
| VMe Version:<br>umber of Name  |                                    |                                | 256  |                    |                    |            |           |            |  |
| ocal Time is:                  |                                    |                                | Tue Jun 25 09:28:58 2024 UTC   |                    |                    |            |           |            |  |
| irmware Updat                  |                                    | i):                            | 1 Slot, Slot 1 R/0   |                    |                    |            |           |            |  |
| ptional Admin                  |                                    |                                | Format NS_Mngmt Drbl_Bf_Cfg  |                    |                    |            |           |            |  |
| ptional NVM C                  |                                    |                                | Comp DS_Mngmt Wr_Zero Sav/Sel_   | Feat Timestmp *Oth | er*                |            |           |            |  |
| og Page Attri                  | butes (@                           | x07):                          | S/H_per_NS Cmd_Eff_Lg Ext_Get_   | Lg .               |                    |            |           |            |  |
| aximum Data T                  | Fransfer                           | Size:                          | 128 Pages  |                    |                    |            |           |            |  |
| arning Comp.                   |                                    |                                | 70 Celsius   |                    |                    |            |           |            |  |
| ritical Comp.                  | . Тетр. Т                          | hreshold:                      | 100 Celsius  |                    |                    |            |           |            |  |
| upported Powe                  | er States                          |                                |  |                    |                    |            |           |            |  |
| t Op Max<br>0 + 25.00W         | Active                             |                                | LRTWLWT Ent_Lat Ex_Lat<br>0 0 0 0 16 4   |                    |                    |            |           |            |  |
|                                |                                    | A SECTION ===<br>elf-assessmen | t test result: PASSED  |                    |                    |            |           |            |  |
|                                |                                    | on (NVMe Log                   |  |                    |                    |            |           |            |  |
| ritical Warni                  | ing:                               |                                | 0×00   |                    |                    |            |           |            |  |
| emperature:                    |                                    |                                | 50 Celsius   |                    |                    |            |           |            |  |
| vailable Spar                  |                                    | io] d i                        | 0%   |                    |                    |            |           |            |  |
| vailable Spar<br>ercentage Use |                                    |                                | 0%<br>ค%   |                    |                    |            |           |            |  |
| ercentage Use<br>ata Units Rea |                                    |                                | 0%<br>139,489 [71.4 GB]  |                    |                    |            |           |            |  |
| ata Units Wri                  |                                    |                                | 74,819 [38.3 GB]   |                    |                    |            |           |            |  |
| ost Read Comm                  |                                    |                                | 2,492,356  |                    |                    |            |           |            |  |
| ost Write Com                  |                                    |                                | 1,881,814  |                    |                    |            |           |            |  |
| ontroller Bus                  |                                    |                                | 0  |                    |                    |            |           |            |  |
| ower Cycles:                   |                                    |                                | 0  |                    |                    |            |           |            |  |
| ower On Hours                  |                                    |                                | 126  |                    |                    |            |           |            |  |
| isafe Shutdow                  |                                    |                                | 0  |                    |                    |            |           |            |  |
| edia and Data                  |                                    |                                | 0  |                    |                    |            |           |            |  |
| rror Informat                  |                                    |                                | 0  |                    |                    |            |           |            |  |
|                                |                                    | inne:                          | 0  |                    |                    |            |           |            |  |
| arning Comp.<br>ritical Comp.  |                                    |                                | 0  |                    |                    |            |           |            |  |

# Monitoring System Input/Output Statistics for Devices Using iostat

The sysstat package contains the tools most commonly used to monitor I/O statistics in Linux systems. The sysstat package includes the iostat tool, which monitors system I/O device loading by observing the time the devices are active relative to their average transfer rates. The **iostat** command generates reports that allow you to fine-tune the system configuration to better balance the I/O load between physical disks.

For example, to monitor specific devices and display statistics in megabytes per second (Mbps), issue the following command:

#### \$ iostat -m md124 sda nvmeOn1

The following figure shows an output example.

| •••                              |      |                          |           |                |          |         |         |
|----------------------------------|------|--------------------------|-----------|----------------|----------|---------|---------|
| [graid@graid-d<br>Linux 4.18.0-3 |      |                          |           | /06/2022 _x8   | 6_64_ (1 | 6 CPU)  |         |
| avg-cpu: %use<br>0.0             |      | ystem %iowai<br>0.15 0.0 |           | %idle<br>99.84 |          |         |         |
| Device                           | tps  | MB_read/s                | MB_wrtn/s | MB_dscd/s      | MB_read  | MB_wrtn | MB_dscd |
| md124                            |      |                          |           |                | 5        |         |         |
| nvme3n1                          |      |                          |           |                |          |         |         |
| sda                              | 6.35 | 0.74                     | 0.05      |                | 80843    | 5208    |         |

### sysstat Versions v12.3.3 and Later

For sysstat versions v12.3.3 and later, the iostat tool includes an alternative directory feature that allows you to specify the directory from which to read device statistics.

- Add a +f parameter to the tool and use the /sys/devices/virtual/graid/graid sysfs device path to read device statistics from both the standard kernel files and the files in the alternative directory.
- Add a -f parameter to the tool and use the /sys/devices/virtual/graid/graid sysfs device path to read device statistics from the files in the alternative directory.

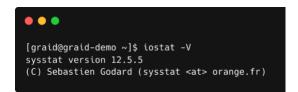
The following figure shows an alternative directory description from the iostat manual page.

| -f directory   |
|--|
| - directory  |
| Specify an alternative directory for iostat to read devices statistics. Option -f tells iostat to use only the files located |
| in the alternative directory, whereas option of tells it to use both the standard kernel files and the files located in the  |
| alternative directory to read device statistics.   |
| directory is a directory containing files with statistics for devices managed in userspace. It may contain:                  |
| - a "diskstats" file whose format is compliant with that located in "/proc",   |
| - statistics for individual devices contained in files whose format is compliant with that of files located in "/sys".       |
| In particular, the following files located in <u>directory</u> may be used by iostat:  |
| directory/block/device/stat  |
| <u>directory</u> /block/ <u>device/partition</u> /stat   |
|  |
| <u>partition</u> files must have an entry in <u>directory</u> /dev/block/ directory, e.g.:                                   |
| <u>directory/dev/block/major:minor</u> >//block/ <u>device/partition</u>   |
|  |

To check the iostat version, issue the following command:

```
$ iostat -V
```

The following figure shows an output example.



The gpd# statistics are not displayed in the iostat report without appending the **+f** parameter and defining the sysfs path.

```
$ iostat -m +f /sys/devices/virtual/graid/graid gdg0nl md124 sda nvme0n1 gpd3
```

The following figure shows an output example.

| [graid@graid- | demo ~]\$ io | stat -m gvd0r | ıl md124 sda r | vme0n1 gpd3   |          |         |        |
|---------------|--------------|---------------|----------------|---------------|----------|---------|--------|
| Linux 4.18.0- | 348.7.1.el8  | _5.x86_64 (gr | aid-demo) 01   | ./06/2022 _x8 | 6_64_ (1 | 6 CPU)  |        |
|               |              |               |                |               |          |         |        |
| avg-cpu: %us  |              | %system %iowa |                | %idle         |          |         |        |
| 0.            | 01 0.00      | 0.14 0.       |                | 99.84         |          |         |        |
| Device        | tps          | MB_read/s     | MB_wrtn/s      | MB_dscd/s     | MB_read  | MB_wrtn | MB_dsc |
| gvd0n1        | 0.68         |               |                |               |          |         |        |
| nd124         |              |               |                |               |          |         |        |
| nvme0n1       |              |               |                |               |          |         |        |
|               | 5.62         | 0.66          | 0.03           |               | 118093   | 5468    |        |

The gpd# statistics are displayed when the **+f** parameter is appended and the sysfs path is defined.

\$ iostat -m +f /sys/devices/virtual/graid/graid gdg0nl md124 sda nvme0n1 gpd3

The following figure shows an output example.

| •••                                |      |                          |           |                |         |                      |              |
|------------------------------------|------|--------------------------|-----------|----------------|---------|----------------------|--------------|
| [graid@graid-de<br>Linux 4.18.0-34 |      |                          | · · ·     |                | -       | .mdl24 sda<br>6 CPU) | nvmeOnl gpd3 |
| avg-cpu: %use<br>0,0               |      | %system %iowa<br>0.15 0. |           | %idle<br>99.84 |         |                      |              |
| Device                             | tps  | MB_read/s                | MB_wrtn/s | MB_dscd/s      | MB_read | MB_wrtn              | MB_dscd      |
| gpd3                               |      |                          |           |                |         |                      |              |
| gvd0n1                             |      |                          |           |                | 2       |                      |              |
| md124                              |      |                          |           |                | 5       |                      |              |
| nvme0n1                            |      |                          |           |                |         |                      |              |
| sda                                | 6.22 | 0.72                     | 0.05      |                | 80853   | 5208                 |              |

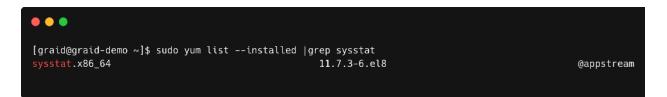
### sysstat Versions Prior to v12.3.3

For operating systems with sysstat versions prior to v12.3.3 (for example, CentOS), Graid Technology provides an alternate tool called giostat to display device statistics.

In the following example, the operating system version of iostat is prior to v12.3.3.

\$ sudo yum list --installed |grep sysstat

The following figure shows an output example.



The giostat and iostat tools are very similar and their usage is the same. Set the parameter preferences using giostat. The following figure shows an output example.

|   | 5)     | DG ID                   | DEVIC   | E PATH                  | NQN/WWID   |                     |                  |  | IQN/W/ID M   |                          |  | SLOT ID | STATE  |
|---|--------|-------------------------|---|-------------------------|--|---------------------|------------------|--|--|--------------------------|--|---------|--------|
| θ         θ         /dev/gpd0           1         θ         /dev/gpd3           2         θ         /dev/gpd3           3         θ         /dev/gpd1           4         N/A         /dev/gpd4 |        | 'gpd3<br>'gpd2<br>'gpd1 | nqn.2019-10.com.kioxia:KCM61VUL3T20:Z0G0A001TL8<br>nqn.2019-10.com.kioxia:KCM61VUL3T20:Z010A004T1L8<br>nqn.2019-10.com.kioxia:KCM61VUL3T20:X0X0A01ET1L8<br>nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A04HT1L8<br>nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A038T1L8 |                         |  |                     |                  | KCM61VUL3T20<br>KCM61VUL3T20<br>KCM61VUL3T20 | 3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB<br>3.2 TB | 12<br>19<br>18<br>8<br>0 | <br>  ONLINE<br>  ONLINE<br>  ONLINE<br>  UNCONFIGURED_GOD |         |        |
| st dri  | ve gro | oup suc                 | cessful   | ιιy.                    |  |                     |                  |  |  | i j                      | i i  |         | ,<br>, |
|   | MODE   | VD I                    | иим с   | APACITY                 | FREE   | USED                | STATE            | 1  |  |                          |  |         |        |
| -<br>0  | RAID6  | -                       | 4 6   | .4 TB                   | -  <br>  6.4 TB                                      | <br>25 GB           | OPTIMAL          | ł  |  |                          |  |         |        |
| ——i   |        | -i—                     | —i—   |                         | - <u> -</u>  |                     |                  |  |  |                          |  |         |        |
| st vir  | tual ( | irive s                 | uccessi   | fully.                  |  |                     |                  |  |  |                          |  |         |        |
| D ID (  | 4)     | DG ID                   | SIZE  | DEVI                    | CE PATH  | STATE               | EXPORTED         |  |  |                          |  |         |        |
|   | 0      | 0                       | 10 GB   |                         | /gvd0n1  | RESYNC              | No               |  |  |                          |  |         |        |
|   | 1      | 0                       | 5.0 G   | iB   ∕dev               | /gvdlnl  | RESYNC              | No               |  |  |                          |  |         |        |
|   | 2      | 0                       | 5.0 G   |                         |  | RESYNC              | No               |  |  |                          |  |         |        |
|   | 3      | 0                       | 5.0 G   | B   /dev                | /gvd3n1  | RESYNC              | Na               |  |  |                          |  |         |        |
|   |        | 8.2.1.0<br>%nio         | el8_5.×<br>ce ∿sys  | :86_64 (g<br>∶tem 5∷iow | Wonl gpd3 n<br>praid-demo)<br>Dait %stea<br>).00 0.0 | ) 01/06/<br>⊔l %idl | /2022 _x80<br>le | 6_64_ (1                                     | 28 CPU)  |                          |  |         |        |
| ice   |        | tps                     |   | _read/s                 | MB_wrtn  |                     | B_dscd/s         | MB_read                                      |  | MB_dscd                  |  |         |        |
|   |        | 1449.98                 |   | 3.79                    |  |                     |                  | 3355542                                      | 3707736  |                          |  |         |        |
| 10n1<br>1e10n1  |        | 0.0                     |   | 0.01                    |  |                     |                  | 9530   |  |                          |  |         |        |
|   |        |                         |   |                         |  |                     |                  |  |  |                          |  |         |        |

## Setting Up the Auto-mount File Systems on Linux Using the SupremeRAID™ Driver

To set up the auto-mount file systems on Linux using the SupremeRAID<sup>™</sup> driver:

Step 1 Create a virtual drive. \$ sudo graidctl create virtual\_drive [DG\_ID] [size] [flags] Step 2 Format the virtual drive and create a mount point for it. \$ sudo mkdir /mnt/[name-of-the-drive] \$ sudo mkfs.[file-system-type] /dev/gdgXnY \$ sudo mount /dev/gdgXnY /mnt/[name-of-the-drive]/

Step 3 Obtain the name, and file system type.

\$ ls -l /dev/[disk]/[by-id]/

#### Step 4 Edit the /etc/fstab file:

A Edit the /etc/fstab file.

\$ sudo vim /etc/fstab

B Append one line of code to the end of the file using the following format.

\$ /dev/[disk]/[by-id] [mount-point] [file-system-format] x-systemd.requires=graid.service,nofail [dump] [pass]



#### C Show the output example.

| <pre>[root@graid-demo ~]# ls -l /dev/disk/by-id/<br/>total 0</pre>                                   |   |  |  |  |  |  |  |  |  |
|--|---|--|--|--|--|--|--|--|--|
| lrwxrwxrwx. 1 root root 12 Sep 8 06:27 gdg-eui.  | 00abcdef00136d5b65a1d3d7ecb5b8ad ->//gdg0n1   |  |  |  |  |  |  |  |  |
| lrwxrwxrwx. 1 root root 12 Sep 8 06:27 gdg-GRAID   |   |  |  |  |  |  |  |  |  |
|  | id-cjIZ8z-5SmL-8NmF-z6lA-1z1k-J5DT-HGFlnS ->//sda3  |  |  |  |  |  |  |  |  |
| <pre>lrwxrwxrwx. 1 root root 9 Sep 7 23:12 md-name-graid-demo:0 -&gt;//md0</pre>                     |   |  |  |  |  |  |  |  |  |
| lrwxrwxrwx. 1 root root 9 Sep 7 23:12 md-uuid-6  | lrwxrwxrwx. 1 root root 9 Sep 7 23:12 md-uuid-636e39c5:cbfa794e:91f4dd06:e8fbc6be ->//md0 |  |  |  |  |  |  |  |  |
| lrwxrwxrwx. 1 root root 13 Sep 7 23:12 nvme-   |   |  |  |  |  |  |  |  |  |
| nvme.1b36-4e564d4530303032-51454d55204e564d652043  | 374726c-00000001 ->//nvme0n1  |  |  |  |  |  |  |  |  |
| lrwxrwxrwx. 1 root root 13 Sep 7 23:12 nvme-   |   |  |  |  |  |  |  |  |  |
| nvme.1b36-4e564d4530303034-51454d55204e564d652043  |   |  |  |  |  |  |  |  |  |
| lrwxrwxrwx. 1 root root 13 Sep 7 23:12 nvme-QEMU<br>lrwxrwxrwx. 1 root root 13 Sep 7 23:12 nvme-QEMU |   |  |  |  |  |  |  |  |  |
| ITWXIWXIWX. I FOOT FOOT 13 Sep / 23:12 NVMe-QEMU   | J_NVMe_Ctri_NVME0004 ->//hvmeini  |  |  |  |  |  |  |  |  |
| [root@graid-demo ~]# sudo vim /etc/fstab   |   |  |  |  |  |  |  |  |  |
| #  |   |  |  |  |  |  |  |  |  |
| # /etc/fstab   |   |  |  |  |  |  |  |  |  |
| # Created by anaconda on Thu May 18 23:02:31 2023  | 3   |  |  |  |  |  |  |  |  |
| #  |   |  |  |  |  |  |  |  |  |
| <pre># Accessible filesystems, by reference, are maint</pre>   |   |  |  |  |  |  |  |  |  |
| <pre># See man pages fstab(5), findfs(8), mount(8) and</pre>   | d/or blkid(8) for more info   |  |  |  |  |  |  |  |  |
| <pre>//dev/mapper/rhel-root / /////////////////////////////////</pre>                                | xfs defaults 00   |  |  |  |  |  |  |  |  |
| UUID=f6f00b7c-87d8-472a-90d1-41b73372b792 /boot  | xfs defaults 0.0  |  |  |  |  |  |  |  |  |
|  | vfat umask=0077, shortname=winnt 0 0  |  |  |  |  |  |  |  |  |
|  | swap defaults 00  |  |  |  |  |  |  |  |  |
|  |   |  |  |  |  |  |  |  |  |
| /dev/disk/by-id/gdg-GRAID-SR_96BCDBC839F109EE_1 /  | /mnt/graid_demo ext4 x-   |  |  |  |  |  |  |  |  |
| <pre>systemd.requires=graid.service,nofail 0 0</pre>   |   |  |  |  |  |  |  |  |  |
|  |   |  |  |  |  |  |  |  |  |
| #UUID=9c2ca3e2-6adc-44cc-926a-4125282cef15 /mnt/g<br>0 0   | graid_demol.5 xfs x-systemd.requires=graid.service,nofail                                 |  |  |  |  |  |  |  |  |
| ~  |   |  |  |  |  |  |  |  |  |



Step 5 Remove the device line and reboot the system.

```
$ sudo vim /etc/fstab
```

| <pre>[root@graid-demo ~]# ls -l /dev/disk/by-id/<br/>total 0<br/>lrwxrwxrwx. 1 root root 12 Sep 8 06:27 gdg-eui.00abcdef00136d5b65a1d3d7ecb5b8ad -&gt;//gdg0n1<br/>lrwxrwxrwx. 1 root root 12 Sep 8 06:27 gdg-GRAID-SR_96BCDBC839F109EE_1 -&gt;//gdg0n1<br/>lrwxrwxrwx. 1 root root 10 Sep 6 05:09 lvm-pv-uuid-cjIZ8z-5SmL-8NmF-z6lA-1z1k-J5DT-HGFINS -&gt;//<br/>lrwxrwxrwx. 1 root root 9 Sep 7 23:12 md-name-graid-demo: 0 -&gt;//md0<br/>lrwxrwxrwx. 1 root root 9 Sep 7 23:12 md-uuid-636e39c5:cbfa794e:91f4dd06:e8fbc6be -&gt;//md0<br/>lrwxrwxrwx. 1 root root 13 Sep 7 23:12 nvme-<br/>nvme.1b36-4e564d4530303032-51454d55204e564d65204374726c-00000001 -&gt;//nvme0n1<br/>lrwxrwxrwx. 1 root root 13 Sep 7 23:12 nvme-<br/>nvme.1b36-4e564d4530303034-51454d55204e564d65204374726c-00000001 -&gt;//nvme1n1<br/>lrwxrwxrwx. 1 root root 13 Sep 7 23:12 nvme-</pre> | sda3  |
|--|-------|
| <pre>lrwxrwxrwx. 1 root root 13 Sep 7 23:12 nvme-QEMU_NVMe_Ctrl_NVME0004 -&gt;//nvmeln1 [root@graid-demo ~]# sudo vim /etc/fstab #     //etc/fstab #     //etc/fstab #     //etc/fstab #     Accessible filesystems, by reference, are maintained under '/dev/disk' # See man pages fstab(5), findfs(8), mount(8) and/or blkid(8) for more info # </pre>   |       |
| //dev/mapper/rhel-root / xfs defaults 0 0<br>UUID=f6f00b7c-87d8-472a-90d1-41b73372b792 /boot xfs defaults 0 0<br>UUID=6C6D-B3E9 /boot/efi vfat umask=0077,shortname=winnt 0 0<br>/dev/mapper/rhel-swap swap swap defaults 0 0  |       |
| <pre>#/dev/disk/by-id/gdg-GRAID-SR_96BCDBC839F109EE_1 /mnt/graid_demo ext4 x- systemd.requires=graid.service,nofail 0 0</pre>  |       |
| #UUID=9c2ca3e2-6adc-44cc-926a-4125282cef15 /mnt/graid_demol.5 xfs x-systemd.requires=graid.service,n<br>0 0<br>~   | ofail |

Note: To disable the automount point or delete the virtual drive, edit the /etc/fstab file to delete/comment that entry, and then reboot the system.

# ESXi Virtual Machine Support Using GPU Passthrough

You can create virtual machines with SupremeRAID<sup>™</sup> support to maximize performance.

The following procedure describes how to set a single VM with SupremeRAID<sup>™</sup>. This setup is for use only within a single virtual machine and cannot be shared from the volume back to ESXi to a datastore for other virtual machines.

Hypervisor VMware support is ESXi 7.0U3.

### Configuring Hosts for NVIDIA GPU Device Passthrough

#### Setting the ESXi Host in Maintenance Mode

From the Navigator menu, select **Host > Enter maintenance mode**.



#### Managing PCI Device Passthrough

- Step 1 From the Navigator menu, select Manage > Hardware > PCI Devices. The Passthrough Configuration page appears, listing all available passthrough devices.
- Step 2 Select the NVIDIA T1000 (Quadro T1000 Mobile) and its Audio device.
- Step 3 Click Toggle passthrough.
- Step 4 Confirm that the Passthrough status is Active.

| PCI Devices      | 2 | Toggle passthrough | 🥖 Configure SR-IOV 🛛 🥖 Hardware label 🛛 💽 Reboot host 📔 🤁 Refresh           |             | (0          | Search           |
|------------------|---|--------------------|---|-------------|-------------|------------------|
| Power Management | D | Address 🗸          | Description v   | SR-IOV      | Passthrough | V Hardware Label |
|                  |   | 0000:40:03.1       | Advanced Micro Devices, Inc. [AMD] Starship/Matisse GPP Bridge              | Not capable | Not capable |                  |
|                  |   | 0000:42:00.1       | nVidia Corporation Audio device   | Not capable | Active      |                  |
|                  |   | 0000:42:00.0       | NVIDIA Corporation TU117GLM [Quadro T1000 Mobile]                           | Not capable | Active      |                  |
|                  |   | 0000:40:04.0       | Advanced Micro Devices, Inc. [AMD] Starship/Matisse PCIe Dummy Host Bridge  | Not capable | Not capable |                  |
|                  |   | 0000:40:05.0       | Advanced Micro Devices, Inc. [AMD] Starship/Matisse PCIe Dummy Host Bridge  | Not capable | Not capable |                  |
|                  |   | 0000:40:07.0       | Advanced Micro Devices, Inc. [AMD] Starship/Matisse PCIe Dummy Host Bridge  | Not capable | Not capable |                  |
|                  |   | 0000:40:07.1       | Advanced Micro Devices, Inc. [AMD] Starship/Matisse Internal PCIe GPP Bridg | Not capable | Not capable |                  |

Note: If you move the SupremeRAID<sup>™</sup> card to a different hardware slot or plan to do so, you MUST cancel its passthrough before shutting down the ESXi server. After the hardware change, you MUST set up the passthrough again; otherwise, the virtual machine will not recognize the PCIe device properly.

### **Configuring Virtual Machines**

#### Attaching PCI Devices to the Virtual Machine

To attach PCI devices to the virtual machine:

- Step 1 From the Edit VM setting page, select Virtual Hardware > Add other device > PCI device.
- Step 2 Select Quadro T1000 and its Audio device as the two PCI devices.

| PCI device 1 | TU117GLM [Quadro T1000 Mobile] - 0000:42:00.0 | ~ | ٢ |
|--------------|---|---|---|
| PCI device 2 | <class> Audio device - 0000:42:00.1</class>   | ~ | 0 |

- Note: When the T1000 PCI device is assigned to the virtual machine, you must set the memory reservation to accommodate the fully configured memory size.
- Step 3 Select Virtual Hardware > Memory.
- Step 4 Check Reserve all guest memory (All locked).

| Virtual Hardware | VM Options  |           |                    |               |       |   |
|------------------|-------------|-----------|--------------------|---------------|-------|---|
| Add hard disk    | Add network | k adapter | 블 Add other de     | evice         |       |   |
| CPU              |             | 8         | ~ 🚺                |               |       |   |
| - Memory         |             |           |                    |               |       |   |
| RAM              |             | 16        | GB                 | ~             |       |   |
| Reservation      |             | 1638      | 34                 | ~             | MB    | ~ |
|                  |             | 🗹 Res     | serve all guest me | emory (All Io | cked) |   |

#### Enabling Point-to-Point (P2P) on the Virtual Machine

Enabling P2P on the virtual machine optimizes performance. To enable P2P on the virtual machine:

Step 1 From the Edit VM setting page, select VM Options > Advanced > Configuration Parameters > Edit Configuration....

| General Options               |   |
|-------------------------------|---|
| General Options               | VM Name: tiff-Ubuntu  |
| VMware Remote Console Options | Lock the guest operating system when the last remote user disconnects   |
| VMware Tools                  | Expand for VMware Tools settings  |
| Power management              | Expand for power management settings  |
| Boot Options                  | Expand for boot options   |
| Advanced                      |   |
| Settings                      | Disable acceleration  |
| Debugging and statistics      | Run normally  |
| Swap file location            | Default Use the settings of the cluster or host containing the virtual machine.     Virtual machine directory Store the awap file in the same directory as the virtual machine.     Defautore specified by host Store the awap files in the datastore specified by the host to be used for swap files. If not                   |
| Configuration Parameters      | Store the swap final in the datastore specified by the role to be slided to twap final. If not<br>possible, store the swap final in the same directory as the virtual machine. Using a datastore<br>to all not usuale isoth hosts during villotion might affect the villotion performance for the<br>affected virtual machines. |

Step 2 Add the following two parameters:

```
hypervisor.cpuid.v0 = "FALSE"
pciPassthru.allowP2P = "TRUE" pciPassthru.use64bitMMIO= "TRUE"
```

- Step 3 From the Edit VM setting page, select VM Options > Boot Options > Firmware > EFI.
- Step 4 Uncheck Whether or not to enable UEFI secure boot for this VM.

| Virtual Hardware VM Options         |  |  |
|-------------------------------------|--|--|
| <ul> <li>General Options</li> </ul> | VM Name: GRAID   |  |
| + VMware Remote Console Options     | Lock the guest operating system when the last remote user disconnects                |  |
| + VMware Tools                      | Expand for VMware Tools settings   |  |
| Power management                    | Expand for power management settings   |  |
| * Boot Options                      |  |  |
| Firmware                            | Choose which firmware should be used to boot the virtual machine:                    |  |
| Enable UEFI secure boot<br>Unche    | Whether or not to enable UEFI secure boot for this VM<br>ck UEFI secure boot         |  |
| Boot Delay                          | Whenever the virtual machine is powered on or reset, delay boot by                   |  |
| Force BIOS setup                    | The next time the virtual machine boots, force entry into the BIOS setup screen.     |  |
| Failed Boot Recovery                | When the virtual machine fails to find a boot device, sutomatically reiny boot after |  |
| + Advanced                          | Expand for advanced settings   |  |
| Fiber Channel NPIV                  | Expand for fiber channel NPIV  |  |

## Using Self-Encrypting Drives (SEDs)

Self-Encrypting Drives (SEDs) provide hardware-based full-disk encryption, ensuring data security by automatically encrypting all data written to the drive and decrypting data read from it. SupremeRAID<sup>™</sup> supports managing SEDs, including setting encryption keys, taking ownership of drives, and securely erasing data. Before configuring an SED drive, follow these guidelines:

### Guidelines for Configuring an SED Drive

Before configuring an SED drive, follow these guidelines:

- SED Key Configuration: The SED key must be configured using the graidctl tool before creating physical drives or during the creation process if the drive is not yet locked.
- Supported Devices: Only NVMe devices are supported for SED configurations.
- Locking Range: Only the global locking range is supported.

### Importing SED Keys

SupremeRAID<sup>™</sup> allows you to import encryption keys (SED keys) to manage the SEDs. These keys are essential for unlocking drives during accessing data.

#### Importing a Single SED Key Using NQN/WWID

To import a single SED key for a specific drive identified by its NQN (NVMe Qualified Name) or WWID (World Wide Identifier), use the following command:

```
$ sudo graidctl edit config sed_key [NQN/WWID]
```

#### Importing a Batched SED Key Using NQN/WWID

To import multiple SED keys from a file, use the --input-file option:

```
$ sudo graidctl edit config sed key --input-file [filename]
```

To import a single SED key using NQN/WWID, issue the following command:

\$ sudo graidctl edit config sed key [NQN/WWID]

File content format:

```
[NQN1/WWID1], [KEY1]
[NQN2/WWID2], [KEY2]
...
[NQNn/WWIDn], [KEYn]
```

### **Creating Physical Drives with SED Support**

You can create a physical drive with SED support directly from the command line using graidctl. The following options allow you to either import an existing SED key or take ownership of the SED during creation.

#### Importing an SED Key During PD Creation

To create a physical drive with an SED and import an existing key, use the --sed-import-key option:

```
$ sudo graidctl create physical drive /dev/nvme1 --sed-import-key
```

This command will prompt you for confirmation and the current SID (Security Identifier) password. To skip prompts, use additional options:

```
$ sudo graidctl create physical_drive /dev/nvme1 --sed-import-key --current-
sid mypassword
```

#### Taking Ownership of an SED During PD Creation

To take ownership of a physical drive with SED support (if the drive is not yet locked), use the --sed-take-ownership option. The command will prompt you for confirmation, a new SED key, and credentials:

Note: This action will erase all user data on the drive.

```
$ sudo graidctl create physical drive /dev/nvme1 --sed-take-ownership
```

To skip prompts, use the following options:

```
$ sudo graidctl create physical_drive /dev/nvme1 --sed-take-ownership --new-
sed-key newpassword --no-current-sid --confirm-to-erase
```

\$ sudo graidctl create physical\_drive /dev/nvme1 --sed-take-ownership --newsed-key newpassword --current-sid mypassword --confirm-to-erase

```
$ sudo graidctl create physical_drive /dev/nvme1 --sed-take-ownership --new-
sed-key newpassword --psid XXXXXXXXXXXXXXXX --confirm-to-erase
```

Note: When taking ownership, the SID and admin1 key will both be set to the same key (known as the SED key), and only this SED key will be stored in the system.

### Secure Erasing Physical Drives (PDs)

SupremeRAID<sup>™</sup> supports securely erasing all data on physical drives that support SEDs. This action leverages the SED's built-in secure erase functionality, which is faster and more secure than standard data deletion methods.

To securely erase physical drives, use the following command:

```
$ sudo graidctl delete physical_drive 0-2 --secure-erase
```

Flags for Secure Erase:

• -s, --secure-erase - Instantly and securely erase data on the physical drives. All specified PDs must support SED.

### **Displaying SED Key Information**

To display the current SED key information for all managed SED drives, issue the following command:

```
$ sudo graidctl describe config sed
```

### **Deleting SED Keys**

To delete a specific SED key, issue the following command:

\$ sudo graidctl delete config sed\_key [GUID]

To delete all SED keys, issue the following command:

```
$ sudo graidctl delete config sed key all
```

### **Rotating SED Keys**

SupremeRAID<sup>™</sup> supports rotating SED keys to enhance security. You can rotate the SED key for individual or multiple drives as needed.

#### Rotating SED Key for a Specific Drive

To rotate the SED key for a specific physical drive, use the following command:

\$ sudo graidctl edit pd 0 sed key [ORIGINAL KEY] [NEW KEY]

#### Rotating SED Keys for Multiple Drives

To rotate SED keys for multiple drives at once, use the command:

\$ sudo graidctl edit pd 0-22 sed key [ORIGINAL KEY] [NEW KEY]

## Setup Mail Notification Service

SupremeRAID<sup>™</sup> offers a daemon service in Linux that enables users to receive email notifications for monitoring service status. This includes actions like creating or deleting physical drives (PD), drive groups (DG), or virtual drives (VD) and so on.

### Install the Mail Notification Service

- Step 1 Download the Mail Notification installation package.
- Step 2 Install the Mail Notification package.
  - For CentOS, Rocky Linux, and Alma Linux.
    - \$ sudo rpm -ivh [filename]
  - For Ubuntu
    - \$ sudo dpkg -i [filename]
- Step 3 Edit the configuration file, save the changes, and then exit.

\$ sudo vim /etc/graid/sendmail.toml

Step 4 Start the Mail Notification service.

 $\$  sudo systemctl start graid-mail-notification

- Step 5 Send a testing mail to specified email address.
  \$ sudo graid mail notification -t
- Step 6 Check if the mail is received the correctly.
- Note: The mail daemon service will monitor for changes every 30 seconds and send an email to the user's specified address whenever it detects events that alter the Graid management daemon status.

### Remove the Mail Notification Service

For CentOS, RHEL Rocky Linux and Alma Linux

```
$ sudo rpm -e graid-mail-notification
```

For Ubuntu

\$ sudo dpkg -r graid-mail-notification

## Setup Graphical Management Console

SupremeRAID<sup>™</sup> offers a graphical management console for user to control the RAID resource via web portal. This intuitive interface streamlines the process, enhancing user experience and operational fluency.

### Install the Graphical Management Console Service

```
Step 1
        Download the installer and finish SupremeRAID<sup>™</sup> installation process.
Step 2
       Apply license before enable the service, the license state should be 'APPLIED'.
        $ sudo graidctl apply license <LICENSE KEY>
        $ sudo graidctl describe license
Step 3
       Add port of management console into firewall service, then reload it.
        $ sudo firewall-cmd --zone=public --add-port=50060/tcp
        $ sudo firewall-cmd --zone=public --permanent --add-port=50060/tcp
        $ sudo firewall-cmd --reload
Step 4
       Enable the graphical management console service and start it.
        $ sudo systemctl enable graid-mgr.service
        $ sudo systemctl start graid-mgr.service
        OR
        $ sudo systemctl --now enable graid-mgr.service
```

Step 5 Open web browser, key-in 'https://<SYSTEM-IP>:50060' and login with default account.

| Host o   | O Healthy                      | The RAID system is          | operating norms               | ally with all component       | s functioning proper                 | y.              |   |                     | 0                                 | Alert |   | Last 7 days 📓     |
|--|--------------------------------|-----------------------------|-------------------------------|-------------------------------|--------------------------------------|-----------------|---|---------------------|-----------------------------------|-------|---|-------------------|
| NVMe Drive<br>SCSI Drive<br>Exported Target<br>Remote Target | Drive Group<br>Total<br>1      | 0                           | M                             | Physical Drive<br>Total<br>16 | 0                                    | • Haatiy        | Controller<br>CC1 Creine<br>SR-1010<br>2 54 °C   30 | s.                  | 0                                 |       |   |                   |
| RAID Management ~  | Performance                    |                             |                               |                               |                                      |                 |   |                     |                                   | 8 4   | il drive group $\vee$                     | ast 30 minutes 🗸  |
| Physical Drive<br>Drive Group<br>Virtual Drive<br>Controller | IOPS<br>• Current read<br>2.2M |                             | Current write                 | Max IOPS: 21.8M               | Latency<br>- Current read<br>0.05 ms |                 | Min late Current write O ms                         | ncy: 0.04 ms        | Throughput Current read 9.14 GB/s |       | Max throu<br>• Current write<br>0.00 MB/s | ighput: 89.1 GB/s |
| Statistic<br>Task<br>Event                                   | 128                            | 138                         | 2024-04-<br>• read<br>• write | 30 1155pm<br>21.7M<br>0       | 128                                  | 126             | 1044 T  | 5                   | 128                               | 136   | 144                                       | 150               |
| Ucense   | CPU Utilization                |                             |                               |                               |                                      | Last 30 minutes | Memory Utilization                                  |                     |                                   |       |   | Last 30 min       |
| User<br>System Configuration                                 | • User                         | • System<br>14 <sup>%</sup> |                               |                               |                                      | ····            | • Used  | Total<br>85.2/251.3 | GB                                |       |   |                   |

Note: The default account and password for graphical management console is 'admin' and 'admin'.

# TROUBLESHOOTING

## Sequential Read Performance is Not as Expected on a New Drive Group

Unlike SAS/SATA hard drives, many NVMe SSDs support the de-allocate dataset management command. Using this command, you can reset all data in the NVMe SSD immediately, eliminating the need to synchronize data between physical drives when creating a drive group.

For other SSDs, however, the performance is not as expected when reading unwritten sectors after issuing the de-allocate dataset management command. While this behavior also impacts the performance of the new drive group, it does not affect the applications because they do not read sectors that do not contain data.

To test SupremeRAID<sup>™</sup> performance, write the entire virtual drive sequentially using a large block size.

## Kernel Log Message "failed to set APST feature (-19)" Appears When Creating Physical Drives

Some NVMe SSD models might display a "failed to set APST feature (-19)" message in the kernel log when creating the physical drive.

When SupremeRAID<sup>™</sup> creates the physical drive, the SSD is unbound from the operating system so the SupremeRAID<sup>™</sup> can control the SSD. When the APST feature is enabled during the unbinding process, the NVMe driver tries and fails to set the APST state to SSD and the error message is issued. This message is expected and can be ignored. SupremeRAID<sup>™</sup> is working normally.

## Decoding LED Patterns on the Backplane

You might notice that the HDD/SSD activity indicator blink pattern is different on SupremeRAID™ than on traditional RAID cards.

SupremeRAID<sup>™</sup> does not require a buffering or caching mechanism to improve read/write performance as do traditional RAID cards. This feature causes SupremeRAID<sup>™</sup> indicators to blink differently than traditional RAID cards.

# Received "The arch of the controller and SupremeRAID™ software mismatched" Message When Applying License

To activate the SupremeRAID<sup>™</sup> server with your license key, it's essential to install the correct driver version that matches your specific SupremeRAID<sup>™</sup> model. If the incorrect version is installed, the following error message appears when you try to activate the SupremeRAID<sup>™</sup> server with a license key: Apply license failed: The arch of the controller and SupremeRAID<sup>™</sup> software mismatched.

To ascertain which model you installed, use the command graidctl version. Issuing this command displays the model information at the end of the string.

001 -> SupremeRAID™ SR-1001 000 -> SupremeRAID™ SR-1000 010 -> SupremeRAID™ SR-1010

The following figure shows an example of the message, if you receive the error message, uninstall the incorrect driver, and then install the correct one.



Step 1 Stop SupremeRAID<sup>™</sup> service. If you have already enabled the graphical management console, please ensure to disable it as well.

\$ sudo systemctl stop graid

- \$ sudo systemctl stop graid-mgr.service
- Step 2 Unload the SupremeRAID<sup>™</sup> kernel module.

```
$ sudo rmmod graid_nvidia graid
```

- Step 3 Uninstall the package using the command appropriate for your operating system:
  - For Centos, Rocky Linux, AlmaLinux, RHEL, openSUSE, and SLES:

```
$ sudo rpm -e graid-sr
```

• For Ubuntu:

```
$ sudo dpkg -r graid-sr
```

Step 4 Confirm that the SupremeRAID<sup>™</sup> module is unloaded. The output should be empty.

\$ sudo lsmod | grep graid

- Step 5 Confirm that the SupremeRAID<sup>™</sup> package is uninstalled using the command appropriate for your operating system, the output should be empty.
  - For Centos, Rocky Linux, AlmaLinux, RHEL, openSUSE, and SLES:

```
$ sudo rpm -qa | grep graid
```

• For Ubuntu:

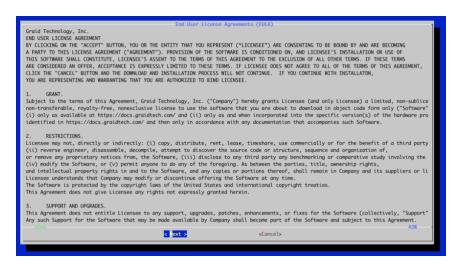
\$ sudo dpkg -1 | grep graid

Step 6 Install the correct SupremeRAID<sup>™</sup> driver:

A At the Welcome page, select Next and click Enter to view the end-user license agreement.

| Welcome to the SupremeRAID <sup>™</sup> Driver Installerr  |
|--|
|  |
|  |
| Welcome to the SupremeRAID™ Driver Installer   |
| Copyright © 2021-2023 Graid Technology Inc. All Rights Reserved. SupremeRAID <sup>™</sup> is trademarked by Graid Technology Inc.<br>and/or its affiliates in the United States, certain other countries, and/or the EU. The term GraidTech refers to Graid Technology Inc.<br>and/or its subsidiaries. For more information, please visit www.graidtech.com. Graid Technology Inc. reserves the right to make changes<br>without further notice to any products or data described herein. Information provided by Graid Technology Inc. is believed to be accurate. |
| However, Graid Technology Inc. does not assume any liability arising from the use of any application or product described herein, neither does it convey any license under its patent rights nor the rights of others.   |
| Publication: Aug 1, 2023   |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |
| < ext > <cancel></cancel>  |
|  |

B In the end-user license agreement, use the spacebar to scroll through the content. When you complete your review, select Next and click Enter to proceed.



C Type **accept**, click tab, select Next, and click Enter to accept the license agreement.

| Do you accept the EULA? (accept/decline/quit): | Confirm the EULA |                   |  |
|--|------------------|-------------------|--|
| accept   |                  |                   |  |
| < Back >                                       | < Next >         | <cancel></cancel> |  |
|  |                  |                   |  |



D Check the package version and click NEXT.



E To activate the software, apply the SupremeRAID<sup>™</sup> license key.

\$ sudo graidctl apply license [LICENSE\_KEY]

## SupremeRAID<sup>™</sup> Service Fail to Start

The SupremeRAID<sup>™</sup> service may fail to run if there is insufficient root disk space available. Ensure that you have adequate free space in the root partition for the graid service to operate correctly. Lack of sufficient disk space can cause the graid\_service to fail during the enabling process.

# SAFETY INFORMATION

## **English Version**

CE Directives Declaration: NVIDIA Corporation hereby declares that this device complies with all material requirements and other relevant provisions of the 2014/30/EU and 2011/65/EU. A copy of the Declaration of Conformity may be obtained directly from NVIDIA GmbH(Bavaria Towers - Blue Tower, Einsteinstrasse 172, D-81677 Munich, Germany)

NVIDIA products are designed to operate safely when installed and used according to the product instructions and general safety practices. The guidelines included in this document explain the potential risks associated with equipment operation and provide important safety practices designed to minimize these risks. By carefully following the information contained in this document, you can protect yourself from hazards and create a safer environment.

This product is designed and tested to meet IEC 60950-1 and IEC 62368-1 Safety Standards for Information Technology Equipment. This also covers the national implementations of IEC 70950-1/62368-1 based safety standards around the world e.q. UL 62368-1. These standards reduce the risk of injury from the following hazards:

- Electric shock: Hazardous voltage levels contained in parts of the product
- Fire: Overload, temperature, material flammability
- Energy: Circuits with high energy levels (240-volt amperes) or potential as burn hazards.
- Heat: Accessible parts of the product at high temperatures.
- Chemical: Chemical fumes and vapors
- Radiation: Noise, ionizing, laser, ultrasonic waves

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This product, as well as its related consumables and spares, complies with the reduction in hazardous substances provisions of the "India E-waste (Management and Handling) Rule 2016". It does not contain lead, mercury, hexavalent chromium, polybrominated biphenyls or polybrominated diphenyl ethers in

concentrations exceeding 0.1 weight % and 0.01 weight % for cadmium, except for where allowed pursuant to the exemptions set in Schedule 2 of the Rule.

Retain and follow all product safety and operating instructions.

Always refer to the documentation supplied with your equipment. Observe all warnings on the product and in the operating instructions found on the product's User Guide.



This is a recycling symbol indicating that the product/battery cannot be disposed of in the trash and must be recycled according to the regulations and/or ordinances of the local community.



Hot surface warning. Contact may cause burns. Allow to cool before servicing.

## **Chinese Version**

NVIDIA 产品在设计时充分考虑到操作安全性,可根据产品说明和常规安全做法进行安全安装和使用。本文 档中包含的准则解释了设备操作所涉及的风险,并提供了最大限度降低这些风险的重要安全做法。请详细 阅读本文档中的信息并按要求操作,这样可保护您免遭受为显并创建一个更加安全的环境。

本产品按照信息技术设备安全标准 IEC 60950-1 和 IEC 62368-1 进行设计,并且经测试表明符合这些设备。此处所述标准也包括全球各国/地区实施的基于 IEC 60950-1/62368-1 的安全标准,例如 UL 62328-1。 这些标准降低了因以下危险而受伤的风险:

- 电击:部分产品中包含的危险电压水平起火:超载、高温、可燃性材料
- 机械:锋利的边缘、活动部件、不稳定性
- 电源:高电压电路(240 伏安)或潜在的烧伤风险
- 高温:产品的可触及部分存在高温化学:化学烟雾和蒸气
- 辐射:噪音、电离、激光、超声波

请牢记并遵守所有产品安全和操作说明。请务必参考您的设备随附的说明文档。请注意产品上以及产品用 户指南的操作说明中列

示的所有警告。



这是一个通用的回收标志·表示产品/电池不能以 丢弃的方式处置·必须按造本**地社区的法**规和/**或** 条例回收。



警告!表面高溫。接觸可能導致灼傷。請再冷卻後 再使用。



产品中有害物质的名称及含量根据中国 电器电子 产品有害物质限制使用管理办 法)

|              | 0  | 0 | 0 | 0 | 0 | 0 |  |  |  |  |
|--------------|--|---|---|---|---|---|--|--|--|--|
| 结构间以及风扇      | х  | 0 | 0 | 0 | 0 | 0 |  |  |  |  |
|              | х  | 0 | 0 | 0 | 0 | 0 |  |  |  |  |
| 提接金属         | 0  | 0 | 0 | 0 | 0 | 0 |  |  |  |  |
| 助規剂、場寬、标签及耗材 | 0  | 0 | 0 | 0 | 0 | 0 |  |  |  |  |
|              | 本表格依据SJ/T 11364-2014的规定编制<br>O:表示该有害物质在该部件所有的均质材料中的含量均在GB/T 26572 标准规定的限量要求以下。<br>X:表示该有害物质至少在该部位的某一均质材料中的含量超出GB/T 26572标准规定的限量要求。<br>此表中所有名称中含"X" 的部件均符合RoHS立法。 |   |   |   |   |   |  |  |  |  |

## Chinese Version (TC)

在遵照產品說明與一般安全做法進行安裝與使用產品的情況下 · NVIDIA 產品可安全地操作。本文件所列的 準則說明與設備操作相關的潛在風險 · 同時也提供將這些風險降到最低的重要安全做法。謹慎遵守本文件 中的資訊 · 您就可以避免危險並創造更安全的環境。 此產品係根據 Safety Standards for Information Technology Equipment(資訊技術設備安全標準) IEC 60950-1 和 IEC 62368-1 進

行設計與測試。同時也涵蓋全世界國家以 IEC 60950-1/62368-1 為根據的安全標準,例如 UL 62368-1。這些標準可降低下列危險造成的傷害的風險:

- 觸電危險:本產品部分零件的電壓等級具危險性
- 火災危險:超載、溫度、材料可燃性
- 機械危險:尖銳邊緣、移動零件、不穩定性
- 電燒力危險:電路電壓高(240 電壓)或具有潜在起火燃燒熱能危險:產品表面可能達到高溫,注意燙 傷危機
- 化學危險:化學異味氣體與蒸氣
- 輻射危險:噪音、游離輻射、雷射、超音波

**請保留並遵守所有**產品安全與操作說明的相關規定。請務必參閱設備隨附的文件。請遵守產品上·和產品 使用者只能中操作說明裡的警告規定。



此國際回收標誌表示此產品/電池不能棄置於垃圾 桶中,必須根據當地社區的規範和/或法令回收。



表面高溫警告。接觸時可能燙傷。使用前請先降溫

|   | 限用物        | 加質含有 | 情況標志 | 、聲明書        |      |       |
|---|------------|------|------|-------------|------|-------|
| 設備名稱:續圓太  |            |      |      |             |      |       |
| 單元  | 限用物質及其佔學符號 |      |      |             |      |       |
|   | 鉛          | 汞    | 鎘    | 六價 <u>路</u> | 多溴醚苯 | 多溴二苯酰 |
| PCB板  | 0          | 0    | 0    | õ           | 0    | 0     |
| 結構閒以及風扇   | -          | 0    | 0    | õ           | 0    | 0     |
| 連結器   | -          | 0    | 0    | õ           | 0    | 0     |
| 被動電子零件  | -          | 0    | 0    | 0           | 0    | 0     |
| 主動電子零件  | -          | 0    | 0    | 0           | 0    | 0     |
| <u>内在</u>   | 0          | 0    | 0    | 0<br>0      | 0    | 0     |
|   | 0          | 0    | 0    | 0           | 0    | 0     |
|   | 0          | 0    | 0    | õ           | 0    | 0     |
| 助提劑、錫寬、標籤及耗材  | 0          | 0    | 0    | 0           | 0    | 0     |
| 備考1:0: 像指該限用物質未超出百分比含量基準值<br>備考2:-: 像指該限用物質為排处項目。<br>此表中所有名稱含"-" 的部件均符合歐盟RoHS立法。<br>注:環保使用期限的參考標識取決於產品正常工作的溫度和濕度等條件 |            |      |      |             |      |       |

# ATTACHMENTS

## Events for SupremeRAID™

| Category          | Severity | Description  |
|-------------------|----------|--|
|                   | Warning  | Physical Drive <pd_id> state has transitioned from <state_old> to unconfigured bad.</state_old></pd_id>  |
|                   | Critical | Physical Drive <pd_id> state has transitioned from <old_state> to failed.</old_state></pd_id>  |
|                   | Warning  | Physical Drive <pd_id> state has transitioned from <old_state> to offline.</old_state></pd_id>   |
|                   | Critical | Physical Drive <pd_id> state has transitioned from <old_state> to missing.</old_state></pd_id>   |
|                   | Info     | Physical Drive <pd_id> state has transitioned from <old_state> to online.</old_state></pd_id>  |
|                   | Info     | Physical Drive <pd_id> state has transitioned from <old_state> to rebuild.</old_state></pd_id>   |
|                   | Info     | Physical Drive <pd_id> state has transitioned from <old_state> to unconfigured good.</old_state></pd_id>   |
|                   | Info     | Physical Drive <pd_id> has been successfully created.</pd_id>  |
| Physical<br>Drive | Info     | Physical Drive <pd_id> has been deleted.</pd_id>   |
|                   | Info     | Physical Drive <pd_id> has been hot-plugged.</pd_id>   |
|                   | Warning  | Physical Drive <pd_id> has been hot-removed.</pd_id>   |
|                   | Warning  | The temperature of Physical Drive <pd_id> is currently <current_temp> degrees, which exceeds the Warning threshold of <threshold_temp> degrees. Critical Warning error code: ERROR_CODE.</threshold_temp></current_temp></pd_id>                 |
|                   | Critical | The temperature of Physical Drive <pd_id> is currently <current_temp> degrees, which exceeds the Critical threshold of <threshold_temp> degrees. Critical Warning error code: ERROR_CODE.</threshold_temp></current_temp></pd_id>                |
|                   | Critical | The available spare capacity <avail_spare> of Physical Drive <pd_id> has fallen<br/>below the threshold <spare_threshold>. Critical Warning error code:<br/><error_code>.</error_code></spare_threshold></pd_id></avail_spare>                   |
|                   | Critical | The NVM subsystem reliability of Physical Drive <pd_id> has been degraded due to significant media related errors or any internal error that degrades NVM subsystem reliability. Critical Warning error code: <error_code>.</error_code></pd_id> |

|       | Critical | All of the media of Physical Drive <pd_id> has been placed in read only mode.<br/>Critical Warning error code: <error_code>.</error_code></pd_id>                  |
|-------|----------|--|
|       | Critical | The volatile memory backup device of Physical Drive <pd_id> has failed. Critical Warning error code: <error_code>.</error_code></pd_id>                            |
|       | Critical | The Persistent Memory Region of Physical Drive <pd_id> has become read-only or unreliable. Critical Warning error code: <error_code>.</error_code></pd_id>         |
|       | Warning  | Physical Drive <pd_id> is currently experiencing a wearout level of WEAROUT, surpassing the Warning threshold of <threshold_wearout>.</threshold_wearout></pd_id>  |
|       | Critical | Physical Drive <pd_id> is currently experiencing a wearout level of WEAROUT, surpassing the Critical threshold of <threshold_wearout>.</threshold_wearout></pd_id> |
|       | Fatal    | Drive Group <dg_id> state has transitioned from <old_state> to failed.</old_state></dg_id>   |
|       | Critical | Drive Group <dg_id> state has transitioned from <old_state> to offline.</old_state></dg_id>  |
|       | Critical | Drive Group <dg_id> state has transitioned from <old_state> to degraded.</old_state></dg_id>   |
|       | Warning  | Drive Group <dg_id> state has transitioned from <old_state> to rescue.</old_state></dg_id>   |
|       | Warning  | Drive Group <dg_id> state has transitioned from <old_state> to partially degraded.</old_state></dg_id>   |
|       | Info     | Drive Group <dg_id> state has transitioned from <old_state> to optimal.</old_state></dg_id>  |
|       | Info     | Drive Group <dg_id> state has transitioned from <old_state> to recovery.</old_state></dg_id>   |
| Drive | Info     | Drive Group <dg_id> state has transitioned from <old_state> to init.</old_state></dg_id>   |
| Group | Info     | Drive Group <dg_id> state has transitioned from <old_state> to resync.</old_state></dg_id>   |
|       | Info     | Drive Group <dg_id> has been successfully created.</dg_id>   |
|       | Info     | Drive Group <dg_id> has been deleted.</dg_id>  |
|       | Info     | Consistency Check for Drive Group <dg_id> has been manually aborted.</dg_id>   |
|       | Info     | Consistency Check for Drive Group <dg_id> has been aborted due to the deletion of the Drive Group.</dg_id>   |
|       | Info     | Consistency Check for Drive Group <dg_id> was aborted due to the Drive Group migrating from Controller <cx_old> to <cx_new>.</cx_new></cx_old></dg_id>             |
|       | Info     | Consistency Check for Drive Group <dg_id> has been aborted due to the Drive Group's state transitioning to <dg_state>.</dg_state></dg_id>                          |

|                  | Info     | Manual Consistency Check for Drive Group <dg_id> has been completed.</dg_id>  |
|------------------|----------|---|
|                  | Info     | Scheduled Consistency Check for Drive Group <dg_id> has completed.</dg_id>  |
|                  | Info     | Manual Consistency Check for Drive Group <dg_id> has started.</dg_id>   |
|                  | Info     | Scheduled Consistency Check for Drive Group <dg_id> has started.</dg_id>  |
|                  | Info     | Inconsistency in Drive Group <dg_id> has been fixed at: Drive Group block range: <dg_inters>.</dg_inters></dg_id>   |
|                  | Critical | Inconsistency detected in Drive Group <dg_id> at: Drive Group block range: <dg_inters>.</dg_inters></dg_id>   |
|                  | Critical | Consistency Check for Drive Group <dg_id> has been aborted due to the 'stop_on_error' policy.</dg_id>   |
|                  | Critical | Consistency Check for Drive Group <dg_id> has been aborted due to numerous inconsistencies found and fixed.</dg_id>   |
|                  | Info     | Journal Replay for Drive Group <dg_id> has started.</dg_id>   |
|                  | Info     | Journal Replay for Drive Group <dg_id> has been completed. Entry replayed <replaynr>.</replaynr></dg_id>  |
|                  | Critical | Journal Replay for Drive Group <dg_id> has been waiting Physical Drive <pd_id> to be active.</pd_id></dg_id>  |
|                  | Critical | Journal Replay for Drive Group <dg_id> has been aborted due to inconsistency detected on journal.</dg_id>   |
|                  | Info     | Inconsistency for Virtual Drive <vd_id> within Drive Group <dg_id> has been fixed at: Virtual Drive block range: <vd_offsets>.</vd_offsets></dg_id></vd_id> |
| Virtual<br>Drive | Critical | Inconsistency found in Virtual Drive VD_ID of Drive Group <dg_id> at: Virtual Drive block range: <vd_offsets>.</vd_offsets></dg_id>                         |
|                  | Info     | Virtual Drive VD_ID for Drive Group <dg_id> has been created successfully.</dg_id>  |
|                  | Info     | Virtual Drive VD_ID for Drive Group <dg_id> has been deleted.</dg_id>   |
|                  | Info     | Stripe cache for Virtual Drive <vd_id> on Drive Group <dg_id> has been deleted.</dg_id></vd_id>   |
|                  | Info     | Stripe cache for Virtual Drive <vd_id> on Drive Group <dg_id> has been created successfully.</dg_id></vd_id>  |
|                  |          | The temperature of Controller <cx_id> is currently <current_temp> degrees,</current_temp></cx_id>   |

| Warning  | The temperature of Controller <cx_id> is currently <current_temp> degrees, which exceeds the GPU memory threshold of <threshold_temp> degrees.</threshold_temp></current_temp></cx_id> |
|----------|--|
| Warning  | The temperature of Controller <cx_id> is currently <current_temp> degrees, it will cause controller slowdown.</current_temp></cx_id>   |
| Critical | The temperature of Controller <cx_id> is currently <current_temp> degrees, it will cause controller shutdown.</current_temp></cx_id>   |