# SupremeRAID™ User Guide for Linux

Mar. 2025



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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.

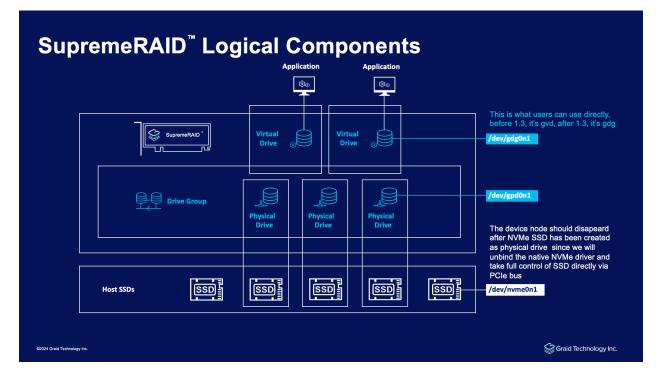
## SupremeRAID<sup>™</sup> Linux Specification

SupremeRAID™ Linux Driver Specifications				
Supported models:	SR-1000, SR-1000-AM, SR-1001, SR-1010 SR-1010-AD, SR-1011			
Supported RAID levels:	RAID 0, 1, 5, 6, 10			
Recommended minimum drive number for each RAID level:	RAID 0 : at least one drives RAID 1 : at least two drives RAID 5 : at least three drives RAID 6 : at least four drives 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 four 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™ 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>.

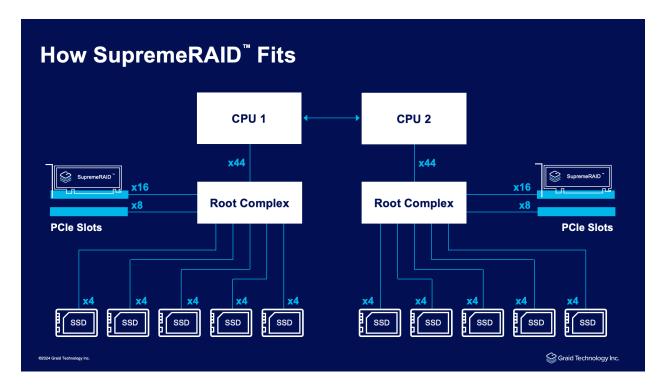
Note: The consistency check function is not supported on SupremeRAID<sup>™</sup> systems configured in RAID0 mode because RAID0 does not provide data redundancy and does not require data consistency checks.

### 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.

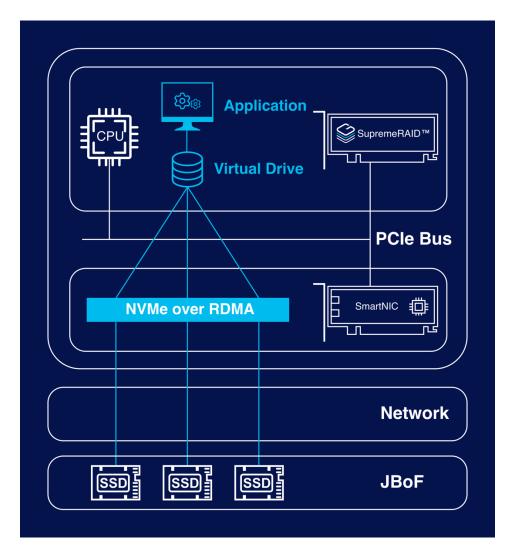
For detailed information about the commands for setup dual-controller, please refer to: <u>Setting Up the</u> <u>Dual-Controller to Enable HA and Auto-Failover</u>.



### 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.

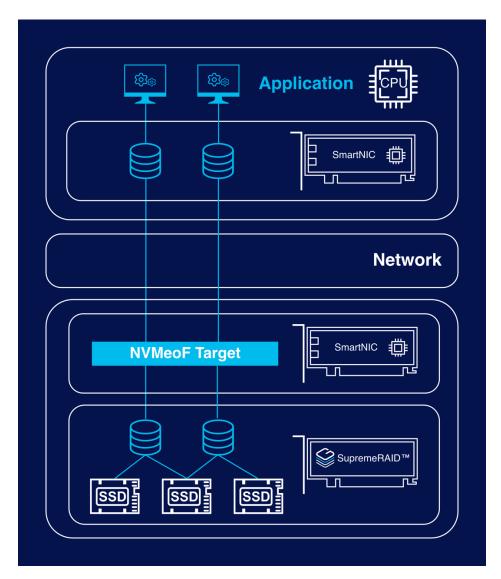
For detailed information about the commands for managing the NVMe-oF initiator, please refer to: <u>Managing Remote NVMe-oF Targets</u>.



# 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™

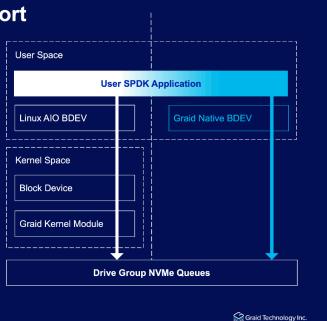
The SupremeRAID<sup>™</sup> software incorporates SPDK (Storage Performance Development Kit) feature, enabling direct access to operate the NVMe queue from user space through the SupremeRAID<sup>™</sup> native BDEV (Block Device) interface. This integration offers significant benefits that enhance the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

### Enhancing Robustness with Error Retry Mechanism

With the release of Linux driver 1.7.0, the SupremeRAID<sup>™</sup> driver introduces the error retry mechanism. The error retry mechanism enhances data resiliency by mitigating transient failures in physical drives before they escalate into critical issues. It detects and retries failed operations, preventing drives from being prematurely marked as degraded, and reduces the likelihood of premature drive failures caused by temporary read/write issues. Without this mechanism, drives may be wrongly identified as failed, leading to unnecessary rebuilds and increased system downtime. With the retry mechanism in place, transient errors are managed more efficiently, enhancing drive lifespan and overall system stability.

## 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>Latest Linux Release Notes</u> 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.
- System suspension and hibernation are currently unsupported due to a limitation in the NVIDIA driver.
- [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:

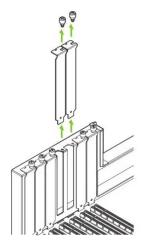
- Leaving circuit boards in their antistatic packaging until they are ready to be installed.
- Using a grounded wrist strap when handling circuit boards, at a minimum you should touch a grounded metal object to dissipate any static charge that may be present on you.
- Only handling circuit boards in 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

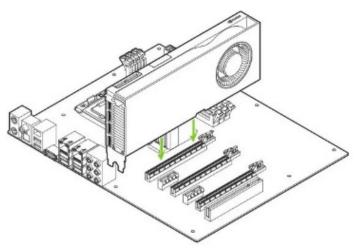
Perform the following procedure to install SupremeRAID™ into your system.

- 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, SR-1000-AM, SR-1001 and SR-1011 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, SR-1000-AM, SR-1001 and SR-1011 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 <u>manual installation procedure</u> 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 the <u>Latest Linux Release Notes</u>.
  - \$ sudo wget[filelink]

\$ sudo chmod +x [Filename]

#### Dependencies and Utilities

	Links	
NVIDIA Driver	NVIDIA-Linux-	
	graid-sr-pre-installer	
SupremeRAID™ Pre-installer	(MD5: 8218aaa	

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

\$ sudo ./[filename]

<pre>root@graid-demo:/home/graid/driver# ./g Reading package lists Done</pre>	raıd-sr-pre-installer-	1.5.0-98-x86_64.run						
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 (1:3.6.4-1ubuntu0.20.04.1).								
tar is already the newest version $(1.30)$	+dfsg-7ubuntu0.20.04.3	5).						
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'								
Sourcing file '/etc/default/grub.d/init-se	lect cfa'							
Generating grub configuration file								
Found linux image: /boot/vmlinuz-5.4.0-163	-generic							
Found initrd image: /boot/initrd.img-5.4.0								
Adding boot menu entry for UEFI Firmware S	ettings							
done Setting kernel options done.								
Secting Kernet 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								
Nouveau module has been loaded, graid-prei	nstaller will unload nou	uveau for NVIDIA driver	install.					
Unload nouveau module successfully.								
Running install NVIDIA Driver. (This step Wed Feb 21 11:27:41 2024	WILL TAKE A WHILE.)							
NVIDIA-SMI 535.154.05 Driver			 _					
	Bus-Id Disp.A							
I Fan Temp Perf Pwr:Usage/Cap	I Memory-Usage	I GPU-Util Compute M.						
		MIG M.						
	+======================================	+===========						
	00000000:01:00.0 Off   0MiB / 5754MiB							
' +								
+								
Processes:		CDU M						
GPU GI CI PID Type Proce	ss name	GPU Memory						
ID ID		Usage 						
<pre>No running processes found</pre>								
+								
Install NVIDIA Driver succeeded.								
This anaid projectallon will pohoot the su								
This arala-preinstaller will repool the sy	stem for apply previous	settina!						
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 4 Go to the Graid Technology website, download the latest version of the installer in <u>Latest</u> <u>Linux Release Notes</u> and make it executable.

\$ sudo wget[filelink]

\$ sudo chmod +x [filename]

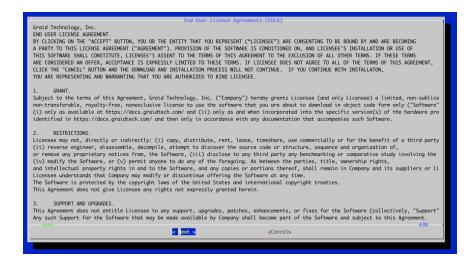
#### **Driver Package**

SR-1000	SR-1000-AM	SR-1001	SR-1010	SR-1010-AD	SR-1011	
	rted GPU: <b>NVID</b> oad Installer: gr		iller-			
c490	cbf887ed51e3192f	F27ad07a65a1	55			md5

- 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® Driver Installerr					
Hercone to the suprementation tree anstancem					
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. and/or its affiliates in the United States, certain other countries, and/or the EU. The term GraidTech refers to Graid Technology Inc. and/or its subsidiaries. For more information, please visit www.graidtech.com. Graid Technology Inc. reserves the right to make changes 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					
<pre>&lt; ext &gt; <cancel></cancel></pre>					

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 Confirm stopping SupremeRAID<sup>™</sup> Management Console, select **Yes** to set the new admin password.

Confi We should stop the graid-mgr service to s Do you want to proceed with this action?	rm Stopping SupremeRAID" Mana et the new admin password.	agement Console	
	<yes></yes>	< No >	

F Setup admin password and then select **Next** to continue with the installation.

Setup SupremeRAID <sup>®</sup> Management Console Please set a secure password for the admin account to protect your management console. Create a strong password with a mix of letters and numbers.	
Account: admin	
Confirm Password:	
< Next > <cancel></cancel>	

G Complete the installation. You can access the SupremeRAID<sup>™</sup> Management Console at: https://[IP]:50060. If port 50060 is occupied by other applications, please refer to the <u>instructions</u> to change the port.



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 ~/driver# sudo ./graid-sr-installer-1.5.0-001-659-82-x86\_64.run --accept-license raid-demo: Extracting installer files, please wait a few seconds ... Extracting installer files done. Starting installer ... systemctl stop graid 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: cleaning build area. make -j32 KERNELRELEASE=5.15.0-83-generic... Signing module: /var/lib/dkms/grebar/0.1.0/5.15.0-83-generic/x86\_64/module/grebar.ko Secure Boot not enabled on this system. cleaning build area... grebar.ko: Running module version sanity check. - Original module - No original module exists within this kernel - Installation - Installing to /lib/modules/5.15.0-83-generic/updates/dkms/ 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 -> /usr/src/graid-1.5.0 Kernel preparation unnecessary for this kernel. Skipping... Building module: cleaning build area... ./build.sh 5.15.0-83-generic /lib/modules/5.15.0-83-generic/build...... Signing module: - /var/lib/dkms/graid/1.5.0/5.15.0-83-generic/x86\_64/module/graid-nvidia.ko - /var/lib/dkms/graid/1.5.0/5.15.0-83-generic/x86\_64/module/graid.ko Secure Boot not enabled on this system. cleaning build area... graid.ko: Running module version sanity check. Original module - No original module exists within this kernel - Installation - Installing to /lib/modules/5.15.0-83-generic/updates/dkms/ graid-nvidia.ko: Running module version sanity check. No original module exists within this kernel - Installation - Installing to /lib/modules/5.15.0-83-generic/updates/dkms/ depmod.. Processing triggers for man-db (2.10.2-1) ... Suggestion!! This installer will reboot the system for apply previous kernel module grebar setting! Do you want to continue? [Y/n]

Step 4 To activate the software, apply the SupremeRAID<sup>m</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 <u>openSUSE operating systems</u>.
- 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/ 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		
sqlite-libs	sqlite-libs	sqlite3	sqlite3		
		libudev-devel			
			initramfs-tools		
			gawk		
gcc-c++-\$(VERSION_ID)	gcc-c++	g++	g++		
gcc-\$(VERSION_ID)					
kernel-devel- \$(kernel_version)	kernel-devel- \$(kernel_version)				
kernel-headers- \$(kernel_version)	kernel-headers- \$(kernel_version)	-C kernel-default- devel=\$(kernel_version_sus e)	linux-headers- \$(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>Latest Linux Release Notes</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 perl nvme-cli

• For RHEL9, issue the following commands:

\$ sudo yum install https://dl.fedoraproject.org/pub/epel/epelrelease-latest-9.noarch.rpm

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

• For RHEL8, issue the following commands:

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

\$ sudo yum install make automake kernel-devel-\$(uname -r) kernelheaders-\$(uname -r) dkms gcc gcc-c++ ipmitool tar mdadm sg3\_utils sqlite-libs automake dialog perl nvme-cli vim wget

• 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 make automake kernel-devel-\$(uname -r) kernelheaders-\$(uname -r) dkms ipmitool tar mdadm sg3\_utils sqlite-libs automake dialog vim wget

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, 9 and above versions, 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 file /etc/modprobe.d/graid-blacklist.conf 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 RHEL9:

[root@localhost ~] # cat/proc/cmdline BOOT_IMAGE=(md/root)/boot/vmlinuz-5.14.0-284.30.1.el9_2.x86_64 root=UUID=f2440cd3-491b-4d55-af1b-fe14b545c09e ro crashkernel =1G-4G:192M,4G-64G:256M,64G-:512M resume=UUID=1aed4049-d82a-4d23-802d 7ac9f4c73a24 rd.md.uuid=4fe3b4ad:6e55c5eb:6a5da201: bd307bb4 rd.md.uuid=e6e24cf5:6149f434:ff7292d3:3c77e608 rhgb quiet iommu=pt nvme_core.multipath=Y iommu=pt nvme_core.multipath=Y	
For RHEL8:	
<pre>[root@localhost ~]# cat /proc/cmdline BO0T_IMAGE=(hd9,gpt2)/vmlinuz-4.18.0-553.5.1.el8_10.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 iommu=pt nvme_core.multipath=Y</pre>	
For RHEL7:	



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.

	A-SMI 5		4 						CUDA Versio	
										JN: 12.4
GPU I	Name	Perf	Pe Pv	ersiste wr:Usag	nce-M e/Cap	Bus-Id	Memo	Disp.A ry-Usage	Volatile   GPU-Util 	Uncorr. ECC Compute M. MIG M.
	75C	T400 4GB P0		N/A /	0n 31W	000000 1271M	000:01: 1iB /	00.0 Off 4096MiB	   100% 	N/A E. Process N/A
Proces										GPU Memory Usage
·====: 0	====== N/A	======= N/A	====== 720	 C	usr/t/	in/graid	core	======		======================================

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>Latest Linux Release Notes</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 perl nvme-cli
```

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

						535.154.05		
GPU	Name		Persist Pwr:Usa	ence-M ge/Cap	Bus-Id 	Disp.A Memory-Usage	Volatile   GPU-Util 	Uncorr. ECC Compute M. MIG M.
	46C	P0	N/A .	0ff / 31W	00000000   0Mi	):01:00.0 Off .B / 4096MiB	   0% 	N/A Default N/A
Proce								
GPU	GI ID	ID	PID Type	Proces	ss name			GPU Memory Usage

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>Latest Linux Release Notes</u>.

\$ sudo chmod +x [Filename]

#### Dependencies and Utilities

				Links			
NVIDIA D	IVIDIA Driver		VIDIA-Linu:	x-			
SupremeRAID™ Pre-installer		er	r <mark>aid-sr-pre</mark> - ND5: 8218a				
	Package	SR-1001	SR-1010	SR-1010-AD	SR-1011		
sR-1000 • Suppo		T1000		SR-1010-AD	SR-1011		

Step 11 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>Latest Linux Release Notes</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 perl nvme-cli \$ 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.

root@graid-demo:~# nvidia-smi Tue Aug 29 18:18:37 2023 +			
NVIDIA-SMI 515.86.01 Driver V	ersion: 515.86.01	CUDA Version: 11.7	
GPU Name Persistence-M    Fan Temp Perf Pwr:Usage/Cap  		GPU-Util Comput	
0 NVIDIA RTX A2000 Off     30% 48C P2 24W / 70W   	00000000:22:00.0 Off 0MiB / 5754MiB		0   ault   N/A
+   Processes:   GPU GI CI PID Type   ID ID	Process name	GPU Me Usage	
No running processes found			=====     +

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>Latest Linux Release Notes</u>.

\$ sudo chmod +x [Filename]

	Links	
NVIDIA Driver	NVIDIA-Linux-	
Commence DAIDTH Des Grantelles	graid-sr-pre-installer	
SupremeRAID™ Pre-installer	grad-sr-pre-installer (MD5: 8218aai	
	(MD5: 8218aar	
river Package	(MD5: 8218aa: 01 SR-1010 SR-1010-AD SR-1011	

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>Latest Linux Release Notes</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 perl nvme-cli
$ 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.

```
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:

o o
root@graid:~ # cat /proc/cmdline
BOOT\_IMAGE=/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								CUDA Versi		
GPU N		Perf	F	Persist Pwr∶Usa	enc ige/	:e-M   'Cap   	Bus-Id	Memo	Disp.A ry-Usage	+   Volatile   GPU-Util 	Unco Coi	orr. ECC mpute M. MIG M.
		======= T400 40 P0		N/A /		0n   31W	000000 1271	000:01: MiB /	00.0 Off 4096MiB	+========     100% 	Е.	N/A Process N/A
Proces	  sses:									+		
GPU	GI ID	CI ID	PID	Туре	F	roces	s name					J Memory age
·====== 0	====== N/A	======== N/A	 720	с С	/	′usr/b	======== in/graid <sub>-</sub>	 _core				======== 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>Latest Linux Release Notes</u>.

\$ sudo cł	nmod +x [Filename]	]
Dependencies and	Utilities	
	Links	
NVIDIA Driver	NVIDIA-Linux-	
SupremeRAID™ Pre-installer	graid-sr-pre-installer	
Supremervito Pre-installer	(MD5: 8218aaa	
Driver Package		
SR-1000 SR-1000-AM SR-	1001 SR-1010 SR-1010-AD SR-1011	
Supported GPU: NVIDIA T <sup>*</sup> Download Installer: graid-s     c49cbf887edS1e3192f27add	r-installer-	md5

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

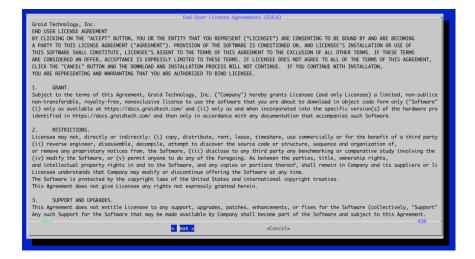
Step 1 Execute the installer and follow the provided steps to complete the installation.

```
$ 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™ Driver Installer
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Publication: Aug 1, 2023
< encel>

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.



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

accept		Confirm the EULA	u accept the EULA? (accept/decline/quit):
< Back > < Next > <cancel></cancel>			pt
	<cancel></cancel>	< Next >	<mark>&lt; Back &gt;</mark>

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

Confirm reboot for grebar	1
Suggestion!! This installer will reboot the system for apply previous kernel module great	par setting!
< <mark>( es &gt;</mark> < No	
< NO	·

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

\$ sudo graidctl apply license [LICENSE KEY]

# 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

```
Download the installer and finish SupremeRAID™ installation process.
Step 1
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.
        For RHEL/SUSE
        $ sudo firewall-cmd --zone=public --add-port=50060/tcp
        $ sudo firewall-cmd --zone=public --permanent --add-port=50060/tcp
        $ sudo firewall-cmd -reload
        For Ubuntu
        $ sudo ufw allow 50060/tcp
        $ sudo ufw 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.

Graid Techno	5,											SR-10
			Sup			anagei	ment Con	sole				
				Acco	Account							
					word Password		ø					
						.og in						
			aid Technology	Inc. All Rights F								
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Note: The default account and password for graphical management console is 'admin' and 'admin'.

Step 6 You can also use the following command to set up the admin password.

\$ sudo graid-mgr set admin password

## Setup the port and IP

To set up your own port and IP, please edit the configuration file **/etc/graidmgr/service.conf.** For example, if you want to set the port and IP to 8888 and 123.456.7.889 respectively, it would be as follows:

[common] web\_port=8888 web\_addr=123.456.7.889

# 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 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 Modifying Journal Mode on a RAID5 Drive Group.
- 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:

[graid@graid demo⁄ ✓Apply license su		license XXXXXXXX	
	~]\$ sudo graidctl descri	be license	
✓Describe license			
License State:	APPLIED		
Controller 0:			
	Name: SR-1000		
	Serial Number: 1xxxxx	xxxxxx0	
	License State: APPLIE		
	License Key: XXXXXXXX	-xxxxxxxx-xxxxx	(XX-XXXXXXXX
	License Type: Full		
	Expiration Days: Unli	mited	
	NVMe / NVMe-oF PD Num		
Controller 1:			
	Name: SR-1000		
	Serial Number: 1xxxxx	xxxxxx1	
	License State: APPLIE		
	License Key: XXXXXXXX	-xxxxxxxx-xxxxx	(XX-XXXXXXXX
	License Type: Full		
	Expiration Days: Unli	mited	
	NVMe / NVMe-oF PD Num		
Features:			
	NVMe / NVMe-oF PD Num	ber: 32	
	RAID5: true		
	RAID6: true		
	Export VD via NVMe-oF	: true	
	Multiple Controller S	upport: true	
[graid@graid demo <sup>,</sup>	~]\$ sudo graidctl list c	ontroller	
✓List controller	successfully.		
		I	-
ID CONTROLLER	MODEL SERIAL NUMBER	NUMA STATE	DG
i — i — — — — — — — — — — — — — — — — —	ii	i	-[]
0 SR-1000	1xxxxxxxxxxxx0	0 ONLINE	0,1
1   SR-1000	1xxxxxxxxxxxx1	1 ONLINE	2,3
i i——i———	ii	i	-
[graid@graid demo	~]\$sudo graidctl disable	controller 1	
✓Disable controll	er successfully.		
✓Disable controll	er Controller 1 successi	fully.	
[graid@graid demo <sup>,</sup>	~]\$ sudo graidctl disabl	e controller 1	
✓Disable controll			
	er Controller 1 successi		
		e controller 1 >	xxxxxxx-xxxxxxx-xxxxxxx-xxxxxxx
✓Replace controll			
✓Replace controll	er Controller 1 success	fully.	

- 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
✓Create physical drive successfully. ✓Create physical drive PD0 (/dev/nvme0: nqn.2019-08.org.qemu:NVME0002) successfully.
✓Create physical drive PD1 (/dev/nvme1: nqn.2019-08.org.qemu:NVME0004) successfully. ✓Create physical drive PD2 (/dev/nvme2: nqn.2019-08.org.gemu:NVME0001) successfully.
✓Create physical drive PD3 (/dev/nvme3: nqn.2019-08.org.qemu:NVME0003) successfully.
✓Create physical drive PD4 (/dev/nvme4: nqn.2019-08.org.qemu:NVME0005) successfully. [graid@graid demo~]\$ sudo graidctl create drive_group raid5 0-4
✓Create drive group successfully. ✓Create drive group DG0 successfully.
[graid@graid demo~]\$ sudo graidctl create virtual_drive 0 5T
✓Create virtual drive successfully. ✓Create virtual drive DG0/VD0 successfully.
[graid@graid demo~]\$ sudo graidctl list virtual_drivedg-id=0 ✔List virtual drive successfully.
VD ID DG ID SIZE DEVICE PATH STATE EXPORTED
0 0 4.7 TiB /dev/gdg0n1 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 graidctl create drive_group raid6 0-4no-journal							
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:	ngn.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:	30 GiB (32007782400 B)						
Used Space:	0 B						
Strip Size:	4096						
State:	OPTIMAL						
PD IDs:	[0 1 2 3 4]						
Number of VDs:	0						
Prefer Controller:	0						
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:

•••									
root@graid:~# graid	root@graid:~# graidctl edit drive_group 0 journal always_on								
<pre>/Edit drive group successfully.</pre>									
root@graid:~# graid	ctl describe drive_group 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:									
Running Controller:									
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:

•••						
✓Connect remote ta ✓Connect remote ta	rget suc rget Tar ]\$ sudo	get 0 successfully. graidctl list nvme_drive	1.81 i	pv4 4420		
DEVICE PATH (4)	MODEL	NQN/WWID	NSID	CAPACITY	ADDRESS	
/dev/nvme0n1	   Linux	uuid.b951d877-76af-4dfe-84ee-a45164554fe2		22 GB	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		22 GB	traddr=172.16.11.81,trsvcid=4420	
f75429d7d74b Create physical d Create physical d Create physical d Create physical d Create physical d [graid@graid demo~	rive suc rive PD0 rive PD1 rive PD2 rive PD3 ]\$ sudo	<pre>0 (uuid.b951d877-76af-4dfe-84ee-a45164554fe2) ( //dev/nvme1: uuid.6f21ec8f-00ee-4a30-a9b8-4 2 (/dev/nvme3: uuid.d846f451-31af-49ae-b3db-8 8 (uuid.34d16aa-41fc-4c02-a660-f75429d7d74b) graidctl create drive_group raid5 0-3</pre>	succes 13447b8 ca90f45	sfully. f138) succe 4c3b) succe	essfully.	d.34d1d6aa-41fc-4c02-a660-
	]\$ sudo	graidctl create drive_group raid5 0-3	succes	sturry.		

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

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

Step 1 Check the status of the physical drive. If the drive is already displaying as MISSING or another 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:

/dev/gpd0   nqu /dev/gpd1   nqu /dev/gpd2   nqu /dev/gpd3   nqu /dev/gpd4   nqu 	M/WHID qn.2019-10.com.kioxia:KCM61VUL3T26 qn.2019-10.com.kioxia:KCM61VUL3T26 qn.2019-10.com.kioxia:KCM61VUL3T26 qn.2019-10.com.kioxia:KCM61VUL3T26 qn.2019-10.com.kioxia:KCM61VUL3T26	0:Z060A006T1L8   0:Z010A001T1L8   0:Z080A04HT1L8	MODEL KCM61VUL3T20 KCM61VUL3T20 KCM61VUL3T20 KCM61VUL3T20	CAPACITY 3.2 TB 3.2 TB 3.2 TB 3.2 TB	SLOT ID 15 9 8	STATE FAILED ONLINE ONLINE	
/dev/gpd1   nq /dev/gpd2   nq /dev/gpd3   nq /dev/gpd4   nq 	n.2019-10.com.kioxia:KCM61VUL3T20 n.2019-10.com.kioxia:KCM61VUL3T20 n.2019-10.com.kioxia:KCM61VUL3T20	0:Z060A006T1L8   0:Z010A001T1L8   0:Z080A04HT1L8	KCM61VUL3T20 KCM61VUL3T20	3.2 TB 3.2 TB	9	ONLINE	
/dev/gpd2   nqu /dev/gpd3   nqu /dev/gpd4   nqu 	n.2019-10.com.kioxia:KCM61VUL3T20 n.2019-10.com.kioxia:KCM61VUL3T20	0:Z010A001T1L8   0:Z080A04HT1L8	KCM61VUL3T20	3.2 TB			
/dev/gpd3   nqu /dev/gpd4   nqu udo graidctl lis	n.2019-10.com.kioxia:KCM61VUL3T20	0:Z080A04HT1L8					
/dev/gpd4   nqu udo graidctl lis				3.2 TB	11	ONLINE	
		0:2080A05KT1L8	KCM61VUL3T20	3.2 TB	3	ONLINE	
ssfully.	t nvme_drive						
		MODEL	CAPACITY				
1qn.2019-10.com.k		KCM61VUL3T20	3.2 TB				
DEVICE PATH NQ	N/WWID		MODEL	CAPACITY	SLOT ID		
			KCM61VUL3T20	3.2 TB	15	ONLINE	
			KCM61VUL3T20	3.2 TB 3.2 TB	3		9%, 54 mins remaining)
udo graidctl list	st drive group						
essfully.							
IM CAPACITY F	FREE USED STATE						
1   13 TB   12	12 TB 1.0 TB RECOVERY						
	qn.2019-10.com.k udo graidctl rep a successfully. udo graidctl lis uccessfully. DEVICE PATH NQ /dev/gpd1 nq /dev/gpd3 nq /dev/gpd3 nq /dev/gpd3 nq /dev/gpd4 nq	qn.2019-10.com.kioxia:KCM61VUL3T20:Z050A002T1L8         udo graidctl replace physical_drive 0 /dev/nvme5         a successfully.         udo graidctl list physical_drive         uccessfully.         DEVICE PATH         NQN/WWID         /dev/gpd1         nqn.2019-10.com.kioxia:KCM61VUL3T2         /dev/gpd2         nqn.2019-10.com.kioxia:KCM61VUL3T2         /dev/gpd3         nqn.2019-10.com.kioxia:KCM61VUL3T2         /dev/gpd4         nqn.2019-10.com.kioxia:KCM61VUL3T2         /dev/gpd5         uqn.2019-10.com.kioxia:KCM61VUL3T2         udo graidctl         list drive_group	qn.2019-10.com.kioxia:KCM61VUL3T20:Z050A002T1L8         KCM61VUL3T20           udo graidctl replace physical_drive 0 /dev/nvme5         kCM61VUL3T20           udo graidctl list physical_drive         udo graidctl list physical_drive         udo graidctl list physical_drive           uccessfully.         udo graidctl list physical_drive         udo graidctl list physical_drive           DEVICE PATH         NQN/WWID         NQN/WWID           /dev/gpd1         nqn.2019-10.com.kioxia:KCM61VUL3T20:Z060A006T1L8           /dev/gpd2         nqn.2019-10.com.kioxia:KCM61VUL3T20:Z060A006T1L8           /dev/gpd3         nqn.2019-10.com.kioxia:KCM61VUL3T20:Z060A006T1L8           /dev/gpd3         nqn.2019-10.com.kioxia:KCM61VUL3T20:Z060A006T1L8           /dev/gpd5         nqn.2019-10.com.kioxia:KCM61VUL3T20:Z060A004T1L8           udo graidctl         list drive_group           udo graidctl         list drive_group	qn.2019-10.com.kioxia:KCM61VUL3T20:Z050A002T1L8         KCM61VUL3T20         3.2 TB           udo graidctl replace physical_drive 0 /dev/nvme5         successfully.         3.2 TB           udo graidctl replace physical_drive         udo graidctl list physical_drive         1.2 TB           udo graidctl neplace physical_drive         1.2 TB         1.2 TB           udo graidctl list physical_drive         1.2 TB         1.2 TB           udo graidctl list physical_drive         1.2 TB         1.2 TB           veccessfully.         1.2 TB         1.2 TB           DEVICE PATH         NQN/WNID         1.4 TB           /dev/gpd1         ngn.2019-10.com.kioxia:KCM61VUL3T20:Z010A001TL8         KCM61VUL3T20           /dev/gpd2         ngn.2019-10.com.kioxia:KCM61VUL3T20:2080A04TTL8         KCM61VUL3T20           /dev/gpd3         ngn.2019-10.com.kioxia:KCM61VUL3T20:2080A04TTL8         KCM61VUL3T20           /dev/gpd5         ngn.2019-10.com.kioxia:KCM61VUL3T20:2080A04TTL8         KCM61VUL3T20           udo graidctl list drive_group         1.2 TB         1.2 TB         1.2 TB	MODEL         CAPACITY           /dev/gpd1         nqn.2019-10.com.kioxia:KCM61VUL3T20:2050A002T1L8         KCM61VUL3T20         3.2 TB           /dev/gpd1         nqn.2019-10.com.kioxia:KCM61VUL3T20:2050A005T1L8         KCM61VUL3T20         3.2 TB           /dev/gpd1         nqn.2019-10.com.kioxia:KCM61VUL3T20:2010A0801T1L8         KCM61VUL3T20         3.2 TB           /dev/gpd2         nqn.2019-10.com.kioxia:KCM61VUL3T20:2010A0801T1L8         KCM61VUL3T20         3.2 TB           /dev/gpd3         nqn.2019-10.com.kioxia:KCM61VUL3T20:2010A0801T1L8         KCM61VUL3T20         3.2 TB           /dev/gpd4         nqn.2019-10.com.kioxia:KCM61VUL3T20:2010A0801T1L8         KCM61VUL3T20         3.2 TB           /dev/gpd5         nqn.2019-10.com.kioxia:KCM61VUL3T20:2080A04HT1L8         KCM61VUL3T20         3.2 TB           /dev/gpd5         nqn.2019-10.com.kioxia:KCM61VUL3T20:2080A04HT1L8         KCM61VUL3T20         3.2 TB           /dev/gpd5         nqn.2019-10.com.kioxia:KCM61VUL3T20:2080A04HT1L8         KCM61VUL3T20         3.2 TB           /dev/gpd5         nqn.2019-10.com.kioxia:KCM61VUL3T20:2080A04ET1L8         KCM61VUL3T20         3.2 TB           /dev/gpd5         nqn.2019-10.com.kioxia:KCM61VUL3T20:2080A04ET1L8         KCM61VUL3T20         3.2 TB	MODEL         CAPACITY         SLOT ID           /dev/gpd1         nqn.2019-10.com.kioxia:KCM61VUL3T20:2050A002T1L8         KCM61VUL3T20         3.2 TB           /dev/gadidctl replace physical_drive         /dev/nvme5             /dev/gadidctl list physical_drive         /dev/nvme5             /dev/gpd1         nqn.2019-10.com.kioxia:KCM61VUL3T20:2060A006T1L8         KCM61VUL3T20         3.2 TB         15           /dev/gpd2         nqn.2019-10.com.kioxia:KCM61VUL3T20:2010A0001T1L8         KCM61VUL3T20         3.2 TB         15           /dev/gpd2         nqn.2019-10.com.kioxia:KCM61VUL3T20:2010A0001T1L8         KCM61VUL3T20         3.2 TB         8           /dev/gpd3         nqn.2019-10.com.kioxia:KCM61VUL3T20:2080A001T1L8         KCM61VUL3T20         3.2 TB         11           /dev/gpd4         nqn.2019-10.com.kioxia:KCM61VUL3T20:2080A001T1L8         KCM61VUL3T20         3.2 TB         11           /dev/gpd5         nqn.2019-10.com.kioxia:KCM61VUL3T20:2080A002T1L8         KCM61VUL3T20         3.2 TB         31           /dev/gpd5         nqn.2019-10.com.kioxia:KCM61VUL3T20:2080A002T1L8         KCM61VUL3T20         3.2 TB         31           /dev/gpd5         nqn.2019-10.com.kioxia:KCM61VUL3T20:2050A002T1L8         KCM61VUL3T20         3.2 TB         32	gn.2019-10.com.kioxia:KCM61VUL3T20:Z050A002T1L8         KCM61VUL3T20         3.2 TB           udo graidctl replace physical_drive 0 /dev/nvme5 e successfully. udo graidctl tist physical_drive uccessfully.         SLOT ID         SLOT ID           DEVICE PATH         NQN/WWID         MODEL         CAPACITY         SLOT ID         STATE           /dev/gpd1         ngn.2019-10.com.kioxia:KCM61VUL3T20:Z060A006T1L8         KCM61VUL3T20         3.2 TB         15         ONLINE           /dev/gpd2         ngn.2019-10.com.kioxia:KCM61VUL3T20:Z060A006T1L8         KCM61VUL3T20         3.2 TB         9         ONLINE           /dev/gpd3         ngn.2019-10.com.kioxia:KCM61VUL3T20:Z060A006T1L8         KCM61VUL3T20         3.2 TB         9         ONLINE           /dev/gpd3         ngn.2019-10.com.kioxia:KCM61VUL3T20:Z060A006T1L8         KCM61VUL3T20         3.2 TB         1         ONLINE           /dev/gpd3         ngn.2019-10.com.kioxia:KCM61VUL3T20:Z060A00FT1L8         KCM61VUL3T20         3.2 TB         1         ONLINE           /dev/gpd5         ngn.2019-10.com.kioxia:KCM61VUL3T20:Z060A00FT1L8         KCM61VUL3T20         3.2 TB         3         REBUILD (12.6           udo graidctl         list drive_group

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:

•••											
	[graid@graid-demo ~]\$ sudo graidctl list virtual_drive 										
VD ID	DG ID	SIZE	DEVICE PATH	STATE	EXPORTED						
0	0 0	93 GiB 93 GiB	/dev/gdg0n1 /dev/gdg0n2	OPTIMAL   OPTIMAL	No No						
<pre></pre>											
Transport Address: Interface	2:	tcp 172.17 eno1	7.2.20								
ServiceId	AddressFamily: ipv4 ServiceId: 4420 Subsystems:										
NAME				DG ID	VD ID	DEVICE PATH					
nqn.202	20-05.com	n.graidted	8A5:dg0vd0	0	0	/dev/gdg0n1					
								1			

# 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. One drive group can only run on one 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.
	<pre>\$ sudo graidctl create drive_group [RAID_MODE] [PD_IDs] -c [Controller_ID]</pre>
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 l graid@gr (Apply l graid@gr /Apply l graid@gr /List co	icense su Taid demo icense fa Taid demo icense su Taid demo ntroller	nccessfu ~]\$ suda iled: Ne ~]\$ suda nccessfu ~]\$ suda success	lly. 9 graidctl a 2w license F 9 graidctl a 1ly. 9 graidctl l fully. 	pply licen: PD number 1 pply licen: ist contro	se YYYY 2 is le se YYYY ller -	xxxx-xxxxxxxx-xxxxxxxx-x YYYY-YYYYYYY-YYYYYYY ss than old license PD n YYYY-YYYYYYY-YYYYYYYY — []	xxxxxxx number 32							
—i—	ONTROLLER	MODEL	SERIAL NUM	——i——	STAT	—i—i								
	R-1000 R-1000		1xxxxxxxxxx 1xxxxxxxxxx		ONLI									
	aid demo me drive		graidctl l fully.	ist nvme_d	ive -n	0 ' '								
DEVICE	PATH (3)	MODE	iL	NQN/WWID			N	ISID	CAPACITY	NUMA NODE	ADDRESS	5		
/dev/nv /dev/nv /dev/nv	/me2n1	KCM6	1VUL3T20	nqn.2019-10	).com.k	ioxia:KCM61VUL3T20:Z080A ioxia:KCM61VUL3T20:Z0F0A ioxia:KCM61VUL3T20:Z080A	031T1L8	1 1 1	50 GiB 50 GiB 50 GiB	000000000000000000000000000000000000000	0000:22	3:00.0		
	aid demo me drive		graidctl l fully.	ist nvme_d	⁻ive -n	1	ı					I		
DEVICE	PATH (3)	MODE	L	NQN/WWID			Ν	ISID	CAPACITY	NUMA NODE	ADDRESS	5		
/dev/nv /dev/nv /dev/nv	/me3n1	KCM6	1VUL3T20	nqn.2019-10	.com.k	ioxia:KCM61VUL3T20:Z060A ioxia:KCM61VUL3T20:Z080A ioxia:KCM61VUL3T20:Z010A	058T1L8	1 1 1	50 GiB 50 GiB 50 GiB	1 1 1	0000:22	3:00.0		
/Create /Create graid@gr	physical physical aid demo ysical dr 	drive Pl drive Pl ~]\$ sudo rive suce 	04 (/dev/nvr	ne3: nqn.20 ne4: nqn.20	19-10.c	om.kioxia:KCM61VUL3T20:2 om.kioxia:KCM61VUL3T20:2 om.kioxia:KCM61VUL3T20:2 e		B) su	ccessfullý. ccessfully. 		SLOT ID	NUMA NODE	   STATE	
0 1 2 3 4 5		/A   // /A   / /A   / /A   / /A   /	dev/gpd0 dev/gpd1 dev/gpd2 dev/gpd3 dev/gpd4 dev/gpd5	nqn.2019   nqn.2019   nqn.2019   nqn.2019   nqn.2019   nqn.2019	-10.com -10.com -10.com -10.com	.kioxia:KCM61VUL3720:208 .kioxia:KCM61VUL3720:208 .kioxia:KCM61VUL3720:208 .kioxia:KCM61VUL3720:206 .kioxia:KCM61VUL3720:208 .kioxia:KCM61VUL3720:201	0A031T1L8 0A058T1L8 0A006T1L8 0A006T1L8	KCM6 KCM6 KCM6 KCM6	51VUL3T20   51VUL3T20   51VUL3T20   51VUL3T20   51VUL3T20   51VUL3T20   51VUL3T20	50 GiB 50 GiB 50 GiB 50 GiB 50 GiB 50 GiB	N/A N/A N/A N/A N/A N/A	0 0 1 1 1	UNCONFIGURED_GOOD UNCONFIGURED_GOOD UNCONFIGURED_GOOD UNCONFIGURED_GOOD UNCONFIGURED_GOOD UNCONFIGURED_GOOD	
<pre>/Create of /Create of graid@gr /List dr </pre>	drive gro drive group  MODE    RAID5   	vip succe vip DG0 : ~]\$ sudd o succes: VD NUM 0 ~]\$ sudd	essfully. graidctl l sfully. CAPACITY 100 GiB	/. ist drive_!     FREE   100 GiB	group USED 0 B	raid5 0-2 -c 0 CONTROLLER running: 0 prefer: 0 raid5 3-5 -c 1	STATE OPTIMAL							
∕Create o graid@gr	drive gro	up <mark>DG1</mark> : ~]\$ suda	successfully graidctl l		group									
DG ID	MODE	VD NUM	CAPACITY	FREE	USED	CONTROLLER	STATE							
0	RAID5 RAID5	0 0	100 GiB   100 GiB	100 GiB 100 GiB	0 B 0 B	running: 0 prefer: 0 running: 1 prefer: 1	OPTIMAL OPTIMAL							
′Edit dr graid@gr	ive group	succes: ~]\$ sudo	sfully. graidctl l											
DG ID	MODE	VD NUM	CAPACITY	FREE	USED	CONTROLLER	STATE							
0	RAID5 RAID5	0 0	100 GiB   100 GiB	100 GiB 100 GiB	0 B 0 B	running: 0 prefer: 0   running: 0 prefer: 0 	OPTIMAL OPTIMAL							
		ul¢ cudo	graidctl e	dit drive (	aroup 1	controller 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-opengl-
files --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>Latest Linux Release Notes</u>.

\$ sudo chmod +x [Filename]

#### Dependencies and Utilities

	Links			
NVIDIA Driver	NVIDIA-Linux-			
SupremeRAID™ Pre-installer	graid-sr-pre-installer			
Supremerkalo Pre-installer	(MD5: 8218aaa			

#### Driver Package

SR-1000	SR-1000-AM	SR-1001	SR-1010	SR-1010-AD	SR-1011					
oqqu2 •	Supported GPU: NVIDIA T1000									
	Supported GPU: NVIDIA 11000     Download Installer: graid-sr-installer-									
c490	c49cbf887ed51e3192f27ad87a65a155 md5									

- 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

- 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 Back up the configuration file.
  \$ sudo cp /etc/graid.conf graid.conf.bak
- Step 4 Make sure the SupremeRAID<sup>M</sup> kernel module is unloaded.

\$ sudo rmmod graid\_nvidia graid

Step 5 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 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, the output should be empty.

\$ 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.
  - Centos, Rocky Linux, AlmaLinux, RHEL, openSUSE, and SLES:

\$ sudo rpm -qa | grep graid

• Ubuntu:

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

- Step 9 Power-off the server, and then install the new card into the server.
- Step 10 Power-on the server.
- 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>Latest Linux Release Notes</u>.

\$ sudo chmod +x [Filename]

#### Dependencies and Utilities

	Links							
NVIDIA Driver NVIDIA-Linux-x86_64-550.67.run >								
SupremeRAID™ Pre-installer	graid-sr-pre-installer-1.6.1-134-x86_64.run ↗ (MD5: 8218aaa3efaa0050cf21742b218f600b)							
Driver Package								
SR-1000 SR-1000-AM SR-	1001 SR-1010 SR-1010-AD SR-1011							
Supported GPU: NVIDIA T1000     Download Installer: graid-sr-installer-1.6.1-000-334-324.run ス								
c49cbf887ed51e3192f27ad07a65a155 md5								

- Step 12 Proceed to Executing the Installer and Completing the Installation to execute the installer and to complete the installation.
- Step 13 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	rep	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	е	drive_group	dg
	list	l, ls	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	е	virtual_drive	vd
	list	l, ls	virtual_drive	vd
Controller	enable		controller	СХ
	disable		controller	сх
	delete	d, del	controller	сх
	list	l, ls	controller	сх
	replace	rep	controller	СХ
MD Boot Drive	import	im, imp	md_drive	md
	replace	rep	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	export_target	nt
	describe	desc	export_target	nt
	delete	d, del	export_target	nt
	list	l, ls	export_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
Copyback	start		copyback	ср
	stop		copyback	ср

## **Managing Licenses**

You can apply the license and check license information.

## Applying the License

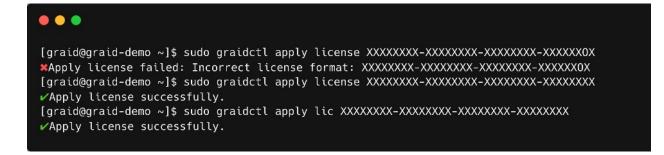
To apply the license and complete the installation, issue the following command:

```
$ 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 ✓Describe license Controller 0:	~]\$ sudo graidctl describe license successfully.
controtter 0.	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 Default: -1



#### Output example:

DEVICE PATH(4)	MODEL	NQN/WWID	NSID	CAPACITY	NUMA NODE	ADDRESS
/dev/nvme0			   1	3.2 TB	1	0000:e4:00.0
/dev/nyme1	KCM61VUL3T20	ngn.2019-10.com.kioxia:KCM61VUL3T20:Z050A002T1L8	1	3.2 TB	0	0000:01:00.0
/dev/nvme2	KCM61VUL3T20	ngn.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
	-		i			
	-		i——			
/dev/nvme0	KCM61VUL3T20		1	3.2 TB	1	0000:e4:00.0
/dev/nvmel	KCM61VUL3T20	nqn.2019-10.com.kioxia:KCM61VUL3T20:Z050A002T1L8	1	3.2 TB	0	0000:01:00.0
/dev/nvmel /dev/nvme2	KCM61VUL3T20 KCM61VUL3T20	nqn.2019-10.com.kioxia:KCM61VUL3T20:2050A002T1L8 nqn.2019-10.com.kioxia:KCM61VUL3T20:2080A05KT1L8	1	3.2 TB 3.2 TB	0	0000:01:00.0 0000:e1:00.0
/dev/nvme1 /dev/nvme2 /dev/nvme3	KCM61VUL3T20 KCM61VUL3T20 KCM61VUL3T20	nqn.2019-10.com.kioxia:KCM61VUL3T20:Z050A002T1L8 nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A05KT1L8 nqn.2019-10.com.kioxia:KCM61VUL3T20:X0N0A015T1L8	1	3.2 TB	0	0000:01:00.0
/dev/nvmel /dev/nvme2	KCM61VUL3T20   KCM61VUL3T20   KCM61VUL3T20 	nqn.2019-10.com.kioxia:KCM61VUL3T20:Z050A002T1L8 nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A05KT1L8 nqn.2019-10.com.kioxia:KCM61VUL3T20:X0N0A015T1L8	1	3.2 TB 3.2 TB	0	0000:01:00.0 0000:e1:00.0
/dev/nvme1 /dev/nvme2 /dev/nvme3 graid@graid-demo	KCM61VUL3T20   KCM61VUL3T20   KCM61VUL3T20 	nqn.2019-10.com.kioxia:KCM61VUL3T20:Z050A002T1L8 nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A05KT1L8 nqn.2019-10.com.kioxia:KCM61VUL3T20:X0N0A015T1L8	1	3.2 TB 3.2 TB	0	0000:01:00.0 0000:e1:00.0
/dev/nvme1 /dev/nvme2 /dev/nvme3 graid@graid-demo List nvme drive	KCM61VUL3T20   KCM61VUL3T20   KCM61VUL3T20   KCM61VUL3T20 -	nqn.2019-10.com.kioxia:KCM61VUL3T20:Z050A002T1L8 nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A05KT1L8 nqn.2019-10.com.kioxia:KCM61VUL3T20:X0N0A015T1L8 tl ls nd -n 1		3.2 TB 3.2 TB 3.2 TB		0000:01:00.0 0000:e1:00.0 0000:43:00.0

#### 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 .ve successfully.		
DEVICE PATH	WWID	MODEL	CAPACITY
/dev/sda /dev/sdb	t10.ATA INTEL SSDSC2KB240G7 BTYS83010GKS240AGN t10.ATA INTEL SSDSC2KB240G8 BTYF052107VH240AGN	INTEL SSDSC2KB24   INTEL SSDSC2KB24	240 GB 240 GB
		_	
DEVICE PATH	WWID	MODEL	CAPACITY
/dev/sda	t10.ATA INTEL SSDSC2KB240G7 BTYS83010GKS240AGN	INTEL SSDSC2KB24	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 graidctl 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 physical_drive
-c,current-sid string	Current SID password of the SEDs. Can be used with eithersed-take-ownership or –sed-import- key
-i,sed-import-key	Import the "SED key" of the Self-Encrypting Drives (SEDs). It will ask for the current SID password, which must also be the admin's password. The password will be saved as the SED key of the drive
-k,new-sed-key string	Set a new SED key of the drives. Can only be used withsed-take-ownership
-n,no-current-sid	Indicates that Block SID authentication is currently disabled on the SEDs. Can only be used withsed- take-ownership
-o,sed-take- ownership	Take ownership of the SEDs with the specified new SED key. Can be used with one ofno-current-sid, new-sed-key, andpsid to specify the authentication method
-p,psid string	Physical Secure ID (PSID) of SEDs. Can only be used withsed-take-ownership

Flag	Description
-p,confirm-to- erase	Confirm to erase all data on the SED supporting physical drives forcibly
-w,wipe- metadata	Wipe metadata forcibly

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

[graid@graid-demo ~]\$ sudo graidctl create physical_drive /dev/nvme0-3
<pre>/Create physical drive successfully.</pre>
✓Create physical drive PD0 (/dev/nvme0: nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A064T1L8) successfully.
✓Create physical drive PD1 (/dev/nvme1: nqn.2019-10.com.kioxia:KCM61VUL3T20:Z050A002T1L8) successfully.
✓Create physical drive PD2 (/dev/nvme2: nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A05KT1L8) successfully.
✓Create physical drive PD3 (/dev/nvme3: nqn.2019-10.com.kioxia:KCM61VUL3T20:X0N0A015T1L8) successfully.
[graid@graid-demo ~]\$ sudo graidctl create physical_drive nqn.2019-10.com.kioxia:KCM61VUL3T20:X0X0A01ET1L8 \
> nqn.2019-10.com.kioxia:KCM61VUL3T20:Z0F0A031T1L8
✓Create physical drive PD8 (nqn.2019-10.com.kioxia:KCM61VUL3T20:X0X0A01ET1L8) successfully.
<pre> /Create physical drive PD9 (nqn.2019-10.com.kioxia:KCM61VUL3T20:Z0F0A031T1L8) successfully. </pre>
[graid@graid-demo ~]\$ sudo graidctl c pd /dev/nvme4,7,8
✓Create physical drive successfully.
<pre>/Create physical drive PD10 (/dev/nvme4: nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A032T1L8) successfully.</pre>
<pre>/Create physical drive PD11 (/dev/nvme7: nqn.2019-10.com.kioxia:KCM61VUL3T20:Z050A078T1L8) successfully.</pre>
✓Create physical drive PD12 (/dev/nvme8: nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A09XT1L8) successfully.

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 Default: -1
-f,free	List unused PDs
-l,locating	List locating PDs
-n,numa-node	[int32] Filter by NUMA node Default: -1



#### Output example:

		successfully.		·I			-1	
	DG ID	DEVICE PATH	NQN/WNTD	MODEL	CAPACITY	SLOT ID	NUMA NODE	STATE
	N/A	/dev/gpd0		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:KCM61VUL3T20:2080A04WT1L8	KCM61VUL3T20	3.2 TB	2	11	UNCONFIGURED GOOD
	N/A	/dev/gpd3	ngn.2019-10.com.kioxia:KCM61VUL3T20:2050A002T1L8	KCM61VUL3T20	3.2 TB	3	j e	UNCONFIGURED GOOD
	Í NZA	/dev/gpd4	ngn.2019-10.com.kioxia:KCM61VUL3T20:Z010A003T1L8	KCM61VUL3T20	3.2 TB	4	İ 1	UNCONFIGURED GOOD
	N/A	/dev/gpd5	ngn.2019-10.com.kioxia:KCM61VUL3T20:Z060A005T1L8	KCM61VUL3T20	3.2 TB	5	9	UNCONFIGURED_GOOD
	N/A	/dev/gpd6	ngn.2019-10.com.kioxia:KCM61VUL3T20:Z0F0A031T1L8	KCM61VUL3T20	3.2 TB	6	1 1	UNCONFIGURED_GOOD
	N/A	/dev/gpd7	ngn.2019-10.com.kioxia:KCM61VUL3T20:Z010A002T1L8	KCM61VUL3T20	3.2 TB	7	0	UNCONFIGURED GOOD
2	4	/dev/nvme0n1	ngn.2019-10.com.kioxia:KCM61VUL3T20:Z080A04HT1L8	KCM61VUL3T20	3.2 TB	N/A	11	ONLINE
3	4	/dev/nvmeln1	ngn.2019-10.com.kioxia:KCM61VUL3T20:Z010A001T1L8	KCM61VUL3T20		N/A	1	ONLINE
	-	successfully.		[	<u> </u>		·[	
	DG ID	DEVICE PATH	NQN/WWID	MODEL	CAPACITY	SLOT ID	NUMA NODE	STATE
	N/A	/dev/gpd0	ngn.2019-10.com.kioxia:KCM61VUL3T20:Z080A038T1L8	KCM61VUL3T20		0	1	UNCONFIGURED_GOOD
	N/A	/dev/gpd1	nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A06QT1L8	KCM61VUL3T20	3.2 TB		0	UNCONFIGURED_GOOD
	N/A	/dev/gpd2	nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A04WT1L8	KCM61VUL3T20	3.2 TB	2	1	UNCONFIGURED_GOOD
	N/A	/dev/gpd3	nqn.2019-10.com.kioxia:KCM61VUL3T20:Z050A002T1L8	KCM61VUL3T20		3	0	UNCONFIGURED_GOOD
	N/A	/dev/gpd4	nqn.2019-10.com.kioxia:KCM61VUL3T20;Z010A003T1L8	KCM61VUL3T20	3.2 TB		1	UNCONFIGURED_GOOD
	N/A	/dev/gpd5	nqn.2019-10.com.kioxia:KCM61VUL3T20:Z060A005T1L8	KCM61VUL3T20	3.2 TB		0	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		0	UNCONFIGURED_GOOD
2	4	/dev/nvme0n1	nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A04HT1L8	KCM61VUL3T20	3.2 TB	N/A	1	ONLINE
3	4	/dev/nvmelnl	nqn.2019-10.com.kioxia:KCM61VUL3T20:Z010A001T1L8	KCM61VUL3T20	3.2 TB	N/A	11	ONLINE
		sudo graidctl ls successfully.	-	-	1		-	
		DEVICE PATH	NQN/VWID	MODEL	CAPACITY	SLOT ID	NUMA NODE	STATE
st physic	DG ID		ngn.2019-10.com.kioxia:KCM61VUL3T20:Z080A06QT1L8	KCMG1VUL3T20	3.2 TB	1	0	UNCONFIGURED_GOOD
st physic	DG ID N/A	/dev/gpd1			3 3 TO	3	o i	UNCONFIGURED GOOD
st physic D ID (4)	——i	/dev/gpd1 /dev/gpd3	ngn.2019-10.com.kioxia:KCM61VUL3T20:Z050A002T1L8	KCM61VUL3T28	3.2 TB		6	
	N/A		ngn.2019-10.com.kioxia:KCM61VUL3T20:2050A002T1L8   ngn.2019-10.com.kioxia:KCM61VUL3T20:2060A005T1L8	KCM61VUL3T20 KCM61VUL3T20	3.2 TB		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.
СОРУВАСК	Physical drive is performing copyback.

If an (!) appears after the state mentioned above, it represents a critical warning.

## 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:

• • •	
	dctl describe physical_drive 1
	drive successfully.
PD ID:	
DG ID:	0
Slot ID:	10
GUID:	nqn.2019-10. com. kioxia: KCM61VUL3T20:Z080A038T1L8
Mode:	KCM61VUL3T20
Capacity:	2.9 TiB
State:	ONLINE
Device Path:	/dev/gpd6
Numa Node:	0
Volatile Cache:	Enabled
Wearout:	0%
Critical Warning:	
	No warning.
Attributes:	
	locating = false
	hotspare =
root@graid:~# grai	dctl desc pd 4
Describe physical	drive successfully.
PD ID:	
DG ID:	0
Slot ID:	
GUID:	nqn.2019-10. com. kioxia: KCM61VUL3T20:Z080IP38T1L8
Mode:	KCM61VUL3T20
Capacity:	2.9 TiB
State:	ONLINE
Device Path:	/dev/gpd3
Numa Node:	0
Volatile Cache:	Enabled
Wearout:	0%
Critical Warning:	
	No warning.
Attributes:	
	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	l drive l drive demo ~]\$	successfully. PD0 successful	edit physical_dri ly. list physical_dri					1	
PD ID (5)	DG ID	DEVICE PATH	NQN/WWID			MODEL	CAPACITY	SLOT ID	STATE
0   1   2   3   4	0 0 0 0 0	/dev/gpd0 /dev/gpd1 /dev/gpd2 /dev/gpd3 /dev/gpd4	nqn.2019-10.com. nqn.2019-10.com. nqn.2019-10.com.	kioxia:KCM61VUL3T kioxia:KCM61VUL3T kioxia:KCM61VUL3T kioxia:KCM61VUL3T kioxia:KCM61VUL3T	20:Z060A006T1L8 20:Z010A001T1L8 20:Z080A04HT1L8	KCM61VUL3T20	3.2 TB 3.2 TB 3.2 TB 3.2 TB 3.2 TB 3.2 TB 3.2 TB	15   9   8   11   3	FAILED ONLINE ONLINE ONLINE ONLINE
[graid@graid ↓ ✔List nvme dr			list nvme_drive						
DEVICE PATH	(1)	NQN			MODEL	CAPACITY			
/dev/nvme5		nqn.2019-10.cc	om.kioxia:KCM61VUL	3T20:Z050A002T1L8	KCM61VUL3T20	3.2 TB			
[graid@graid	demo ~]\$	ve successfull; sudo graidctl successfully.	y. list physical_dri     NON/WWID	ve			CAPACITY	SLOT ID	
1   2   3   4   5	00 1D   0   0   0   0   0	/dev/gpd1 /dev/gpd2 /dev/gpd3 /dev/gpd4 /dev/gpd5	nqn.2019-10.com. nqn.2019-10.com. nqn.2019-10.com. nqn.2019-10.com.	kioxia:KCM61VUL3T kioxia:KCM61VUL3T kioxia:KCM61VUL3T kioxia:KCM61VUL3T kioxia:KCM61VUL3T kioxia:KCM61VUL3T	20:Z010A001T1L8 20:Z080A04HT1L8 20:Z080A05KT1L8	   KCM61VUL3T20   KCM61VUL3T20   KCM61VUL3T20	3.2 TB 3.2 TB 3.2 TB 3.2 TB 3.2 TB 3.2 TB 3.2 TB	15   9   8   11   3	ONLINE ONLINE ONLINE ONLINE ONLINE REBUILD (12.69%, 54 mins remaining)
DG ID MOD	E VD	NUM CAPACITY	FREE USED	STATE					
0 RAI	05   	1   13 TB	12 TB   1.0 TB	RECOVERY					
[graid@graid ✔List virtual			list virtual_driv	e					
VD ID DG	ID SIZ	E DEVICE P#	ATH STATE						
 	0 1.0	TB / /dev/gdg@	Dn1   RECOVERY						
	I.								

# 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]

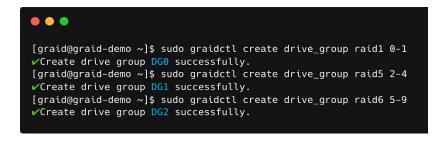
OR

\$ 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 Default: -1
-z,foreground-init	Foreground initialization (Write Zeros)
-s,strip-size	[uint32] Strip Size (KiB) Values: 4, 8, 16, 32, 64, 128 Default: 4

Output example:



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 - init, -b	Default option. Use standard methods to initialize the drive group. When all the physical drives in the drive group support the de-allocate dataset management command, it is used to synchronize the data, or parity, between the physical drives during the creation of the drive group.	An I/O-capable device path similar to /dev/gdg0n1 is created.
foreground - init, -z	Foreground initialization. This method writes zeros to the entire drive.	The virtual drive appears in the system after initialization is complete. Use the following command to check the initialization progress: \$ sudo graidctl list drive_group
controller, -c	Specific controller to control this drive_group. 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.
strip-size, -s	Strip size of the drive_group. [RAID0, RAID10] Values: 4, 8, 16, 32, 64, 128 Default: 4, [Int32]	Adjust RAID0/RAID10 strip size to a specific size: (4k, 8k, 16k, 32k, 64k, or 128k)

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 (cp)	Drive group is in optimal state and the copyback 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 graidctl describe drive_group 0				
✓Describe drive gro	up successfully.				
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:					
	<pre>spdk_bdev = DISABLE</pre>				
	rebuild_speed = high				
	auto failover = ENABLE				
	cc_speed = high				
	resync_speed = high				
	init_speed = high				
root@graid:~# graid					
✓Describe drive gro					
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)				
	0 B				
Free Space: Used Space:					
	59 GiB (63172509696 B)				
Strip Size:	4096				
State:	OPTIMAL [3 1 2]				
PD IDs:					
Number of VDs:	1				
Prefer Controller:	0				
Running Controller:					
Volatile Cache:	Disabled				
PD Volatile Cache:	Enabled				
Journal:	Degrade Only				
Attributes:					
	<pre>init_speed = high</pre>				
	<pre>spdk_bdev = DISABLE</pre>				
	rebuild_speed = high				
	resync_speed = high				
	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 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:

- 0 - 0		p~]\$ sudo ( p successf	graidctl lis ully.	st drive_q	group		11
DG ID	MODE	VD NUM	CAPACITY	FREE	USED	CONTROLLER	STATE
	RAID1 RAID5	1 35	3.5 TiB 10 TiB	0 B 10 TiB	3.5 TiB 0 B	running: 0 prefer: 0 running: 1 prefer: 1	OPTIMAL
		successfu	graidctl lis lly.	st contro	ller _1	· 	1 1
ID C	ONTROLLE	R MODEL	SERIAL NUMBE	ER NUMA	STATE	DG	
	R-1000 R-1000		1xxxxxxxxxxx 1xxxxxxxxxxx		ONLINE ONLINE		
✓Edit dr [graid@g							
DG ID	MODE	VD NUM	CAPACITY	FREE	USED	CONTROLLER	STATE
	RAID1 RAID5	1 35	3.5 TiB 10 TiB	0 B 10 TiB	3.5 TiB 0 B	running: 0 prefer: 0 running: 0 prefer: 1	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]

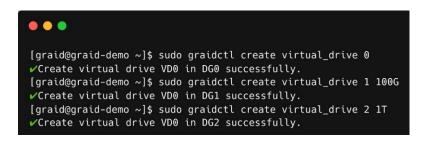
OR

\$ 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 <u>Setting Up the Auto-mount File Systems on Linux Using the SupremeRAID™ Driver</u>. 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



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 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.

#### 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]
```

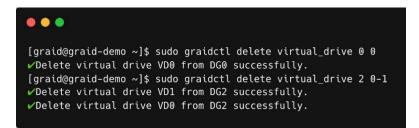
OR

```
$ 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:

<pre>[graid@graid-demo ~]\$ sudo graidctl describe virtual_drive 0 4</pre>				
ADDRESS	INTERFACE	ADDRESS FAMILY	SERVICE ID	
172.16.11.64	ens192	 ipv4	4420	
()	successfully. C79373ED375F /gdg0n1 GB MAL ADDRESS	successfully. C79373ED375F /gdg0n1 GB MAL ADDRESS INTERFACE	successfully. C79373ED375F /gdg0n1 GB MAL ADDRESS INTERFACE ADDRESS FAMILY	successfully. C79373ED375F /gdg0n1 GB MAL ADDRESS INTERFACE ADDRESS FAMILY SERVICE ID

### 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.

•••					
<pre> Create virtua Create virtua [graid@graid-si Create virtual Create virtual [graid@graid-si Edit virtual</pre>	l drive l drive ake ~]\$ s drive su l drive ake ~]\$ s drive su ake ~]\$ s	successfu DO/VDO su sudo graio uccessfull DG1/VDO s sudo graio ccessfull sudo graio	ccessfully. dctl create virtual_ ly. uccessfully. dctl edit virtual_dr y. dctl list virtual_dr	drive 1 4GB ive 0 0 stripecache 0 1	
VD ID (2)	DG ID	SIZE	DEVICE PATH	STATE	EXPORTED
0	0	9.3 GB	/dev/gdg0nl	OPTIMAL cache:ACTIVE	No
0	1 	4.0 GB	Cache of DG0 VD0	OPTIMAL -	No   

# 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

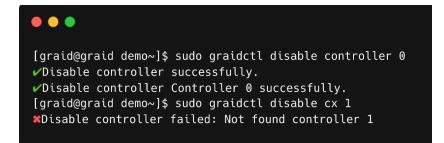
### Deactivating a Controller

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:

- 5	d@graid demo~]\$ sudd controller success	2	controll	ler	
ID	CONTROLLER MODEL	SERIAL NUMBER	NUMA	STATE	DG
	SR-1000 SR-1000	1xxxxxxxxxxx0 1xxxxxxxxxxx1	0 1	ONLINE OFFLINE	0,1 2,3
- 5	d@graid demo~]\$ sudo controller success	2			
ID	CONTROLLER MODEL	SERIAL NUMBER	NUMA	STATE	DG
0	SR-1000	1xxxxxxxxxxx0	0	ONLINE	0,1
	SR-1000	1xxxxxxxxx1	1	OFFLINE	2,3
I					

### **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]

PD ID	DG ID	NON/WVE						MODEL	CAPACITY	SLOT ID	STATE
								-			
32 33	4   4		<pre>nqn.2014-08.org.nvmexpress:uuid:527970f1-8f0f-27b3-fb2f-8462d3c8f972 nqn.2014-08.org.nvmexpress:uuid:5218a65c-e259-6392-ff5c-35759b31b537</pre>						27 GB 27 GB	N/A   N/A	ONLINE     ONLINE
4	   RAID1 	3	27 GB	0 В	27 GB	OPTIMAL					
		nude ann	idctl ls vd								
			essfully.								
		rive succ		—i—							

# 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 cessfully,									
PD ID	DG ID	NQN/WWI	D					 MODEL	CAPACITY	SLOT ID	STATE	
32 33	4	nqn.2014-08.org.nvmexpress:uuid:527970f1-8f0f-27b3-fb2f-8462d3c8f972 nqn.2014-08.org.nvmexpress:uuid:5218a65c-e259-6392-ff5c-35759b31b537						VMware Virtu   VMware Virtu	27 GB 27 GB	N/A N/A	ONLINE MISSING	
		sudo gra up succes	idctl ls dg sfully.			1				I		
DG ID	MODE	VD NUM	CAPACITY	FREE	USED	STATE						
4	RAID1	3	27 GB	0 B	27 GB	DEGRADED						
			idctl ls vd essfully.		·ı		I					
VD ID	DG ID	SIZE	DEVICE PAT	гн эт.	ATE							
0	4	11 GB 5.4 GB	/dev/md12: /dev/md125		GRADED							
2	4	5.4 GB	/dev/md120	5   DE 	GRADED							



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

32   4 33   4	 1								CAPACITY	SLOT ID	
55   4	· · · · ·	nqn.2014-08.org.nvmexpress:uuid:527970f1-8f0f-27b3-fb2f-8462d3c8f972   VMware Vir nqn.2014-08.org.nvmexpress:uuid:52524729-5a31-13e7-a316-f6e765e16ec8   VMware Vir								N/A   N/A	ONLINE
 4   R. 	AID1	VD NUM	CAPACITY 27 GB	FREE	USED 27 GB	STATE REBUILD					
graid@grai ′List virt l			.dctl ls vd essfully.	1							

## 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]
```

•••						
		sudo gra up succes	idctl ls dg sfully.			
DG ID	MODE	VD NUM	CAPACITY	FREE	USED	STATE
4	-    RAID1	  3	27 GB	0 B	27 GB	OPTIMAL
		sudo gra proup succ	idctl delete essfully.	e dg 4		I I

## 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: NVME0002
Enter Key: √Edit config successfully.
```

## **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:

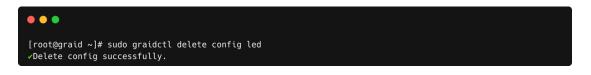
```
$ sudo graidctl delete config [config_name] [flags]
```

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 #Restore config failed: Please stop the graid service before restoring the config, and restart the graid service after restored the config [graid@graid demo~]\$ sudo graidctl re conf Skip /dev/sda: no config found
Srup Jeevisda. Ho conrug Found Found the following configs: 0: Device /dev/nvme0n1, UUID 00200000-0000-0000-4d02-000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST
1: Device /dev/nvmelnl, UUID 002000000-0000-0000-4002-00000000000000
3. Device / devine /
✓Restore 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
-n,max_entries	[int32] Limit the number of events returned
-o,output	[string] Output to a file
-s,severity	[string] Filter events by severity



### **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

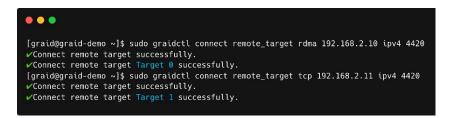
```
$ sudo graidctl con rt [transport type] [addr] [address family] [port service
id]
```



#### 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 et successfu I	aidctl list nvme lly.	eof_target		II
PORT ID	ТҮРЕ	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
	[graid@graid-demo ~]\$ sudo graidctl ls nt ✔List nvmeof target successfully.					
PORT ID	ТҮРЕ	INTERFACE	ADDRESS	ADDRESS FAMILY	SERVICE ID	SUBSYSTEMS
0	tcp	ens160	172.16.11.81	ipv4	4420	DG0/VD0, DG0/VD1
1	tcp	ens161	172.16.11.82	ipv4	4420	DG0/VD0, DG0/VD1, DG0/VD3

### Disconnecting from NVMe-oF Remote Targets

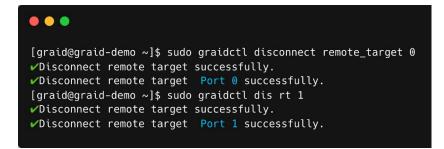
Note: You cannot delete the target when there are physical drives created from the target.

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]
```

•••						
<ul> <li>Creat</li> <li>Creat</li> <li>graid</li> <li>Creat</li> <li>Creat</li> <li>Graid</li> </ul>	te expor d@graid- te expor te expor d@graid-	rt target suc rt target Tar -demo ~]\$ suc rt target suc rt target Tar	ccessfully. -get 0 successf to graidctl cre ccessfully. -get 1 successf to graidctl lis	eate export_target		
ID	TYPE	INTERFACE	ADDRESS	ADDRESS FAMILY	SERVICE ID	SUBSYSTEMS
0	tcp	enol	172.17.2.20	ipv4	4420	
1	tcp	eno1	172.17.2.20	ipv4	4421	
					I	I I

### 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 ~]\$ •Export virtual drive •Export virtual drive [graid@graid-demo ~]\$ •Export virtual drive	<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

[graid@graid-demo ~]\$ sudo graidctl list export_target ✓List export target successfully.									
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			
[graid@graid-demo ~]\$ sudo graidctl ls et <pre>////////////////////////////////////</pre>									
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			
						I I			

### 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:

•••	
<pre></pre>	Target 0 successfully. sudo graidctl del et 1 successfully.

### 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:

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

# 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

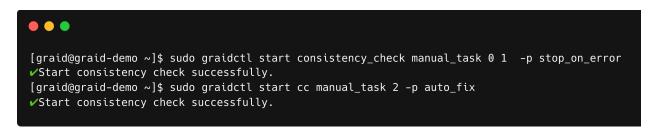
\$ sudo graidctl start cc [flags]

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

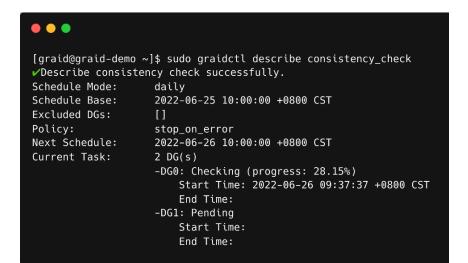
To view detailed consistency check information, issue the following command:

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

OR

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

Output example:



### Setting the Consistency Check Policy

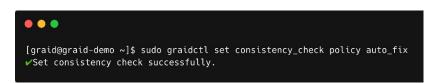
To set a consistency check policy, issue the following command.

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
- Mail Notification Service
- Drive Copyback

## **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 LINU	X 8 INSTALLATION Help!
	LOCALIZATION	SOFTWARE	SYS	STEM
	Keyboard English (US)	Installation Sou     Closest mirror	urce	Installation Destin No disks selected
	Language Support English (United States)	Software Select	ction 🕤	KDUMP Kdump is enabled
	S Time & Date Asia/Taipei timezone		ŧ	Network & Host Mired (ens192) connected
	USER SETTINGS		<b>e</b>	Security Policy
	Root Password Root account is disabled.			
			Quit	Begin Installation
		We won't touc	h your disks until y	ou click 'Begin Installation'.
	A Please complete items marked with t	this icon before continuing t	o the next step.	

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

Device Selection Select the device(s) you'd like to install to. They will be left untouched	
Select the device(s) you'd like to install to. They will be left untouched	
	until you click on the main menu's "Begin Installation" button.
Local Standard Disks	
10 GiB	10 GiB
	-
re Virtual NVMe Disk i.6b4f27116183325d000c296a891bb4a3	VMware Virtual NVMe Disk i.1c65d3900abf288f000c296788e2902a nvme0n2 / 10 GiB free
INITEONIE / TO OID THEE	Disks left unselected here will not be touched.
Specialized & Network Disks	Disks tert unselected here will not be touched.
Add a disk	
	Disks left unselected here will not be touched
Storage Configuration	
Automatic Custom     I would like to make additional space available.	
Encryption	
Encrypt my data. You'll set a passphrase next.	
ull disk summary and boot loader	2 disks selected; 20 GiB capacity; 20 GiB free Refresh

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

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

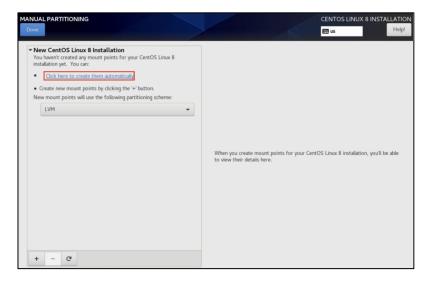
					/	
NSTALLATION	DESTINATION	N			CENTOS	LINUX 8 INSTALLATIO
Done					🖽 us	Help!
evice Selection						
elect the device	ce(s) you'd like	to install to	. They will be left untouched unti	l you click on the main menu's "B	legin Insta	illation" button.
ocal Standard D	lieke					
ocat Standard D	1383					
		10 GiB			10 GiB	
		-				
VMware Virt	ual NVMa Dick	i 654£2711	6183325d000c296a891bb4a3	VMware Virtual NVMe Disk	i 1c65d39	003bf288f000c29678
vi-iware vire	nvme0n1	/	10 GiB free	nvme0n2	/	10 GiB free
				Disk	s left unsele	ected here will not be touche
pecialized & Net	twork Disks					
Add a disk						
				Disk	s left unsele	ected here will not be touche
Storage Confid	guration					
Automatic	Custor	n				
		-				

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.

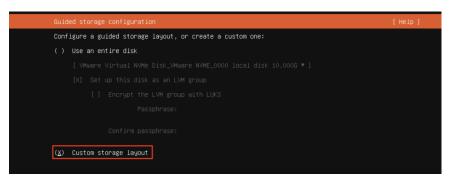
MANUAL PARTITIONING			CENTOS LINUX 8 INSTALLATION
New CentOS Linux 8 Installation		cl-root	
SYSTEM / cl-root	16.41 GiB >	Mount Point:	Device(s): VMware Virtual NVMe Disk i. 6b4f27116183325d000c296a891bb4a
/boot/efi nvme0nlp1	600 MiB	Desired Capacity:	3 (nvmeOnl) and 1 other
/boot nvme0n1p2	1024 MiB	16.41 GiB	Modify
swap cl-swap	2 GiB	Device Type: RAID    Encrypt  File System:	RAID Level: RAID1 •
		Label:	Name: root
+ - C		Note: T be appl	Update Settings he settings you make on this screen will not led until you click on the main memú's Begin Installation' button.

### Procedure for Ubuntu

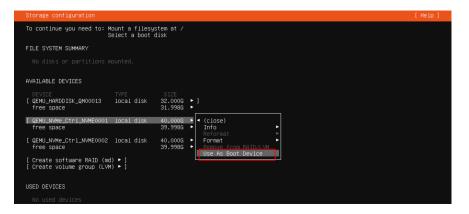
### Creating and Configuring Storage Partitions

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.

To continue you need to: Mount a filesystem at ∕								
FILE SYSTEM SUMMARY								
MOUNT POINT SIZE TYPE DEVICE TYPE [/boot/efi 1.0496 new fat32 new partition of local disk •								
AVAILABLE DEVICES								
DEVICE [ QEMU_HARDDISK_QM00013 free space	TYPE local disk	SIZE 32.000G ►] 31.998G ►						
[ QEMU_NVMe_Ctrl_NVME0001 free space	local disk	40.000G ►] 38.948G ►						
[ QEMU_NVMe_Ctrl_NVMe0002 free space [ Create software RAID (md) ● ] [ Create volume group (LVM) ● ]	local disk	40.0006 • (close) 39.9986 • Info Reformat Format Remove from RhID/LVH Add As Another Boot Der	► ► Vice					
USED DEVICES								
DEVICE [QEMU_NVMe_Ctrl_NVME0001 partition 1 new, primary ESP, to be formatted as fat32, mounted	TYPE local disk at ∕boot/efi	SIZE 40.000G ►] 1.0496 ►						

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			
MOUNT POINT SIZE TYPE DEVICE TYPE [/boot/efi 1:049G new fat32 new partition of local disk ►	u		
AVAILABLE DEVICES			
DEVICE [ QEMU_HARDDISK_QM00013 free space	TYPE local disk	SIZE 32.000G ► ] 31.998G ►	
[ QEMU_NVMe_Ctrl_NVME0001 free space	local disk	40.000G ►] 38.948G ►	
[ QEMU_NVMe_Ctrl_NVME0002 free space	local disk	40.000G ►] 38.948G ►	
[ Create software RAID (md) ⊨ ] [ Create volume group (LVM) ► ]			
USED DEVICES			
DEVICE [ QEMU_NVMe_Ctrl_NVWE0001 partition 1 new, primary ESP, to be formatted as fat32, mounted	TYPE local disk at ∕boot∕efi	SIZE 40.000G ►] 1.049G ►	
[ QEMU_NVMe_Ctrl_NVME0002 partition 1 new, backup ESP, to be formatted as fat32	local disk	40.000G ►] 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.

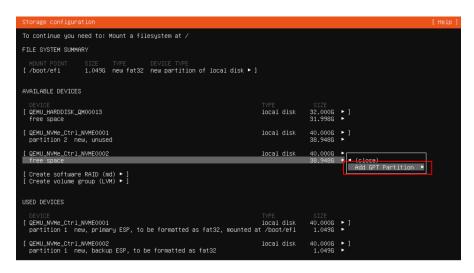


To continue you need to: Mount a filesystem at /				
FILE SYSTEM SUMMARY				
HOUNT POINT SIZE TYPE DEVICE TYPE [/boot/efi 1.049G new fat32 new partition of local disk •				
AVAILABLE DEVICES				
DEVICE [ QEMU_HARDDISK_QM00013 free space	TYPE local disk	SIZE 32.000G 31.998G		
[ QEMU_NVMe_Ctrl_NVME0001 free space	local disk	40.000G 38.948G	↓ (close)	
[ QEMU_NVMe_Ctrl_NVME0002 free space	local disk	40.000G 38.948G	Add GPT Partition ►	
[ Create software RAID (md) ⊨ ] [ Create volume group (LVM) ► ]				
USED DEVICES				
DEVICE [QEMU_WVMe_Ctrl_NVME0001 partition 1 new, primary ESP, to be formatted as fat32, mounted	TYPE local disk at ∕boot∕efi	SIZE 40.000G 1.049G		
[ QEMU_NVMe_Ctrl_NVME0002 partition 1 new, backup ESP, to be formatted as fat32	local disk	40.000G 1.049G		

B Leave the drive unformatted.

Adding GP Size (max 38.948G):	<pre>r partition to QEMU_NVMe_Ctrl_NVME0001</pre>
Format:	[Leave unformatted ▼ ]
	[Create] [Cancel]

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.

			[Help]
To continue you need to: Mount a filesystem at /			
FILE SYSTEM SUMMARY			
MOUNT POINT SIZE TYPE DEVICE TYPE [/boot/efi 1.049G new fat32 new partition of local disk • ]			
AVAILABLE DEVICES			
		SIZE 32.000G 31.998G	
[QEMU_NVMe_Ctrl_NVME0001 ] partition 2 new, unused	ocal disk	40.000G 38.948G	
[ QEMU_NVMe_Ctrl_NVME0002 ] partition 2 new, unused	ocal disk	40.000G 38.948G	
[ Create software RAID (md) ▶ ] { Create volume group (LVW) ▶ }			
USED DEVICES			
	YPE .ocal disk /boot/efi	SIZE 40.000G 1.049G	
[ QEMU_NVMe_Ctrl_NVME0002 ] partition 1 new, backup ESP, to be formatted as fat32	ocal disk	40.000G 1.049G	

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



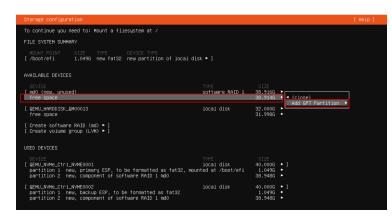
	Create software RAID ("MD	') disk ———		
Name:	md0			
RAID Level:	[ 1 (mirrored) 🔻 ]			
Devices:	[] QEMU_HARDDISK_QM00013 32 [ active ♥ ] unused local disk	2.000G		
		0.000G		
	[X] partition 2 38 [ active ▼ ]	8.948G		
	unused partition of local QEMU_NVMe_Ctrl_NVME0002 40 local disk	l disk 0.000G		
		3.948G		
	[ <u>C</u> reate]			
	[ Cancel ]			
Storage configurati	on			[ H
To continue you nee	d to: Mount a filesystem at /			
FILE SYSTEM SUMMARY				
	NZE TYPE DEVICE TYPE 049G new fat32 new partition of local o	jisk ► ]		
AVAILABLE DEVICES				
DEVICE [ md0 (new, unused) free space		TYPE software RAID 1	SIZE 38.916G ►] 38.914G ►	
[ QEMU_HARDDISK_QMC free space	0013	local disk	32.000G ►] 31.998G ►	
[ Create software R [ Create volume gro				
USED DEVICES				
DEVICE [QEMU_NVHe_Ctrl_NV partition 1 new, partition 2 new,	ME0001 primary ESP, to be formatted as fat32, mc component of software RAID 1 md0	TYPE local disk ounted at ∕boot/efi	SIZE 40.000G ►] 1.049G ► 38.948G ►	
[ QEMU_NVMe_Ctrl_NV partition 1 new, partition 2 new,	MEOOO2 backup ESP, to be formatted as fat32 component of software RAID 1 md0	local disk	40.000G ►] 1.049G ► 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:

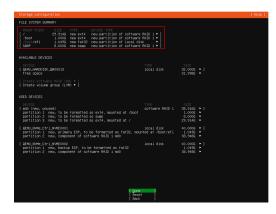
Step 1 Select the **free space** option in the md, then Choose **Add GPT Partition**.



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

	Adding GPT partition to mdO	
Size (max 38.914G):	16	
Format:	[ext4 •]	
Mount:	[/boot 🔻 ]	
	[ <u>C</u> reate ] [Cancel ]	
	- Adding GPT partition to md0 ——————————	
Size (max 37.914G):	8G	
Format:	[swap 🔻 ]	
Mount:		
	[ <u>C</u> neate ] [Cancel ]	
	- Adding GPT partition to mdO	
Size (max 29.914G):		
Format:	[ext4 •]	
Mount:	[/ •]	
	[ <u>C</u> reate ] [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: - 0 not proposed after adjusting the Guided Setup settings: Charges to partitioning: - 0 not a partition of continuendo 11 (0.00 MB) on BIOG Bood Partition - 0 note partition of derivmendo 12 (0.07 GB) (or a ways) - 0 note partition of derivmendo 12 (0.27 GB) for aways - 10 subvolume actions (continuendo)	
	Guided Setup Expert Partitioner	
Help Release Notes		Abort Back Next

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

SUSE							
gretem <u>646</u> grevice yews BAD- SPD- grete- ignore-	Device         •           >: /der.mmsdb11         ·	Size 16.00 GiB 20.00 MB 14.72 GiB 14.72 GiB 10.00 GiB 10.00 GiB 10.00 GiB 10.00 GiB		Type Big point OffSald Mikewen, Inc. Whenese Dakk Big both Sald Mikewen, Inc. Whenese Dakk Big both Saldwalame Big both Saldwalame	Label	Mount Point / /oorlyub2/166-pc /boollyub2/166-pc	
	Edit Add Partition						
Help Release Notes						Cancel	Back Accept

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

or SUSE			
Add RAID /dev/md0           RAD Type         Rad More (sep (stand) (strong)           Image: Add More (sep (stand) (strong)         Rad More (sep (stand) (strong)           Image: Add More (sep (stand) (strong)         Rad More (sep (stand) (strong)           Image: Add More (sep (strong) (strong)         Rad More (sep (strong) (strong)           Image: Add More (sep (strong) (strong) (strong)         Rad More (strong)           Image: Add More (sep (strong) (strong) (strong)         Rad More (strong) (strong)           Image: Add More (strong) (strong) (strong) (strong)         Rad More (strong) (strong) (strong)           Image: Add More (strong) (stron	evice e, dic: VMeans Disk e, dic: VMeans Disk e, dic: VMeans Disk e, for: VMeans Disk	Selected Devices : Device Size Enc Type	Jop Sp Dam Botog
Total size: 84.00 GiB		Resulting size: 0.00 B	<u>Cancel</u> Back

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

💦 SUSE					
/dev/nvme0n2 10.00 GiB ( /dev/nvme0n3 10.00 GiB ( /dev/nvme1n1 16.00 GiB ( /dev/nvme1n2 16.00 GiB ( /dev/nvme1n3 16.00 GiB (	Rajd Name (optional) GRAID_BOOT_DEVICE	Add Add All - Remoye All	Svilected Devroes: Devroe Size Enc Type		Iop Up Dgam Bottom
Total size: 84.00 GIB           Help         Release Notes			Resulting size: 0.00 B	<u>C</u> ancel <u>B</u>	ack <u>N</u> ext

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

💦 SUSE					
Add RAID /dev/md0 RAID Type Raid Name (optional) O RAID (furging) WADD (Morring) O RAID 2 (Networker: Streping) O RAID 10 (Mirrong and Streping) Analiable Devices:		Selected Devices:			
Device Size Enc Type /dev/mmetbr3 16.00.08	Add Add All - Ramore Ramore All	Device Size /dev/mme1n1 10.00 G /dev/mme1n2 10.00 G	Type Part of md0 Part of md0		Iop yp Dywn Botto <u>m</u>
Total size: 32.00 GIB		Resulting size: 9.87 GiB			
Help Release Notes				<u>Cancel</u>	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 systemctl 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

<pre>[graid@graid demo~]\$ sudo graidctl restore config #Restore config failed: Please stop the graid service before restoring the config, and restart the graid service after restored the config. [graid@graid demo~]\$ sudo graidctl re conf Skip /dev/sda: no config found Found the following configs: 0: Device /dev/nvmelnl, UUID 00200000-0000-0000-4d02-000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST 1: Device /dev/nvmelnl, UUID 00200000-0000-4d02-0000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST 2: Device /dev/nvmelnl, UUID 00200000-0000-4d02-0000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST 3: Device /dev/nvmelnl, UUID 00200000-0000-4d02-0000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST 3: Device /dev/nvmelnl, UUID 00200000-0000-4d02-0000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST 3: Device /dev/nvmelnl, UUID 00200000-0000-4d02-0000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST 3: Device /dev/nvmelnl, UUID 00200000-0000-4d02-0000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST 3: Device /dev/nvmelnl, UUID 00200000-0000-4d02-0000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST 3: Device /dev/nvmelnl, UUID 00200000-0000-4d02-0000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST 3: Device /dev/nvmelnl, UUID 00200000-0000-4d02-0000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST 3: Device /dev/nvmelnl, UUID 00200000-0000-4d02-00000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST 3: Device /dev/nvmelnl, UUID 00200000-0000-4d02-0000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST 3: Device /dev/nvmelnl, UUID 00200000-0000-4d02-0000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST 3: Device /dev/nvmelnl, UUID 00200000-0000-4d02-00000000000000, Epoch 1412, Time 2022-12-08 20:14:09 +0800 CST 3: Device /dev/nvmelnl, UUID 00200000-0000-4d02-000000000000000000000</pre>
Please select one config to restore (0-3): 0 Restore to /etc/graid.conf (y/N)?: y #Restore config graid.conf successfully.

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]

 Product Model
 GPU
 x86\_64

 sr-100
 NVIDIA T1000

 sr-1001
 NVIDIA T400

NVIDIA A2000

SR-1010

- 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.

1       N/A       //dev/gpd1       nqn.2019-08.org.qemu:NVME0002       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         2       N/A       //dev/gpd1       nqn.2019-08.org.qemu:NVME0004       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         3       N/A       //dev/gpd3       nqn.2019-08.org.qemu:NVME0004       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         4       N/A       //dev/gpd3       nqn.2019-08.org.qemu:NVME0005       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         5       N/A       //dev/gpd3       nqn.2019-08.org.qemu:NVME0005       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         6       N/A       //dev/gpd3       nqn.2019-08.org.qemu:NVME0005       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         7       N/A       //dev/gpd3       nqn.2019-08.org.qemu:NVME0008       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         7       N/A       //dev/gpd3       nqn.2019-08.org.qemu:NVME0008       QEMU NVMe Ctrl       30 GiB       N	PD ID (8)	DG ID	DEVICE PATH	NQN/WWID	MODEL	CAPACITY	SLOT ID	NUMA NODE	WEAROUT	STATE
1       N/A       //dev/gpd1       nqn.2019-08.org.qemu:NVME0002       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         2       N/A       /dev/gpd2       nqn.2019-08.org.qemu:NVME0003       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         3       N/A       /dev/gpd3       nqn.2019-08.org.qemu:NVME0005       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         4       N/A       /dev/gpd3       nqn.2019-08.org.qemu:NVME0005       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         5       N/A       /dev/gpd7       nqn.2019-08.org.qemu:NVME0006       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         7       N/A       /dev/gpd7       nqn.2019-08.org.qemu:NVME0008       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         7       N/A       /dev/gpd3       nqn.2019-08.org.qemu:NVME0008       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         7       ndvartue       gamacbace-dd:ffffffff       italable_spare       isof C (323 Kelvin)       ialable_spare	0	   N/A	/dev/apd0	nan.2019-08.org.gemu:NVME0001	OEMU NVMe Ctrl	   30 GiB	   N/A	   0	0%	UNCONFIGURED GOOD
3       N/A       /dev/gpd3       nqn.2019-08.org.qemu:NVME0004       QEMU NVMe Ctrl       30 G18       N/A       0       0%       UNCONFIGURED_GOOD         4       N/A       /dev/gpd3       nqn.2019-08.org.qemu:NVME0005       QEMU NVMe ctrl       30 G18       N/A       0       0%       UNCONFIGURED_GOOD         5       N/A       /dev/gpd1       nqn.2019-08.org.qemu:NVME0005       QEMU NVMe ctrl       30 G18       N/A       0       0%       UNCONFIGURED_GOOD         6       N/A       /dev/gpd1       nqn.2019-08.org.qemu:NVME0007       QEMU NVMe Ctrl       30 G18       N/A       0       0%       UNCONFIGURED_GOOD         7       N/A       /dev/gpd6       nqn.2019-08.org.qemu:NVME0007       QEMU NVMe Ctrl       30 G18       N/A       0       0%       UNCONFIGURED_GOOD         7       N/A       /dev/gpd6       nqn.2019-08.org.qemu:NVME0007       QEMU NVMe Ctrl       30 G18       N/A       0       0%       UNCONFIGURED_GOOD         7       N/A       /dev/gpd6       nqn.2019-08.org.qemu:NVME0007       QEMU NVMe Ctrl       30 G18       N/A       0       0%       UNCONFIGURED_GOOD         7       N/A       jdevigod       namezola       10       QEMU NVMe Ctrl       30 G18       N/A						30 GiB		0	0%	UNCONFIGURED_GOOD
4       N/A       /dev/gpd5       nqn.2019-08.org.qemu:NVME0005       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGUEED_GOOD         5       N/A       /dev/gpd4       nqn.2019-08.org.qemu:NVME0006       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGUEED_GOOD         6       N/A       /dev/gpd6       nqn.2019-08.org.qemu:NVME0005       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGUEED_GOOD         7       N/A       /dev/gpd6       nqn.2019-08.org.qemu:NVME0008       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGUEED_GOOD         rot@graid:~# sudo nvme smart-log       /dev/gpd0       nqn.2019-08.org.qemu:NVME0008       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGUEED_GOOD         rot@graid:~# sudo nvme smart-log       /dev/gpd0       nqn.2019-08.org.qemu:NVME0008       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGUEED_GOOD         rot@graid:~# sudo nvme smart-log       /dev/gpd0       nqn.2019-08.org.qemu:NVME008       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGUEED_GOOD         raitable_spare       :50 C (323 Kelvin)       :310       :310       :310       :310 <td>2</td> <td>N/A</td> <td>/dev/gpd2</td> <td>nqn.2019-08.org.qemu:NVME0003</td> <td>QEMU NVMe Ctrl</td> <td>30 GiB</td> <td>N/A</td> <td>0</td> <td>0%</td> <td>UNCONFIGURED_GOOD</td>	2	N/A	/dev/gpd2	nqn.2019-08.org.qemu:NVME0003	QEMU NVMe Ctrl	30 GiB	N/A	0	0%	UNCONFIGURED_GOOD
5       N/A       /dev/gpd4       nqn.2019-08.org.qemu:NVME0006       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         6       N/A       /dev/gpd7       nqn.2019-08.org.qemu:NVME0007       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         rot@graid:~# sudo nvme smart-log       /dev/gpd0       nqn.2019-08.org.qemu:NVME0007       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         rot@graid:~# sudo nvme smart-log       /dev/gpd0       nqn.2019-08.org.qemu:NVME0007       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         rot@graid:~# sudo nvme smart-log       /dev/gpd0       nqn.2019-08.org.qemu:NVME0008       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         rot@graid:~# sudo nvme smart-log       /dev/gpd0       namerature       :50 C (323 Kelvin)       :50	3	N/A	/dev/gpd3	ngn.2019-08.org.gemu:NVME0004	QEMU NVMe Ctrl	30 GiB	N/A	0	0%	UNCONFIGURED_GOOD
6       N/A       /dev/gpd7       nqn.2019-08.org.qemu:NVME0007       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         vot@graid:-#       sudo nvme smart-log       /dev/gpd0       nqn.2019-08.org.qemu:NVME0008       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         vot@graid:-#       sudo nvme smart-log       /dev/gpd0       anart Log for NVME device:gpd0 namespace-ud:ffffff       intrespace       intres	4	N/A	/dev/gpd5	nqn.2019-08.org.qemu:NVME0005	QEMU NVMe Ctrl	30 GiB	N/A	0	0%	UNCONFIGURED_GOOD
7       N/A       /dev/gpd6       nqn.2019-08.org.qemu:NVME0008       QEMU NVMe Ctrl       30 GiB       N/A       0       0%       UNCONFIGURED_GOOD         oot@graid:~# sudo nvme smart-log       /dev/gpd0       aart Log for NVME device:gpd0 namespace-id:fffffff       it       it<		N/A	/dev/gpd4	nqn.2019-08.org.qemu:NVME0006	QEMU NVMe Ctrl	30 GiB	N/A	0	0%	UNCONFIGURED_GOOD
intervent     intervent     intervent     intervent     intervent       intervent     intervent     intervent     intervent       intervent     intervent     intervent     intervent       intervent     intervent     intervent     intervent       intervent     intervent     intervent     intervent       intervent     intervent     intervent     intervent       intervent     intervent     intervent     intervent       intervent     intervent     intervent     intervent       intervent     intervent     intervent     intervent       intervent     intervent     intervent     intervent       intervent     intervent     intervent     intervent       intervent     intervent     intervent     intervent       intervent     intervent     intervent     intervent       intervent     intervent     intervent     intervent       intervent     intervent     intervent     intervent       intervent     intervent     intervent     intervent       intervent     intervent     intervent     intervent       intervent     intervent     intervent     intervent       intervent     intervent     intervent     intervent </td <td>6</td> <td>N/A</td> <td>/dev/gpd7</td> <td>nqn.2019-08.org.qemu:NVME0007</td> <td>QEMU NVMe Ctrl</td> <td>  30 GiB</td> <td>N/A</td> <td>0</td> <td>0%</td> <td>UNCONFIGURED_GOOD</td>	6	N/A	/dev/gpd7	nqn.2019-08.org.qemu:NVME0007	QEMU NVMe Ctrl	30 GiB	N/A	0	0%	UNCONFIGURED_GOOD
Nart Log for NVME device:gpd0 namespace-id:fffffffittical_warning: 0imperature: 50 C (323 Kelvin)vailable_spare: 0%vailable_spare_threshold: 0%iduate_spare_threshold: 0%iduarce group critical warning summary:0ita_units_read: 139,489ist_read_commands: 2,492,356ist_read_commands: 1,881,814ontroller_busy_time: 0wer_cycles: 0wer_on_hours: 126isafe_shutdowns: 0idia_errors: 0idia_errors: 0immer_togeneture Time: 0intic_units_read: 0idia_errors: 0idia_errors: 0immer_togeneture Time: 0immer_togeneture Time: 0immer_togeneture Time: 0immer Timegrature Time <td: 0<="" td="">iermal Management T1 Trans Count: 0iermal Management T2 Trans Count: 0</td:>		N/A	/dev/gpd6	nqn.2019-08.org.qemu:NVME0008	QEMU NVMe Ctrl	30 GiB	N/A	0	0%	UNCONFIGURED_GOOD
Introller_busy_time : 0 wer_or_hours : 126 isafe_shutdowns : 0 isafe_shutdowns : 0 idia_errors : 0 im_err_log_entries : 0 itical Composite Temperature Time : 0 iermal Management T1 Trans Count : 0 iermal Management T2 Trans Count : 0	ata_units_rea ata_units_wr ost_read_com	ad itten mands	al warning sur	: 139,489 : 74,819 : 2,492,356						
wer_o_hours : 126 safe_shutdowns : 0 sdia_errors : 0 wrning Temperature Time : 0 ritical Composite Temperature Time : 0 sermal Management T1 Trans Count : 0 Hermal Management T2 Trans Count : 0	ontroller_bu	sy_time		: 0						
Isafe_shutdowns : 0 Ida_errors : 0 Imm_err_log_entries : 0 Irning Temperature Time : 0 Ititical Composite Temperature Time : 0 Ivermal Management T1 Trans Count : 0 Iermal Management T2 Trans Count : 0	ower_cycles									
wdia_errors       : 0         m_err_log_entries       : 0         rnring Temperature Time       : 0         ritical Composite Temperature Time       : 0         wermal Management T1 Trans Count       : 0         rermal Management T2 Trans Count       : 0	ower on hour:									
im_err_log_entries       : 0         irning Temperature Time       : 0         ritical Composite Temperature Time       : 0         remal Management T1 Trans Count       : 0         remal Management T2 Trans Count       : 0		wns								
rning Temperature Time : 0 itical Composite Temperature Time : 0 sermal Management T1 Trans Count : 0 sermal Management T2 Trans Count : 0	nsafe_shutdo									
itical Composite Temperature Time : 0 ermal Management T1 Trans Count : 0 ermal Management T2 Trans Count : 0	nsafe_shutdon dia_errors									
ermal Management T1 Trans Count : 0 ermal Management T2 Trans Count : 0	isafe_shutdon edia_errors im_err_log_en									
ermal Management T2 Trans Count : 0	safe_shutdo dia_errors m_err_log_e rning Tempe	rature Ti								
	safe_shutdo dia_errors m_err_log_e rning Tempe itical Comp	rature Ti osite Tem	nperature Time	: 0						
	safe_shutdon dia_errors m_err_log_en rning Tempe itical Compo ermal Manago	rature Ti osite Ten ement T1	nperature Time Trans Count	: 0 : 0						
ermal Management T1 Total Time : 0 ermal Management T2 Total Time : 0	nsafe_shutdon edia_errors um_err_log_en arning Tempen ritical Componermal Managon nermal Managon	rature Ti osite Ten ement T1 ement T2	nperature Time Trans Count Trans Count	: 0 : 0 : 0						



The following figure shows an output example using smartctl.

OG ID         DEVICE PATH         NQN/WNID           N/A         /dev/gpd0         nqn.2019-08.org.qemu:NVME000           N/A         /dev/gpd1         nqn.2019-08.org.qemu:NVME000           N/A         /dev/gpd2         nqn.2019-08.org.qemu:NVME000           N/A         /dev/gpd2         nqn.2019-08.org.qemu:NVME000           N/A         /dev/gpd2         nqn.2019-08.org.qemu:NVME000           N/A         /dev/gpd3         nqn.2019-08.org.qemu:NVME000           N/A         /dev/gpd5         nqn.2019-08.org.qemu:NVME000		CAPACITY	SLOT ID	NUMA NODE	WEAROUT	
N/A         /dev/gpd1         nqn.2019-08.org.qemu:NVME00           N/A         /dev/gpd2         nqn.2019-08.org.qemu:NVME00           N/A         /dev/gpd3         nqn.2019-08.org.qemu:NVME00           N/A         /dev/gpd3         nqn.2019-08.org.qemu:NVME00           N/A         /dev/gpd3         nqn.2019-08.org.qemu:NVME00           N/A         /dev/gpd5         nqn.2019-08.org.qemu:NVME00					WEAROUT	STATE
N/A /dev/gpd2   nqn.2019-08.org.qemu:NVME00 N/A /dev/gpd3   nqn.2019-08.org.qemu:NVME00 N/A /dev/gpd5   nqn.2019-08.org.qemu:NVME00	02   QEMU NVMe Ctrl	30 GiB	N/A	0	0%	UNCONFIGURED_GOOD
N/A   /dev/gpd3   nqn.2019-08.org.qemu:NVME00    N/A   /dev/gpd5   nqn.2019-08.org.qemu:NVME00		30 GiB	N/A	0	0%	UNCONFIGURED_GOOD
N/A /dev/gpd5   nqn.2019-08.org.qemu:NVME00		30 GiB   30 GiB	N/A   N/A	0   0	0% 0%	UNCONFIGURED_GOOD     UNCONFIGURED GOOD
		30 GiB	N/A	0	0%	UNCONFIGURED_GOOD
N/A   /dev/gpd4   nqn.2019-08.org.qemu:NVME00	06 QEMU NVMe Ctrl	30 GiB	N/A	0	0%	UNCONFIGURED_GOOD
N/A   /dev/gpd7   nqn.2019-08.org.qemu:NVME00   N/A   /dev/gpd6   nqn.2019-08.org.qemu:NVME00	07   QEMU NVMe Ctrl	30 GiB   30 GiB	N/A N/A	0   0	0% 0%	UNCONFIGURED_GOOD     UNCONFIGURED_GOOD
ht (C) 2002-20, Bruce Allen, Christian Franke, www.smartme         RT OF INFORMATION SECTION ===         umber:       QEMU NVMe Ctrl         Number:       NVME0001         e Version:       7.2.2         dor ID:       0x1b36         dor Subsystem ID:       0x1b36         l Identifier:       0x525400         ler ID:       0         rsion:       1.4         of Namespaces:       256         ine is:       Tue Jun 25 09:28:58 2024 UTC         e Updates (0x03):       1 Slot, Slot 1 R/0         Admin Commands (0x010a):       Format NS_Mngmt Drll_Bf_Cfg         l NVM Commands (0x015d):       Comp DS_Mngmt Wr_Zero Sav/Se         Data Transfer Size:       128 Pages         Comp. Temp. Threshold:       70 Celsius         l Comp. Temp. Threshold:       100 Celsius	l_Feat Timestmp ★Oth	er*				
ed Power States Max Active Idle RL RT WL WT Ent_Lat Ex_Lat 25.00W 0 0 0 16 4 RT OF SMART DATA SECTION === verall-health self-assessment test result: PASSED						
ealth Information (NVMe Log 0x02)						
l Warning: 0x00						
ture: 50 Celsius						
le Spare: 0% le Spare Threshold: 0%						
age Used: 0%						
its Read: 139,489 [71.4 GB]						
its Written: 74,819 [38.3 GB]						
ad Commands: 2,492,356						
ite Commands: 1,881,814 ler Busy Time: 0						
ycles: 0						
n Hours: 126						
Shutdowns: 0						
nd Data Integrity Errors: 0						
nformation Log Entries: 0 Comp. Temperature Time: 0						
Comp. Temperature Time: 0 l Comp. Temperature Time: 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 nvme0n1

The following figure shows an output example.

•••							
[graid@graid-c Linux 4.18.0-3				/06/2022 _x8	6_64_ (1	6 CPU)	
avg-cpu: %use 0.(		ystem %iowai 0.15 0.0		%idle 99.84			
Device	tps	MB read/s	MB wrtn/s	MB dscd/s	MB read	MB wrtn	MB dscd
md124		0.00	0.00	0.00	5	- 0	- 0
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.

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

f directory
-f <u>directory</u> +f directory
Specify an alternative directory for lostat to read devices statistics. Option of tells lostat to use only the files located
in the alternative directory, whereas option 📲 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:
directory is a directory containing rites with statistics for devices managed in der space. It may contain
<ul> <li>- a "diskstats" file whose format is compliant with that located in "/proc",</li> </ul>
- 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:
in purcleater, the following files totaled in <u>uncertainy</u> may be used by contact.
<u>directory</u> /block/ <u>device</u> /stat
<u>directory</u> /block/ <u>device/partition</u> /stat
partition files must have an entry in <u>directory</u> /dev/block/ directory, e.g.:
Notector receiptor and an entry of <u>accessive</u> accessive, e.g.
<pre>directory/dev/block/major:minor&gt;//block/device/partition</pre>

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.

•••							
			il md124 sda n aid-demo) 01		6_64_ (1	6 CPU)	
<b>J</b> 1		%system %iowa 0.14 0.		%idle 99.84			
Device	tps	MB read/s	MB wrtn/s	MB dscd/s	MB read	MB wrtn	MB dscd
gvd0n1	0.68						
110.4							
md 124							
md124 nvme0n1							

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-dem Linux 4.18.0-348			· · ·		-	. md124 sda 6 CPU)	nvme0nl gpd3
avg-cpu: %user 0.01	%nice 0.00	%system %iowa 0.15 0.		%idle 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	

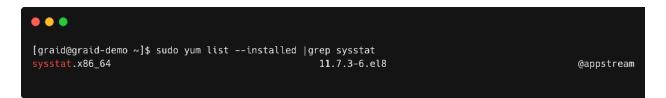
### sysstat Versions Prior to v12.3.3

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.

PD ID (5	) D(	G ID	DEVICE	РАТН	NQN/WWID					MODEL	CAPACITY	SLOT ID	STATE
) L 2 3		/A	/dev/gp /dev/gp /dev/gp /dev/gp /dev/gp	d3 d2 d1	nqn.2019-10.com.kioxia:KCM61VUL3T20:Z0G0A001T1L8 nqn.2019-10.com.kioxia:KCM61VUL3T20:Z010A004T1L8 nqn.2019-10.com.kioxia:KCM61VUL3T20:X0X0A01ET1L8 nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A04HT1L8 nqn.2019-10.com.kioxia:KCM61VUL3T20:Z080A038T1L8				KCM61VUL3T20 KCM61VUL3T20 KCM61VUL3T20 KCM61VUL3T20 KCM61VUL3T20	L3T20   3.2 TB   19 L3T20   3.2 TB   18 L3T20   3.2 TB   8	19   18   8	ONLINE ONLINE ONLINE ONLINE UNCONFIGURED_GOOD	
ist driv	/e grou	p succ	essfully	<i>.</i>									
	MODE	VD N	UM CAP	ACITY	FREE	USED	STATE	 					
- 0	RAID6		4 6.4	TR	   6.4 ТВ	25 GB	   OPTIMAL						
——i-		i	_										
ist virt	ual dr	ive su	ccessful	ly.									
D ID (4	) D	5 ID	SIZE	DEVI	CE PATH	STATE	EXPORTED	-					
	0	0	10 GB	   /dev	/gvd0nl	RESYNC	No	-  					
	1	0	5.0 GB	/dev	/gvdlnl	RESYNC	No	i -					
	2	0	5.0 GB		/gvd2nl	RESYNC	No						
	3	0	5.0 GB	/dev	/gvd3n1	RESYNC	No	_					
ux 4.18		.2.1.e	l8_5.x86 e ∿syste	_64 (g m ‰iow	Wonl gpd3 n praid-demo vait ∿stea ).00 0.0	) 01/06 al %id	/2022 _×8 le	' 6_64_ (1	.28 CPU)				
ice		tps	MB_r	ead/s	MB_wrti	n∕s Mi	B_dscd/s	MB_read	MB_wrtn	MB_dscd			
13		449.98						3355542	3707736				
		0.05		0.01				9530					
d0nl me10nl													

## 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™ 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.

#### RHEL base

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

Debian base

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



C Show the output example (Debian).

<pre>[root@graid-demo ~]# ls -l /dev/disk/by-id/ total 0</pre>					
total 0 lrwxrwxrwx. 1 root root 12 Sep 8 06:27 gdg-eui.00abcdef00136d5b65ald3d7ecb5b8ad ->//gdg0n1 lrwxrwxrwx. 1 root root 12 Sep 8 06:27 gdg-GRAID-SR 96BCDBC839F109EE 1 ->//qdg0n1					
<pre>LivxIrwXrwx.l root root 10 Sep 6 05:09 l/um-py-uuid-cjI28z=5SmL-8NMF-z6lA-lzlk-J5DT-HGFlnS -&gt;//sda3 LivxXrwxrwx.l root root 9 Sep 7 23:12 md-name-graid-demo:0 -&gt;//md0</pre>					
<pre>lrwxrwxrwx. 1 root root 9 Sep 7 23:12 md-uuid-636e39c5:cbfa794e:91f4dd06:e8fbc6be -&gt;//md0 lrwxrwxrwx. 1 root root 13 Sep 7 23:12 nvme-</pre>					
nvme.1b36-4e564d4530303032-51454d55204e564d65204374726c-00000001 ->//nvme0n1 lrwxrwxrwx. 1 root root 13 Sep 7 23:12 nvme- nvme.1b36-4e564d4530303034-51454d55204e564d65204374726c-00000001 ->//nvme1n1					
<pre>lrwsrwsrws. 1 root root 13 Sep 7 23:12 nvme-QEMU_NVMe_Ctrl_NVME00004 -&gt;//nvme1n1 lrwsrwsrwsr. 1 root root 13 Sep 7 23:12 nvme-QEMU_NVMe_Ctrl_NVME0004 -&gt;//nvme1n1</pre>					
<b>[root@graid-demo ~]</b> # sudo vim /etc/fstab # # /etc/fstab					
# /GtC/IStab # Created by anaconda on Thu May 18 23:02:31 2023 #					
<pre># 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         /UUID=f6f00b7c-87d8-472a-90d1-41b73372b792 /boot       xfs       defaults       0         UUID=6660b-B3E9       /boot/efi       vfat       umask=0077,shortname=winnt       0         /dev/mapper/rhel-swap       swap       swap       defaults       0       0					
/dev/disk/by-id/gdg-GRAID-SR_96BCDBC839F109EE_1 /mnt/graid_demo ext4 x- systemd.requires=graid.service,nofail 0 0					
#UUID=9c2ca3e2-6adc-44cc-926a-4125282cef15 /mnt/graid_demo1.5 xfs x-systemd.requires=graid.service,nofail 0 0 ~					

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.

Remove the device line and reboot the system.

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

```
[root@graid-demo ~]# ls -l /dev/disk/by-id/
total 0
Invxrwxrvx. 1 root root 12 Sep 8 06:27 gdg-eui.00abcdef00136d5b65ald3d7ecb5b8ad -> ../../gdg0n1
Invxrwxrvx. 1 root root 12 Sep 8 06:27 gdg-eRAID-SR_96BCDBC839F109EE_1 -> ../../gdg0n1
Invxrwxrvx. 1 root root 10 Sep 6 05:09 lvm-pv-uuid-cjIZ8z-5SmL-8NmF-26lA-121k-J5DT-HGFlnS -> ../../sda3
Invxrwxrvx. 1 root root 9 Sep 7 23:12 md-name-graid-demo:0 -> ../../md0
Invxrwxrvx. 1 root root 9 Sep 7 23:12 nd-name-graid-demo:0 -> ../../md0
Invxrwxrvx. 1 root root 13 Sep 7 23:12 nvme-
nvme.1b36-4e56d4d530930932-51454d55204e56dd65204374726c-000000001 -> ../../nvme0n1
Invxrwxrvx. 1 root root 13 Sep 7 23:12 nvme-
nvme.1b36-4e56d4d530930934-51454d55204e56dd65204374726c-00000001 -> ../../nvme0n1
Invxrwxrvx. 1 root root 13 Sep 7 23:12 nvme-
nvme.1b36-4e56dd4530930934-51454d55204e56dd65204374726c-00000001 -> ../../nvme0n1
Invxrwxrvx. 1 root root 13 Sep 7 23:12 nvme-QEMU_NVMe_Ctrl_NVME0002 -> ../../nvme0n1
Invxrwxrvx. 1 root root 13 Sep 7 23:12 nvme-QEMU_NVMe_Ctrl_NVME0004 -> ../../nvme1n1
Invxrvxrvx. 1 root root 13 Sep 7 23:12 nvme-QEMU_NVMe_Ctrl_NVME0004 -> ../../nvme1n1
Invxrvxrvx. 1 root root 13 Sep 7 23:12 nvme-QEMU_NVMe_Ctrl_NVME0004 -> ../../nvme1n1
Invxrvxrvx. 1 root root 13 Sep 7 23:12 nvme-QEMU_NVMe_Ctrl_NVME0004 -> ../../nvme1n1
Invxrvxrvx. 1 root root 13 Sep 7 23:12 nvme-QEMU_NVMe_Ctrl_NVME0004 -> ../../nvme1n1
Invxrvxrvx. 1 root root 14 Sep 7 23:12 nvme-QEMU_NVMe_Ctrl_NVME0004 -> ../../nvme1n1
Invxrvxrvx ... 1 root root 15 Sep 7 23:12 nvme-QEMU_NVMe_Ctrl_NVME0004 -> ../../nvme1n1
Invxrvxrvx ... 1 root root 13 Sep 7 23:12 nvme-QEMU_NVMe_Ctrl_NVME0004 -> ../../nvme1n1
Invxrvxrvx ... 1 root root 13 Sep 7 23:12 nvme-QEMU_NVMe_Ctrl_NVME0004 -> ../../nvme1n1
Invxrvxrvx ... 1 root root 13 Sep 7 23:12 nvme-
y dev/mapper/rhel-root / / xfs defaults 0 0
#/dev/mapper/rhel-root / xfs defaults 0 0
#/dev/mapper/rhel-swap swap swap swap defaults 0 0
#/dev/disk/by-id/gdg-GRAID-SR_96BCDBC839F109EE_1 /mnt/graid_demo ext4 x-
systemd.requtres=graid.service,nofail 0 0
#/UUID=9c2ca3e2-6
```

# ESXi Virtual Machine Support Using GPU Passthrough

You can create virtual machines with SupremeRAID™ 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	a -	Toggle passthrough	🥒 Configure SR-IOV 🏾 🥒 Hardware label 🛛 🚡 Reboot host 📋 🤁 Refresh		Q S	earch
Power Management		Address 🗸	Description ~		Passthrough ~	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	~	0
PCI device 2	<class> Audio device - 0000:42:00.1</class>	~	$\odot$

- 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 ad	apter 🛛 🔚 Add othe	r device	
CPU		8 ~		
▼ IIII Memory				
RAM		16 GE	3 ~	
Reservation		16384	~ MB	~
		Reserve all guest	t memory (All locked)	

#### 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....

Virtual Hardware VM 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 swap file in the same directory as the virtual machine.     Datastore specified by host     Store the swap files in the datastore specified by the host to be used for swap files. If not     possible, store the swap files in the same directory as the virtual machine. Using a datastore     that a not visible to both hosts during vibotion might aftect the vibotion performance for the     affected virtual machines.	
Configuration Parameters	Edit Configuration	

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	
General Options	VM Name: GRAID
▶ VMware Remote Console Options	C 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 Uncheck	Whether or not to enable UEFI secure boot for this VM
Boot Delay	Whenever the virtual machine is powered on or reset, delay boot by           0         milliseconds
Force BIOS setup	$\hfill\square$ 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, automatically retry 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 --new-
sed-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]

## Mail Notification Service

SupremeRAID<sup>™</sup> offers a mail notification 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.

#### Setup the Mail Notification Service

To set up mail notification service, issue the following command:

\$ sudo graid-mgr set notification <Command>

Related Commands:

Command	Description
on	Enable notification service
off	Disable notification service
smtp_host	Edit SMTP host
smtp_port	Edit SMTP port
smtp_user	Edit SMTP username
smtp_password	Edit SMTP password
sender_mail	Edit sender mail of notification service

#### Setup mail notification for admin user

To set up admin user email notification, issue the following command:

\$ sudo graid-mgr set admin <Command>



Related Commands:

Command	Description
email	Set email of user admin
notification	Configuration of notification

#### To view the configuration of the mail notification

To see the configuration of mail notification, issue the following command:

- \$ sudo graid-mgr show notification
- \$ sudo graid-mgr show admin

## Drive Copyback – Controlled Data Migration for Drive Replacement

Drive Copyback feature allows users to manually initiate data migration from one drive to another without affecting the overall Drive Group state. This operation is user-controlled and can be performed for various reasons, such as replacing an aging drive before it reaches its wear limit, preparing for hardware upgrades, or managing storage configurations.

### Guidelines for Drive Copyback

To initiate data copy from the source PD (SrcPD) to the destination PD (DstPD), follow these guidelines:

- The drive group state for SrcPD must be **OPTIMAL**.
- The DstPD state must be **UNCONFIGURED\_GOOD** and not a hotspare in the drive group. If the DstPD is a hotspare, the -f flag must be used, and the DstPD must be a global hotspare or a hotspare under the SrcPD drive group.
- DstPD and SrcPD must have identical capability (PD type, LBA size, DSM support, Write-uncor support).
- A drive group can only execute one Copyback task at a time. If multiple drive groups are running Copyback, only one drive group will perform the Copyback task.

## Starting a Copyback

To start a Copyback, issue the following command:

```
$ sudo graidctl start copyback [SrcPD_ID][DstPD_ID][flag]
```

```
OR
```

\$ sudo graidctl start cp [SrcPD\_ID][DstPD\_ID][flag]

Related command flags:

Flag	Description	
-f,fallback-to- spare	Use copyback physical drive as a hotspare of the drive group when physical drive failure	

You can also log in to the <u>SupremeRAID<sup>™</sup> Management Console</u>, then navigate to the RAID management / Drive Group section on the sidebar menu. Select the drive group which you want to perform the Copyback, and click the "Physical Drives" tab. Choose the physical drive, then click the "Actions" button to initiate the Copyback.

Dashboard	Drive Groups		< Drive	Groups	/ DG-0									
K <sup>®</sup> Hosts ✓	Y		Detail	Set	tings	Physical drives	Virtual drives	Hot spare						
RAID Management A	ID 💠 State 🌩	Mode \$		On 4	2 off	Actions (1) V								
Physical Drives	DG-0 Optimal	RAID 1							≑ GUID			¢		
Drive Groups	DG-1 Optimal	RAID 10					∋path ≑	Model		÷	Size	Ŧ	LED \$	
Virtual Drives	DG-2 Optimal	RAID 0		PD-0	0	Good	pd0	QEMU NVMe Ctrl	ngn.2019-08.org.gemu:NVME0009		49.9 GiB		Ø Off	
Controllers	1-3 of 3 items < 1 >	10 / page 🗸		PD-1	0	Bad (1)	pd1	QEMU NVMe Ctrl	nqn.2019-08.org.qemu:NVME0005		49.9 GiB		Ø Off	-
	Poor o Reina - C - D >	107 page		PD-2	0	Copyback	pd2	QEMU NVMe Ctrl	nqn.2019-08.org.qemu:NVME0007		49.9 GiB		Ø Off	
✓ Statistics											1-3 of 3 items	s < 🚺	> 10/	page V

### Stopping a Copyback

To stop a Copyback, issue the following command:

```
$ sudo graidctl stop copyback [SrcPD_ID|DstPD_ID]
```

OR

```
$ sudo graidctl stop cp [SrcPD ID|DstPD ID]
```

### Editing a Copyback Speed

The system's default speed is set to high. To edit the speed of Copyback, issue the following command:

```
$ sudo graidctl edit dg [dg_ID] copyback_speed [low|normal|high|extreme]
```

OR

```
$ sudo graidctl e dg [dg_ID] copyback_speed [low|normal|high|extreme]
```

# 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:

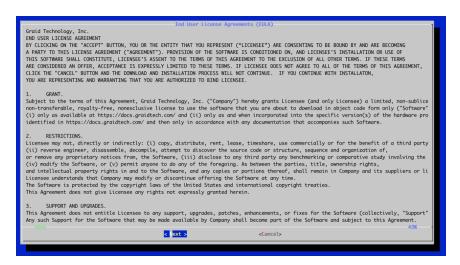
\$ sudo dpkg -1 | grep graid

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™ is trademarked by Graid Technology Inc. and/or its affiliates in the United States, certain other countries, and/or the EU. The term GraidTech refers to Graid Technology Inc. and/or its subsidiaries. For more information, please visit www.graidtech.com. Graid Technology Inc. reserves the right to make changes 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
焊接金属	0	0	0	0	0	0
助焊剂,损意,标签及耗材	0	0	0	0	0	0
O:表示该有書物质在该部件所有的均质材料中的含量均 X:表示该有書物质至少在该部位的某一均质材料中的含 此表中所有名称中含"x"的部件均符合RoBS立法。						
注:死保使用期限的参考标识取决于产品正常工作的温度和透	最度等条件					

## 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	質及其化	學符號			
	鉛	汞	鎘	六價 <u>路</u>	多溴醚苯	多溴二苯醚
PCB板	0	0	0	õ	0	0
結購買以及風扇	-	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	0	0
	0	0	0	0	0	0
	0	0	0	0 0	0	0
助提劑、錫賣、標籤及耗材	0	0	0	0	0	0
備考1:0: 係指該限用物質未超出百分比含量基準值 備考2:-: 係指該限用物質為排外項目。 此表中所有名稱含"-" 的部件均符合歐型RoHS立法。 注:環保使用期限的參考標識取法於產品正常工作的溫度和	濕度等條	銑				

# 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 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 below the threshold <spare_threshold>. Critical Warning error code: <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. 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>
	Critical	Inconsistency found in Virtual Drive VD_ID of Drive Group <dg_id> at: Virtual Drive block range: <vd_offsets>.</vd_offsets></dg_id>
Virtual	Info	Virtual Drive VD_ID for Drive Group <dg_id> has been created successfully.</dg_id>
Drive	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>
Controller	Warning	The temperature of Controller <cx_id> is currently <current_temp> degrees, which exceeds the GPU threshold of <threshold_temp> degrees.</threshold_temp></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>