Linux Ubuntu On HighPoint NVMe RAID AICs Installation Guide

V1.00-July 31st 2023

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1 Overview

The purpose of this document is to provide clear instructions on how to install Linux Ubuntu to an SSD or RAID array hosted by HighPoint NVMe RAID AICs.

The following is a list of supported RAID AICs, Linux distributions and computing platforms.

Supported Linux distributions	Ubuntu 20.04
	Ubuntu 20.04.1
	Ubuntu 20.04.2
	Ubuntu 20.04.3
	Ubuntu 20.04.4
	Ubuntu 20.04.5
	Ubuntu 20.10
	Ubuntu 22.04
	Ubuntu 22.04.1
	Ubuntu 22.10
Supported RAID AICs	SSD7105
	SSD7202
	SSD7502
	SSD7505
	SSD7540
Supported computing platforms	Dell Precision 7920 Tower
	Dell Precision 7960 Tower

In order to configure a bootable NVMe RAID array, you will need the following:

Note: Prior to system installation, please do not connect any NVMe to the system board M.2 SLOT to prevent any unexpected situation during the installation process.

1. **An NVMe SSD must be installed**. You must have at least one NVMe SSD installed into the NVMe RAID AICs.

2. **A PCIe 3.0/ 4.0/ 5.0 slot with x8 or x16 lanes.** The NVMe RAID AICs must be installed into a PCIe 3.0/ 4.0/ 5.0 slot with x8 or x16 lanes.

3. **Secure Boot must be disabled.** The UEFI capability of the NVMe NVMe RAID AIC has not been signed and certified. If Secure Boot is enabled, the system board will not recognize the NVMe NVMe RAID AIC, and you will be unable to proceed with installation.

4. **Prepare the Linux OS Installation media.** You will need an official Linux installation DVD or flash drive, or access to an official downloadable copy (which will then have to be burned/transferred to a DVD or flash drive).

5. If you are installing the OS using a DVD/Blu-Ray disc, you will need to **Install an optical drive into the system** (such as a DVD-ROM, DVD-RW or Blu-Ray drive).

6. **You will need a USB flash drive** – the UEFI package and driver should be extracted to the root directory of this flash drive.

   Note: If you are using a USB flash drive as the Linux OS Installation media, then you will need to prepare another USB flash drive. Linux OS cannot be stored in a USB flash drive with UEFI package and driver.

7. **Remove all other drives during the OS installation process.** Make sure only the NVMe RAID AICs, the USB flash drive, and the optical drive are installed into the system during this procedure. This includes any other USB hard drives, USB flash drives, memory sticks, or SAS/SATA drives. You can reattach these drives after the operating system has been successfully installed.

8. Make sure any non-HighPoint drivers are uninstalled for any SSDs hosted by the NVMe RAID AIC. 3rd party software and manufacturer provided drivers may prevent the NVMe RAID AIC from functioning properly.

2 Installing Linux Ubuntu on NVMe RAID AIC

If you would like to install Linux Ubuntu onto drives attached to the NVMe RAID AIC, please perform the following operations:

Step 1 Prepare Your Hardware for Installation

After you attach your NVMe SSDs to the NVMe RAID AICs, you can use **EFI Utility** to configure your NVMe SSDs into RAID arrays, or just use them as single disks.

Before installation, you must remove all the NVMe SSDs, which are not physically attached to NVMe RAID AIC, from your system.
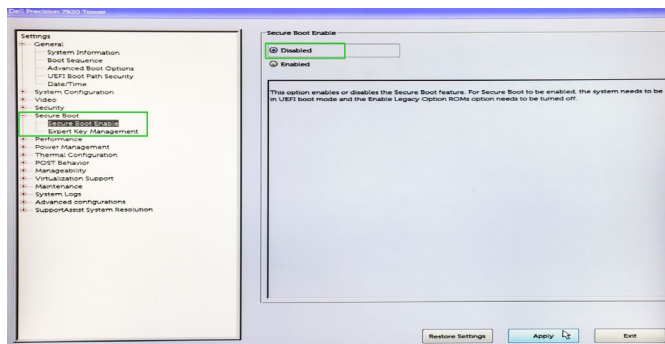
Note

NVMe RAID AICs only support EFI boot. If you have other SCSI adapters installed, you must make sure the NVMe RAID AIC EFI will be loaded first. If not, try to move it to another PCI slot. Otherwise, you may be unable to boot up your system.

Step 2 Check System BIOS Settings

1. Boot the system and press **F12** to enter BIOS menus.

2. Enter **BIOS Setup**.
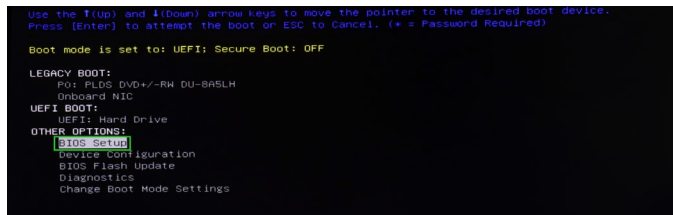
3. Find **Settings→Secure Boot→Secure Boot Enable**, select **Disabled**.

4. Save configuration and restart the system.

Step 3 Flash UEFI ROM to NVMe RAID AICs

Example: SSD7505

Note: Make sure your USB flash partition format is FAT32.

1. Unzip SSD7505 UEFI package to the root dir(/) of a USB flash drive, and connect the USB flash drive to the system board.

2. Enter the system board's BIOS menus, and select the "**UEFI: USB**" from the UEFI BOOT.
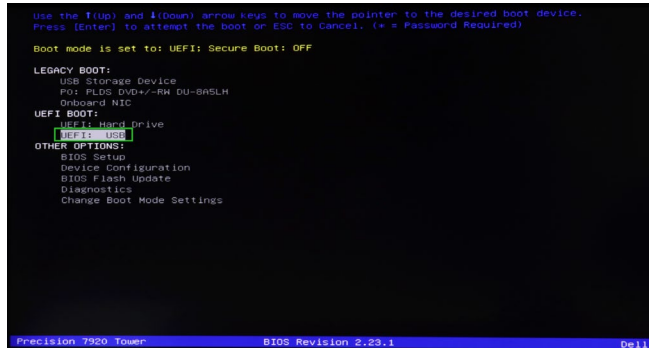
3. Use the command "**go.nsh**" to flash UEFI ROM to the SSD7505 and reboot the system.
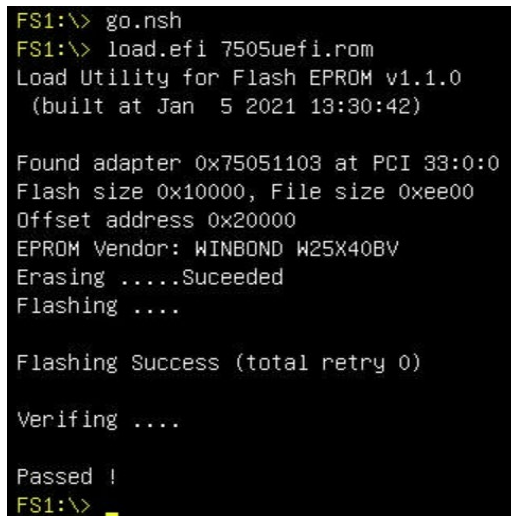
4. Use the "**exit**" command to exit the utility.

Step 4 Create the RAID Array

Two methods are provided to create the RAID arrays.

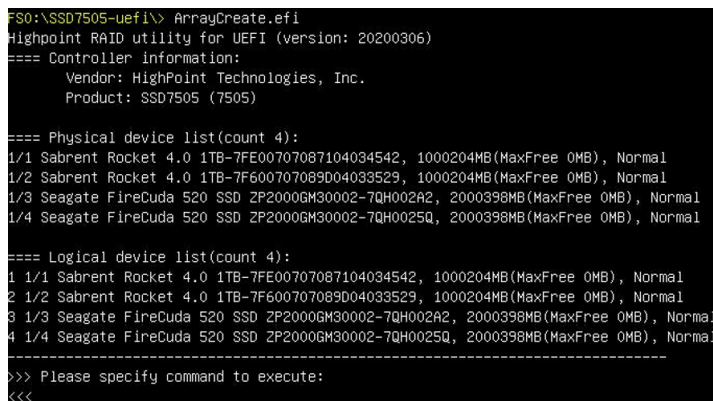*Note: The following installation process uses the SSD7505 as an example.*

Note2: The following screenshots are only used for reference.

Method 1 UEFI Command Line (RAID Tool)

1. Attach NVMe SSDs to the NVMe RAID AIC.

2. Enter the system board's BIOS menus, and select the "**UEFI: USB**" from the UEFI BOOT.
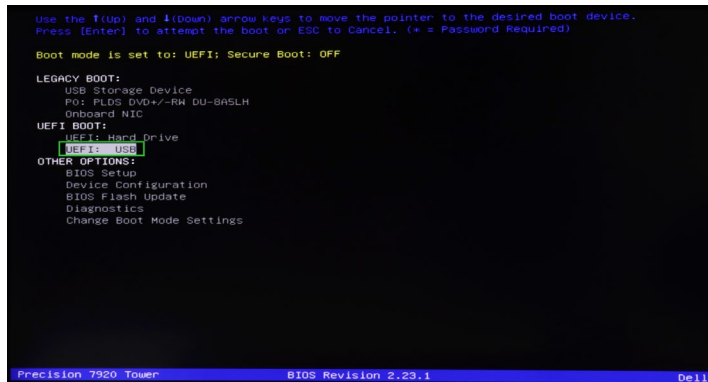
3. Use the command "**ArrayCreate.efi**" to enter the Utility:

4. Use the command "**create RAID0**".

This will create a RAID0 array using all of the NVMe SSDs, and the maximum available capacity.

```
<<< create RAID0
    Creating array: RAID0_000041A7.
    Array created successfully.
=============================================================================

==== Physical device list(count 4):
1/1 Sabrent Rocket 4.0 1TB-7FE00707087104034542, 1000123MB(MaxFree 0MB), Normal
1/2 Sabrent Rocket 4.0 1TB-7F600707089D04033529, 1000123MB(MaxFree 0MB), Normal
1/3 Seagate FireCuda 520 SSD ZP2000GM30002-7QH002A2, 2000313MB(MaxFree 1000190MB), Normal
1/4 Seagate FireCuda 520 SSD ZP2000GM30002-7QH0025Q, 2000313MB(MaxFree 1000190MB), Normal

==== Logical device list(count 1):
1 [VD4] RAID0_000041A7 (RAID0), 4000493MB (Stripe 512KB), Normal
    1/1 Sabrent Rocket 4.0 1TB
    1/2 Sabrent Rocket 4.0 1TB
    1/3 Seagate FireCuda 520 SSD ZP2000GM30002
    1/4 Seagate FireCuda 520 SSD ZP2000GM30002
-----------------------------------------------------------------------------
>>> Please specify command to execute:
<<< _
```
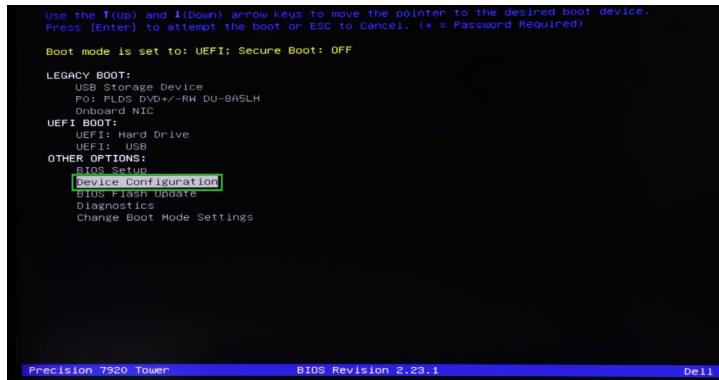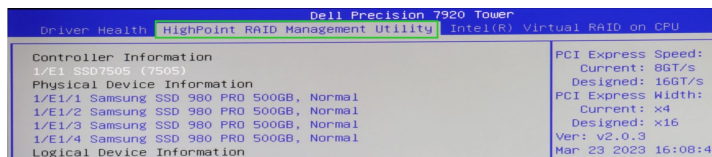
5. Use the "exit" command to exit the utility.
6. For additional command lines, refer to Appendix A.

Method 2 UEFI HII（UEFI Utility）

1. Boot the system and press **F12** to enter BIOS menus.
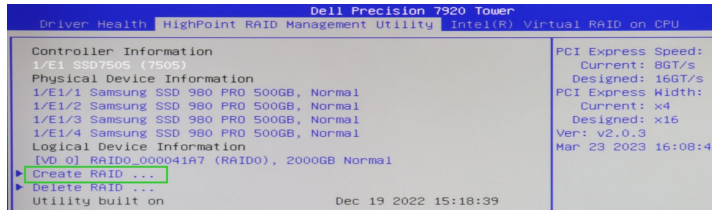
2. Enter **Device Configuration**.

```
Use the ↑(Up) and ↓(Down) arrow keys to move the pointer to the desired boot device.
Press [Enter] to attempt the boot or ESC to Cancel. (* = Password Required)

Boot mode is set to: UEFI; Secure Boot: OFF

LEGACY BOOT:
    USB Storage Device
    P0: PLDS DVD+/-RW DU-8A5LH
    Onboard NIC
UEFI BOOT:
    UEFI: Hard Drive
    UEFI:  USB
OTHER OPTIONS:
    BIOS Setup
    Device Configuration
    BIOS Flash Update
    Diagnostics
    Change Boot Mode Settings

Precision 7920 Tower          BIOS Revision 2.23.1                    Dell
```

3. Select "**HighPoint RAID Management Utility**".

```
                        Dell Precision 7920 Tower
Driver Health  HighPoint RAID Management Utility  Intel(R) Virtual RAID on CPU

Controller Information                            PCI Express Speed:
1/E1 SSD7505 (7505)                                 Current: 8GT/s
Physical Device Information                         Designed: 16GT/s
1/E1/1 Samsung SSD 980 PRO 500GB, Normal          PCI Express Width:
1/E1/2 Samsung SSD 980 PRO 500GB, Normal            Current: x4
1/E1/3 Samsung SSD 980 PRO 500GB, Normal            Designed: x16
1/E1/4 Samsung SSD 980 PRO 500GB, Normal          Ver: v2.0.3
Logical Device Information                         Mar 23 2023 16:08:41
```
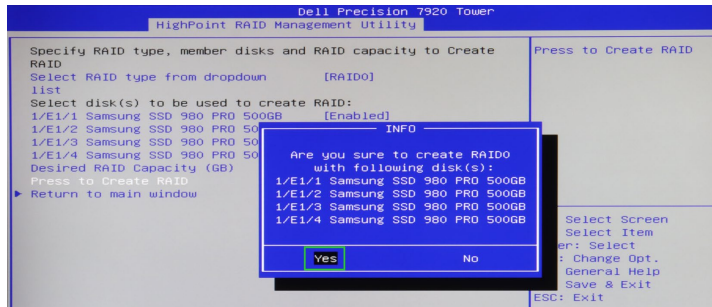
4. Select **Create RAID…**

5. In **Create** menu, a device list will appear, and display all available hard disks.

Select the RAID type from dropdown list. Use the **up** and **down** keys of the keyboard or the mouse to select the RAID type and press the **Enter** key.

Step 5 Prepare the Driver Diskette

Extract **HighPoint_NVMe_Ubuntuxx.xx_x86_64_vx.x.x_xx_xx_xx.tar.gz** to the top(/) directory of a USB flash drive. It will look like:

Step 6 Install Linux Ubuntu

Example: Ubuntu22.10 server

1. Before starting the installation procedure, verify the status of your network environment. To ensure Ubuntu is successfully installed to the RAID array, we recommend that the system is disconnected from the internet and any local network.

2. Insert the USB flash drive into the target system.

3. Boot the system using a bootable USB drive.

4. When the Installation screen appears, press '**e**' to edit boot command line option.

On the edit command window, move the cursor to the end of line "linux /install/vmlinuz... ", and append "**modprobe.blacklist=nvme** " (do not include the quotation marks).

Press **CTRL+X** or **F10** to start the system.

5. When the following window appears during the installation process.

Press "**ALT+F2**" to switch to the shell on console 2, and press **ENTER** to activate this console.

If you use Ubuntu Desktop, please press **CTRL+ALT+F3** to switch to the shell on console 2 and press **ENTER** to activate this console.

Ubuntu login: ubuntu

```
Welcome to Ubuntu 20.04.5 LTS (GNU/Linux 5.4.0-125-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

 System information as of Thu Mar  9 01:35:21 UTC 2023

 System load:    1.77      Memory usage: 1%   Processes:       781
 Usage of /home: unknown   Swap usage:   0%   Users logged in: 0

0 updates can be applied immediately.


The list of available updates is more than a week old.
To check for new updates run: sudo apt update


The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

ubuntu-server@ubuntu-server:~$ _
```

6. Next, execute the following commands:

    # mkdir /hptdd   ← Create mount point for USB flash drive

    # mount /dev/sda1 /hptdd/   ← Mount the USB flash drive to /hptdd

    # cp -a /hptdd/hptdd /tmp/   ← Copy driver installation file to system
                                             temporary directory

    # umount /hptdd   ← Unmount the USB flash drive

```
root@ubuntu-server:/home/ubuntu-server# mkdir /hptdd
root@ubuntu-server:/home/ubuntu-server# mount /dev/sda1 /hptdd/
root@ubuntu-server:/home/ubuntu-server# cp -a /hptdd/hptdd/ /tmp/
root@ubuntu-server:/home/ubuntu-server# umount /dev/sda1
```

7. When the USB flash drive is unmounted, please unplug the USB flash drive from the system.
    Next, execute the following commands to install driver for Linux Ubuntu.

    # sh /tmp/hptdd/preinst.sh   ← Load NVMe RAID AIC driver.

```
root@ubuntu-server:/home/ubuntu-server# sh /tmp/hptdd/preinst.sh
This step succeeded!
root@ubuntu-server:/home/ubuntu-server#
```

8. Then press **"ALT+F1"** to switch back to installation screen and continue the installation as
    usual**.**

9. When the screen shows that "**install complete**".

press "**ALT+F2**" to the shell and type the following commands:

 # sh /tmp/hptdd/postinst.sh ← Install NVMe RAID AIC driver.

A message will be displayed that the driver has been installed successfully.

10. Press **"ALT+F1"** to switch back to installation screen and finish the installation.

11. If you want to boot from another kernel, please install the NVMe RAID AIC driver after entering the system.

    1) use "apt-get update" to retrieve new lists of ubuntu packages (**please connect to the internet**)

    2) Download the appropriate driver from the Software Downloads web page.

    3) Extract the driver package:

        tar zxvf HighPoint_NVMe_G5_Linux_Src_Src_vx.xx.xx_xx_xx_xx.tar.gz

    4) Run the **.bin** file to install the driver package.

        sh hptnvme_g5_linux_src_vxx.x.x_xx_xx_xx.bin or

> **./ hptnvme_g5_linux_src_vxx.x.x_xx_xx_xx.bin**

```
root@test:/home# ./hptnvme_g5_linux_src_v1.5.1_2023_02_21.bin
Verifying archive integrity... All good.
Uncompressing HighPoint NVMe RAID Controller Linux Open Source package installer.......
Checking and installing required toolchain and utility ...
Installing program make ... done
Installing program gcc ... done
Found program perl (/usr/bin/perl)
Found program wget (/usr/bin/wget)
```

12. Follow the prompts to complete the driver installation.

```
Sourcing file `/etc/default/grub'
Sourcing file `/etc/default/grub.d/90_iommuoff.cfg'
Sourcing file `/etc/default/grub.d/init-select.cfg'
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-5.19.0-21-generic
Found initrd image: /boot/initrd.img-5.19.0-21-generic
Warning: os-prober will be executed to detect other bootable partitions.
Its output will be used to detect bootable binaries on them and create new boot entries.
Found FreeDOS on /dev/sda1
Adding boot menu entry for UEFI Firmware Settings ...
done
Synchronizing state of hptdrv-monitor.service with SysV service script with /lib/systemd/systemd-sysv-install.
Executing: /lib/systemd/systemd-sysv-install enable hptdrv-monitor
update-rc.d: warning: enable action will have no effect on runlevel 1
Created symlink /etc/systemd/system/default.target.wants/hptdrv-monitor.service + /lib/systemd/system/hptdrv-monitor.service.

SUCCESS: Driver hptnvme is installed successfully for kernel 5.19.0-21-generic.
Please restart the system for the driver to take effect.
If you want to uninstall the driver from the computer♦ please run hptuninhptnvme to uninstall the driver files.
```

13. After Ubuntu has been installed, you can reconnect the system to the network/internet and update the system as needed.

3 Monitoring the Driver

Once the driver is running, you can monitor it through the Linux proc file system support. There is a special file under /proc/scsi/hptnvme /. Through this file you can view driver status and send control commands to the driver.

Note

The file name is the SCSI host number allocated by OS. If you have no other SCSI cards installed, it will be 0. In the following sections, we will use x to represent this number.

Using the following command to show driver status:

cat /proc/scsi/hptnvme /x

This command will show the driver version, physical device list and logical device list.

4 Installing RAID Management Software

HighPoint's RAID Management Software can be used to check the status of the SSDs and RAID arrays hosted by the NVMe RAID AIC. Installation of the management software is optional but recommended.

Please refer to HighPoint RAID Management Software documentation for more information.

5 Trouble Shooting

If you do not install the system or update the kernel according to the installation manual, the system will crash and you will not be able to enter. Please follow the steps below.

1. Select the default (kernel: 5.19.0-21-amd64) and enter the system.

2. Install Linux Opensource driver.
3. Download the appropriate driver from the Software Downloads web page.
    Run the **.bin** file to install the driver package.

    sh hptnvme_g5_linux_src_vxx.x.x_xx_xx_xx.bin or

    ./ hptnvme_g5_linux_src_vxx.x.x_xx_xx_xx.bin

4. Follow the prompts to complete the driver installation.

5. After the installation is complete, you can perform system update operations.

6 Rebuilding Driver Module for System Update

When the system updates the kernel packages, the driver module hptnvme.ko should be built and installed manually before reboot.

Please refer to the README file distributed with NVMe RAID AIC opensource package on how to build and install the driver module.

7 Appendix A

Support command: help/info/quit/exit/create/delete.

- **Create Command**
Syntax
Create Array Type (RAID0/RAID1/RAID10) Member Disk list (1/1,1/2|*)
Capacity (100|*)

  Examples
  <<< create RAID0
  <<< create RAID0 *
  <<< create RAID0 * *
      Create RAID0 array with all disks and with maximum capacity.

  <<< create RAID1 1/1, 1/3 10
      Create RAID1 array with disk 1/1 and 1/3 and with 10GB capacity.

  <<< create RAID10
  <<< create RAID10 *
  <<< create RAID10 * *
      Create RAID10 array with all disks and with maximum capacity.

- **Delete Command**
Syntax
delete {array ID}

  Examples
  <<< delete 1
      Delete the first array from Logical device list.
  <<< delete 2
      Delete the second array from Logical device list.

- **Info Command**
Syntax
info
Display physical device list and logical list

- **Exit Command**
Syntax
Q/q/quit/exit
Quit the application

- **Help Command**
Syntax
H/h/help
This is help message.