

SSD7103&SSD7202 数据 RAID Linux 安装指南

V1.00 – June 2020

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概述

本指南包含重要的硬件/软件要求、安装和升级过程，以及有关在 Linux 操作系统上使用 SSD7202 和 SSD7103 NVMe RAID 控制器的故障排除提示

要求

这部分介绍 SSD7202 和 SSD7103 PCIe 3.0 NVMe RAID 控制器的基本软硬件要求

UEFI BIOS 设置

这部分介绍使用 SSD7202 和 SSD7103 NVMe RAID 控制器应如何配置您的主板 UEFI 设置

驱动安装

这部分介绍了 Linux 环境中 SSD7202/7103 NVMe RAID 控制器的驱动程序安装，驱动程序升级和驱动程序卸载过程

管理软件安装

这部分说明了如何下载和安装适用于 Linux 发行版的 HighPoint RAID 管理软件套件，下载内容包括 Web RAID 管理界面（WebGUI）和 CLI（命令行界面）

故障排除

如果在安装或使用 SSD7202 和 SSD7103 NVMe RAID 控制器时遇到任何困难，请查阅这部分，它包括对常见报告的技术问题的描述和解决方案

附录

这部分介绍了如何收集通过我们的在线支持门户网站提交的支持案例的故障排除信息

数据 RAID 配置的先决条件

HighPoint SSD7202 和 SSD7103 旨在支持纯数据 NVMe 存储配置，为了配置不可引导的 NVMe RAID 阵列，您将需要以下内容：

1. **必须安装一个 NVMe SSD** 您必须在 SSD7202 和 SSD7103 RAID 控制器中至少安装一个 NVMe SSD
2. **一个具有 x8 或 x16 通道的 PCIe 3.0 插槽** SSD7202 或 SSD7103 RAID 控制器必须与具有 x8 或 x16 通道的 PCIe 3.0 插槽一起使用
3. **您的主板必须具有 UEFI BIOS** 该 BIOS 具有用于第三方设备（例如 SSD7202 / SSD7103，光盘驱动器和 USB 闪存驱动器）的可选 ROM 设置，如果未正确配置，系统将无法加载 SSD7000 RAID 控制器，请检查 SSD7202 和 SSD7103 兼容性列表以获取推荐的主板
4. **必须禁用安全启动** SSD7202 / SSD7103 UEFI 功能尚未经过签名和认证，如果启用了安全启动，则主板将无法识别 SSD7000 控制器，并且您将无法继续安装
5. **确保为 SSD7000 系列 RAID 控制器托管的任何 SSD 卸载了所有非 HighPoint 驱动程序** 第三方软件和制造商提供的驱动程序可能会阻止 SSD7000 控制器正常运行

警告：

- 1) **卸载驱动程序时未能删除控制器和 SSD 可能会导致数据丢失**
- 2) **在将 SSD7000 系列 NVMe RAID 控制器和 RAID 阵列移至另一个 Linux 系统之前，请始终确保已安装 SSD7000 驱动程序**

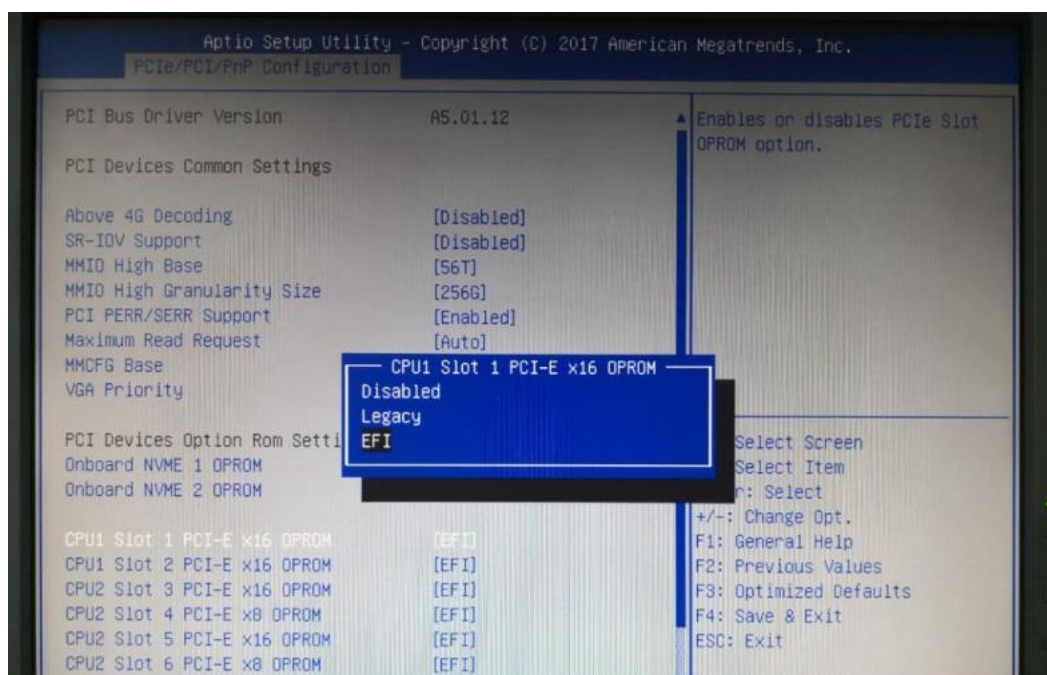
卸载 SSD7000 驱动程序后，Linux 发行版将始终加载默认的 NVMe 支持，或者在未加载驱动程序时检测到卡的存在，Linux 驱动程序仅将 NVMe SSD 识别为单独磁盘

如果单独识别 SSD，则其中包含的所有数据都可能会丢失，包括 RAID 配置数据

UEFI BIOS 设置

不同的主板将提供与 UEFI 相关的不同 BIOS 设置，请参阅主板的用户手册以获取更多信息。这一部分提供了使用 SuperMicro X11DAi-N 主板的示例

1. 启动系统，访问主板 BIOS 菜单
2. 在 **Advanced->PCIe/PCI/PnP Configuration->**下更改 CPUx Slot x PCI-E OPRM 为



EFI, x 代表 PCIE 插槽分配，在此示例中，SSD7103 安装在 CPU1 插槽 1 中



3. 禁用 **Secure Boot**，设置 **Attempt Secure Boot** 为 **Disabled**

驱动安装

安装驱动程序

1. 打开系统电源并启动 Linux 发行版
2. 使用 root 用户特权打开系统终端，并使用以下命令验证是否检测到 SSD7000 系列控制器或机箱：

lspci

屏幕截图示例
SSD7103:

```
File Edit View Search Terminal Help
02:01.0 PCI bridge: Advanced Micro Devices, Inc. [AMD] 300 Series Chipset PCIe Port (rev 02)
02:02.0 PCI bridge: Advanced Micro Devices, Inc. [AMD] 300 Series Chipset PCIe Port (rev 02)
02:03.0 PCI bridge: Advanced Micro Devices, Inc. [AMD] 300 Series Chipset PCIe Port (rev 02)
02:04.0 PCI bridge: Advanced Micro Devices, Inc. [AMD] 300 Series Chipset PCIe Port (rev 02)
02:09.0 PCI bridge: Advanced Micro Devices, Inc. [AMD] 300 Series Chipset PCIe Port (rev 02)
03:00.0 Network controller: Qualcomm Atheros QCA6174 802.11ac Wireless Network Adapter (rev 32)
04:00.0 Network controller: Wilocity Ltd. WL6200 802.11ad Wireless Network Adapter (rev 02)
05:00.0 Ethernet controller: Intel Corporation I211 Gigabit Network Connection (rev 03)
08:00.0 USB controller: ASMedia Technology Inc. ASM2142 USB 3.1 Host Controller
09:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
0a:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
0a:09.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
0a:10.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
0a:11.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
0b:00.0 Non-Volatile memory controller: Samsung Electronics Co Ltd NVMe SSD Controller SM961/PM961
0c:00.0 Non-Volatile memory controller: Samsung Electronics Co Ltd NVMe SSD Controller SM961/PM961
0d:00.0 Non-Volatile memory controller: Samsung Electronics Co Ltd NVMe SSD Controller SM961/PM961
0e:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
0f:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
0f:09.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
0f:10.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
0f:11.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
10:00.0 Non-Volatile memory controller: Samsung Electronics Co Ltd NVMe SSD Controller SM961/PM961
11:00.0 RAID bus controller: HighPoint Technologies, Inc. Device 7103 (rev 01)
14:00.0 Non-Essential Instrumentation [1300]: Advanced Micro Devices, Inc. [AMD] Zeppelin/Raven/Raven2 PCIe Dummy Function
14:00.2 Encryption controller: Advanced Micro Devices, Inc. [AMD] Family 17h (Models 00h-0fh) Platform Security Processor
14:00.3 USB controller: Advanced Micro Devices, Inc. [AMD] Family 17h (Models 00h-0fh) USB 3.0 Host Controller
15:00.0 Non-Essential Instrumentation [1300]: Advanced Micro Devices, Inc. [AMD] Zeppelin/Renoir PCIe Dummy Function
15:00.2 SATA controller: Advanced Micro Devices, Inc. [AMD] FCH SATA Controller [AHCI mode] (rev 51)
15:00.3 Audio device: Advanced Micro Devices, Inc. [AMD] Family 17h (Models 00h-0fh) HD Audio Controller
40:00.0 Host bridge: Advanced Micro Devices, Inc. [AMD] Family 17h (Models 00h-0fh) Root Complex
40:00.2 TDMU: Advanced Micro Devices, Inc. [AMD] Family 17h (Models 00h-0fh) I/O Memory Management Unit
40:01.0 Host bridge: Advanced Micro Devices, Inc. [AMD] Family 17h (Models 00h-1fh) PCIe Dummy Host Bridge
40:02.0 Host bridge: Advanced Micro Devices, Inc. [AMD] Family 17h (Models 00h-1fh) PCIe Dummy Host Bridge
```

SSD7202:

```
16:1e.4 System peripheral: Intel Corporation Sky Lake-E PCU Registers (rev 04)
16:1e.5 System peripheral: Intel Corporation Sky Lake-E PCU Registers (rev 04)
16:1e.6 System peripheral: Intel Corporation Sky Lake-E PCU Registers (rev 04)
17:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
18:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
18:10.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
1a:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
1b:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
1b:09.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
1b:10.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
1b:11.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
1d:00.0 Non-Volatile memory controller: Samsung Electronics Co Ltd NVMe SSD Controller SM961/PM961
1e:00.0 RAID bus controller: HighPoint Technologies, Inc. Device 7202 (rev 01)
1f:00.0 Non-Volatile memory controller: Samsung Electronics Co Ltd NVMe SSD Controller SM961/PM961
64:00.0 PCI bridge: Intel Corporation Sky Lake-E PCI Express Root Port A (rev 04)
64:05.0 System peripheral: Intel Corporation Sky Lake-E VT-d (rev 04)
64:05.2 System peripheral: Intel Corporation Sky Lake-E RAS Configuration Registers (rev 04)
64:05.4 PIC: Intel Corporation Sky Lake-E IOxAPIC Configuration Registers (rev 04)
64:08.0 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:09.0 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0a.0 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0a.1 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0a.2 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0a.3 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0a.4 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0a.5 System peripheral: Intel Corporation Sky Lake-E LMS Channel 1 (rev 04)
64:0a.6 System peripheral: Intel Corporation Sky Lake-E LMS Channel 1 (rev 04)
64:0a.7 System peripheral: Intel Corporation Sky Lake-E LMDP Channel 1 (rev 04)
64:0b.0 System peripheral: Intel Corporation Sky Lake-E DECS Channel 2 (rev 04)
64:0b.1 System peripheral: Intel Corporation Sky Lake-E LMS Channel 2 (rev 04)
64:0b.2 System peripheral: Intel Corporation Sky Lake-E LMS Channel 2 (rev 04)
64:0b.3 System peripheral: Intel Corporation Sky Lake-E LMDP Channel 2 (rev 04)
64:0c.0 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0c.1 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0c.2 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0c.3 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0c.4 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0c.5 System peripheral: Intel Corporation Sky Lake-E LMS Channel 1 (rev 04)
64:0c.6 System peripheral: Intel Corporation Sky Lake-E LMS Channel 1 (rev 04)
64:0c.7 System peripheral: Intel Corporation Sky Lake-E LMDP Channel 1 (rev 04)
64:0d.0 System peripheral: Intel Corporation Sky Lake-E DECS Channel 2 (rev 04)
64:0d.1 System peripheral: Intel Corporation Sky Lake-E LMS Channel 2 (rev 04)
64:0d.2 System peripheral: Intel Corporation Sky Lake-E LMS Channel 2 (rev 04)
64:0d.3 System peripheral: Intel Corporation Sky Lake-E LMDP Channel 2 (rev 04)
65:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
66:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
66:10.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
68:00.0 VGA compatible controller: NVIDIA Corporation GK208B [GeForce GT 710] (rev a1)
68:00.1 Audio device: NVIDIA Corporation GK208 HDMI/DP Audio Controller (rev a1)
b2:00.0 System peripheral: Intel Corporation Sky Lake-E VT-d (rev 04)
b2:05.2 System peripheral: Intel Corporation Sky Lake-E RAS Configuration Registers (rev 04)
b2:05.4 PIC: Intel Corporation Sky Lake-E IOxAPIC Configuration Registers (rev 04)
```

此外，您可以使用以下命令来验证是否检测到 NVMe SSD：

fdisk -l

屏幕截图示例

SSD7103:

```
Disk /dev/nvme0n1: 250.1 GB, 250059350016 bytes, 488397168 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/nvme1n1: 250.1 GB, 250059350016 bytes, 488397168 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/nvme2n1: 250.1 GB, 250059350016 bytes, 488397168 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk label type: dos
Disk identifier: 0x00000000

   Device Boot      Start         End      Blocks   Id  System
 /dev/nvme2n1p1    1855873023    927936511+    ee      GPT

Disk /dev/nvme3n1: 250.1 GB, 250059350016 bytes, 488397168 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
```

SSD7202:

```
Disk /dev/mapper/centos-swap: 8388 MB, 8388608000 bytes, 16384000 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/nvme1n1: 250.1 GB, 250059350016 bytes, 488397168 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/nvme0n1: 250.1 GB, 250059350016 bytes, 488397168 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/mapper/centos-home: 192.9 GB, 192904429568 bytes, 376766464 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

[root@cl test]#
```

3. 从软件下载网页下载适当的驱动程序：

SSD7103: <http://highpoint-tech.cn/product-detail7103.html>

SSD7202: <http://highpoint-tech.cn/product-detail7202.html>

- 使用具有 root 用户特权的系统终端，浏览到驱动程序下载的目录，然后输入以下命令以提取 Linux Open Source Driver 软件包：

tar zxvf HighPoint_NVMe_G5_Linux_Src_vx.x.xx_xx_xx.xx.tar.gz

```
[root@localhost Downloads]# tar zxvf HighPoint_NVMe_G5_Linux_Src_v1.2.13_20_03_17.tar.gz
hptnvme_g5_linux_src_v1.2.13_20_03_17.bin
README_
```

- 使用以下命令安装开源驱动程序：

sh hptnvme_g5_linux_src_vx.x.xx_xx_xx.xx.bin

```
[root@localhost Downloads]# sh hptnvme_g5_linux_src_v1.2.13_20_03_17.bin
Verifying archive integrity... All good.
Uncompressing HighPoint NVMe RAID Controller Linux Open Source package installer.....
Checking and installing required toolchain and utility ...
Found program make (/usr/bin/make)
Found program gcc (/usr/bin/gcc)
Found program perl (/usr/bin/perl)
Found program wget (/usr/bin/wget)
Created symlink from /etc/systemd/system/default.target.wants/hptdrv-monitor.service to /usr/lib/systemd/system/hptdrv-monitor.service.

Please run hptuninhptnvme to uninstall the driver files.

Please restart the system for the driver to take effect.
[root@localhost Downloads]#
```

- 驱动程序安装完成后，系统将提示您重新启动以使驱动程序生效,手动重启系统
- 重新启动发行版后，使用 root 特权打开系统终端，并使用以下命令检查驱动程序状态：

dmesg | grep rsnvme

下面的屏幕截图显示驱动器版本为 v1.2.13.

```
[root@localhost Downloads]# dmesg | grep hptnvme
[ 4.431322] hptnvme: loading out-of-tree module taints kernel.
[ 4.431325] hptnvme: module license 'Proprietary' taints kernel.
[ 4.431786] hptnvme: module verification failed: signature and/or required key missing - tainting kernel
[ 5.381222] hptnvme: HighPoint NVMe RAID controller driver (G5) v1.2.13 block major fc
[ 5.382480] scsi host0: hptnvme
[ 5.382617] hptnvme 0000:03:00.0: irq 145 for MSI/MSI-X
[ 5.382622] hptnvme 0000:03:00.0: irq 146 for MSI/MSI-X
[ 5.382625] hptnvme 0000:03:00.0: irq 147 for MSI/MSI-X
[ 5.382630] hptnvme 0000:03:00.0: irq 148 for MSI/MSI-X
[ 5.382633] hptnvme 0000:03:00.0: irq 149 for MSI/MSI-X
[ 5.382637] hptnvme 0000:03:00.0: irq 150 for MSI/MSI-X
```

此外，您可以使用下面的命令检查 NVMe 驱动器：

fdisk -l

SSD7103:

```
Disk /dev/hptblock10n0: 250.1 GB 250059350016 bytes, 488397168 sectors
Unit = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk label type: dos
Disk identifier: 0x00000000

    Device Boot      Start         End      Blocks   Id  System
/dev/hptblock10n0p1    1 1855873023    927936511+   ee  GPT

Disk /dev/hptblock10n1: 250.1 GB 250059350016 bytes, 488397168 sectors
Unit = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/hptblock10n2: 250.1 GB 250059350016 bytes, 488397168 sectors
Unit = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/hptblock10n3: 250.1 GB 250059350016 bytes, 488397168 sectors
Unit = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
```

SSD7202:

```
Disk /dev/mapper/centos-swap: 8388 MB, 8388608000 bytes, 16384000 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/hptblock8n0: 250.1 GB, 250059350016 bytes, 488397168 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/hptblock8n1: 250.1 GB, 250059350016 bytes, 488397168 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

Disk /dev/mapper/centos-home: 192.9 GB, 192904429568 bytes, 376766464 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes

[root@cl test]#
```

更新驱动

截至 2020 年 5 月，当前的开源驱动程序版本包括我们的自动编译功能在每次引导系统时，自动编译都会检查内核版本，以确保兼容性。如果检测到新内核，自动编译将检查我们的在线数据库以获取所需更新并自动编译新驱动程序

可从 SSD7202 和 SSD7103 软件下载网页获得最新的开源驱动程序，如果要使用此下载手动更新，请按照以下步骤操作：

1. 要求

- 确保 SSD7202/SSD7103 控制器已连接至主板
- 使用下方命令以 root 权限打开系统终端以检查当前驱动程序版本：

dmesg | grep rsnvme

示例的驱动程序版本为 v1.2.13

```
[root@localhost Downloads]# dmesg | grep hptnvme
[ 4.431322] hptnvme: loading out-of-tree module taints kernel.
[ 4.431325] hptnvme: module license 'Proprietary' taints kernel.
[ 4.431786] hptnvme: module verification failed: signature and/or required key missing - tainting kernel
[ 5.381222] hptnvme: HighPoint NVMe RAID controller driver (65) v1.2.13 block major fc
[ 5.382488] SCSI host6: hptnvme
[ 5.382617] hptnvme 0000:03:00.0: irq 145 for MSI/MSI-X
[ 5.382622] hptnvme 0000:03:00.0: irq 146 for MSI/MSI-X
[ 5.382625] hptnvme 0000:03:00.0: irq 147 for MSI/MSI-X
[ 5.382630] hptnvme 0000:03:00.0: irq 148 for MSI/MSI-X
[ 5.382633] hptnvme 0000:03:00.0: irq 149 for MSI/MSI-X
[ 5.382637] hptnvme 0000:03:00.0: irq 150 for MSI/MSI-X
```

2. 更新驱动

- 打开最新驱动程序版本所在的目录，并以 root 特权打开系统终端。执行以下命令以完成安装。图示的驱动程序版本为 v1.2.14
- 打开最新驱动程序版本所在的目录，并以 root 权限打开系统终端，解压缩 Linux 开源程序软件包

tar zxvf RocketNVMe_Linux_Src_vx.x.xx_xx_xx_xx.tar.gz

```
[root@localhost Downloads]# tar zxvf RocketNVMe_Linux_Src_v1.2.18.1_2020_03_18.1.tar.gz
rsnvme_linux_src_v1.2.18.1_2020_03_18.bin
README
```

- c. 确保系统具有活动的网络连接，要安装最新的开源驱动程序请以 root 权限打开系统终端，然后输入以下命令：

./hptnvme_g5_linux_src_vx.x.xx_xx_xx_xx.bin

```
[root@localhost Downloads]# ./hptnvme_g5_linux_src_v1.2.14.20_04_10.bin
Verifying archive integrity... All good.
Uncompressing HighPoint WMe RAID Controller Linux Open Source package installer.....
Checking and installing required toolchain and utility ...
Found program make (/usr/bin/make)
Found program gcc (/usr/bin/gcc)
Found program perl (/usr/bin/perl)
Found program wget (/usr/bin/wget)
old crashkernel=auto rd.lvm.lv=centos/root rd.lvm.lv=centos/swap rhgb quiet intel_iommu=off and iommu=off
new crashkernel=auto
rd.lvm.lv=centos/root
rd.lvm.lv=centos/swap
rhgb
quiet intel_iommu=off and iommu=off
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-3.10.0-1062.18.1.el7.x86_64
Found initrd image: /boot/initramfs-3.10.0-1062.18.1.el7.x86_64.img
Found linux image: /boot/vmlinuz-3.10.0-1062.el7.x86_64
Found initrd image: /boot/initramfs-3.10.0-1062.el7.x86_64.img
Found linux image: /boot/vmlinuz-0-rescue-cd0481dc8d1649da9932eac9f5546670
Found initrd image: /boot/initramfs-0-rescue-cd0481dc8d1649da9932eac9f5546670.img
done

Please run hptuninhptnvme to uninstall the driver files.

Please restart the system for the driver to take effect.
[root@localhost Downloads]#
```

- d. 安装完成后系统将提示您重新启动以使新驱动程序生效，手动重启系统

注释：有关此过程的更多信息，请查阅每个开源下载中随附文件

- e. 发行版重新启动后以 root 权限打开系统终端，并使用以下命令检查当前驱动程序版本：

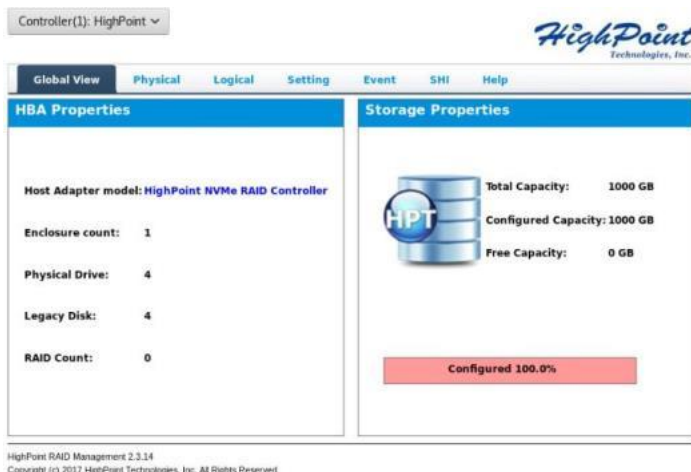
dmesg | grep rsnvme.

下面的屏幕快照显示已安装驱动程序 v1.2.14:

```
[root@localhost test]# dmesg | grep hptnvme
[ 4.267125] hptnvme: loading out-of-tree module taints kernel.
[ 4.267128] hptnvme: module license 'Proprietary' taints kernel.
[ 4.267485] hptnvme: module verification failed: signature and/or required key missing - tainting kernel
[ 5.216390] hptnvme: HighPoint NVMe RAID controller driver (65) v1.2.14 block major fc
[ 5.217073] scsi host0: hptnvme
[ 5.217813] hptnvme 0000:03:00.0: irq 145 for MSI/MSI-X
[ 5.217817] hptnvme 0000:03:00.0: irq 146 for MSI/MSI-X
[ 5.217820] hptnvme 0000:03:00.0: irq 147 for MSI/MSI-X
[ 5.217823] hptnvme 0000:03:00.0: irq 148 for MSI/MSI-X
[ 5.217827] hptnvme 0000:03:00.0: irq 149 for MSI/MSI-X
```

- f. 打开 WebGUI，确保可以连接到控制器并识别 NVMe SSD 的 RAID 阵列
- g. 如下所示，新驱动程序已在启动时成功安装并加载，WebGUI 可以连接到控制器并识别 SSD 和 RAID 阵列：

SSD7103:



SSD7202:



卸载驱动

1. 要求

- a. 关闭系统电源，然后从主板上卸下 SSD7000 设备

注释：Note: 卸载驱动程序时未能删除控制器和 SSD 可能会导致数据丢失

卸载 SSD7000 驱动程序后，Linux 发行版将加载默认的 NVMe 支持——该驱动程序仅将 NVMe SSD 识别为单独的磁盘

2. 卸载驱动程序：

- a. 使用 root 特权打开系统终端。输入以下命令以卸载驱动程序：

hptuninhptnvme

- b. 按‘Y’以确定

```
[root@localhost Downloads]# hptuninhptnvme
Are you sure to uninstall the driver hptnvme from system? (Y/n): y
Removed symlink /etc/systemd/system/default.target.wants/hptdrv-monitor.service.
Removed symlink /etc/systemd/system/sysinit.target.wants/systemd-hptdrv.service.
All files installed have been deleted from the system.
[root@localhost Downloads]#
```

- c. 卸载驱动程序后，手动重新启动系统
- d. 重新启动发行版后，请以 root 权限打开系统终端。并输入以下命令以检查驱动程序状态：

lsmod | grep hptnvme

```
Before uninstalling:
[root@localhost test]# lsmod | grep hptnvme
hptnvme                235401  0

After uninstalling:
[root@localhost test]# lsmod | grep hptnvme
[root@localhost test]#
```

- e. 如果系统未显示“hptnvme”信息，则说明驱动程序已成功卸载

HighPoint RAID 管理器 (WebGUI) 安装 / 驱动程序验证

HighPoint RAID 管理软件用于配置与监视 SSD7000 系列 RAID 控制器和机箱托管的 SSD 及阵列

从 HighPoint 网站下载 RAID 管理软件包:

SSD7103: <http://highpoint-tech.cn/product-detail7103.html>

SSD7202: <http://highpoint-tech.cn/product-detail7202.html>

1. 使用具有 root 用户特权的系统终端，浏览到驱动程序下载的目录，然后输入以下命令以提取管理软件包：

```
tar xzvf HighPoint_NVMe_G5_Linux_Src_vx.x.xx_xx.xx.xx.tar.gz
[root@localhost Downloads]# tar xzvf RAID_Manage_Linux_v2.3.14_17_07_26.tar.gz
HPT_CLI_Guide.pdf
README.txt
RAID_Manage_Linux_v2.3.14_17_07_26.bin
```

2. 使用以下命令安装 HighPoint RAID 管理软件（Web GUI 和 CLI）：
./RAID_Manage_Linux_v2.x.x_x_x_x.bin

```
[root@localhost Downloads]# ./RAID_Manage_Linux_v2.3.14_17_07_26.bin
-----
Install .....
Package readline6/hptsvr-https-2.3.14-17.0718.x86_64.rpm will be installed!
Starting hptdaemon (via systemctl): [ OK ]
Clean .....
Finish .....
```

3. 安装软件后，打开 WebGUI，确保它可以连接到 SSD7201 和 SSD7103 的 RAID 控制器
4. 您也可以使用 CLI（命令行界面）检查控制器在系统终端上输入以下命令：

hptraidconf

有关 CLI 的更多信息，请下载指南

```
[root@localhost test]# hptraidconf
HPT CLI>query devices
-----
ID      Capacity  MaxFree  Flag   Status  ModelNumber
-----
1/E1/1  250.06     0        SINGLE LEGACY  Samsung SSD 960 EVO 250GB
1/E1/2  250.06     0        SINGLE LEGACY  Samsung SSD 960 EVO 250GB
1/E1/3  250.06     0        SINGLE LEGACY  Samsung SSD 960 EVO 250GB
1/E1/4  250.06     0        SINGLE LEGACY  Samsung SSD 960 EVO 250GB
-----
HPT CLI>
```

SSD7103:

SSD7202:

HPT CLI>query devices

ID	Capacity	MaxFree	Flag	Status	ModelNumber
1/E1/1	250.06	0	SINGLE	LEGACY	Samsung SSD 960 EVO 250GB
1/E1/2	250.06	0	SINGLE	LEGACY	Samsung SSD 960 EVO 250GB

HPT CLI>

- 如果 WebGUI / CLI 可以连接到控制器并识别出 NVMe SSD，则表明驱动程序已安装并且可以正常运行：

Controller(1): HighPoint

Global View Physical Logical Setting Event SHI Help

HBA Properties

Host Adapter model: HighPoint NVMe RAID Controller

Enclosure count: 1

Physical Drive: 4

Legacy Disk: 4

RAID Count: 0

Storage Properties

Total Capacity: 1000 GB

Configured Capacity: 1000 GB

Free Capacity: 0 GB

Configured 100.0%

HighPoint RAID Management 2.3.14
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SSD7103:

Controller(1): HighPoint

Global View Physical Logical Setting Event SHI Help

HBA Properties

Host Adapter model: HighPoint NVMe RAID Controller

Enclosure count: 1

Physical Drive: 2

Legacy Disk: 2

RAID Count: 0

Storage Properties

Total Capacity: 500 GB

Configured Capacity: 500 GB

Free Capacity: 0 GB

Configured 100.0%

HighPoint RAID Management 2.3.14
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故障排除

WebGUI

1. WebGUI 安装失败

如果您使用 Ubuntu 系统，则在安装 WebGUI 时，系统可能会提示您缺少 **readline5** 软件包——这会中断安装过程

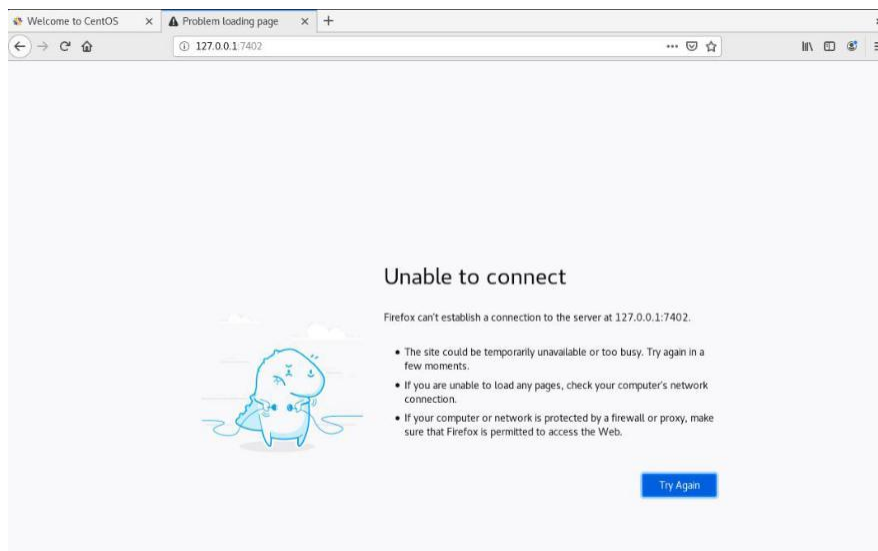
```
root@test-PRIME-Z390-A:/home/test/Downloads# sh RAID_Manage_Linux_v2.3.14_17_07_26.bin
.....
Install .....
Package readline lib not found! will be installed!
Install param error!
Clean .....
Finish .....
```

解决方法：

- 启用 root 权限后，您可以使用以下命令在终端上加载 **readline5**，
WebGUI 将被允许安装：
apt-get install libreadline5
- 完成后，重新启动 WebGUI 安装过程

2. WebGUI 无法连接到控制器

如果无法使用 WebGUI 访问 SSD7202 或 SSD7103RAID 控制器：



- WebGUI 服务未成功启动

解决方法：

通过使用 root 权限打开系统终端并输入以下命令来启动 WebGUI：

hptsvr

b. 驱动程序无法编译

```
[root@localhost test]# hptsvr
proc file invalid, dwControllerId=0
Driver is not loaded.
[root@localhost test]#
```

解决方法:

1. 确保在 SSD7202 或 SSD7103 中至少安装了一个 NVMe SSD
2. 确保主板可以在 BIOS 发布期间识别 SSD7103 设备并显示 NVMe 信息
3. 如果您使用的是 CentOS 系统, 请以 root 特权打开系统终端, 然后输入以下命令来安装 “elfutils-libelf-devel” 1:

yum install elfutils-libelf-devel

完成后, 再次安装 SSD7202/SSD7103 驱动程序

4. 如果您使用 Ubuntu / Debian 系统, 请以 root 权限打开系统终端, 然后输入以下命令来安装 “libelf-dev” :

#yum install libelf-dev

完成后, 再次安装 SSD7202/SSD7103 驱动程序

3. 无法编译 gcc, make 和其他驱动程序文件

安装驱动程序时, 由于各种因素无法编译 gcc 和 make 等驱动程序文件, 从而中断了驱动程序的安装过程:

```
root@test:/hone/test# ./rsnme_linux_src_v1.2.18.1_2020_03_18.bin
Verifying archive integrity... All good.
Uncompressing RocketNvme RAID Controller Linux Open Source package installer....
Checking and installing required toolchain and utility ...
Installing program make ... (failed)
Installing program gcc ... (failed)
Found program perl (/usr/bin/perl)
Found program wget (/usr/bin/wget)
```

此问题可能是由于:

a. 系统未连接到网络 (互联网连接)

解决方法:

- a. 仔细检查系统的互联网连接
- b. 确认后, 重新安装驱动程序

b. 系统进程忙/忙

解决方法:

以 root 用户特权打开系统终端, 然后输入以下命令:

apt-get update

这将提示系统释放该过程并更新下载源，释放系统进程后重新安装驱动程序

4. 如果您遇到任何其他与 **WebGUI 或 CLI** 相关的问题，请使用我们的在线支持门户提交申请，尽可能详细地描述问题，并上传以下内容：

收集以下日志文件： pci.log, drivermod.log, hptdrv.log, kernel.log

请阅读有关查找和收集这些日志的更多信息

第 16 页开始的附录部分中也提供了更多信息

控制器和驱动检测问题

如果系统无法检测到控制器或 SSD，请在故障排除过程中确保从系统中删除与 SSD7202 或 SSD7103RAID 控制器无关的所有 NVMe 设备，因为其他 NVMe 设备的存在可能会干扰 SSD7000 设备的检测

如果您遇到其他与控制器有关的问题，请使用我们的在线支持门户网站提交申请，并尽可能详细地描述问题

请检查从第 16 页开始的附录——提供有关系统的系统日志、屏幕截图和其他信息，将使我们的支持部门能够尽快有效地解决您的问题

附录

通过我们的在线支持门户网站提交申请时，以下信息将帮助支持部门尽快并高效地诊断和解决您的问题：

A. 如何收集 WebGUI 信息

请拍摄每个选项卡的屏幕截图（例如“物理”、“逻辑”、“事件”等）并将其上传到您的支持案例。此外，检查“事件日志”选项卡并保存当前日志的副本，并将此文件上传到支持案例

B. 如何收集日志文件

a. 提供已安装驱动程序的屏幕截图：

```
[root@localhost Downloads]# ./hptnvme_g5_linux_src_v1.2.14_20_04_10.bin
Verifying archive integrity... All good.
Uncompressing HighPoint NVMe RAID Controller Linux Open Source package installer.....
Checking and installing required toolchain and utility ...
Found program make (/usr/bin/make)
Found program gcc (/usr/bin/gcc)
Found program perl (/usr/bin/perl)
Found program wget (/usr/bin/wget)
old crashkernel=auto rd.lvm.lv=centos/swap rhgb quiet intel_iommu=off and_iommu=off
new crashkernel=auto
rd.lvm.lv=centos/root
rd.lvm.lv=centos/swap
rhgb
quiet intel_iommu=off and_iommu=off
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-3.10.0-1062.10.1.el7.x86_64
Found initrd image: /boot/initramfs-3.10.0-1062.10.1.el7.x86_64.img
Found linux image: /boot/vmlinuz-3.10.0-1062.el7.x86_64
Found initrd image: /boot/initramfs-3.10.0-1062.el7.x86_64.img
Found linux image: /boot/vmlinuz-0-rescue-cd0401dc0d1649da9932eac9f5546670
Found initrd image: /boot/initramfs-0-rescue-cd0401dc0d1649da9932eac9f5546670.img
done

Please run hptuninhptnvme to uninstall the driver files.

Please restart the system for the driver to take effect.
[root@localhost Downloads]#
```

1. 打开系统终端，输入以下命令：**lspci >pci.log**

```
File Edit View Search Terminal Help
02:01.0 PCI bridge: Advanced Micro Devices, Inc. [AMD] 300 Series Chipset PCIe Port (rev 02)
02:02.0 PCI bridge: Advanced Micro Devices, Inc. [AMD] 300 Series Chipset PCIe Port (rev 02)
02:03.0 PCI bridge: Advanced Micro Devices, Inc. [AMD] 300 Series Chipset PCIe Port (rev 02)
02:04.0 PCI bridge: Advanced Micro Devices, Inc. [AMD] 300 Series Chipset PCIe Port (rev 02)
02:09.0 PCI bridge: Advanced Micro Devices, Inc. [AMD] 300 Series Chipset PCIe Port (rev 02)
03:00.0 Network controller: Qualcomm Atheros QCA6174 802.11ac Wireless Network Adapter (rev 32)
04:00.0 Network controller: Wilocity Ltd. W16200 802.11ad Wireless Network Adapter (rev 02)
05:00.0 Ethernet controller: Intel Corporation I211 Gigabit Network Connection (rev 03)
08:00.0 USB controller: ASMEDIA Technology Inc. ASM152 USB 3.1 Host Controller
09:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
0a:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
0a:09.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
0a:10.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
0a:11.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
0b:00.0 Non-Volatile memory controller: Samsung Electronics Co Ltd NVMe SSD Controller SM961/PM961
0c:00.0 Non-Volatile memory controller: Samsung Electronics Co Ltd NVMe SSD Controller SM961/PM961
0d:00.0 Non-Volatile memory controller: Samsung Electronics Co Ltd NVMe SSD Controller SM961/PM961
0e:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
0f:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
0f:09.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
0f:10.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
0f:11.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
10:00.0 Non-Volatile memory controller: Samsung Electronics Co Ltd NVMe SSD Controller SM961/PM961
11:00.0 SATA bus controller: HighPoint Technologies, Inc. Device 7103 (rev 01)
14:00.0 Non-Essential Instrumentation [1300]: Advanced Micro Devices, Inc. [AMD] Zeppelin/Raven/Raven2 PCIe Dummy Function
14:00.1 Encryption controller: Advanced Micro Devices, Inc. [AMD] Family 17h (Models 00h-0fh) Platform Security Processor
14:00.3 USB controller: Advanced Micro Devices, Inc. [AMD] Family 17h (Models 00h-0fh) USB 3.0 Host Controller
15:00.0 Non-Essential Instrumentation [1300]: Advanced Micro Devices, Inc. [AMD] Zeppelin/Remore PCIe Dummy Function
15:00.3 SATA controller: Advanced Micro Devices, Inc. [AMD] FCH SATA Controller [AHCI mode] (rev 51)
15:00.3 Audio device: Advanced Micro Devices, Inc. [AMD] Family 17h (Models 00h-0fh) HD Audio Controller
40:00.0 Host bridge: Advanced Micro Devices, Inc. [AMD] Family 17h (Models 00h-0fh) Root Complex
40:00.2 IOMMU: Advanced Micro Devices, Inc. [AMD] Family 17h (Models 00h-0fh) I/O Memory Management Unit
40:01.0 Host bridge: Advanced Micro Devices, Inc. [AMD] Family 17h (Models 00h-1fh) PCIe Dummy Host Bridge
40:02.0 Host bridge: Advanced Micro Devices, Inc. [AMD] Family 17h (Models 00h-1fh) PCIe Dummy Host Bridge
```

下面的屏幕快照显示已确定硬件：

SSD7103:

SSD7202:

```

16:1e.4 System peripheral: Intel Corporation Sky Lake-E PCU Registers (rev 04)
16:1e.5 System peripheral: Intel Corporation Sky Lake-E PCU Registers (rev 04)
16:1e.6 System peripheral: Intel Corporation Sky Lake-E PCI Registers (rev 04)
17:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
18:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
19:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
1a:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
1b:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
1b:09.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
1b:10.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
1b:11.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
1d:00.0 Non-Volatile memory controller: Samsung Electronics Co Ltd NVMe SSD Controller SM961/PM961
1e:00.0 RAID bus controller: HighPoint Technologies, Inc. Device 7202 (rev 01)
1f:00.0 Non-Volatile memory controller: Samsung Electronics Co Ltd NVMe SSD Controller SM961/PM961
64:00.0 PCI bridge: Intel Corporation Sky Lake-E PCI Express Root Port A (rev 04)
64:05.0 System peripheral: Intel Corporation Sky Lake-E VT-d (rev 04)
64:05.2 System peripheral: Intel Corporation Sky Lake-E RAS Configuration Registers (rev 04)
64:05.4 PIC: Intel Corporation Sky Lake-E IOxAPIC Configuration Registers (rev 04)
64:08.0 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:09.0 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0a.0 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0a.1 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0a.2 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0a.3 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0a.4 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0a.5 System peripheral: Intel Corporation Sky Lake-E LMS Channel 1 (rev 04)
64:0a.6 System peripheral: Intel Corporation Sky Lake-E LMS Channel 1 (rev 04)
64:0a.7 System peripheral: Intel Corporation Sky Lake-E LMS Channel 1 (rev 04)
64:0b.0 System peripheral: Intel Corporation Sky Lake-E DECS Channel 2 (rev 04)
64:0b.1 System peripheral: Intel Corporation Sky Lake-E LMS Channel 2 (rev 04)
64:0b.2 System peripheral: Intel Corporation Sky Lake-E LMS Channel 2 (rev 04)
64:0b.3 System peripheral: Intel Corporation Sky Lake-E LMS Channel 2 (rev 04)
64:0c.0 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0c.1 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0c.2 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0c.3 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0c.4 System peripheral: Intel Corporation Sky Lake-E Integrated Memory Controller (rev 04)
64:0c.5 System peripheral: Intel Corporation Sky Lake-E LMS Channel 1 (rev 04)
64:0c.6 System peripheral: Intel Corporation Sky Lake-E LMS Channel 1 (rev 04)
64:0c.7 System peripheral: Intel Corporation Sky Lake-E LMS Channel 1 (rev 04)
64:0d.0 System peripheral: Intel Corporation Sky Lake-E DECS Channel 2 (rev 04)
64:0d.1 System peripheral: Intel Corporation Sky Lake-E LMS Channel 2 (rev 04)
64:0d.2 System peripheral: Intel Corporation Sky Lake-E LMS Channel 2 (rev 04)
64:0d.3 System peripheral: Intel Corporation Sky Lake-E LMS Channel 2 (rev 04)
65:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
66:00.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
66:10.0 PCI bridge: PLX Technology, Inc. PEX 8747 48-Lane, 5-Port PCI Express Gen 3 (8.0 GT/s) Switch (rev ca)
68:00.0 Non-Volatile memory controller: NVIDIA Corporation GK208 HDMI/DP Audio Controller (rev a1)
68:00.1 Audio device: NVIDIA Corporation GK208 HDMI/DP Audio Controller (rev a1)
b2:05.0 System peripheral: Intel Corporation Sky Lake-E VT-d (rev 04)
b2:05.2 System peripheral: Intel Corporation Sky Lake-E RAS Configuration Registers (rev 04)
b2:05.4 PIC: Intel Corporation Sky Lake-E IOxAPIC Configuration Registers (rev 04)

```

2. 使用系统终端，输入以下命令访问 drivermod.log:

lsmod >drivermod.log

下面的屏幕截图显示已安装驱动程序

```

rftkill                22391  7  cfg80211,bluetooth
nvme                   32382  0
nvme_core              63547  1 nvme
pinctrl_cannonlake     31687  0
pinctrl_intel          23466  1 pinctrl_cannonlake
wmi                    21636  2 mxm_wmi,intel_wmi_thunderbolt
acpi_pad               116316  0
rsnvm                  234860  0
ip_tables              27126  5 iptable_security,iptable_filter,iptable_mangle,iptable_nat,iptable_raw
xfs                    997681  3
libcrc32c              12644  3 xfs,nf_nat,nf_conntrack
sd_mod                 46281  3
crc_t10dif             12912  1 sd_mod
crc_t10dif_generic     12647  0
i915                   1859232  11
i2c_algo_bit           13413  1 i915
iosf_mbi                15582  2 i915,intel_rapl
drm_kms_helper         186531  1 i915
syscopyarea            12529  1 drm_kms_helper
sysfillrect            12701  1 drm_kms_helper
sysimgblt              12640  1 drm_kms_helper
ahci                   34056  2

```

3. 在系统终端上，输入以下命令以查看驱动程序日志:

vi /var/log/hptdrv.log

4. 要查看内核日志，请打开系统终端并输入以下命令:

dmesg >kernel.log.