Hewlett Packard Enterprise

HPE Gen10 NVMe Technology

The advantages of small form factor NVMe SSDs in
HPE ProLiant Gen10 servers

Contents

The HPE advantage

Non-volatile Memory Express (NVMe) drives take advantage of the high-speed and low-latency characteristics of the PCI Express (PCIe) bus, as well as the standard protocol and simplified command structure of NVMe. HPE Gen10 servers offer a higher number of small form factor (SFF) drive bays supporting NVMe drives compared to HPE Gen9 servers. The HPE Gen10 NVMe drive bays are directly connected to the host processor with x4 PCIe 3.0 ensuring full bandwidth and performance.

Additional NVMe drive choices are available for HPE Gen10 servers. Low power NVMe solid-state drives (SSDs) are capable of providing good read performance while operating within an 11W power budget. NVMe 1.2 compliant devices are available in HPE Gen10 that provide better compatibility with Windows® inbox drivers for features such as firmware updates. These updates can be performed on the newer NVMe SSDs without requiring a power cycle.

Hardware drive ejection

HPE servers support ejecting and adding NVMe SSDs using a power button located on the front of each drive. To safely eject an NVMe SSD, momentarily press the power button. While the operating system is in the process of safely ejecting the NVMe drive, the Power and Do Not Remove LEDs will flash. This operation usually takes a few seconds.

If a drive is being accessed for read or write transactions at the moment that the power button is pressed, then the Power and Do Not Remove LEDs will quickly return to fully on after briefly flashing; this indicates that the drive is being accessed and the power button must be pressed again to re-initiate the ejection process after the system finishes accessing the drive.

After the operating system has safely ejected the drive, the Power and Do Not Remove LEDs will turn off indicating that it's now safe to physically remove the NVMe drive. You can re-enable the drive by pressing the power button again. When replacing or hot-adding NVMe drives, they are powered on automatically by the operating system.

Note
Review the operating system hot-plug support matrix to determine whether your operating system supports this functionality.

Software drive ejection

Operating systems contain built-in methods to safely eject devices from the server. HPE drives will control the Power and Do Not Remove LEDs to reflect the ejected state of the NVMe drive. Refer to operating system documentation on how to use the software drive eject feature.
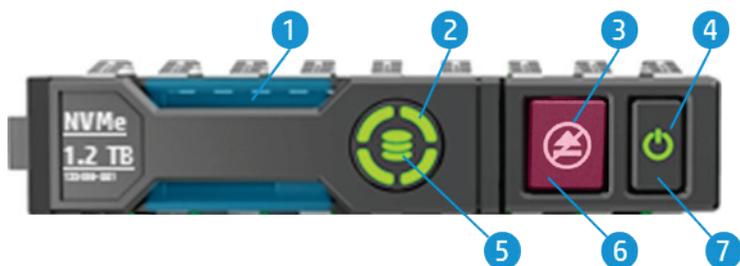
NVMe LED support

Figure 1. NVMe drive LEDs (refer to Table 1 and Table 2 for detailed explanation)

Table 1. NVMe drive LEDs

Item	LED	Status	Definition
1	Locate	Solid blue	The drive is being identified by a host application
		Flashing blue	The drive carrier firmware is being updated or requires an update
2	Activity ring	Rotating green	Drive activity
		Off	No drive activity
3	Do not remove	Solid white	Do not remove the drive; drive must be ejected from PCIe bus prior to removal
		Flashing white	Ejection request pending
		Off	Drive has been ejected
4	Power	Solid green	Do not remove the drive; drive must be ejected from PCIe bus prior to removal
		Flashing green	Ejection request pending
		Off	Drive has been ejected
5	Drive status	Solid green	The drive is a member of one or more logical drives
		Flashing green	The drive is rebuilding or performing a RAID migration, stripe size migration, capacity expansion, or logical drive extension/erasing
		Flashing amber/green	The drive is a member of one or more logical drives; flashing amber indicates the drive will fail
		Flashing amber	The drive is not configured and will fail
		Solid amber	The drive has failed
		Off	The drive is not configured

Table 2. NVMe drive buttons

Item	Button	Definition
6	Handle release	Releases the drive handle for removal and insertion
7	Power button	Momentary press to request PCIe ejection; removal request can be denied any time when the Do Not Remove LED is set
		Press and hold to override the RAID; force an ejection request to be sent to the system PCIe hot-plug controller; logical drives could fail

Operating system specific features

Refer to specific operating system documentation for a complete list of features that are supported.

HPE Server Operating System Support

Operating system hot-plug support

NVMe solutions for HPE Gen10 servers allow NVMe drives to be hot-added, hot-removed, and hot-replaced while the system is running an operating system. Hot-plug operations are not supported until the server has completely booted into the operating system.

Table 3. Operating system hot-plug support matrix

Operating system	Hot-plug support
Microsoft® Windows Server®	Yes Requires HPE software component (NVMe Drive Eject NMI Fix for Intel® Xeon® Processor Scalable Family for Windows)
Red Hat® Enterprise Linux® 6.9	Yes
Red Hat Enterprise Linux 7.3 (and later)	Yes RHEL7.3 Errata kernel 3.10.0-514.26.1 or later
SUSE Enterprise Linux 12 SP2 (and later)	Yes SLES 12 SP2 kernel 4.4.70-18.9.1 or later
VMware®	No

Inbox NVMe drivers

Hewlett Packard Enterprise is focused on leveraging operating system inbox drivers for the long term, which will allow the greatest flexibility and interoperability of NVMe options for our customers. Utilizing inbox drivers also enables customers to reduce IT overhead required to identify vendor-specific drivers.

Table 4. Inbox NVMe driver feature compatibility matrix

OS	HPE SSA serial number	HPE SSA firmware version	HPE SSA Wear Gauge	NVMe firmware updates
Microsoft Windows Server 2012 R2	✓ NVMe 1.2	✗	✗	✗
Microsoft Windows Server 2016 & 2019	✓ NVMe 1.2	✓	✗	✓
Red Hat Enterprise Linux 6.9	✓	✓	✓	✓
Red Hat Enterprise Linux 7.3	✓	✓	✓	✓
SUSE Enterprise Linux 12 SP2	✓	✓	✓	✓
VMware	✗	✗	✗	✗
HPE Intelligent Provisioning	✓	✓	✓	N/A
Offline HPE Service Pack for ProLiant	✓	✓	✓	✓

Software RAID

Most operating systems include software RAID capability for individual drives. Microsoft Windows Server 2012 R2 does not support normal OS software RAID with NVMe drives using the storport.sys driver. During the creation and format, the OS immediately reports a "redundancy failure". However, Storage Spaces (spaceport.sys driver) will allow you to create a RAID volume. This can be enabled using a PowerShell command.

Note

The following command is an example of how to use PowerShell to create software RAID under Windows.

PS C:\Windows\system32> New-VirtualDisk -StoragePoolFriendlyName NVMe_SSD -FriendlyName NVMe_VDisk1 -ResiliencySettingName Mirror -Size 300GB -ProvisioningType Fixed

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Software support

HPE Smart Storage Administrator

HPE SSA software provides a Smart SSD Wear Gauge report that provides information on both the current usage level and expected lifetime of SSDs attached to the system.

Information available:
- Total SSD NVMe Capacity

- SSDs with wear out status

- SSDs with less than an estimated 56 days of life remaining

- SSDs with less than 2% usage remaining

- SSDs with less than 5% usage remaining

HPE Smart Update Manager

Hewlett Packard Enterprise provides a path for customers to update their NVMe Backplane PIC Firmware using the smart component packages and HPE Service Packs for ProLiant (SPPs). These HPE SPPs will be available on the HPE site under the HPE Support and Drivers section.

Hardware features

Risers

HPE ProLiant ML and DL servers use optional PCIe riser options containing up to 4 SlimSAS cable connectors to attach NVMe backplanes directly to the CPU.

Note

HPE Synergy Compute and HPE Apollo do not use optional PCIe risers to attach NVMe drives.

Figure 2. Example of HPE ProLiant DL38X Gen10 4-port 8 NVMe primary SlimSAS Riser

Figure 3. Example of HPE ProLiant DL38X Gen10 2-port 4 NVMe SlimSAS Riser

SlimSAS cables

SlimSAS ports located on select PCIe risers can be cabled to NVMe backplanes. Each SlimSAS port contains eight PCIe lanes that attach to two NVMe drives. Each SlimSAS port attached to CPU 1 is labeled as Port 1A, 2A, and such, where A designates CPU 1. Each SlimSAS port attached to CPU 2 is labeled as Port 1B, 2B, and such, where B designates CPU 2.

Backplane types

Hewlett Packard Enterprise offers a variety of backplanes that support NVMe drives. HPE ProLiant ML and DL servers support various backplanes that range in drive bay types and drive count. HPE Synergy Gen10 Compute Modules support 2 or 4 SFF NVMe/SAS/uFF drive bays with the Premium Backplane CTO option. HPE Apollo 2000 Gen10 supports an optional 16 SFF NVMe drive bay backplane. HPE Apollo 6000 comes standard with 4 SFF NVMe/SAS/uFF bays in the HPE ProLiant XL230k Gen10 Server. Consult the individual server QuickSpecs for more information.

Backplane naming framework

HPE [Bay Count] SFF [Bay Type] Backplane
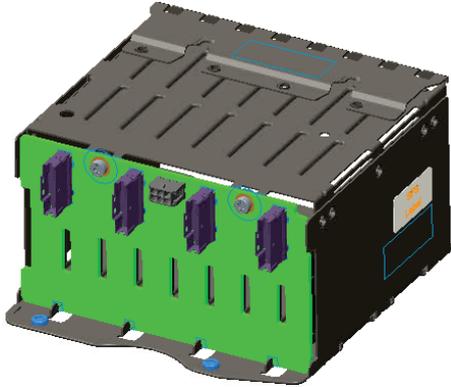
Backplane example

HPE 8SFF NVMe Backplane

Figure 4. This is an example of an HPE ProLiant DL38X with NVMe 8 SSD Express Bay Enablement Kit

Bay types

Table 5. Bay type compatibility matrix

Bay type	NVMe drives	SAS/SATA drives	uFF flash adapter
NVMe/SAS/uFF	✓	✓	✓
NVMe/SAS	✓	✓	✗
NVMe	✓	✗	✗
SAS/uFF	✗	✓	✓
SAS	✗	✓	✗

NVMe drive types

Naming Decoder: HPE [capacity] NVMe x4 [endurance level] SFF [carrier type] [features] SSD

Endurance level

Read intensive (RI)

Mixed use (MU)

Write intensive (WI)

Carrier types

Smart carrier (SC): SFF SAS/SATA drives

Smart carrier M.2 (SCM): SFF flash adapter that holds two micro form factor (uFF) SATA SSD drives

Smart carrier NVMe (SCN): SFF NVMe drives

Featuring digitally signed firmware

BIOS features

UEFI

NVMe drives are supported in UEFI mode and bootable. In UEFI mode, the user can select to use the adapter-provided NVMe Option ROM or to use system BIOS provided NVMe Option ROM. By default, system BIOS provided NVMe Option ROM is used for NVMe drives on the system. If the user chooses to use the adapter-provided NVMe Option ROM, change the NVM Express Options selection in the System Configuration menu. The selected option applies to all NVMe drives on the system.

Legacy BIOS

NVMe drives are supported in legacy BIOS mode, but are not bootable.

HPE iLO features

Thermal management

HPE iLO collects NVMe drive temperatures directly to maintain the temperature of each NVMe drive by using an out-of-band communication method.

Firmware inventory

HPE iLO firmware, OS software, and firmware page will display the firmware version and location (port, box, and bay) of each NVMe drive.

The HPE iLO update firmware task supports non-disruptive firmware updates to the NVMe backplane controller while the server is powered on. HPE iLO may require a server reboot to refresh the versions listed on the firmware inventory page.
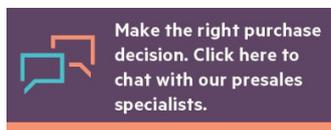
Device inventory

HPE iLO supports displaying the NVMe backplane name, part number, hardware version, and firmware version within the system information and device inventory webpage.

Learn more at

hpe.com/servers/solidstate

[ssd.hpe.com/](ssd.hpe.com/)

Make the right purchase decision. Click here to chat with our presales specialists.

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