



Hewlett Packard
Enterprise

Technologies in HPE ProLiant Gen10 2-socket servers

Using the Intel Xeon Processor Scalable Family

Contents

Abstract	3
Introduction.....	3
HPE Secure Compute Lifecycle	4
Processor technologies.....	6
Intelligent System Tuning	6
Workload Matching.....	7
Jitter Smoothing	7
Core Boosting	7
Memory technologies.....	7
HPE DDR4 SmartMemory.....	7
HPE Advanced Memory Error Detection technology.....	8
HPE Persistent Memory	8
HPE NVDIMMs	9
HPE Scalable Persistent Memory	9
HPE Server Storage	9
HPE hard disk drives.....	9
HPE solid state drives	9
HPE NVMe PCIe SSDs.....	10
HPE Smart Array Controllers.....	10
HPE Universal Media Bay.....	11
Networking for HPE Gen10 2-socket servers.....	12
HPE Standard adapters.....	12
HPE Advanced adapters	13
HPE Performance adapters.....	13
Power efficiency and provisioning.....	14
HPE Flexible Slot power supply	14
HPE 3D Sea of Sensors.....	14
Power provisioning tools	14
Managing HPE ProLiant Gen10 servers.....	15
Embedded management with HPE iLO 5	15
Smart Update Technology.....	15
Intelligent Provisioning.....	16
UEFI.....	16
Converged management using HPE OneView v3.1	16
HPE Pointnext.....	17
Conclusion	17
Additional resources	17

Abstract

Today, IT is operating with a hybrid infrastructure, spanning on and off-premises and including a mix of dedicated IT, on-site computing and hosted clouds. Reducing Hybrid IT complexity while maintaining agility, security, and cloud economics are key goals for the data center. This technical white paper describes the technologies used in the 2-socket HPE ProLiant Gen10 server families and how these innovations allow you to run diverse workloads and applications across traditional and multi-cloud environments.

Introduction

HPE ProLiant Gen10 2-socket rack servers offer the world's most secure industry standard servers¹ for software defined compute and converged infrastructure. We've designed these servers with the security to protect your digital assets, the agility to modernize your infrastructure, and the economic control to consume IT based upon your preferred financial model. Currently, two HPE ProLiant Gen10 2P models are available; the HPE ProLiant DL380 Gen10 Server and the HPE ProLiant DL360 Gen10 Server (Figure 1).



Figure 1. HPE ProLiant Gen10 2-Socket Servers.

HPE ProLiant Gen10 2-socket servers offer the following differentiating innovations:

- World's most secure industry-standard servers:
 - Unmatched threat protection through the Silicon Root of Trust, extensive standards compliance, and supply chain attack detection
 - Unparalleled ability to recover firmware after denial of service attempt or detection of compromised code
- Unprecedented High-Speed Memory Capacity with Persistence: High capacity data acceleration with flash-backed Persistent Memory at multi-terabyte capacities for large data-intensive workloads.
- Intelligent System Tuning:
 - Preconfigured BIOS settings to tune the server to match specific workloads
 - Performance tuning to enable more workloads on more cores at a given CPU frequency for greater application licensing efficiency
 - Predictable latency reduction and balanced workload optimization
- New levels of compute:
 - Latest generation industry standard CPUs with faster processing and higher speed memory access
 - Enhanced GPU levels of performance and choice
- Increased In-Server Storage Density: Substantially greater NVMe capacity for large write-intensive workloads and enhanced storage density with more SFF and LFF drive bays for large database workloads.

¹ Based on third party conducting cybersecurity penetration testing of a range of server products from a range of manufacturers (May 2017).

HPE ProLiant Gen10 2-socket servers meet a particular range of workload and business requirements:

- **HPE ProLiant DL380 Gen10 server:** Offers the expandability required of a workhorse system—the industry’s must trusted compute platform
- **HPE ProLiant DL360 Gen10 server:** Answers the need for a high-density data center running diverse workloads in space-constrained environments

Table 1 offers a general architectural comparison of HPE ProLiant Gen10 2-socket rack and tower servers.

Table 1. Overview of HPE ProLiant Gen10 2-Socket servers

	HPE ProLiant DL360 Gen10	HPE ProLiant DL380 Gen10
Form factor	1U rack mount	2U rack mount
Processors	Intel® Xeon® Processor Scalable Family (up to 28 cores, 3.6 GHz) (8100, 6100, 5100, 4100, and 3100 series)	
System memory	24 slots for HPE SmartMemory DDR4 2666 MT/s DIMMs (maximum of 3 TB [1])	
Persistent memory	12 slots for NVDIMMs (192 GB max)	12 slots for NVDIMMs (192 GB max), up to 1 TB HPE Scalable Persistent Memory
Drive bays	4 LFF + 1 SFF SAS/SATA/SSD or 8+2+1 SFF SAS/SATA/SSD or 10 SFF NVMe, M.2 and dual uFF enablement	12+4+3 LFF + 2 SFF SAS/SATA/SSD or 24+6 SFF SAS/SATA/SSD or 20 SFF NVMe, M.2 enablement
Storage controllers	Embedded S100i	
Universal Media Bay	Yes	
GPGPU support	Up to 2 single-wide	Up to 5 single-wide and 3 dual-wide
Networking	4x1GbE embedded with optional FlexibleLOM and Standup	
Power supply units	Up to 2 Flex Slot PSUs (up to 1600W)	
ASHRAE operating class	3 and 4 [2]	
Management	HPE iLO 5 Management (standard), Intelligent Provisioning (standard), iLO Advanced (optional), iLO Advanced Premium Security Edition (optional), HPE OneView Advanced (optional)	

Notes

[1] Capability to be available 2H 2017.

[2] Compliance to be met 2H 2017.

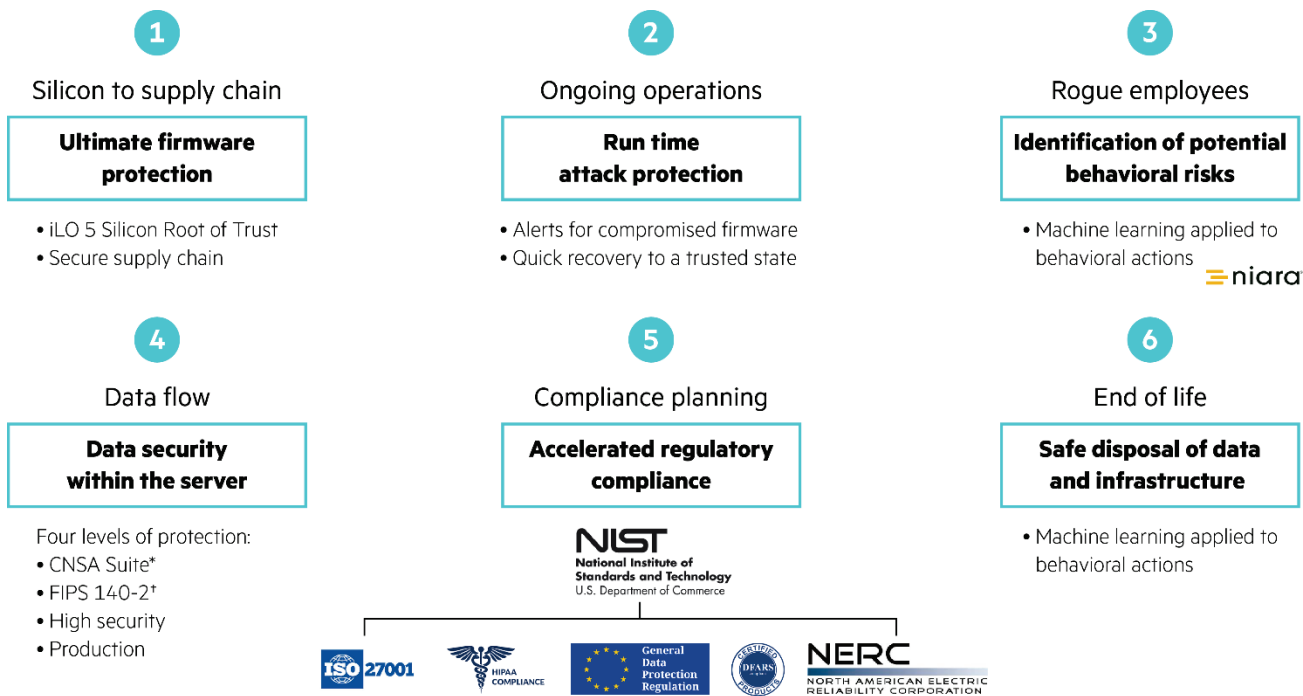
HPE Secure Compute Lifecycle

HPE has answered the need to deliver an end-to-end security solution that addresses protection at every stage in the product’s lifecycle (Figure 2). Beginning with stage one at the very inception of the product with our Silicon Root of Trust, the server’s essential firmware (iLO 5, UEFI, CPLD, IE, and ME) is loaded into our custom silicon with an unbreakable link that anchors it into the hardware. That immutable connection between the silicon and firmware protects the server through the production process, supply chain shipping and distribution, all the way to your final location.

Once the server arrives safely at your location, HPE Secure Compute Lifecycle continues to provide not only protection during operation but also un-paralleled detection and recovery capabilities. As soon as the server is booted and the iLO firmware becomes active, our Silicon Root of Trust looks for the immutable fingerprint that verifies all firmware code is valid and uncompromised. Before the operating system even starts, over a million lines of firmware code run, making it essential to confirm that all server essential firmware is free from malware or compromised code.

HPE has introduced a new technology—Run-Time Firmware Verification, which checks the firmware stored in the server operation. At any point, if compromised code or malware is inserted in any of the critical firmware, an iLO audit log alert is created to notify you that a compromised has occurred. A firmware breach is highly unlikely of course. Nevertheless, a disgruntled employee with access to the data center could insert bad code. A new HPE license called HPE iLO Advanced Premium Security Edition can detect such an event and allow you to securely recover the firmware automatically to a previous known good state.

Stage three in the lifecycle process is security to and through the network. Aruba ClearPass creates a strong networking security clearance protocol for clearing anyone requesting access to the network. ClearPass creates a profile of potential users and clears access of users into our Aruba networks. Niara, a subsidiary of HPE, will be responsible for monitoring activity of users inside the network. Once ClearPass vets and clears users into networks, Niara takes over and, using machine learning, works to predict any nefarious behavior before any serious damage can be done. If Niara identifies abnormal activity resembling potential malicious behavior, it communicates to ClearPass, temporarily terminating the suspected user's access to the network until more thorough vetting can be conducted. In the case of a rogue employee, this predictive capability and block potential bad actors from the network, before any damage is done.



* Commercial National Security Algorithm Suite

† Federal Information Processing Standard

Figure 2. HPE Secure Compute Lifecycle stages.

The next stage (four) is protecting data and communication to and from the server and inside the server. HPE is the first industry server manufacturer to provide support for the commercial national security algorithms, or CNSA suite. This is the very highest level of security, typically used for the most confidential and top secret information. HPE also has FIPS validation on firmware and offers that as another level of protection during the operation phase of the server's life.

Scalable encryption is another differentiation offering from HPE protecting data stored in the server. Unlike competitor servers that use self-encrypting drives requiring management of separate keys in each and every drive, HPE offers secure encryption through our smart array controller cards that contain all encryption keys and manage those at scale. Going one step further, the HPE Atalla Enterprise Secure Key Manager (ESKM) is also qualified with our controller cards that take key management to a higher level. Through this technology, we save you the agony of tracking, sometimes on spreadsheets, an unmanageable number of encryption keys.

Closely related to security are the numerous government regulations that businesses must comply with. HPE is applying the NIST 800-53 security controls to a solution stack of storage, networking, servers, and software, creating a secure baseline. This secure baseline is an important necessary step to issue an authority to operate (ATO) before putting IT infrastructure into operation. Additionally, this NIST 800-53 control set can assist you with certifications like FedRAMP, HIPAA, and ISO 207001. Just recently, the president issued an executive order mandating all federal agencies follow NIST guidelines for cybersecurity protections. The private sector is also beginning to use the same NIST controls as standards for preventing cybercrime.

The final stage (six) of HPE Secure Compute Lifecycle comes after the servers and other equipment have reach their full use and entered end of life. The HPE Pointnext security and protection services provide final disposal of equipment, ensuring the data is properly disposed of according to NIST standards.

Processor technologies

HPE ProLiant Gen10 2-socket rack servers now feature Intel Xeon processor scalable family processors. Based on a new foundation for scalability, the Intel Xeon processor Scalable family is designed to seamlessly address a wide range of key workloads by delivering boosts in performance, efficiency, and security. These new technologies include the following features:

- Increased processor cores (to a maximum of 28 cores)
- Supports 2666 MT/s DDR4 memory
- Six channels per processors with two DIMMs per channel
- Five processor categories:
 - Platinum (8100 series) for ERP, In-memory Analytics, OLAP, HFT, virtualization, containers
 - Gold (6100/5100 series) for OLTP, Analytics, AI, Hadoop/SPARK workloads, server-side Java, VDI, HPC, virtualization, containers
 - Silver (4100 series)—for SMB workloads, web front end, network and storage applications
 - Bronze (3100 series)—SMB workloads

These enhancements allow the HPE ProLiant Gen10 2-socket servers to deliver up to a 71% increase in performance and a 27% increase in cores from the previous generation of processors.

Intelligent System Tuning

Through a partnership with Intel®, HPE offers Intelligent System Tuning (IST), a new set of server tuning technologies that enable you to dynamically configure server resources to match specific workloads. IST produces significant performance improvements, real savings, and a more intelligent server environment.



Workload Matching



Jitter Smoothing



Core Boosting

Figure 3. HPE Intelligent System Tuning.

Workload Matching

Workload Matching allows you to select from preconfigured workload profiles to automatically tune internal server resources to experience up to a nine percent performance improvement over server default settings.² Workload Matching is available on all ProLiant Gen10 servers with iLO 5.

Jitter Smoothing

Engaging processor turbo boost can cause frequency fluctuations or “jitter” that results in a constant struggle between maximum output and deterministic performance needs. HPE’s Jitter Smoothing technology mitigates processor frequency fluctuation to reduce latency and deliver deterministic and reliable performance. In variable workloads where processor frequency changes occur often, Jitter Smoothing can improve overall throughput above turbo boost mode alone.³ Jitter Smoothing is ideal for high frequency traders, high performance computing, and workloads where low processor latency and deterministic processing response is important. Jitter Smoothing is available on all Intel-based Gen10 servers with iLO 5 and an iLO Advanced (or above) license.

Core Boosting

Core Boosting enables higher processor frequencies on more active cores than standard Intel processor profiles, allowing you to utilize fewer processors while improving workload performance with HPE Core Boosting technology. Higher performance across fewer processors can result in significant savings when it comes to core-based licensing. In some cases, customers with core-based licensing like Oracle can experience up to \$100K in annual savings or \$500K over 5 years.⁴ Core Boosting is ideal for virtualized environments, Big Data workloads, core-based licensing applications, and workloads where performance is a competitive advantage. Core boosting will be available with select Intel processors on select Gen10 platforms.

Memory technologies

IT trends such as server virtualization, cloud computing, high-performance computing, and other resource-intensive applications continue to place increasing demands on the requirements for server memory in terms of speed, capacity, and availability. These demands define the system’s reliability, performance, and overall power consumption to a much greater extent than before—making server memory a critical component in meeting your IT solution requirements.

HPE ProLiant Gen10 servers feature HPE DDR4 SmartMemory that supports faster memory speeds than before. HPE also offers Standard Memory—designed to provide reliable memory performance for use in less demanding environments.

HPE also offers Persistent Memory using HPE NVDIMMs. Persistent Memory can deliver the performance of memory combined with the persistence of storage in solution environments designed to take advantage of it.

Finally, HPE Advanced Memory Error Detection Technology delivers enhanced reliability and memory protection on ProLiant Gen10 servers.

HPE DDR4 SmartMemory

HPE DDR4 SmartMemory offers significant improvements over previous memory generations. Unlike third-party memory, HPE SmartMemory is authenticated by the server to verify that memory has passed HPE’s rigorous qualification and testing, ensuring you are using the highest quality server memory.

For the HPE Gen10 ProLiant servers using the Intel Xeon processor Scalable family, HPE DDR4 SmartMemory is now capable of operating at 2666 MT/s, delivering a 12.5% increase in maximum throughput over earlier DDR4 memory and a 29% increase over the last generation of DDR3 memory.⁵ For applications that require maximum memory capacity, HPE SmartMemory Load Reduced DIMMs (LRDIMMs) reduce the electrical load to the memory controller, allowing higher capacity memory to run at maximum speed in all configurations.

HPE SmartMemory also provides the following benefits over third-party memory when used in ProLiant Gen10 servers:

- Extended performance: In many two DPC or three DPC configurations, HPE SmartMemory operates at a higher transfer rate than industry standard DDR4 DIMMs, delivering better memory performance.
- Enhanced manageability: HPE SmartMemory Integrates with the HPE Active Health System for enhanced monitoring, reporting, and problem diagnosis.

^{2,3,5} HPE internal testing from Performance Engineering Benchmarking team, April 2017.

⁴ HPE internal testing from Performance Engineering Benchmarking team, April 2017 and reducing costs in your Oracle database environment hpe.com/h20195/v2/Getdocument.aspx?docname=4AA6-5294ENW

Memory DIMM availability for specific server platforms is dependent upon completion of certification testing.

HPE Advanced Memory Error Detection technology

Uncorrectable memory errors can cause applications and operating systems to crash, so they are costly in terms of downtime and repairs. The best way to prevent unnecessary DIMM replacements is to filter out superfluous errors and identify critical errors that can lead to a shutdown. You can no longer rely on simple error event counts on systems containing up to 14 trillion memory transistors. With HPE Advanced Memory Error Detection Technology, we reinvented a precision system to pinpoint errors that cause downtime.

HPE Advanced Memory Error Detection technology seeks out specific defects that either cause performance degradation or significantly increase the probability of an uncorrectable (non-recoverable) memory condition. By improving the prediction of non-recoverable memory events, this technology prevents unnecessary DIMM replacements and increases server uptime.

The latest addition to the suite of HPE error detection technologies is Fast Fault Tolerance, which enables a server to boot with full memory performance while monitoring for DRAM device failures. In the event of a memory failure, the memory subsystem automatically reorganizes the way data is stored in memory to create a protected region just large enough to correct the DRAM failure, while allowing the remaining portions of memory to continue to run at full performance.

HPE ProLiant Gen10 servers include the following advanced memory protection features:

- **Advanced ECC/SDDC:** Error checking and correcting (ECC) combined with single device data correction (SDDC) ensures continued memory operation in the event of a single memory device failure. The server removes a DRAM from the memory map if the DRAM device exhibits a failure and recovers its data into a new device. SDDC works for both x4 and x8 DIMMs.
- **Rank sparing (online spare):** Dynamic failover to a spare DIMM rank or spare rank pair behind the same memory controller. You cannot enable this feature concurrently with memory mirroring. HPE offers rank sparing rather than DIMM sparing, because rank sparing uses less memory, resulting in less overhead.
- **Demand scrubbing:** Writes corrected data back to the memory after a correctable error is detected on a read transaction.
- **Patrol scrubbing:** Proactively searches the system memory repairing correctable errors. Patrol and demand scrubbing work together to prevent accumulation of correctable errors and reducing the likelihood of unplanned downtime.
- **Failed DIMM isolation:** Identifies a specific failing DIMM, thereby enabling the user to replace only the failed DIMM.
- **Memory thermal control:** Prevents DIMMs from overheating by slowing down the memory access rate. The temperature is monitored by a DIMM sensor.
- **DIMM address/control bus parity protection:** Detects and protect command and address errors.

HPE Persistent Memory

HPE Persistent Memory is persistent memory technology designed to deliver the performance of memory with the persistence of traditional storage. HPE has the broadest persistent memory portfolio in the market and offers high performing NVDIMMs and HPE Scalable Persistent Memory, an integrated storage solution that runs at DRAM speeds.

HPE 8GB and 16GB NVDIMMs are the first NVDIMMs in the HPE Persistent Memory category. These NVDIMMs are installed in the same memory slots as standard DDR4 DIMMs and feature DRAM memory for workload performance backed by NAND flash for persistence. In the event of a power down, the HPE Smart Storage Battery holds up the power on the memory slots so any data residing on DRAM can be moved to NAND flash.

Although HPE NVDIMMs share memory slots with HPE SmartMemory, they are not used as system memory. The HPE NVDIMMs are the fastest tier of storage in ProLiant servers and primarily used for application acceleration and caching use cases. Operating system drivers are required for NVDIMMs and today's applications address this technology as a block storage device—just like applications access traditional storage devices such as HDDs and SSDs. HPE Persistent Memory is capable of delivering data performance with nanosecond latencies compared to latencies in the hundreds of microseconds for other fast storage devices such as PCIe Workload Accelerators.

HPE NVDIMMs

HPE NVDIMMs offer up to 73X lower latency, 24X more I/Os per second (IOPS) and 6X greater bandwidth compared to the HPE PCIe Workload Accelerators.⁶ With Microsoft® SQL Server, HPE lab testing has demonstrated up to 4X faster performance relative to using SSDs alone. Using NVDIMMs with fewer server core pairs can also reduce software licensing by up to 50 percent.⁷

HPE Scalable Persistent Memory

HPE Scalable Persistent Memory, the integrated storage solution, has three primary components; a layer of DRAM for application acceleration, a dedicated flash tier for persistence and a backup power source to facilitate moving data from DRAM to Flash. HPE Scalable Persistent Memory enables much larger in-memory compute with persistence, delivering up to 27X faster checkpoint operations resulting in much faster business operations and up to 20X reduction in database restart time⁸ preserving maximum uptime. HPE Scalable Persistent Memory can also benefit HTAP, software-defined storage caching tiers and more. HPE Scalable Persistent Memory is supported only on the HPE ProLiant DL380 Gen10.

HPE Server Storage

The IT landscape has changed. The amount of data you have to manage and analyze has grown at an unprecedented rate with no end in sight. As data storage requirements grow, you need solutions that can help overcome performance bottlenecks caused by demanding application workloads. Today's storage solutions should:

- Keep pace with data growth
- Enable fast access to data to keep you competitive
- Protect data integrity from outages and data loss
- Perform reliably to maximize uptime

HPE offers a broad portfolio of workload-optimized solutions for every server storage need. Our offerings provide enterprise environments a combination of the latest technologies to enable hassle-free performance, proven reliability and security, backed by more than 3.35 million hours⁹ of the industry's most rigorous testing and qualification program. Our drives feature HPE Digitally Signed Firmware which prevents data loss and malicious attacks by assuring that drive firmware comes from a trusted source.

HPE hard disk drives

HPE hard disk drives (HDDs) deliver proven performance and reliable data integrity at the lowest cost per gigabyte. Most drives feature the HPE SMART Carrier with intuitive icons to report drive activity at-a-glance and a “do not remove” button that prevents data loss caused by human error. There are three categories of drives to choose from: Entry, Midline, and Enterprise.

HPE Entry Hard Disk Drives

HPE entry HDDs are suitable for environments that need reliable, cost-effective performance. These HDDs are ideal for SMB environments new to enterprise-class storage and are also suitable for boot and backup. Entry HDDs are supported on select HPE servers.

HPE Midline Hard Disk Drives

HPE Midline HDDs are suitable for business-critical applications when you need high capacity and high availability such as for bulk storage, backup, archive and reference.

HPE Enterprise Hard Disk Drives

HPE Enterprise HDDs are suitable for mission critical storage environments with I/O intensive workloads requiring the highest levels of performance, reliability and data integrity such as email, CRM, and database applications.

HPE solid state drives

HPE solid state drives (SSDs) remove performance bottlenecks, enabling faster access to data with consistently low latency—all while using less power. These drives are best suited for enterprise environments where highly random data is accessed by a variety of write-workload applications such as online transaction processing or Big Data analytics. HPE SSDs offer improved random read and write input/output operations per second (IOPS) and are available in both SAS and SATA to fit your needs.

^{6,7,8} HPE internal testing from Performance Engineering Benchmarking team, April 2017.

⁹ Test quant derived from a combination of drive qualification test plans, specifically HDDQ spec-supplier responsibility to perform, RDT—Reliability Demonstration test spec, CSI integration test spec, and Pilot test requirements. Test conducted May 2017.

HPE NVMe PCIe SSDs

HPE NVMe PCIe SSDs utilize the NVMe interface to talk directly to your applications via the PCIe bus. By hosting your entire database on one or more HPE NVMe PCIe SSDs you boost I/O performance, leverage in-memory access, reduce latency, and scale performance in-line with your processing requirements. These features create a flexible and dependable solution to proactively address your storage needs. HPE NVMe PCIe SSDs are available in 2.5" and in add-in card form factors.



Figure 4. HPE ProLiant DL360 Gen10 with Premium 10 NVMe System Front.

HPE M.2 & M.2 Enablement Kit SSDs

As the most recent addition to our Read Intensive solid-state drive family, HPE M.2 SSDs are best suitable for boot/swap. This flexible form factor saves hot pluggable bays for removable SSDs.

HPE Flash Media Devices

HPE's high-performance enterprise flash media kits can meet your boot-from-flash requirements for integrated hypervisors and Tier 1 operating systems. With high data retention and read/write cycles, HPE flash media devices are available in secure digital (SD) and microSD form factors.

HPE Optical Drives

HPE optical drives, both DVD-ROM and DVD-RW solutions, are available in half-height, slim, and super-slim models to fit any HPE system in your data center.

HPE Smart Array Controllers

HPE's newest line of enterprise-class RAID controllers help maximize performance, data availability, and storage capacity. They deliver up to 1.6M IOPS—a 65% improvement in performance¹⁰—while using up to 45% less power¹¹ than previous generation controllers. Additionally, you get enterprise-class data-at-rest encryption to help you comply with regulations like HIPAA and Sarbanes-Oxley. New mixed mode allows you to use both HBA and RAID modes simultaneously on one controller, freeing up a PCIe slot for other uses, for additional flexibility. You can choose from Smart Array S-Class software RAID, and Smart Array E-Class or P-Class controllers—each delivering a broad feature set and related benefits.

Ideal for entry-level solutions that use SATA drives in basic RAID configurations, HPE Smart Array Software RAID delivers the reliability and efficiency needed to address evolving data storage needs. Features include RAID levels 0/1/5, support for 6G SATA, and access to the UEFI configuration tool. HPE Smart Array Software RAID is supported on HPE ProLiant Rack, Tower, BladeSystem, and Apollo servers and Synergy Compute Modules.

Cost-effective HPE Smart Array E-Class Controllers provide simple RAID storage with enterprise-class reliability and security. They're supported on HPE ProLiant Rack, Tower, Apollo servers, and Synergy Compute Modules. Key features include ROC (RAID on Chip) and RAID levels 0/1/5/10. These controllers also offer flexibility with mixed mode capabilities, security with HPE Smart Array SR Secure Encryption, and simplicity with the UEFI configuration tool. HPE Smart Array P-Class Controllers maximize the performance of enterprise class server storage. Key features include ROC, support for flash back write cache, and advanced RAID levels 0/1/5/6/10/50/60/ADM. Mixed Mode capability HPE Smart Array SR Secure Encryption, and the EUFI configuration tool are also included. Note that these controllers are also supported on HPE BladeSystem, HPE Apollo servers, and HPE Synergy Compute Modules for cross-platform flexibility.

HPE Smart Array SR Secure Encryption

HPE Smart Array SR Secure Encryption provides broad encryption coverage and complies with sensitive data regulations including HIPAA and Sarbanes-Oxley. Validated as a FIPS 140–2 Level 1 enterprise class controller solution for data-at-rest on all SAS/SATA drives, this solution is available for both local and remote deployments.

¹⁰ HPE Internal lab testing comparing HPE Gen9 to Gen10 Smart Array Controllers, January 2017.

¹¹ HPE Internal lab testing comparing HPE Gen9 to Gen10 Smart Array Controllers, October 2016.

HPE Smart Array SR SmartCache

HPE Smart Array SR SmartCache is an HPE Smart Array controller-based read and write caching solution for HPE ProLiant servers in direct attached storage environments. HPE SmartCache caches the most frequently accessed (“hot”) data onto lower latency SSDs to dynamically accelerate application workloads. HPE SmartCache operates transparently to host applications, which means you do not have to change the application and can realize better performance with a minimal number of SSDs in your configuration. The HPE Server Storage portfolio helps you manage your growing data needs. Whether you need large capacity or fast data access or reliable data integrity, we have a solution to empower any workload.

HPE Universal Media Bay

The HPE Universal Media Bay adds functional flexibility to HPE ProLiant DL380 Gen10 and DL360 Gen10 servers. The Universal Media Bay kits allow you customize your server’s configuration by adding, depending on platform, an optical disk drive bay, USB ports, 2x Dual uFF with M.2 cartridges, and/or a display port. The kit installs in a specific box of the server (for example, box 1 in the HPE ProLiant DL380 Gen10 shown in Figure 5).

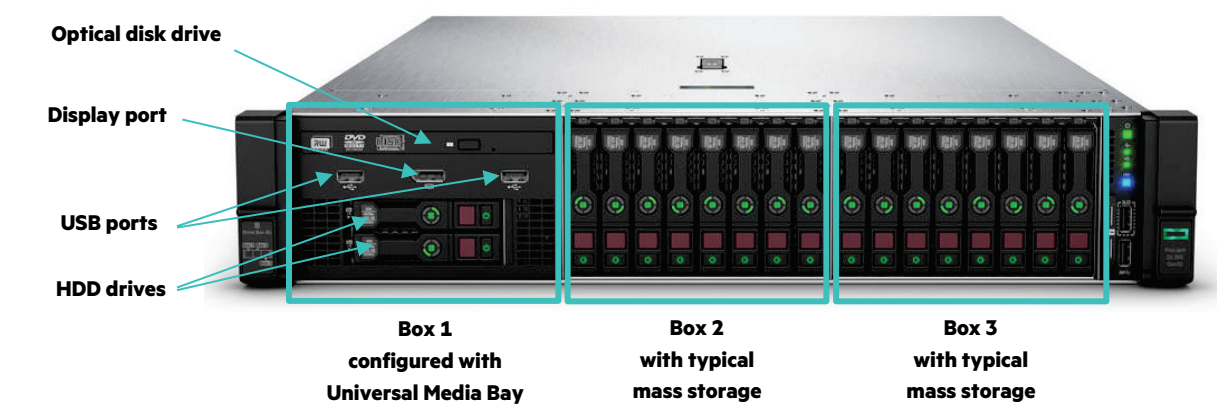


Figure 5. HPE Universal Media Bay implementation example in the HPE ProLiant DL380 Gen10 server.

Table 2 lists the optional Universal Media kits available:

Table 2. Available Universal Media Bay kits.

HPE ProLiant Gen10 Server	Available universal media bay kits
DL380	HPE DL38X Gen10 2SFF Premium HDD Front NVMe/SAS/SATA Kit HPE DL38X Gen10 Universal Media Bay Kit, 2 drive bay, front Display port and 2x USB (SFF only) HPE DL380 Gen10 2SFF Front/Rear SAS/SATA Kit HPE Slim Optical Bay (SATA DVD-RW/ROM Optical Drive)
DL360	HPE DL360 Gen10 Premium 8 SFF CTO Server HPE DL360 Gen10 8SFF DP/USB/ODD Blnk Kit HPE DL360 Gen10 LFF Display Port/USB Kit HPE DL360 Gen9/10 LFF Optical Cable Kit

Note

For additional information, please refer to the specific server’s QuickSpecs available at hpe.com/info/qs.

Networking for HPE Gen10 2-socket servers

For ProLiant Gen10 servers, HPE provides the next generation networking adapters designed to meet the needs of converged IT infrastructure with higher performance and support for key Ethernet features. Gen10 servers come with embedded multi-port 1GbE NICs on the system board, but can utilize the new Dual- and Quad-port stand-up NICs at speeds up to 25 Gb/s. The HPE ProLiant DL380 and DL360 Gen10 servers can also use the HPE FlexibleLOM adapters that provide speeds up to 40 Gb/s.

Gen10 networking adapters also feature several capabilities such as NIC Partitioning (NPAR), Data Plane Development Kit (DPDK), Tunnel Offload (NVGRE/VXLAN) and RDMA over Converged Ethernet (RoCE) that deliver improved network performance and efficiency in specific environments.

Gen10 networking adapters come with security features that help protect, detect, and recover from malicious attacks to the firmware. It all starts with digitally signing the firmware. HPE sends firmware and security requirements to the adapter manufacturer, who then creates a public and private key pair through a secure code signing process. The public key is embedded in the NIC silicon. The network adapter's "Chain of Trust" is created from a true hardware Root of Trust. Firmware encrypted with a private key must be decrypted by the public key in the NIC silicon in order to be validated. In addition to Root of Trust, HPE's adapters offer additional key security features such as UEFI Secure Boot, Authenticated updates, Audit Logs, Device-level Firewall, and Sanitization.

LAN-on-motherboard (LOM) technology provides essential network connectivity without requiring a network card to be installed in an expansion slot. While standard LOM design leaves expansion slots available for expansion functions, it also limits your connectivity options. We developed FlexibleLOM technology, which uses a FlexibleLOM module that attaches to a dedicated edge connector on the system board. FlexibleLOM technology maintains the close-coupled interface of a LOM while allowing you to select the connectivity you need now—and adapt to network changes in the future without using a standard PCIe slot. FlexibleLOM technology is available on HPE ProLiant DL380 and DL360 Gen10 Servers.

Three types of HPE network adapters are available:

- Standard
- Advanced
- Performance

HPE Standard adapters

HPE Standard series networking adapters offer a cost-effective Ethernet solution for ProLiant networking needs. These adapters are intended to meet the price/performance goals for core enterprise workloads. HPE Standard series adapters are available at 1 Gb/s speed in both dual-port and quad-port configurations and as 10GbE dual-port adapters. Standard series adapters also support both single root I/O virtualization (SR-IOV) and NPAR functionality.

Single Root I/O Virtualization

Single Root I/O Virtualization (SR-IOV) is a technology created primarily to benefit the performance of NICs when they are used in virtualized environments. SR-IOV allows a PCIe network adapter to appear to be multiple separate physical devices—or virtual network functions—that can be assigned to individual virtual machines (VMs) within a virtualized server environment. By allowing individual VMs to actually access a portion of the physical NIC, SR-IOV reduces the server processor overhead for network I/O and decreases I/O latencies.

NIC Partitioning

NPAR allows a single port to be presented to the OS as four separate adapters, or partitions, per port (Figure 6). Each partition is an actual PCIe function that appears to the system ROM, OS, or virtualization OS as a discrete physical NIC with its own software driver, and each partition behaves as an independent NIC port. With NPAR, you must configure the partitions in a pre-boot environment, which you must also manage locally on each server.



Figure 6. NPAR NIC Partitioning.

Standard adapters also support the following security features:

- **Authenticated Updates:** Protects user and configuration data from unauthorized access and validates Digitally Signed firmware.
- **Secure Boot:** Safeguards the system and ensures no rogue drivers are being executed on startup.

HPE Advanced adapters

HPE Advanced network adapters help simplify the networking and networking storage topology to build a hybrid server networking infrastructure. HPE FlexFabric architecture gives the flexibility to configure the network ports on Advanced adapters as any of the following:

- Standard Ethernet adapter
- Fibre Channel over Ethernet (FCoE) adapter
- iSCSI adapter

When configured as either FCoE or iSCSI, the network port is made to look like either a Fibre Channel adapter or a SAS HBA, respectively, to the server host OS. In these configurations, the HPE Advanced adapter delivers additional performance benefits because the processing of the storage part of the stack occurs on the adapter and not on the host CPU. This is sometimes referred to by the term **storage offloading**.

As a result of this flexibility, FlexFabric adapters allow you to connect to different types of storage and data networks without requiring additional NICs, thereby reducing cabling and switch requirements.

On ProLiant Gen10 rack and tower servers, HPE offers FlexFabric as dual-port 10GbE adapters. FlexFabric adapters also support other advanced networking capabilities, including Flex-10/20 Converged Network Adapter (CNA). Advanced adapters also support the following security features on top of the features supported on Standard series adapters:

- **Device-level firewall:** Blocks any unmanaged access to memory or storage. This ensures that on-device firmware and configuration data can only be accessed by authorized agents.
- **Audit logs:** A forensics capability that provides traceability into authenticated firmware updates by capturing changes in standard system logs.

Flex-10/20 Converged Network Adapter (CNA)

CNA carries both Ethernet and storage traffic on a single adapter. This reduces the number of network interface cards required to connect to disparate storage and IP networks, reducing the number of cables and switches and reducing power and cooling costs.

HPE Performance adapters

Data center network traffic is continuing to increase significantly, driven in part by the rise in the volume of mobile data and video and the frequency at which they are accessed. Current approaches to managing this increase in traffic (e.g., using a 4-port 10GbE NIC to aggregate 40GbE of bandwidth) are both expensive and require extra infrastructure.

HPE 25GbE Ethernet adapters deliver significantly increased networking throughput to and from the server using fewer networking resources. The new 25GbE adapters are available for both the HPE ProLiant DL380 and DL360 servers and deliver all of the following benefits:

- 2.5 times the bandwidth of 10GbE adapters
- Compatibility with the current copper or fiber cabling used for 10GbE
- Lower CAPEX and OPEX costs compared to 40GbE solutions using more ports/switches to achieve required throughput
- Easier scalability to 100GbE standards

HPE is currently offering the following 25GbE capable adapters for use in the ProLiant DL380 and DL360 Gen10 servers:

- HPE Ethernet 10/25Gb 2-port 631FLR-SFP28 Adapter
- HPE Ethernet 10/25Gb 2-port 631SFP28 Adapter

Performance adapters also support other advanced networking capabilities, including RoCE and Tunnel offload capability.

- **RDMA over Converged Ethernet (RoCE):** RoCE allows applications to access memory directly on other nodes across a fabric for very low latency communications. RoCE works well for endpoints that communicate frequently, such as storage functions, database environments, or virtual machine migrations.
- **Tunnel offload for overlay networks:** Tunnel offload minimizes the impact of overlay networking on host performance for virtual extensible LAN (VXLAN) and network virtualization using generic routing encapsulation (NVGRE). By offloading packet processing to adapters, overlay networking can be used to increase virtual machine (VM) migration flexibility and network scale with minimal impact to performance. HPE tunnel offloading increases I/O throughput, reduces CPU utilization, and lowers power consumption.

Performance adapters also support the following security features on top of the features supported on advanced series adapters:

- **Silicon (hardware) Root of Trust:** Enables a chain of trust for authenticating updates to firmware. This blocks installation of rogue or corrupted firmware and ensures that the executing firmware is trusted.
- **Sanitization:** Renders user and configuration data on the network interface card irretrievable so that they can be safely repurposed or disposed.

Power efficiency and provisioning

We have designed power supplies with industry-leading efficiency ratings and have developed technologies that allow you to precisely monitor and control HPE ProLiant Gen10 servers' energy use.

HPE Flexible Slot power supply

HPE ProLiant DL360 and DL380 Gen10 servers feature HPE Flexible Slot (Flex Slot) power supply unit (PSU) bays that accommodate HPE Flex Slot PSUs. The HPE Flex Slot design represents a new generation of tool-less, hot-swappable components that use the cross-platform interchangeability model introduced with our Common Slot power supplies. For detailed information about Flex Slot PSUs, refer to the white paper HPE Flexible Slot Power Supply Unit.

HPE Flex Slot PSUs achieve the same degree of efficiency as Common Slot power supplies but use 25 percent less space, thus allowing more room for compute and I/O connectivity functions in the server chassis. HPE Flex Slot PSUs are 80 Plus certified and offer from 94 to 96% efficiencies. They are available in the following models:

- 500W and 800W models for 100–240 VAC input power
- 800W and 1600W models for 200–240 VAC input power

HPE 3D Sea of Sensors

HPE 3D Sea of Sensors provides the data to precisely control the server fans and directly cool specific components while not overcooling other components. This significantly reduces fan power consumption per server. HPE Sea of Sensors extends the use of sensors to select PCI Express option cards and FlexibleLOM adapters to get a three-dimensional temperature profile in the server. This additional data enables more precise and efficient cooling of HPE ProLiant Gen10 servers. The data is included in the always-on diagnostic information of the HPE Active Health System.

Power provisioning tools

HPE Power Provisioning tools include Dynamic Power Capping and Power Regulator for ProLiant. These tools, summarized below, help administrators maximize data center power usage by fitting more IT equipment in the available power and cooling capacity.

HPE Power Regulator for ProLiant

HPE Power Regulator for ProLiant is a hardware feature that enables ProLiant servers to dynamically control performance states (p-states) of the system processors. HPE Power Regulator features Dynamic Power Capping, sophisticated monitoring and control circuitry that prevents server power from exceeding a preset level. Because Dynamic Power Capping is hardware-based, it can quickly control sudden surges in power consumption by servers and prevent tripping even the fastest circuit breakers used in HPE Power Distribution Units (PDUs). You can set a power cap for an individual server from the iLO user interface. For groups of servers, you can set the power caps from the power management module with iLO Federation Group Power Capping within HPE iLO. HPE iLO functionality of Group Power Capping requires an iLO Advanced or iLO Scale-Out license.

Compliance with ASHRAE expanded operating ranges¹²

ASHRAE establishes temperature and humidity guidelines for data center operation. HPE ProLiant Gen10 2-socket servers meet ASHRAE ambient temperature operating classes A3 and A4, which define maximum allowable ambient temperatures of 40°C and 45°C, respectively. These extended operating ranges may allow you to raise your data centers' operating temperature and/or use more efficient cooling strategies in your facility, significantly reducing energy consumption.

Managing HPE ProLiant Gen10 servers

HPE offers a set of server management capabilities that give you complete control of your IT infrastructure. For Gen10 servers, we have introduced a number of management innovations for HPE ProLiant servers, all working together to give you complete control of the monitoring and management of the servers and infrastructure in your data center.

Embedded management with HPE iLO 5

HPE Integrated Lights-Out (iLO) allows you to configure, monitor, and update your HPE servers seamlessly from anywhere in the world. Featuring the latest innovations in simplified operations, performance and security, HPE iLO allows you to manage your entire server environment with ease. For HPE ProLiant Gen10 servers, iLO 5 provides several new improvements in security, speed, and simplicity (some features require an optional iLO Advanced or iLO Advanced Premium Security Edition license):

- **Security:**

- **Protect:** HPE Secure Start uniquely ensures that only HPE-signed firmware will boot by validating through HPE's Silicon Root of Trust so you can be confident that the server's essential firmware stack (UEFI BIOS, iLO, etc.) is safe. New secure access controls like Commercial National Security Algorithm (CNSA) & Common Access Card (CAC) factor authentication are also available with iLO 5.
- **Detect:** Runtime firmware verification is a new feature in iLO 5 that ensures that your firmware is checked at regular intervals to identify any potential intrusions that may occur post-boot.
- **Recover:** Avoid lasting damage to your business by quickly restoring firmware to the factory settings or the last known authenticated safe setting in the unlikely event of a breach with automatic and manual firmware recovery capabilities.

- **Speed:**

- With 2X the CPU MHz in iLO 5, Virtual Media performance is twice as fast vs. iLO 4.¹³
- iLO service port: Available on Gen10 servers, the new iLO service port is a USB port for integrated remote console and active health system (AHS) downloads that gives you direct, front of server access to iLO. This new feature also allows you to give iLO access without the need to connect and authenticate on your network, making it simpler to access the information you need quickly.

- **Simplicity:**

- **Agentless Management:** With iLO 5, we're moving to full agentless management. Freedom from the hassle of inventorying and updating various management agents, agentless management allows for a more simplified and streamlined way to monitor your servers.
- **IPMI:** Gen10 enhancements allow for increased interoperability with industry IPMI tools.

Smart Update Technology

The Service Pack for ProLiant (SPP) and Smart Update Manager (SUM) utilities combine to create Smart Update Technology that solves the problem of time-consuming, expensive, and error-prone updates. SPP is a comprehensive collection of firmware, drivers, and system software tested together as a single solution stack used for updating your HPE ProLiant servers, HPE Synergy, and HPE BladeSystem infrastructures. SUM is an innovative tool for keeping the firmware, drivers, and system software of HPE ProLiant, HPE Synergy, HPE BladeSystem, and HPE Moonshot infrastructures and associated options up to date and secure. SUM provides an innovative update process that applies updates in an efficient order to reduce impact on operations.

¹² Compliance to be met 2H 2017.

¹³ iLO 5 has double the CPU MHz as iLO 4. iLO 5 Virtual Media is 1.9964X faster than iLO 4. Comparison: DL360 Gen10 about 5 MB/s (catch point 5.53 MB/s) (note: encrypted) vs. DL360 Gen9 about 2.5 MB/s (catch point 2.77 MB/s) (note: not encrypted), April 2017.

For Gen10 servers, Smart Update has been enhanced to provide secure, tamper-free updates. HPE firmware, driver, and software updates now include a digital signature that prevents unauthorized or modified updates from being applied. Through integrations with iLO Amplifier Pack and HPE OneView, Smart Update Technology has been extended to provide simple and secure server updates at scale from a few servers to thousands of servers.

Firmware and driver updates are also smarter than ever with Smart Update in Gen10 servers. iLO with Integrated Smart Update utilizes the iLO Repository to reduce maintenance widows, overall downtime and the number of personnel required to execute firmware updates. Enhanced rollback capabilities also ensure peace of mind by enabling IT administrators to revert back to a known “good” update so you can be confident and in control of your environment. Staging and scheduling of updates is also a new feature executed through the RESTful API.

Intelligent Provisioning

Intelligent Provisioning is an embedded server assistance tool that streamlines deployment through an easy-to-use wizard. For HPE ProLiant Gen10 servers, Intelligent Provisioning delivers a number of new enhancements, including:

- 3X faster deployment on Gen10 servers¹⁴ and up to 22% faster initial setup over previous generations¹⁵
- Always On Intelligent Provisioning, now accessible from the iLO browser user interface anytime without rebooting the server with the same capabilities as accessing from F10 from the POST screen
- Management of your advanced BIOS settings on Intelligent Provisioning

UEFI

HPE ProLiant Gen10 servers use the unified extensible firmware interface (UEFI) as the default system firmware. UEFI offers functionality, performance, and configuration management capabilities beyond those of legacy BIOS firmware. For HPE ProLiant Gen10 servers, UEFI delivers a number of new improvements, including:

- 67% reduction in boot time vs. Gen9 so you can get your systems up and running faster¹⁶
- Smart Array configuration now available on UEFI boot mode
- Select from 15 preconfigured workload profiles that tune server resources to match your workload needs and improve performance
- Enablement of memory RAS features such as Address-Based Memory Mirroring and HPE Fast Fault Tolerant Memory

Converged management using HPE OneView v3.1

HPE OneView is an infrastructure automation engine built with software-defined intelligence and a template-based approach to management that makes Hybrid IT simple. HPE OneView provides faster and simpler lifecycle operations across compute, storage and fabric resources. Productivity is increased via a unified API that connects infrastructure with applications and places you firmly on the path toward composable infrastructure.

HPE OneView continues to evolve and grow, with HPE OneView v3.1 incorporating the following new features:

- **Common approach to storage management**—simplifies provisioning of storage volumes and removes inefficiencies with support for HPE’s leading composable, software-defined StoreVirtual VSA storage.
- **Extended platform support**—gives you the ability to easily manage HPE platforms with one, comprehensive management tool. HPE OneView now provides support for HPE Synergy, ProLiant BL, DL and ML, HPE Apollo and HPE Superdome X servers.
- **Simplified firmware management**—enables updates to occur faster and easier with minimal disruption to production workloads.
- **Enhanced remote support**—allows planning service contracts more efficiently. Contract and warranty display is available for each device, so you can easily see in advance what is going to be out of contract and warranty.

¹⁴ HPE internal testing, with Gen10, users avoid at least 3 steps and a reboot depending on how they launch their server (specifically from the iLO GUI now), April 2017.

¹⁵ HPE internal testing, comparing DL380 Gen10 VP1 with P408i using latest QA build 338 vs. Gen9. ML350 Gen10 with P4xx array controller using the QA build of 2.60 vs. Gen9, April 2017.

¹⁶ HPE internal testing, comparing DL360 Gen10 with a single 16-core processor, 1 x 8 GB DIMM, the embedded 4-port 331i NIC, and a Smart Array P450ar controller vs. DL380 Gen9 with 2 processors, and 2 x 8 GB DIMMs. The Gen10 configuration took 50 second vs. Gen9 took 2 minutes and 30 seconds on average.

- **Global dashboard**—extends functionality to even more HPE platforms, adding support for up to 12,800 servers and 20 HPE OneView appliances. Also added is the ability to backup and restore the global dashboard in the event of a disaster and easy access to data using customized reports with built-in filtering, sorting, and saving.
- **New HPE Composable Ecosystem additions**—offer more choices to take advantage of the unified API to automate their solutions. The latest include: Mesosphere for provisioning and extending clusters, ServiceNow for improving service levels with immediate event visibility, Densify.com by Cirba for intelligent capacity optimization, and Red Hat® OpenShift for bare-metal containers as a service.

HPE continues to offer HPE Systems Insight Manager (SIM) to manage Gen10 servers within your data center. Note, however, that our strategic management platform for our next generation platforms is HPE OneView.

HPE Pointnext

HPE Pointnext leverages our strength in infrastructure, partner ecosystems, and end-to-end lifecycle support to offer you powerful, scalable IT solutions for faster time to value. HPE Pointnext provides a comprehensive portfolio including Advisory and Transformational, Professional, and Operational Services to accelerate your digital transformation.

HPE Pointnext services include:

- **Flexible Capacity:** An infrastructure service that offers on-demand capacity, combining the agility and economics of public cloud with the security and performance of on-premises IT.
- **Datacenter Care:** HPE's most comprehensive support solution tailored to meet your specific data center support requirements. It offers a wide choice of proactive and reactive service levels to cover requirements ranging from the most basic to the most business-critical environments. HPE Datacenter Care Service is designed to scale to any size and type of data center environment while providing a single point of contact for all your support needs for HPE as well as selected multivendor products.
- **Proactive Care:** An integrated set of reactive and proactive services designed to help you improve the stability and operation of your device.
- **Foundation Care:** Support for HPE servers, storage, networking hardware and software to meet your availability requirements with a variety of coverage levels and response times.
- **Advisory and Transformation Services:** Designs the transformation and builds a road map tuned to your unique challenges including Hybrid IT, Workload and Application Migration, Big Data, and the Intelligent Edge. HPE leverages proven architectures and blueprints, integrates HPE Enterprise Group and partner products and solutions, and engages HPE Pointnext Professional and Operational Services teams as needed.
- **Professional Services:** Creates and integrates configurations that get the most out of software and hardware, and works with your preferred technologies to deliver the optimal solution. Services provided by the HPE Pointnext team, certified channel partners, or specialist delivery partners include installation and deployment services, mission-critical and technical services, and education services.

Conclusion

Integrating HPE's leading-edge security, memory, storage, networking, and management technologies with the latest Intel Xeon Processor Scalable Family make HPE ProLiant Gen10 2-socket servers the ideal platforms to support a range of compute needs and workloads. With the ability to reduce provisioning time from hours to seconds and offering right-sized and workload-optimized performance, HPE ProLiant Gen10 2-socket rack-mount servers lower your TCO and deliver value of service.

Additional resources

HPE ProLiant Gen10 Server Options
hpe.com/info/serveroptions

HPE ProLiant DL380 Gen10
hpe.com/servers/dl380

HPE ProLiant DL360 Gen10
hpe.com/servers/dl360

Technical white paper

QuickSpecs main page
hpe.com/info/quickspecs

HPE Memory Configurator
hpe.com/info/ddr4/memoryconfig

Technical white paper: Population Rules for HPE DDR4 Memory with HPE ProLiant and Synergy Gen10 Servers
hpe.com/docs/memory-population-rules

HPE Server Memory Whiteboard Video:
h22228.www2.hpe.com/video-gallery/us/en/sss/87e5788d-e82c-4993-b993-2ccb892d9876/Server-Memory-Portfolio/video/

Technology brief: HPE Smart Storage for HPE ProLiant Gen10 Servers
hpe.com/h20195/v2/Getdocument.aspx?docname=4AA5-4526ENW

Technical white paper: Networking Innovations for HPE ProLiant Gen10 Servers
hpe.com/h20195/v2/Getdocument.aspx?docname=4AA5-4076ENW

Server Management: HPE OneView webpage:
hpe.com/info/oneview

Server remote management with HPE Integrated Lights Out (iLO)
hpe.com/info/ilo

HPE Infrastructure Security
hpe.com/info/security

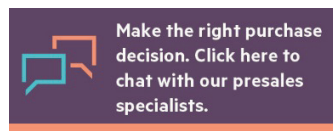
HPE Intelligent System Tuning
hpe.com/info/ist

HPE Pointnext
hpe.com/info/pointnext

HPE Persistent Memory
hpe.com/info/persistentmemory

HPE Power Advisor
hpe.com/info/poweradvisor

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