Hewlett Packard Enterprise

HPE Server Options

High-performance, reliable, secure, and efficient components for accelerating HPE servers

Family guide

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A new compute experience

The era of digital transformation
Digital transformation is all about accelerating innovation, and we see digital transformation creating remarkable new value for companies of all sizes. Our customers are applying digital technologies to their business in fundamental ways to enable new value creation.

This requires the Right Mix of dedicated IT, on-premises and hosted clouds, or what we refer to as **Hybrid IT**, to drive the right business outcomes. Historically, Hybrid IT required trade-offs—obtaining the flexibility offered by the off-premises clouds but at the potential loss of the security and control offered by on-premises computing. Hewlett Packard Enterprise has changed that paradigm with a new compute experience that marries the advantages of on and off-premises. And with the word "compute" we are not limiting ourselves to just the server but the whole infrastructure with storage, networking, and the software that controls it.

HPE provides a new compute experience with a better way to deliver business results through a **software-defined infrastructure**. A better way to protect your business and data with new security capabilities, and finally, a better way to consume and pay only for what you use. This new compute experience is powered by the world's most secure industry standard servers based on our Gen10 architecture.

These Gen10 servers are built using our next-generation **HPE Server Options**. HPE Server Memory, Server Storage, Persistent Memory, Server Networking, and Power Supplies deliver key innovations that enable the performance, security, reliability, and efficiency found in our next-generation servers. In turn, HPE servers, storage, and networking are powered and protected by our next-generation Rack and Power Infrastructure.

HPE Server Options portfolio

The HPE Server Options portfolio features user-inspired innovations that help improve HPE Server performance—reliably and securely—with a level of efficiency that leads to lower **total cost of ownership (TCO)**.

The HPE Server Options portfolio spans several key technologies designed to improve server performance, reliability, and efficiency, including:

- **HPE Server Memory**—Choose from a large selection of memory types and capacities to support a variety of price points as well as both current and future computing needs.
- **HPE Server Storage**—A broad portfolio of workload optimized solutions that includes: hard disk drives (HDDs), solid-state drives (SSDs), and Smart Array Controllers featuring HPE SMART technologies to deliver high performance, outstanding reliability, security and improved operational efficiency.
- **HPE Persistent Memory**—HPE now offers the industry's first servers enabled with Persistent Memory, a new technology category that delivers the performance of memory with the persistence of storage.
- **HPE Server Networking**—Presents a wide variety of server-networking offerings including Standard, Advanced, and Performance Series adapters from 1GbE to 25/50GbE. These adapters are supplemented by a broad range of Transceiver and cable offerings.
- **HPE Rack and Power Infrastructure**—Includes HPE rack enclosures and HPE power and cooling management offerings that provide the foundation for a secure and reliable hybrid cloud infrastructure.
- **HPE Power Supplies**—HPE Power Supplies offer high-efficiency power options available in multiple input and output options, allowing you to "right size" a power supply for specific server/storage configurations and environments. This flexibility helps to minimize power waste, lower overall energy costs, and avoid trapped power capacity in the data center.

Why choose HPE Server Options?

One of Hewlett Packard Enterprise's core tenets for servers and Server Options is creating a customer experience that is second to none. Thus, HPE Servers and HPE Server Options are backed by one of the most rigorous quality programs in the industry. Hewlett Packard Enterprise's relentless focus on quality and innovation is integrated into every phase of the product development lifecycle.

For example, our focus on quality can be found in each of the following areas:

Design: Customer-first approach to designing in world-class innovation and quality

- Engineers and product managers meet with customers around the world to define requirements for next-generation HPE Servers and HPE Server Options
- Secondary research is examined for market trends, and competitive offerings are analyzed
- Hewlett Packard Labs enables fast, fluid transfer of advanced technologies into next-generation products and solutions
- Data from the technical support organization is used to improve design specifications from one generation to the next

Source: Laser focus on technology supplier selection, quality, and management

- Source only from tier one suppliers that can pass our quality and timeliness standards
- Drive consistent quality standards, process controls, and sub-supplier management
- Enter into strategic agreements to ensure supply and cost management
- Conduct comprehensive component testing, HPE supply chain experts on-site at the suppliers, and closed loop reporting ensure quality adherence and continuous improvement

Build: World-class manufacturing and rigorous product testing for the highest quality

- Coordinate with R&D for design for manufacturing
- Conduct factory monitoring and built-in early warning detection of component failure
- Utilize world-class factories with lean deployment, maturity metrics, and zero defect quality cultures
- Conduct extensive server and option run-in testing
- Pursue ongoing server option reliability testing and test optimization

Support: Comprehensive server management and end-to-end support services

- **HPE OneView infrastructure management** enables customers to deploy infrastructure faster, simplify lifecycle operations, and improve productivity with efficient workflow automation, a modern dashboard and the industry's broadest partner ecosystem
- **HPE iLO server management** is integrated into the server design to configure and monitor the health of the server to reduce downtime
- **HPE Pointnext Services** with 25,000 IT experts around the globe work directly with customers to ensure they have the right technologies, tools and processes to achieve their goals for digital transformation
- A global network of channel partners is selected and trained to assist in design, configuration, and support of HPE Servers and Server Options

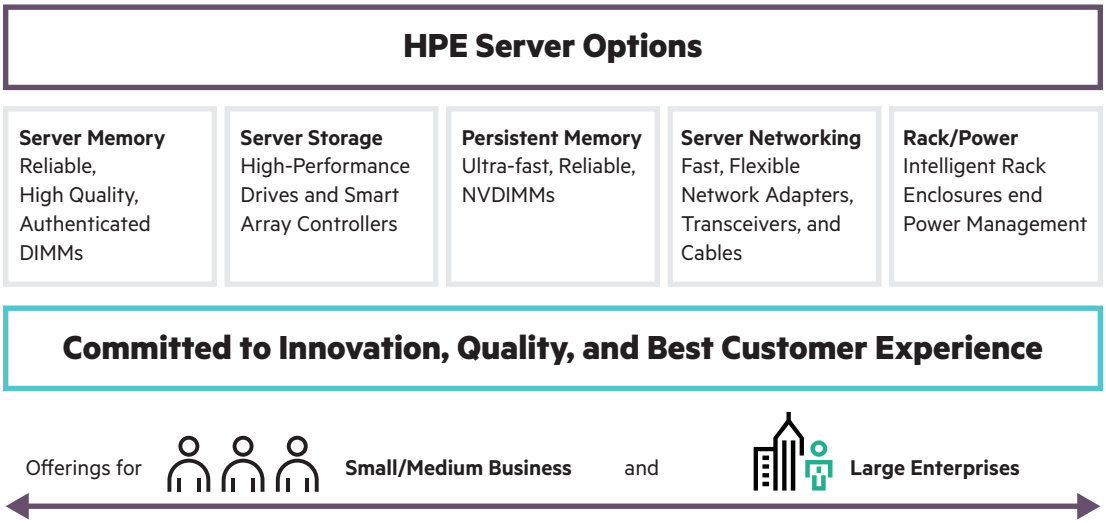


Figure 1. The HPE Server Options portfolio at-a-glance

HPE Server Memory

For more information, visit
hpe.com/info/memory

Expect the efficiency, performance, and reliability to productively manage your expanding workloads

Cloud computing, hybrid infrastructures, virtualization, and Big Data all increase server workloads, requiring additional resources to ensure your server is running as reliably and efficiently as possible. One such critical resource is server memory. Choosing a server configuration that provides the best combination of speed, bandwidth, and capacity will ensure your server is optimized to handle its anticipated workloads.

HPE Server Memory is more than an option—it is a critical component in meeting today's IT priorities: reducing operational costs, and maximizing performance for workloads such as server virtualization, cloud computing, high-performance computing, and resource-intensive applications. Hewlett Packard Enterprise provides a large selection of server memory types and capacities at a variety of price points to support your current and future computing needs. All HPE Server Memory solutions are rigorously tested and authenticated to ensure the utmost compatibility with HPE servers.

HPE Server Memory Options

High-performance, reliable, and efficient components for optimizing the performance of your HPE server

HPE SmartMemory
Designed specifically for enterprise customers with a significant need for performance and capacity along with a desire to manage TCO, HPE SmartMemory offers the widest selection of server memory types and capacities. HPE's server memory configuration options enable total memory capacity optimization to support server workloads while reducing power consumption. In fact, using HPE SmartMemory in your HPE ProLiant server can help it use less energy in comparison to third-party server memory, improving your return on IT investment (RoIT).

HPE SmartMemory runs at top throughput speed, which reduces transaction response time, and enables improved use of applications. High-capacity HPE SmartMemory dual in-line memory modules (DIMMs) give an extra boost to performance, providing servers with the bandwidth to host performance-intensive applications.

In addition to performance and efficiency, HPE SmartMemory also delivers on reliability. HPE selects only the highest quality dynamic random access memory (DRAM) modules from top suppliers. The higher quality minimizes issues that could affect system reliability in any way. Each DIMM is then put through rigorous firmware and integration testing to simulate extreme operating environments and conditions. Such rigorous testing and subsequent authentication unlocks performance and high-efficiency features—optimized for HPE servers.

Hewlett Packard Enterprise continuously improves our memory testing processes, both at supplier manufacturing sites and in our own facilities. From more stringent test algorithms to voltage, temperature, and frequency adjustments to exercise all memory operating modes, our goal is to guarantee that you are getting the most efficient, high-performing, and reliable memory available to maximize uptime.

Memory device failures are a top concern for IT professionals as—if not corrected—they can result in service events, even server crashes. To outpace increasing threats, HPE servers support a comprehensive suite of memory error detection and correction features—collectively called Memory RAS (reliability, availability, serviceability). Recent HPE engineering reports corroborate that when memory RAS technologies are implemented on a scale-up server, the annual crash rate (ACR) can be reduced by approximately 85%.

The latest innovative addition to the suite of HPE memory RAS features is HPE Fast Fault Tolerance, which monitors and corrects DRAM device failures, while allowing the remaining memory to run at full speed. HPE Fast Fault Tolerance is an Intel® RAS feature and is not enabled on AMD servers.

HPE Gen10 Servers configured with HPE SmartMemory offer an extra layer of protection against unplanned downtime and even server crashes. But, unlike the previous Double Device Data Correction (DDDC) feature, you no longer need to compromise on performance. Fast Fault Tolerance enables the system 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 SmartMemory:

- Operates at 2666 MT/s data transfer speeds with Gen10 memory subsystem bandwidth 66% faster than 2400 MT/s in Gen9 servers, increasing the applications performance for memory-intensive applications
- Uses HPE's iLO technology to provide rapid insight into and resolutions for memory-related problems
- Ensures authentic HPE memory modules with the highest quality in the industry
- Consumes less power, reducing IT budgets
- Delivers exceptional total server memory capacity by configuring high-capacity registered DIMM (RDIMM) and load-reduced DIMM (LRDIMM) options—up to 128 GB octal rank LRDIMMs

Need help choosing server memory?
HPE Server Memory Configurator

HPE Standard Memory

SMBs and remote or branch offices (ROBOs) often grapple with the need to grow the business while simultaneously controlling costs. Spending on technology and equipment is a large part of your capital and operating expenses, and to survive, you need to reduce costs and extend the life of your servers by adding low-cost memory. But this decision can leave your IT infrastructure at risk due to quality and compatibility issues. When workloads don't require high memory capacities, HPE Standard Memory is the best combination of quality and performance at the right price for your HPE ProLiant server.

As part of the HPE server memory portfolio, HPE Standard Memory is also sourced from the highest quality DRAM. It undergoes the same rigorous testing and authentication process as HPE SmartMemory to ensure it is completely compatible with HPE servers and will perform to industry-defined specifications. Although HPE Standard Memory still offers the performance and reliability you have come to expect from HPE, it is ideal as an affordable solution for SMB and ROBO customers.

HPE Standard Memory:

- Meets the needs of SMBs and ROBOs with the right memory at the right price without compromising quality
- Ensures memory is optimized on every HPE server platform
- Performs to industry-defined specifications
- Provides lower memory capacity solutions

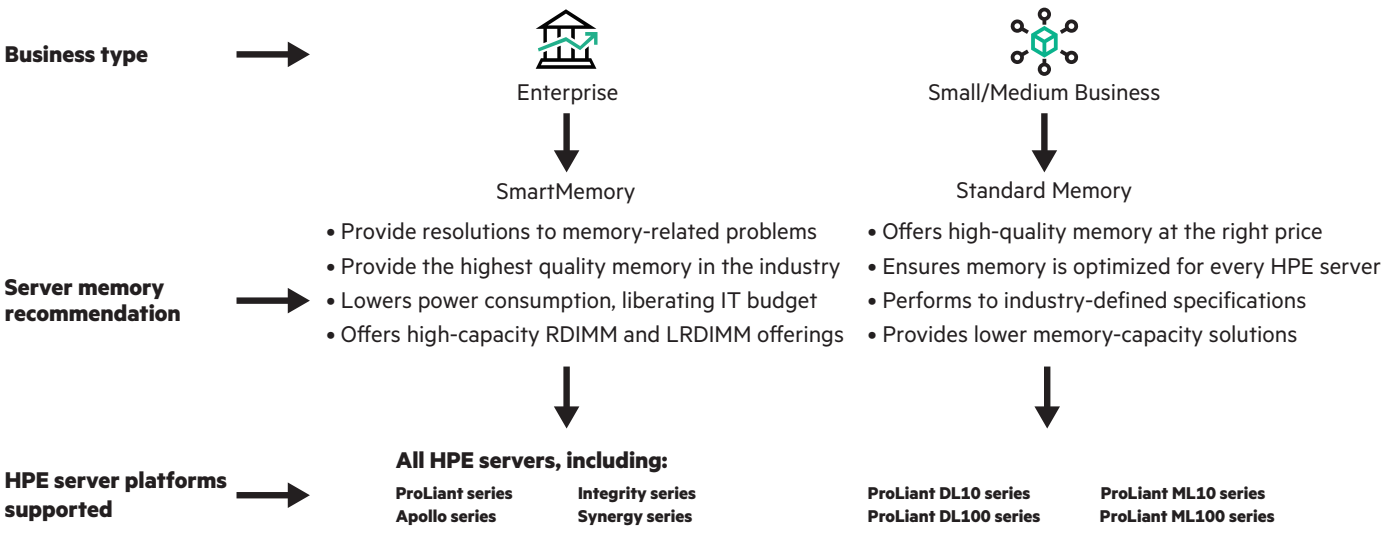


Figure 2. HPE Server Memory—Help me choose!

HPE Server Storage

Delivers the performance, reliability, and security required for your most demanding application workloads

For more information, visit **hpe.com/info/serverstorage**

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 customers a combination of the latest technologies to enable hassle-free performance, proven reliability and security, backed by more than 3.35 million hours[1] 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.

[1] HPE Internal Lab Testing 3.35 million hours test quant is 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 Hard Disk Drives

HPE 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.

	Enterprise—10K	Enterprise—15K	Midline—7.2K	Entry—7.2K
	Mission Critical High I/O workloads Highest levels of performance and reliability for enterprise-class—storage such as transaction processing, database applications and high-performance computing Up to 2.4 TB Up to 900 GB		Business Critical workloads High capacity, high availability applications such as bulk storage, backup, archive and reference Up to 12 TB	Non-mission critical Low I/O workloads Boot and backup Up to 4 TB
Interface	SAS 12 Gb	SAS 12 Gb	SAS 12 Gb/SATA 6 Gb	SATA 6 Gb
Format	512n, 512e	512n, 512e	512n, 512e	512e
Form Factor	Hot plug SFF	Hot plug SFF Hot plug LFF	Hot plug SFF Hot plug LFF RW (NHP) LFF	RW (NHP) LFF
Warranty	3 years		1 year	1 year

Figure 3. Proven performance for every workload with HPE HDDs

HPE Entry Hard Disk Drives

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

HPE Midline Hard Disk Drives

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

Enterprise HDDs are suitable for customers with mission-critical storage needs and 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 SSDs remove performance bottlenecks, enabling faster access to data with consistently low latency—all while using less power. They are best suited for enterprise environments with highly random data under a variety of write-workload applications such as online transaction processing or Big Data analytics. HPE SSDs provide significantly better random read and write input/output operations per second (IOPS). Available in both SAS and SATA to fit your needs.

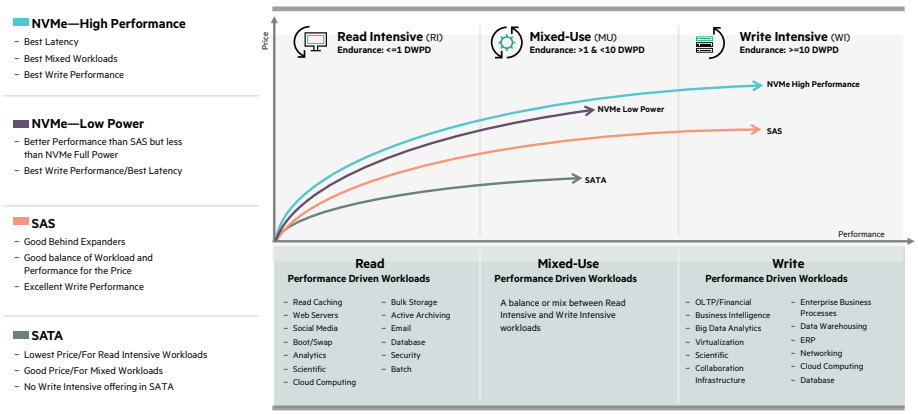


Figure 4. HPE Solid-State Drives

HDD with intuitive icons

Finding the right SSD for your HPE server has never been easier with the new, web-based HPE SSD Selector Tool. It reduces the time and eliminates the complexity of choosing just the right solution for your most demanding application workloads. To learn more, visit **hpe.com/info/serverstorage**.

- Drive faster data insights with a range of data acceleration technologies that boost read and write performance.
- HPE Smart Array Gen10 Controllers deliver up to 65% better performance over previous generation controllers—that's **1.6M IOPS (4 KB random reads)**.[4]
- Increase RAID 5 and RAID 6 performance by up to 25% for sequential workloads such as active archiving and video surveillance.[5]
- Save time and boost performance on RAID 5 or RAID 6 logical drives with **rapid parity initialization (RPI)**.[6]
- Enhance performance in storage environments where data is read repeatedly from a large number of SSDs. Using **HPE SSD Smart Path**, you can create a faster I/O path between the controller and SSD.
- Accelerate access to data by up to 4X in HDD environments by caching hot data onto SSDs with **HPE Smart Array SR SmartCache**.

HPE NVMe PCIe SSDs

HPE NVMe PCIe SSDs talk directly to your applications via the peripheral component interconnect express (PCIe) bus. Hosting your entire database on one or more HPE NVMe PCIe SSDs boost I/O, leverage in-memory access, reduce latency, and scale performance in-line with your processing requirements. These features, coupled with HPE Express Bay's front accessibility and serviceability, create a flexible and dependable solution to proactively address your storage needs. Available in 2.5" and in add-in card form factors.

HPE M.2 & M.2 Enablement Kit SSDs

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

HPE Flash Media Devices

If you require boot-from-flash for integrated hypervisors and Tier 1 operating systems, trust HPE's high-performance enterprise flash media kits to meet those needs. 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

Available as both DVD-ROM and DVD-RW solutions, HPE optical drives are available in half-height, slim, and super-slim models to fit any HPE system in your data center. Available on select HPE ProLiant Gen9 servers, the HPE Universal Media Bay provides functional flexibility to add an optical disk drive bay, USB, and/or VGA ports to the server while providing two drive bays for small form factor drives.

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—65% better performance[2]—while using up to 45% less power[3] than previous generation controllers. Customers 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. Use both HBA and RAID mode simultaneously on one controller for added flexibility. **Mixed mode for Smart Array controllers** frees up a PCIe slot for other uses and is now available on P-class and E-class controllers.

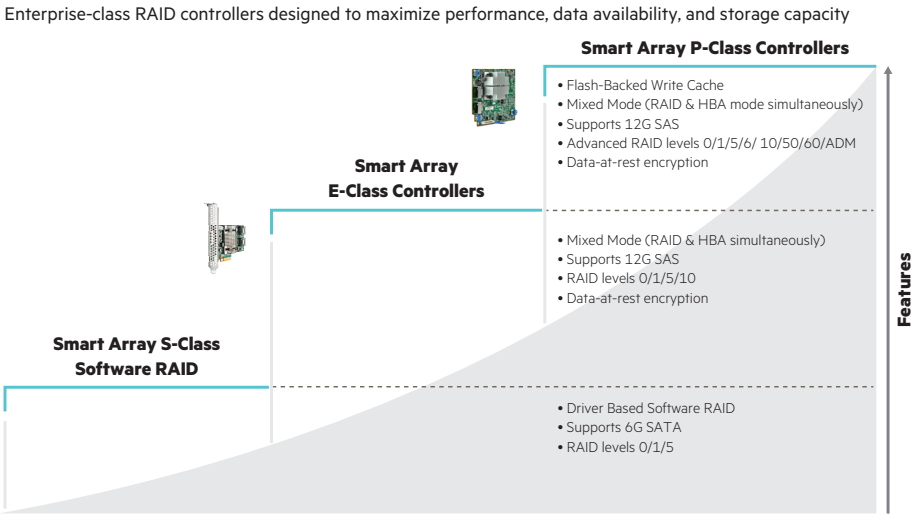


Figure 5. HPE Smart Array Gen10 Controllers

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, and Apollo servers and Synergy Compute Modules. Key features include ROC (RAID on Chip) and

[2], [3], [4] HPE Internal Lab Testing comparing HPE Gen9 to Gen10 Smart Array Controllers, January 2017.

[5] Based on Gen9 vs. Gen10 with 256 KB sequential writes.

[6] Based on internal HPE testing comparing the Gen9 solution to using the UEFI Configuration Tool saves approximately three minutes, May 2017.

RAID levels 0/1/5/10. You also get added flexibility with mixed mode capabilities, security with HPE Smart Array SR Secure Encryption, and simplicity with the UEFI configuration tool.

Maximize the performance of enterprise-class server storage with **HPE Smart Array P-Class Controllers**. These controllers are supported on HPE ProLiant Rack, Tower, BladeSystem, and Apollo servers and Synergy Compute Modules. 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 UEFI configuration tool are also included.

HPE Smart Array SR Secure Encryption
Gain broad encryption coverage and comply with regulations for sensitive data, such as HIPAA and Sarbanes-Oxley with HPE Smart Array SR Secure Encryption—a FIPS 140–2 Level 1 validated enterprise-class controller-based encryption solution for data-at-rest on all SAS/SATA drives. The solution is available for both local and remote deployments.

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. It 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, but can still realize better performance with a minimal number of SSDs in your configuration.

The HPE Server Storage portfolio can help 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 Persistent Memory

Increase the performance of your database and analytics applications

For more information, visit
hpe.com/info/persistentmemory

HPE Persistent Memory is the technology of the future for data-intensive workload computing, delivering the performance of memory with the persistence of traditional storage. If you're looking for offerings that give you faster access to your data so you can reach faster business decisions, look no further. Faster access to data means you get the answer you need more quickly, to gain an advantage against competitors and even increase revenue potential—all at a lower TCO.

Hewlett Packard Enterprise was first in the market with the practical implementation of persistent memory server technology and is the partner you can trust now and in the future.

Performance of Memory—Persistence of Storage

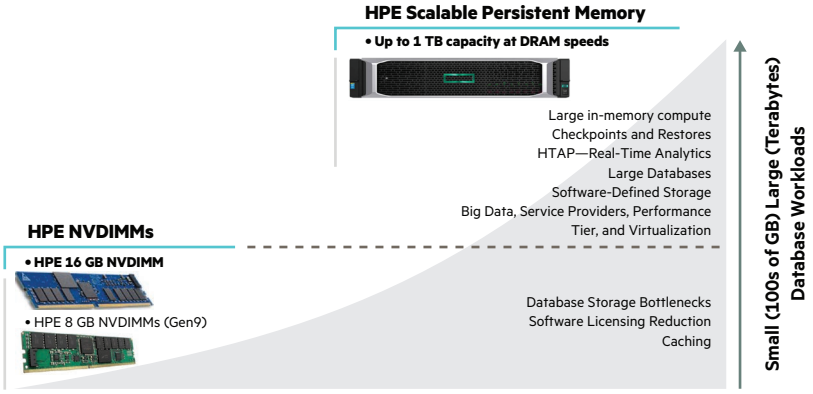


Figure 6. HPE Gen10 Persistent Memory Portfolio

HPE NVDIMMs

The HPE 8 GB NVDIMM was the first product in the HPE Persistent Memory portfolio. It was designed for HPE ProLiant Gen9 servers featuring Intel Xeon® E5-2600 v4 processors. The first two servers supporting HPE NVDIMMs were the HPE ProLiant DL360 and DL380 Gen9 servers.

HPE next-generation NVDIMM is 16 GB, double the capacity of the first generation. With up to 384 GB capacity in a single server, HPE NVDIMMs improve application performance by reducing traditional storage hardware bottlenecks like write latency.

HPE NVDIMMs are ideal for accelerating databases and analytics workloads, and are complementary to existing storage technology, such as SSDs. HPE NVDIMMs are one of the fastest tiers of storage on HPE ProLiant servers. HPE NVDIMMs can also benefit other workloads and applications where traditional storage bottlenecks would benefit from the lower latency storage tier of HPE Persistent Memory.

Additionally, HPE NVDIMMs have the resiliency you have come to expect from storage technology by utilizing higher endurance DRAM and components that help verify data is moved to non-volatile technology in the event of a power loss. You have the added assurance that data will be preserved and is recoverable after an outage. HPE NVDIMMs include a flash component plus an HPE Smart Storage Battery that provides you with a persistent storage capability at memory speeds without the data volatility of memory.[7]

HPE NVDIMM hardware is only half of the puzzle—with the other half being the software ecosystem enablement we are driving in the industry. Hewlett Packard Enterprise is working directly with software application and operating system partners to develop the software ecosystem for HPE Persistent Memory to verify that you can take full advantage of the performance potential of this exciting new technology.

HPE Scalable Persistent Memory

The newest addition to the HPE Persistent Memory portfolio is HPE Scalable Persistent Memory, an integrated storage solution that runs at memory speeds with terabyte capacity unlocking new levels of compute performance with built-in persistence for your business workloads.

HPE Scalable Persistent Memory is the right offering to transform your IT infrastructure, providing new levels of performance while still delivering high levels of reliability and efficiency.

How does HPE Scalable Persistent Memory work? First, we reserve a portion of DRAM as persistent memory for application acceleration. DRAM is the media used on server memory DIMMs. As an enterprise-class technology and the fastest technology on the memory bus, DRAM is the best choice for application acceleration. It's also volatile, which means data is only retained when DRAM has a power source.

[7] Based on the NVDIMM utilizing NAND Flash as a persistent store and the HPE Smart Storage Battery providing the backup power source to move data from DRAM to NAND Flash.

> "With the use of predictive analytics across the application-to-storage stack, media companies can pinpoint problems faster, stop the finger pointing, and avoid time-wasting disruption. Time is money, and being able to restore operations 20 times faster with Scalable Persistent Memory is huge for our customers."
>
> – Dr. Glodina Connan-Lostanlen, CMO, Imagine Communications

Imagine COMMUNICATIONS

We use Flash technology, the same media used by solid-state devices, as a persistent store for the data accelerated on DRAM. Data running on the persistent memory DRAM portion moves to flash when the server is powered down. A backup power source holds power up on the memory bus to facilitate moving data from DRAM to Flash. All of this functionality is controlled by HPE server BIOS using industry-standard components you have deployed in your data center.

What can HPE Scalable Persistent Memory deliver for your business workloads?

- First, HPE Scalable Persistent Memory delivers the fastest persistent memory in the market at scale. Higher capacity persistent memory running at DRAM speeds, means opening up many possibilities for enhancing business workload performance. Larger in-memory compute can help eliminate storage bottlenecks with in-memory databases.
- With HPE Scalable Persistent Memory, checkpoints operations can now save to larger persistent memory. This helps improve overall application performance with up to 27X faster application checkpoint operations.[8]
- Faster restores are a reality as well with HPE Scalable Persistent Memory, up to 20X faster than restoring from Flash media alone.[9]
- HPE Scalable Persistent Memory also enables faster real-time analytics through HTAP and enhanced caching tiers for software-defined storage.

HPE Scalable Persistent Memory can be used to unlock storage bottlenecks in most applications and help you conduct business more quickly. Put your vital business data to work for you faster with HPE Scalable Persistent Memory.

HPE Server Networking

Choose your bandwidth, simplify your infrastructure, and network with confidence

Network adapters, transceivers, and cables are the data and storage fabric that hold the server and data center infrastructure together. For any given workload, the Right Mix of performance and cost with reliability and security are paramount. Whether purchasing a new HPE ProLiant server platform or upgrading your existing infrastructure with the latest server configuration, **HPE Server Networking** has your network covered.

- **Choose your bandwidth**—From 1 Gbps to 100 Gbps and beyond, HPE adapters are available for every SMB, cloud, Oracle enterprise manager, Telco, or enterprise server workload
- **Simplify your infrastructure**—HPE innovations such as 25/100GbE combined with Converged Network Adapters (CNAs), RDMA over Converged Ethernet (RoCE v2), and virtualization features make the hybrid converged infrastructure a reality—today
- **Network with confidence**—**HPE ProLiant Server Networking** options have end-to-end reliability and compatibility; all are tested and qualified to rigid HPE quality standards and guaranteed to work seamlessly with trusted HPE ProLiant servers with enhanced security features

HPE Server Networking delivers:

- **Performance**—Improve network bandwidth and lower latency with HPE's broad Ethernet-enhanced network adapters portfolio
- **Reliability and security**—Eliminate downtime and ensure seamless integration with servers through rigorous qualification and testing. Monitor health with HPE iLO, and avail critical software updates and latest security features to protect, detect, and recover from a cyberattack
- **Efficiency**—Optimize workload with HPE software-defined features, from virtualization to network partitioning, boosting application performance

Performance, efficiency, reliability, and security are designed into HPE Server Networking products for a secure and end-to-end ecosystem experience.

[8] TPC-C Benchmark Throughput with Checkpoint (trans/sec). Calculated Time to Checkpoint and Restore a Docker Container running MySQL, compare Persistent memory vs. SSD, November 2016.

[9] HPE Internal Lab test. HPE Scalable Persistent Memory, restarting 1000 GB Hekaton Database is as fast as restarting 200 GB database or 20X, March 31, 2017.

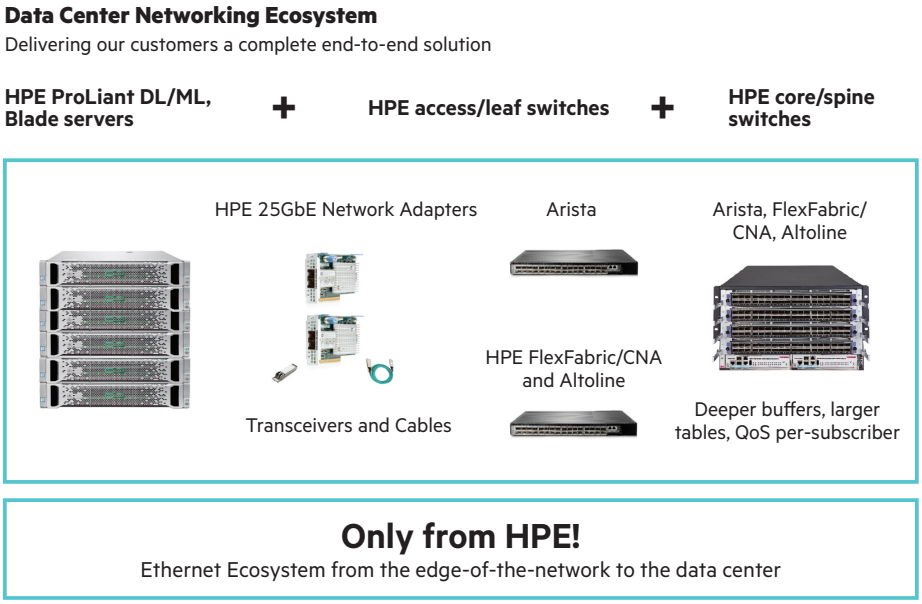


Figure 7. From the switch to the adapter inside your Server, HPE offers end-to-end branded Networking Solutions

HPE Network Adapters

Standard Series HPE Network Adapters

Enable a cost-effective Ethernet solution for your current HPE ProLiant server workload needs. The economic scalability of these adapters contains functionality like Single Root I/O virtualization (SR-IOV) for increased performance via direct access to hardware from a virtual environment. Other benefits include:

- **Efficiency**—Meets price/performance goals for 1GbE and 10GbE core enterprise workloads
- **Trusted quality**—Reliable and integrated into HPE ProLiant platform infrastructure
- **Virtualization**—The SR-IOV feature enables basic virtualization for expanding network fabric
- **NPAR**—Network partitioning allows you to design "right size" datapaths for better efficiency
- **Ethernet**—All our HPE adapters meet the IEEE 802.3 standard for local area networks
- **Security features**—Such as authenticated FW updates with Digitally Signed FW and UEFI Secure boot

Advanced Series HPE Network Adapters

Simplify your network and storage topology to build the new hybrid server infrastructure using converged network adapters. HPE CNA architecture leads the industry with the configurable flexibility needed from basic Ethernet NIC functionality to advanced features like Fibre Channel over Ethernet (FCoE).

- **CNA**—Cost effective software and hardware solutions and features, including storage offloads which leverages onboard chip vs. the motherboard CPU, in keeping with the newest performance I/O speed
- **FCoE**—Reduces the number of network interface cards required to connect to disparate storage and IP networks, the number of cables and switches, and power and cooling costs
- **Security features**—Firmware Root of Trust, device-level firewall and audit logs

Performance Series HPE Network Adapters

The Performance Series delivers even higher bandwidth at a lower latency, with several choices for boosting I/O bandwidth for your most demanding application workloads. These

expressly fast adapters can maximize packet throughput and workload performance with the Data Plane Development Kit (DPDK) support. The new 25GbE adapters are tuned to work with the latest 10/25/50/100 Ethernet standards and with HPE Networking Top-of-the-Rack switches. These new 25GbE adapters maximize performance while auto negotiating down to 10 Gbps or up to 25 Gbps. In addition, using a 25GbE enabled server can reduce TCO up to 27% over a 10GbE server infrastructure while increasing bandwidth by 56%.

- **Multispeed**—10/25/50/100 Gbps: The latest adapter cards are the 25GbE adapters that enable optimal PCIe slots usage to reduce the total number required to build a 25/50/100 Gbps infrastructure with future support to include speeds beyond 100 Gbps using 8 lanes for 400 Gbps.
- **RDMA over Converged Ethernet (RoCE)**—Network-intensive applications like networked storage or cluster computing need a network infrastructure with a high bandwidth and low latency. The advantages of RoCE over other strategies are lower latency, lower CPU load and higher bandwidth.
- **DPDK**—The DPDK allows software-based customization and optimization of network performance by using polling instead of traditional interrupt-driven network processing.
- **Security features**—HW Root of trust to create Chain of Trust for DS Firmware Authentication. Sanitization (Secure User Data Erase) renders User and configuration data on the NIC irretrievable so that NICs can be safely repurposed or disposed.

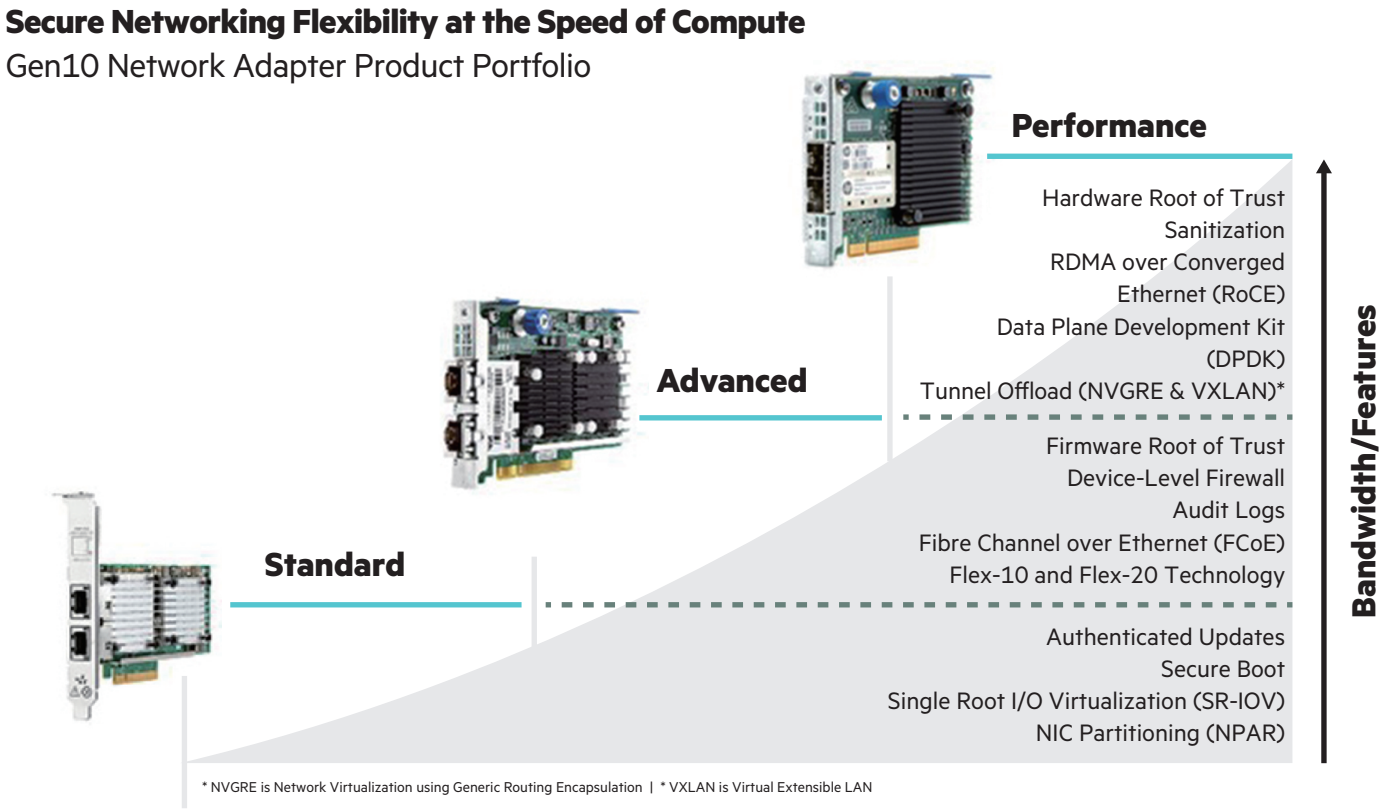


Figure 8. Network Adapter Cards by Bandwidth and Feature Set

HPE Transceivers and Cables

Transceivers and cables play an important role in data center infrastructure management. They support Ethernet connection for SMB, traditional enterprise, telco, and cloud customers, providing cost-effective transceiver/cable solutions with various speed, form factors, connection distances, and signal transduction media. HPE Server Options also include the copper and optical cabling needed to connect your networking. As with all HPE Server Options, transceivers and cables are also tested with network adapters to ensure 100% compatibility with the chosen server platform.

Table 1. Transceivers and Cables for your Networking Connectivity

	Small Form-Factor Pluggable (SFP)	**Enhanced Small Form-Factor Pluggable (SFP+)**	**Enhanced Quad Small Form-Factor Pluggable (QSFP+)**	**SFP and Quad Small Form-Factor Pluggable (SFP/QSFP)**
	Support 1 Gb Ethernet	Support 10 Gb Ethernet	Support 40 Gb Ethernet	Support 25/100 Gb Ethernet
Transceivers	RJ-45 SX	SFP+: • SR • LR • LRM • 10GBASE-T	QSFP+: • MPO SR4 100 m • MPO SR4 300 m • LC LR4	SFP28: • SR 100 m QSFP28: • SR4 100 m
Cables		DAC: • 10 Gb to 10 Gb: 0.35 m, 1 m, 3 m, 5 m, 7 m	DAC: • 40 Gb to 40 Gb: 0.35 m, 1 m, 3 m, 5 m, 7 m • 40 Gb to 4 x 10 Gb breakout: 3 m, 5 m AOC: • 40 Gb to 40 Gb: 7 m, 10 m, 15 m • 40 Gb to 4 x 10 Gb breakout: 7 m, 10 m, 15 m	DAC: • 25 Gb SFP28 to SFP28 DAC: 0.5 m, 1 m, 3 m, 5 m • 100 Gb QSFP28 to 4 x 25 Gb SFP28 DAC 3 m, 5 m • 100 Gb QSFP28 to QSFP28 DAC 0.5 m, 251 m, 3 m, 5 m

HPE Rack and Power Infrastructure

For more information, please visit
hpe.com/info/rackandpower

Smarter infrastructure means smarter business

Your data center's job is to provide the foundational agility and compute power to support your business and enable your customers. HPE Rack and Power Infrastructure provides configurable, state-of-the-art infrastructure solutions, out of the box, that are able to meet the needs of businesses of all sizes, now and in the future.

The demand for data center infrastructure is growing. Big Data and analytics, mobility, the Internet of Things, and social media drive the digital transformation taking place in business. At HPE, we identified key business challenges you face today—density optimization, power and cooling, security, ease of use, and interoperability—and used them to create an improved infrastructure to drive better business. HPE understands these challenges, and we've reimagined the future of rack and power infrastructure from the ground up to make the next generation of infrastructure stronger, smarter, and simpler.

HPE Racks

Today, IT is looked upon as an enabler and driver of business outcomes. But that doesn't usually come with a commensurate increase in budget and floor space. Whether you're just looking into getting your first server rack, or researching advanced, high-density options for your enterprise data center, HPE Racks offer you an amazing range of features and options designed to satisfy your business needs and fit within your IT budget.

You can choose from a variety of models up to 48U, 800 mm wide, and 1,200 mm deep—and then add standard options to customize your rack for your exact IT requirements. From the 80% open perforation front door—to optimize airflow—to flexible power distribution units (PDUs) and installation options, HPE Racks are designed to accommodate HPE and third-party servers and equipment with minimal cabling, and still facilitate airflow and equipment access.

With the exponential increase in business critical and confidential data that traverses the internet and is stored on- and off-premises, security is foremost on everyone's mind. In many cases, stringent corporate, industry, and government regulations dictate the security provisions required of a data center. So it goes without saying that the more secure your rack and power infrastructure the more secure your server, storage, and networking.

How secure? How about multifactor authentication with options like fingerprint biometric scanners, wireless card readers and digital keypads before you ever even get into the rack.

Of course, HPE Racks are optimized to the size and dimensions of HPE servers to offer a complete data center solution from a name you trust. In fact your complete HPE solution—from racks and power infrastructure to servers and networking equipment—is designed to work together for easy installation and manageability.

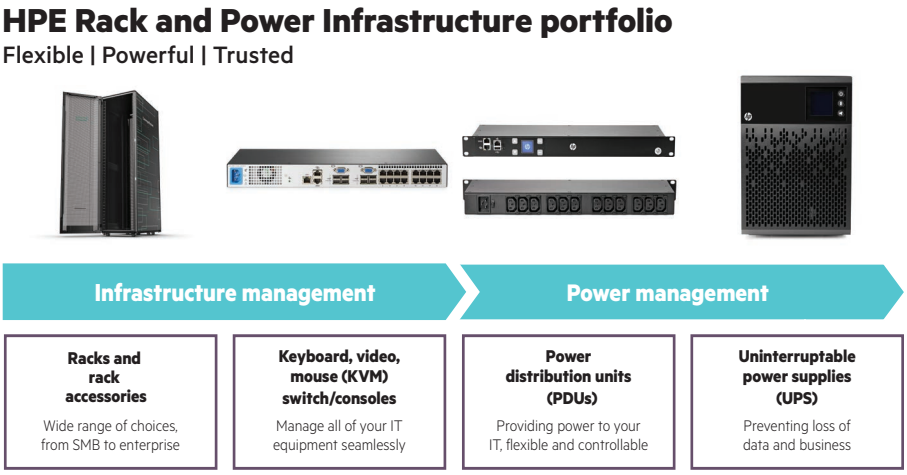


Figure 9. HPE Rack and Power Infrastructure portfolio, visit the online **HPE Power Advisor**

HPE Keyboard/Video/Mouse

Running data centers is a 24x7 operation. HPE Keyboard/Video/Mouse (KVM) switches allow you to check in on your IT operations whenever and from wherever. HPE's KVM solutions enable you to communicate with all your installed IT equipment and manage any device locally or remotely from a single console.

Analog switches allow for local, direct access to equipment in your data center while our IP-based switches add remote configurability at the rack, row, and data center level.

Should your needs change, many of our analog switches are easily upgraded to IP-based capabilities through the addition of a USB remote access key. Arguably the most important piece of hardware in the server management process, there's an HPE KVM switch to fit your application with a wide variety of port quantities available.

To provide easy access to your KVM switch, HPE KVM consoles plug into your switches and serve as a dashboard for your entire rack—or even your entire data center. Easily accessible, comprehensive status data for each individual server, storage, and networking device enables you to pinpoint problems quickly and accurately, saving you time and minimizing unit downtime.

Of course, this efficiency carries over to the console itself. It will go to sleep whenever you're not using it, saving power for what matters—your data center and business. A display port comes standard with all HPE KVM consoles, facilitating easy sharing of the data and a cut above industry-standard VGA ports you'll find elsewhere. And the best part? Our 1U switches and consoles are form factor optimized, leaving more room for servers, compute power for your data center, and growth for your business.

HPE Power Distribution Units

No matter what pieces of equipment you add to your rack, they all have one thing in common—they need power.

Secure, intelligent, and flexible power distribution is foundational to a safer and more efficient data center. Across a variety of workloads, our Standard, Advanced and Enterprise PDU solutions get power where it needs to go, when it needs to get there—and give you the data you need to make informed management decisions along the way.

Our next-generation PDUs are designed to be smarter, to get power where you need it to go—and keep it there. Innovative features like optional dual-locking power cords secure the PDU to both power source and device, protecting against disconnection—accidental or intentional.

Our next-generation PDUs are designed to be stronger, with a 3-year warranty, and power continuity and maintained performance at elevated temperatures like a 60-degree centigrade operating temperature for more performance and less cooling costs.

HPE G2 Power Distribution Unit (PDU) is designed to be simpler, with a wide range of mounting options to fit every application. Power where you need it, plus more room for compute, and the highest-density PDUs on market means more power and less headache for even the most demanding compute applications. Our PDU options are available in both single-phase and three-phase configurations. Our PDUs can be mounted vertically or horizontally with minimal time and effort required for installation. HPE metered PDUs monitor the power consumption of each individual server to ensure balanced loads and operation within power thresholds, while optional environmental sensors ensure you'll be the first to know if something is amiss. If you require the ability to remotely power cycle IT equipment in your racks, try our HPE metered, switched, and intelligent PDUs—all you'll need to control power usage in your data center, down to the individual outlet level, is an internet connection. Guarantee quality power distribution and empower control with HPE PDUs.

HPE Uninterruptable Power Supplies

So you've invested in a new data center and infrastructure. What happens when you experience your first power outage? Data center outages can be taxing on your IT resources and catastrophic for your business. Take worry out of the equation with HPE Uninterruptable Power Supplies (UPS).

HPE's UPS solutions protect against power issues. They provide enough time to gracefully shut down connected IT loads or ride through short-lived power problems, helping ensure you don't lose any data and can restart with confidence when power returns.

Available in both tower and rack configurations, as well as density-optimized configurations to fit most any setup, our UPS systems are as reliable as they are scalable. Optional Extended Runtime Modules can be added to increase your backup time by a factor of 10, ensuring you're covered until the power comes back on. When available power supply fluctuates outside of acceptable limits, your UPS activates in anticipation of a total outage, ensuring a seamless transition and no downtime. Protect your investments by protecting your data center with HPE UPS.

Visit the online **HPE Power Advisor**

HPE Power Advisor

As IT evolves and system density increases, systems housed in a single rack can now consume the amount of power once required for several racks. Effective sizing of a compute infrastructure while managing IT costs requires realistic estimates of current and future power and cooling requirements. Accurately estimating the power consumption of a server can define power distribution requirements at the rack level and can be the starting point for estimating the total power consumption and cooling needs for a data center. The HPE Power Advisor is an easy-to-use tool that estimates data center power requirements for server and storage configurations. HPE Power Advisor allows you to configure each individual server or node. You can then duplicate the server configuration as often as necessary to populate an enclosure, and then duplicate it to populate a rack. The result is you can build a complete data center quickly. Version 7.x includes the new HPE ProLiant Gen9 servers and options.

Features of the HPE Power Advisor:

- Accurately estimate power consumption of your HPE server and storage products
- Select the appropriate power supplies and other system components
- Configure and plan power usage at a system, rack, and multirack level
- Access useful tools including a cost-of-ownership calculator, power report, and bill of materials
- Both a downloadable and online Microsoft® Windows® application is available. The Power Advisor online tool supports Google™ Chrome and Mozilla Firefox

For more information, visit
hpe.com/info/powersupplies

HPE Power Supplies

Efficiency drives productivity. HPE Power Supplies help your servers—and your business—go further

HPE Power Supplies offer high-efficiency power options available in multiple input and output options, allowing you to "right size" a power supply for specific server/storage configurations and environments. This flexibility helps to minimize power waste, lower overall energy costs, and avoid trapped power capacity in the data center.

HPE Standard Power Supplies

HPE Standard Power Supplies for Gen9

HPE Entry-level Power Supplies offer an optimized set of features for most HPE ProLiant DL/ML 10/100 Gen9 series servers, with options for both redundant and non-redundant power configurations. The HPE 550W FIO Power Supply offers Silver-certified 80 Plus power efficiency (up to 89%) with an optimized set of features for non-redundant power configurations. The HPE 900W AC 240VDC Power Input Module with Power Backplane can be configured to support power redundancy in HPE ProLiant servers that offer only a single power supply bay, providing additional protection against power loss. With an 80 Plus Gold power efficiency rating (up to 92%), this power option helps reduce operating expenses while protecting against trapped power capacity in the data center. Hot-plug AC 240 VDC power input modules enable better serviceability with fast and easy deployment and replacement.

HPE Standard Power Supplies for Gen10

HPE Entry-level Power Supplies offer an optimized set of features for most HPE ProLiant DL/ML 10/100 and ML350 Gen10 series servers, with options for both redundant and non-redundant power configurations. The HPE 500W FIO Power Supply offers Gold-certified 80 Plus power efficiency (up to 92%) with an optimized set of features for non-redundant power configurations. Gen10 DL/ML 10/100 customers can also choose to upgrade to an advanced power supply with the HPE Flex Slot products.

HPE Advanced Power Supplies

HPE Common Slot Power Supplies

HPE Common Slot Power Supplies share a common electrical and physical design that allows for hot-swap, tool-less installation into HPE server and storage solutions. High-efficiency options rated for up to 94% (Platinum/Platinum Plus) are available for many ProLiant Gen8 and ProLiant Gen9 DL500 series servers. Most options also support HPE Power Discovery Services via embedded power line communication technology. This feature enables each server to communicate identification, location, and power-related data to the HPE Intelligent PDU in the rack, which can then be shared with HPE Insight Control to manage power usage and efficiency in the data center.

HPE Flexible Slot Power Supplies

HPE Flexible Slot Power Supplies provide up to 96% power efficiency with 80 Plus Titanium-certified power supplies that lower server power requirements and reduce power waste in your data center. Flexible Slot Power Supplies have a form factor that is 25% smaller than previous generation common slot power supplies, providing more space to add additional Server Options and improve the performance of your servers. Flexible Slot Power Supplies provide fast, tool-less, hot-plug access to server power supplies for greater Serviceability.

HPE Flexible Slot Power Supplies are supported in the following Gen9 servers: DL360, DL380, ML350, and Apollo. Gen10 servers utilize the new Gen10 Low Halogen Flex Slot power supplies for Gen10 DL360, DL380, DL560, DL580, ML350, ML/DL 10/100, and Apollo servers. Gen9 and Gen10 Flexible Slot Power Supplies are not interchangeable.

Additionally the Gen10 ProLiant DL380 now offers the option of the HPE Scalable Persistent Memory 800W Flex Slot PSU with integrated 400W Battery Backup Unit.

HPE Performance Power Supplies

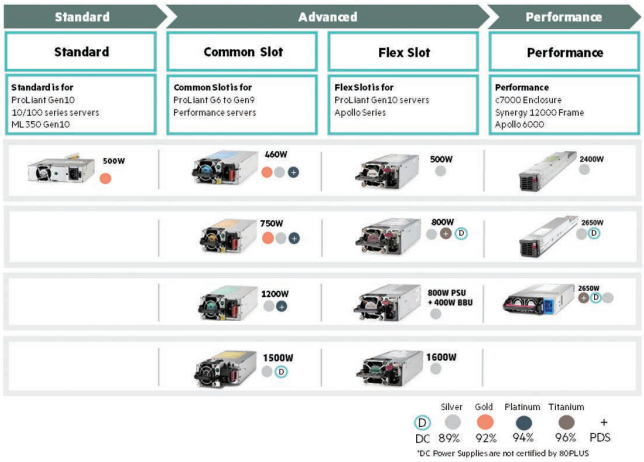
HPE Performance Power Supplies for Synergy 12000 Frame

HPE High-Output Power Supplies provide highly efficient and flexible power options that are specifically designed for the HPE Synergy 12000 frame. The Synergy 12000 frame can support up to six Titanium (96%) 80 Plus-certified power supply options, providing high-efficiency power solutions that lower your power requirements and decrease data center operating costs. Each power option supports hot-plug installation and removal, providing fast, tool-less access to your Synergy 12000 frame power supplies. Support for HPE Power Discovery Services allows you to automatically map the power topology inside your rack, speeding implementation time and greatly reducing the risk of human errors that can cause power outages.

HPE Performance Power Supplies for HPE BladeSystem c7000

HPE High-Output Power Supplies provide highly efficient and flexible power options that are specifically designed for the HPE BladeSystem c7000 enclosure. The c7000 enclosure can support up to six Platinum (94%) 80 Plus-certified power supply options, providing high-efficiency power solutions that lower your power requirements and decrease data center operating costs. HPE High-Output Power Supply options provide you with the ultimate flexibility of operating in different data center power infrastructure environments with multiple options for AC and DC power input voltages. Each power option supports hot-plug installation and removal, providing fast, tool-less access to your c7000 enclosure power supplies. Support for HPE Power Discovery Services is added by selecting a Platinum power option, allowing you to automatically map the power topology inside your rack, speeding implementation time, and greatly reducing the risk of human errors that can cause power outages.

HPE Gen10 Power Supply Offering



HPE Gen9 Power Supply Portfolio

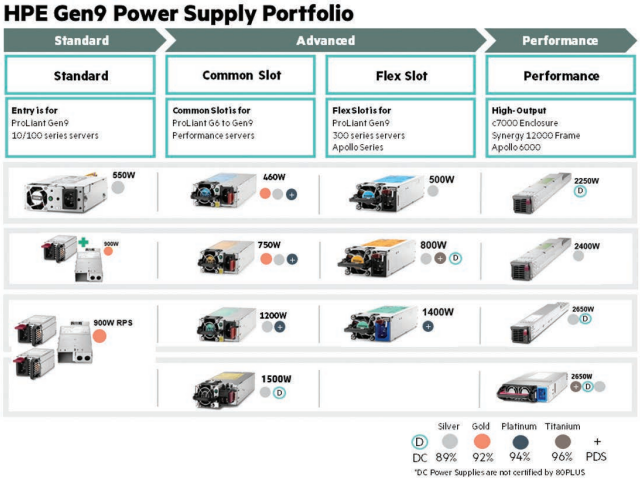


Figure 10. HPE Power Supplies portfolio

HPE Service and Support

Unlock the benefits of your investment and protect it beyond warranty

For more information, visit
hpe.com/services/getconnected

Warranty and Support Services will extend to include HPE Server Options configured with your server or storage device. The price of support service is not impacted by configuration details. HPE sourced options that are compatible with your product will be covered under your server support at the same level of coverage, enabling you to upgrade freely. Installation for HPE Server Options is available as needed. To keep support costs low, some high value options will require additional support. Additional support is only required on select high-value HPE Workload Accelerators, fiber switches, InfiniBand, and UPS batteries over 12 kVA. See the specific high value options that require additional support on the **HPE Care Pack Services coverage for HPE ProLiant Options**.

Protect your business beyond warranty with HPE Support Services

HPE Pointnext delivers confidence, reduces risk, and helps you realize agility and stability. Connect to Hewlett Packard Enterprise to help prevent problems and solve issues faster. **HPE Support Services** enable you to choose the right service level, length of coverage, and response time as you purchase your new server, giving you full entitlement to the support you need for your IT and business.

- HPE Foundation Care provides ongoing hardware and software support for your server and industry-leading third-party software.
- We recommend HPE Proactive Care Services to proactively address issues before they become problems, improve first-time fix rates, and reduce unplanned downtime.
- To cover your entire data center, HPE recommends HPE Datacenter Care Services, which provide flexible, proactive services and hardware and software support. We can tailor the service to your needs with building blocks of additional features such as spare parts management, multivendor support, and the innovative capacity management of HPE Flexible Capacity Service.

Connect your devices

Unlock all of the benefits of your technology investment by connecting your products to Hewlett Packard Enterprise. Reduce downtime, increase diagnostic accuracy and have a single consolidated view of your environment. By connecting, you will receive 24x7 monitoring, prefailure alerts, automatic call logging, and automatic parts dispatch. HPE Proactive Care Service and HPE Datacenter Care Service customers will also benefit from proactive activities to help prevent issues and increase optimization. All of these benefits are already available to you with your server storage and networking products, securely connected to HPE support.

Learn more at
hpe.com/info/serveroptions

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

Sign up for updates

4AA5-6065ENN, December 2017, Rev. 5