HPE Server Options
High-performance, reliable, secure, and efficient components for accelerating HPE servers
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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 cloud, to drive the right business outcomes. Historically, hybrid cloud 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. 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**—Industry leading persistent memory technology that delivers the performance, resiliency, and efficiency required of data-intensive applications.

• **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.

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1 Based on external firm conducting cybersecurity penetration testing of a range of server products from a range of manufacturers, May 2017.
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
HPE Server 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 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 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 or Arm® servers.

HPE SmartMemory:

- Operates at 2933 MT/s data transfer speeds with Gen10 memory subsystem bandwidth, 81% faster than 2400 MT/s in Gen9 servers, increasing performance for memory-intensive applications
- Uses HPE 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

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 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

HPE Standard Memory:

- Provide resolutions to memory-related problems
- Provides the highest quality memory in the industry
- Lowers power consumption, liberating IT budget
- Offers high-capacity RDIMM and LRDIMM offerings
- Offers high-quality memory at the right price
- Ensures memory is optimized for every HPE server
- Performs to industry-defined specifications
- Provides lower memory capacity solutions

**HPE Server Storage**

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

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 hours² 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 HDDs deliver proven performance and reliable data integrity at the lowest cost per gigabyte. Most drives feature the HPE SMART Carrier with intuitive report to 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.
Family guide

Midline—7.2K
High capacity, high availability applications such as bulk storage, backup, archive, and reference
Up to 12 TB

Entry—7.2K

Boot and backup
Up to 4 TB

High capacity, high availability applications such as bulk storage, backup, archive, and reference
Up to 12 TB

Enterprise—10K

Mission-critical high I/O workloads
Highest levels of performance and availability for enterprise-class—storage such as transaction processing, database applications, and high-performance computing
Up to 2.4 TB

Enterprise—15K

Mission-critical high I/O workloads
Highest levels of performance and availability for enterprise-class—storage such as transaction processing, database applications, and high-performance computing
Up to 900 GB

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 3. Proven performance for every workload with HPE HDDs

Figure 4. HPE Solid-State Drives
HPE NVMe 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 SR 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—while using up to 45% less power 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.

Enterprise-class RAID controllers designed to maximize performance, data availability, and storage capacity

Features

- Flash-Backed Write Cache
- Mixed mode (RAID & HBA mode simultaneously)
- Supports 12G SAS
- Advanced RAID levels 0/1/5/10/50/6/60/ADM
- Data-at-rest encryption
- Supports up to 24 internally attached SAS or SATA drives without the need for a SAS expander
- Mixed mode (RAID & HBA simultaneously)
- Supports 12G SAS
- RAID levels 0/1/5/10
- Data-at-rest encryption
- Driver-based software RAID
- Supports 6G SATA
- RAID levels 0/1/5

Note: Check HPE Smart Array Controller QuickSpecs for specific product features

Figure 5. HPE Smart Array Gen10 Controllers

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1, 2, 3 HPE Internal Lab Testing comparing HPE Gen9 to Gen10 Smart Array Controllers, January 2017

4 Based on Gen9 versus Gen10 with 256 KB sequential writes

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

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 or HPE Smart Array MR CacheCade 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.

**New Smart Array MR Controller**

Maximize connectivity and increase performance with the new HPE Smart Array P824i-p MR Controller. It supports up to 24 internally attached SAS or SATA drives on a single controller without having to use a SAS expander card. This newest member of the Smart Array portfolio supports RAID levels 0/1/5/6/10/50/60 and enables long-term data retention with 4 GB flash-backed write cache. It supports HPE Smart Array MR Fast Path which accelerates solid-state drive (SSD) performance for random read/write workloads and also supports HPE Smart Array MR CacheCade which caches hot data from hard disk drives onto higher performing SSDs. Use HPE MR Storage Administrator to monitor, maintain, and troubleshoot this controller and associated drives.

**HPE Persistent Memory**

Increase the performance of your database and analytics applications

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.

For more information, visit [hpe.com/info/persistentmemory](http://hpe.com/info/persistentmemory)
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.

Our current NVDIMM offering, the HPE 16 GB NVDIMM, is supported on first generation Intel Xeon Processors on HPE ProLiant, Synergy, and BladeSystem Gen10 servers. 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.

HPE NVDIMMs are ideal for accelerating databases and analytics workloads, and are complementary to existing storage technology, such as SSDs. HPE NVDIMM is 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.

HPE NVDIMMs:
- DRAM-level performance for fastest performing persistent memory
- Up to 192 GB total capacity in a single server
- HPE Smart Storage battery for backup power
- 2X the capacity of first generation HPE NVDIMMs

HPE Persistent Memory

New HPE Persistent Memory, available in 128, 256, and 512 GB modules, features Intel® Optane™ DC Persistent Memory and is supported on the second generation of Intel Xeon Scalable processors. HPE Persistent Memory is the next step in the evolution of persistent memory and provides fast, high capacity, cost-effective memory and storage.

This new persistent memory product will transform Big Data workloads and analytics possibilities in the data center by enabling data to be stored, moved, and processed at unprecedented speed.

### Memory mode
- For virtualized database deployments and Big Data analytics applications
- Performance comparable to DRAM at low latencies
  - High capacity
  - Lower cost when compared to DRAM

### App Direct mode
- For in-memory databases and in-memory analytics applications
- Data persistence with higher capacity than DRAM
  - Low latency persistence
  - High availability/less downtime

### Mixed mode
- Capacity is split between Memory mode and App Direct mode

HPE Persistent Memory is the first persistent memory product that offers two different operating modes—Memory mode and App Direct mode. Customers can choose which operating mode to enable, and can even partition the persistent memory module to operate in different modes simultaneously.

HPE Persistent Memory:
- Flexibility to be used as large capacity memory or fast storage
- Capacities up to 3 TB per socket
- Up to 1.2X more virtual machines
- Greater capacity/dollar than DRAM alone
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 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.

**Data center networking ecosystem**
Delivering our customers a complete end-to-end solution

HPE ProLiant DL/ML, Blade servers + HPE access/leaf switches + HPE core/spine switches

**Figure 6.** 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
• 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 adapter 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 versus 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 adapter irretrievable so that adapters can be safely repurposed or disposed.
Secure Networking Flexibility at the Speed of Compute
Gen10 Network Adapter Product Portfolio

Performance
- RDMA over Converged Ethernet (RoCE)
- Data Plane Development Kit (DPDK)
- Tunnel Offload (NVGRE & VXLAN)*
- Includes Standard & Advanced features
  - Hardware Root of Trust
  - Sanitization
- Fibre Channel over Ethernet (FCoE)
- Flex-10 and Flex-20 Technology
  - Includes Standard features
    - Firmware Root of Trust
    - Device-Level Firewall
    - Audit Logs
- Single Root I/O Virtualization (SR-IOV)
- NIC Partitioning
- Authenticated Updates
- Secure Boot

* NVGRE is Network Virtualization using Generic Routing Encapsulation  
* VXLAN is Virtual Extensible LAN

Figure 7. 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

<table>
<thead>
<tr>
<th>Transceivers</th>
<th>Small form-factor pluggable (SFP)</th>
<th>Enhanced small form-factor pluggable (SFP+)</th>
<th>Enhanced quad small form-factor pluggable (QSFP+)</th>
<th>SFP and quad small form-factor pluggable (SFP/QSFP)</th>
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<td>• 40 Gb to 4 x 10 Gb 3m</td>
<td>• 100 Gb QSFP28 4x25 Gb 3m</td>
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<tr>
<td></td>
<td></td>
<td>• 40 Gb QSFP+ 7m, 15m</td>
<td>• 100 Gb QSFP28 1m, 3m, 5m</td>
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DAC: Data Access Cockpit
AOC: Active Optical Cable
HPE Rack and Power Infrastructure

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.

For more information, please visit hpe.com/info/rackandpower
HPE Rack and Power Infrastructure portfolio

Flexible | Powerful | Trusted

Customer Focused Products

<table>
<thead>
<tr>
<th>Series</th>
<th>Standard</th>
<th>Advanced</th>
<th>Enterprise</th>
</tr>
</thead>
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<tr>
<td>Racks and Rack Accessories</td>
<td>Wide range of choices, from SMB to Enterprise</td>
<td>Update Coming in 2019</td>
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<tr>
<td>Keyboard, Video, Mouse (KVM)</td>
<td>Manage IT equipment seamlessly</td>
<td>Update Coming in 2019</td>
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<td>Switch/Consoles</td>
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<tr>
<td>Power Distribution Units (PDU)</td>
<td>Providing power to your IT, flexible &amp; controllable</td>
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<td></td>
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<tr>
<td>Uninterruptible Power Systems (UPS)</td>
<td>Preventing loss of data and business</td>
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Figure 8. HPE Rack and Power Infrastructure portfolio, visit the online HPE Power Advisor

HPE IT Management

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 IT Management 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 IT Management switch to fit your application with a wide variety of port quantities available.

To provide easy access to your KVM switch, HPE IT Management 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 IT Management 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.

Data Center Infrastructure Architecture—Power Advisor is part of DCIA.

Intelligent Tools from HPE
And when it comes to building out your IT infrastructure, at HPE, we think it should be easy and reliable. That’s why we created the one place to look for all things data center selection and configuration—the Data Center Infrastructure Advisor, or DCIA for short.

The DCIA features intelligent, flexible and straightforward tools to help you select, configure, and evaluate your data center compute environment—whether you’re upgrading an existing IT system or designing a new one from scratch. And as quickly as configurations change or compute environments need to be updated, the DCIA tools and calculators provide you the information and recommendations you need easily and seamlessly.

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
HPE Power Supplies

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

With three innovative power supply product lines, HPE offers a versatile portfolio that focuses on what you need most: efficiency, high power density, and redundancy. The HPE Power Supplies allows you to pick the right power supply to ensure business continuity with increased power efficiencies and power savings.

The HPE Power Supplies are available in three categories to serve your power needs:

**Figure 9.** HPE Power Supplies portfolio

- **Standard:** Optimized features at an entry-level price
  HPE Standard Power Supplies offer an optimized set of features for HPE ProLiant ML350 Gen10 with up to 500W output.
  - **Optimal for:** HPE ProLiant ML350 Gen10 server
  - **Up to 92% efficiency and 80Plus Certified**

- **Advanced:** Compact Flexibility and Efficiency
  The HPE Flex Slot Power Supplies are 25% smaller than previous generation power supplies, providing more space to add additional server options and improve the performance of your servers. The HPE Flex Slot Power Supplies are low halogen compliant, hot swappable, and offer 500W to 2200W power options.
  - **Optimal for:** ProLiant DL 10/300/500 series, ML350, and Apollo 2000/4000
  - **Up to 96% efficiency and 80Plus Certified**

- **Performance:** Higher Power Density, Enhanced Business Continuity
  HPE Performance Power Supplies provide highly efficient and flexible power options specifically designed for HPE dense computing environments. The hot-swappable HPE Performance Power Supplies offer support for high-line AC, 48VDC, 380VDC, and 277VAC and up to 3400W power options for the ultimate flexibility of operating in different data center power infrastructure environments.
  - **Optimal for:** HPE Synergy 12000 Frame, c7000 Enclosure, and Apollo 6000
  - **Up to 96% efficiency and 80Plus Certified**
HPE Service and Support

Unlock the benefits of your investment and protect it beyond warranty

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 Operational 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 GreenLake Flex 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