

Overview

HPE Cray Storage Systems C500

Put your HPC/AI storage beast on an effective diet while improving the utilization of your CPU/GPU investments

With the introduction of HPE Cray Storage Systems C500, HPE is bringing the storage technology of the largest supercomputers to entry and mid-range HPC/AI clusters. Users of entry-level and mid-range HPC/AI compute clusters can now enjoy the same price/performance benefits than the largest supercomputing leadership sites. They now can spend less of their budget on HPC/AI storage and more on CPU/GPU compute nodes while improving the utilization of their CPU/GPU investments. This is made possible by the unique combination of open source, parallel file systems and an innovative architecture that exploits the strengths of different storage media (solid state and spinning disk) while avoiding their respective weaknesses.

The HPE Cray Storage Systems C500 consists of a global POSIX single name space file system that is configured to provide access between compute clients and the HPE Cray Storage Systems C500 storage nodes using the Lustre parallel file system.

The C500 is offered in 2 basic configurations:

- All Flash
- Hybrid Flash/HDD

The all-flash configuration is suitable for lots of small, random read I/O, high sequential performance required in many AI applications including Machine Learning.

The hybrid configuration combines the best of flash and HDD performance into one configuration. Customers can utilize hybrid building blocks to combine flash and disk into one filesystem.

What's New

- ProLiant DL325 Gen11 Based System Management Unit (SMU)
 - Converged Storage Unit hosting both metadata and data (C500 CSU)
 - Data-encryption-at-rest (DEAR) and key management.
 - Integrated Tiering
 - Integrated Monitoring
 - Managed Gateway nodes
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Overview



HPE Cray Storage Systems C500



Standard Features

HPE Cray Storage Systems C500 Building Blocks

The HPE Cray Storage Systems C500 is configured from storage building blocks along with surrounding network, rack and power infrastructure. These building blocks are:

HPE Cray Storage Systems C500 System Management Unit (SMU)

Each C500 Storage System contains a system management unit built on the ProLiant DL325 Gen11, that contains SSDs to hold configuration and logging data. The SMU delivers Lustre and the HPE Cray Storage Systems C500 system management services. The HPE Cray Storage Systems C500 system management unit is required for managing hardware configuration, software images, boot up of the underlying hardware system (servers, devices, software stack), monitoring system, metrics, system health, and reporting on system status. The SMU runs a web and CLI service that allows the administrator to monitor, configure, and administer the file system, the C500 management framework, and the C500 hardware.

HPE Cray Storage Systems C500 Converged Storage Unit

The HPE Cray Storage Systems C500 Converged Storage Unit Controller is built on a 2-node, 2U24 SSD enclosure that hosts both metadata and storage.

The C500 CSU is the smallest flash storage building block but can also be configured with additional SSU-Fs for a larger all flash configuration or with the 5U84 JBOD to create a hybrid flash configuration.

All Flash Array (SSU-F)

SSU-F provides flash-based Lustre I/O data services and network request handling for the file system with a pair of Lustre object storage servers (OSS) each configured with a one or more Lustre object storage target(s) (OSTs) to store and retrieve the portions of the file system data that are assigned to it. Two OSTs are distributed evenly between the two OSSs in each SSU-F so both OSSs are active concurrently (that is, OSSs are active-active), each operating on its own exclusive subset of the available OSTs (that is, each OST is active-passive).

SSU-F is populated with 24 SSDs. For a throughput optimized configuration, approximately half the capacity are each configured with the HPE Cray Storage Systems C500's GridRAID (parity declustered RAID) using LDISKFS. LDISKFS is used to improve small random I/O workloads. Each controller can be configured with two network adapters configured with Mult-Rail LNet to exploit maximum throughput performance per SSU-F.

High Density 5U84 HDD Enclosure

The 5U84 HDD-based Lustre I/O data services and network request handling for the file system with similar OSS and OST features mentioned above for the HPE Cray Storage Systems C500's SSU-F building block.

The HPE Cray Storage Systems C500 has multiple hybrid flash configurations with either one or two high-density HDD enclosures. Each high-density disk enclosure is configured with 84 SAS HDDs and contains two Lustre OSTs, each configured with the HPE Cray Storage Systems C500's GridRAID using LDISKFS and its parity declustering RAID support.

Management Switches

The HPE Cray Storage Systems C500 utilizes Aruba switches for a private management network between all building blocks in the filesystem. The private management network is deployed in as a highly-available configuration. Only back-to-front (also called power-to-port or reverse air flow) Aruba switches are supported for the HPE Cray Storage Systems C500's private management network.



Standard Features

Racks and PDUs

The HPE Cray Storage Systems C500 storage systems are compatible with HPE G2 Advanced and Enterprise racks. HPE requires racks with a minimum depth of 1200mm to best accommodate the length of the HPE Cray Storage Systems C500 building blocks mentioned above.

The HPE Cray Storage Systems C500 are compatible with select rack-mounted HPE G2 PDUs. A minimum of two PDUs are required with the HPE Cray Storage Systems C500 for power redundancy. The desired HPE G2 and the HPE Cray Storage Systems C500 configuration could limit what PDU options are available.

HPE Cray Storage Systems C500 Software, Services, and Tools

The HPE Cray Storage Systems C500 is configured with powerful software tools and services to create a complete, production-ready storage system that is designed to meet the unique requirements of HPC and AI applications. This software, services, and tools are:

Lustre for the HPE Cray Storage Systems C500

The HPE Cray Storage Systems C500 comes pre-configured with the industry's most powerful and scalable parallel file system to assure that your compute cluster avoids waiting for I/O and is computing with maximum efficiency. Lustre for the HPE Cray Storage Systems C500 is a carefully tested and curated version of the open source community Lustre based on version 2.15 release. Each Lustre feature is exhaustively tested at scale by HPE and any defects corrected before it is released for production use. Lustre for the HPE Cray Storage Systems C500 is offered with LDISKFS as the local object store using HPE's fully declustered GridRAID to deliver maximum application performance and up to 4x faster recovery time from failed drives. Lustre for the HPE Cray Storage Systems C500 is fully supported by HPE Services and the HPE Cray Storage Systems C500 engineering resources guaranteeing fast and thorough responses to any issues found by our customers.

The HPE Cray Storage Systems C500 data services

The HPE Cray Storage Systems C500 data services are the tiering options that make a tiered storage system comprised of flash and disk easy to use and manage. It is designed to manage and monitor data movement between flash tiers and disk tiers. Tiering has multiple modes that can be selected by the administrator and/or the end user. Each of the modes leverage a set of new data services that simplify and/or automate the customers' data management policies.

Transparent Tiering

Transparent mode makes tiering decisions automatically based on policies set by the administrator. Transparent mode uses the the HPE Cray Storage Systems C500 data services policy engine to automate and orchestrate tiering requests based on triggers such as the available capacity in the flash tier or the time of day to move the data.

The C500 introduces a set of new data management tools as part of the data services that enables customers to leverage flash and disk tiers effectively and efficiently within a single Lustre file system.

Scalable Search

The Scalable Search service maintains an efficiently searchable database of filesystem metadata, used by policies to quickly search the filesystem namespace with multiple selection criteria to find matching candidate files amongst billions of files. The databases are maintained automatically as a background process.

Parallel Data Movers

A key component of Transparent Tiering are the the parallel data movers. The parallel data movers provide a scale-out service that efficiently migrates data between tiers within a file system and support the placement use case. One data mover is included and runs on the C500's SMU. Additional parallel data movers are pre-configured HPE servers designed to deliver high throughput data movement. They are coordinated by the Transparent Tiering orchestration manager to execute administrative tiering policies or built-in Lustre commands like 'migrate'.



Standard Features

Purging Data

Administrators can create policies to delete files from the filesystem based on various conditions, such as age of the file, location of the file, last access of the file, size of the file, to name a few examples.

Reporting

Tiering services can automatically generate reports of any filesystem metadata query in JSON or CSV form, timestamped and stored in the designated directory. Reports can be used to track usage information, find users or groups consuming significant capacity, or provide information to fine-tune other policies.

For more information about HPE Cray Storage Systems C500, HPE and Aruba products mentioned in this quickspec, please visit:

<https://www.hpe.com/psnow/doc/a00062184enw>

- Aruba CX 6300M Switch:
<https://www.hpe.com/psnow/doc/a00021857enw.pdf>
 - HPE G2 Enterprise Series Racks:
<https://www.hpe.com/psnow/doc/a00002907enw>
 - HPE G2 Advanced Series Racks:
<https://www.hpe.com/psnow/doc/c05324689>
 - HPE G2 Metered and Switched Power Distribution Units:
<https://www.hpe.com/psnow/doc/a00002910enw>
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Service and Support

HPE Services

No matter where you are in your digital transformation journey, you can count on HPE Services to deliver the expertise you need when, where and how you need it. From planning to deployment, ongoing operations and beyond, our experts can help you realize your digital ambitions.

<https://www.hpe.com/services>

Consulting Services

No matter where you are in your journey to hybrid cloud, experts can help you map out your next steps. From determining what workloads should live where, to handling governance and compliance, to managing costs, our experts can help you optimize your operations.

<https://www.hpe.com/services/consulting>

HPE Managed Services

HPE runs your IT operations, providing services that monitor, operate, and optimize your infrastructure and applications, delivered consistently and globally to give you unified control and let you focus on innovation.

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Operational services

Optimize your entire IT environment and drive innovation. Manage day-to-day IT operational tasks while freeing up valuable time and resources. Meet service-level targets and business objectives with features designed to drive better business outcomes.

<https://www.hpe.com/services/operational>

HPE Complete Care Service

HPE Complete Care Service is a modular, edge-to-cloud IT environment service designed to help optimize your entire IT environment and achieve agreed upon IT outcomes and business goals through a personalized experience. All delivered by an assigned team of HPE Services experts. HPE Complete Care Service provides:

- A complete coverage approach -- edge to cloud
- An assigned HPE team
- Modular and fully personalized engagement
- Enhanced Incident Management experience with priority access
- Digitally enabled and AI driven customer experience

<https://www.hpe.com/services/completecure>

HPE Tech Care Service

HPE Tech Care Service is the operational support service experience for HPE products. The service goes beyond traditional support by providing access to product specific experts, an AI driven digital experience, and general technical guidance to not only reduce risk but constantly search for ways to do things better. HPE Tech Care Service delivers a customer-centric, AI driven, and digitally enabled customer experience to move your business forward. HPE Tech Care Service is available in three response levels. Basic, which provides 9x5 business hour availability and a 2-hour response time. Essential which provides a 15-minute response time 24x7 for most enterprise level customers, and Critical which includes a 6-hour repair commitment where available and outage management response for severity 1 incidents.

<https://www.hpe.com/services/techcare>



Service and Support

HPE Lifecycle Services

HPE Lifecycle Services provide a variety of options to help maintain your HPE systems and solutions at all stages of the product lifecycle. A few popular examples include:

- Lifecycle Install and Startup Services: Various levels for physical installation and power on, remote access setup, installation and startup, and enhanced installation services with the operating system.
- HPE Firmware Update Analysis Service: Recommendations for firmware revision levels for selected HPE products, taking into account the relevant revision dependencies within your IT environment.
- HPE Firmware Update Implementation Service: Implementation of firmware updates for selected HPE server, storage, and solution products, taking into account the relevant revision dependencies within your IT environment.
- Implementation assistance services: Highly trained technical service specialists to assist you with a variety of activities, ranging from design, implementation, and platform deployment to consolidation, migration, project management, and onsite technical forums.
- HPE Service Credits: Access to prepaid services for flexibility to choose from a variety of specialized service activities, including assessments, performance maintenance reviews, firmware management, professional services, and operational best practices.

Notes: To review the list of Lifecycle Services available for your product go to:

<https://www.hpe.com/services/lifecycle>

For a list of the most frequently purchased services using service credits, see the [HPE Service Credits Menu](#)

Other Related Services from HPE Services:

HPE Education Services

Training and certification designed for IT and business professionals across all industries. Broad catalogue of course offerings to expand skills and proficiencies in topics ranging from cloud and cybersecurity to AI and DevOps. Create learning paths to expand proficiency in a specific subject. Schedule training in a way that works best for your business with flexible continuous learning options.

<https://www.hpe.com/services/training>

Defective Media Retention

An option available with HPE Complete Care Service and HPE Tech Care Service and applies only to Disk or eligible SSD/Flash Drives replaced by HPE due to malfunction.

Consult your HPE Sales Representative or Authorized Channel Partner of choice for any additional questions and services options.

Parts and Materials

HPE will provide HPE-supported replacement parts and materials necessary to maintain the covered hardware product in operating condition, including parts and materials for available and recommended engineering improvements.

Parts and components that have reached their maximum supported lifetime and/or the maximum usage limitations as set forth in the manufacturer's operating manual, product QuickSpecs, or the technical product data sheet will not be provided, repaired, or replaced as part of these services.

How to Purchase Services

Services are sold by Hewlett Packard Enterprise and Hewlett Packard Enterprise Authorized Service Partners:

- Services for customers purchasing from HPE or an enterprise reseller are quoted using HPE order configuration tools.
- Customers purchasing from a commercial reseller can find services at <https://ssc.hpe.com/portal/site/ssc/>



Service and Support

AI Powered and Digitally Enabled Support Experience

Achieve faster time to resolution with access to product-specific resources and expertise through a digital and data driven customer experience.

Sign into the HPE Support Center experience, featuring streamlined self-serve case creation and management capabilities with inline knowledge recommendations. You will also find personalized task alerts and powerful troubleshooting support through an intelligent virtual agent with seamless transition when needed to a live support agent.

<https://support.hpe.com/hpesc/public/home/signin>

Consume IT On Your Terms

HPE GreenLake edge-to-cloud platform brings the cloud experience directly to your apps and data wherever they are—the edge, colocations, or your data center. It delivers cloud services for on-premises IT infrastructure specifically tailored to your most demanding workloads. With a pay-per-use, scalable, point-and-click self-service experience that is managed for you, HPE GreenLake edge-to-cloud platform accelerates digital transformation in a distributed, edge-to-cloud world.

- Get faster time to market
- Save on TCO, align costs to business
- Scale quickly, meet unpredictable demand
- Simplify IT operations across your data centers and clouds

To learn more about HPE Services, please contact your Hewlett Packard Enterprise sales representative or Hewlett Packard Enterprise Authorized Channel Partner. Contact information for a representative in your area can be found at "Contact HPE"

<https://www.hpe.com/us/en/contact-hpe.html>

For more information

<http://www.hpe.com/services>



Technical Specifications

Building Blocks	C500 SMU
HPE SKU(s) 1,2 (includes common options)	S3K94A
Dimensions	4.29 X 43.46 X 70.89 cm
Weight	17.07kg 37.63lbs
AC Power Input	200-240VAC
Typical Power	116.91W
Max Power	569.7W
Operating Temperature	10° to 35°C (50° to 95°F)
Shipping Temperature	-30° to 60°C (-22° to 140°F)
Operating Altitude	3050 m (10,000 ft)
Shipping Altitude	9144 m (30,000 ft)
Operating Humidity	8% to 90%
Non-operating Humidity	5 to 95%
Thermal (BTU)	1942.68

Building Blocks	C500 CSU	SSU-F
HPE SKU(s) 1,2 (includes common options)	S3K95A	R7K92A
Dimensions	87.2mm x 438mm x 966mm (H x W x D)	
Weight	28.6kg 63.2 lbs.	27.4kg 60.5 lbs.
AC Power Input	200-240VAC	
AC Power Input Frequency	50-60Hz	
Typical Power	1325 1.472kVA	1254 1.393kVA
Max Power	1543 1.714kVA	1465 1.628kVA
Power Cables⁴	Two 3m Splitter Y C20/2xC13 Two 3m C13/C14	
Operating Temperature	5°C-35°C 41°F-95°F	
Shipping Temperature	-40°C-60°C -40°F-+140°F	
Operating Altitude	-200-10,000ft -61m-3,000m	
Shipping Altitude	-200-40,000ft -61m-12,192m	
Operating Humidity	20% to 80% non-condensing	
Non-operating Humidity	10% to 90% non-condensing	
Operating Vibration	0.10G at 5 Hz to 500 Hz	
Non-operating Vibration	0.5G at 5 Hz to 500 Hz	
Operating Shock	3G at 11ms, 1/2 sine wave pulse	
Non-operating Shock	10G at 11ms, 1/2 sine wave pulse	
Maximum Exhaust Air Flow (CFM)	137	130
Thermal (BTU)	5265	4999
Management network cables	Default of four 10ft (3m) CAT6 Ethernet cables. Lengths may vary when built and shipped in a datacenter rack by HPE.	



Technical Specifications

Notes:

- ¹ Rail kit requires rack EIA rails (or posts) to be set 762mm (30 inches) apart front to back for proper installation of the C500.
- ² Primary building-blocks for HDR / EDR InfiniBand and 200/100 Gb/s Ethernet client high-speed network connectivity.
- ³ Must utilize active optical cables for client high-speed network connectivity.
- ⁴ Must utilize HPE optical SAS cables to connect to SSU-D or SSU-M enclosures.
- ⁵ HPE will determine which power cable is utilized when built and shipped in a datacenter rack by HPE. Both power cable types are provided otherwise.

HPE Cray Storage Systems C500

- **Filesystem**

Lustre 2.15 with supported enhancements

- **Data Path**

ClusterStor GridRAID with LDISKFS

System Management Unit (SMU-S3K94A)

DL325 Gen11 with NVMe Gen 4 SSDs RAID protected for system management, logging, and boot services.

C500 Converged Storage Unit Controller (S3K95A)

- **Storage Controller**

- High availability, dual controller pair with 24 NVMe Gen 4 SSDs

- **SSD Options**

- 1 DWPD: 1.92 / 7.68 / 15.4 / 30.7
- 3 DPWD: 1.6 / 3.2 / 6.4

– All SSD options above are self-encryption capable

Scalable Storage Unit – SSU-F

- **SSD Options**

- 1 DWPD: 1.92 / 3.84 / 7.68 / 15.4 / 30.7
- 3 DPWD: 1.6 / 3.2 / 6.4

– All SSD options above are self-encryption capable

Scalable Storage Unit – Disks 5U84

High-density 5U SAS JBOD with 84 HDDs

- **Configurations**

- SSU-M1: Storage controller plus one 5U84 disk enclosure in 7U
- SSU-M2: Storage controller plus two 5U84 disk enclosures in 12U

- **HDD Options**

- 4 / 10 / 16 TB SAS SED HDDs

Client High-Speed Network Options²

HDR / EDR InfiniBand, HPE M-series 200/100 GbE Switches

It is highly recommended that the HPE Cray Storage Systems C500 utilize a high-speed network that is deployed in a highly-available configuration.

Notes: Contact your sales representative about [network compatibility](#)



Technical Specifications

SSU-M High-Density 5U84 Enclosure ^{2,3}	4TB SED	10TB SED	16TB SED
Cray ClusterStor E1000 SAS 12G 5U 84-disk LFF Drive Enclosure	R6Q55A		
HPE HDD Bundle SKU ¹	R6Q49A	R6Q50A	R6Q51A
Dimensions	176.4mm x 441mm x 1139mm (H x W x D)		
Weight	135 kg 298 lbs.	131 kg 289.5 lbs.	
AC Power Input	200-240VAC		
AC Power Input Frequency	50-60Hz		
Typical Power	1338 W 1487kVA	1151W 1279kVA	1163W / 1292kVA
Max Power	1857W 2063kVA	1590W 1767kVA	1607W / 1786kVA
Power Cables	Two 1m C19/C20		
Operating Temperature	5°C to 35°C 41°F to 95°F - derate 1°C for every 300m above 900m, 20°C/hr max rate of change		
Shipping Temperature	-40°C to +70°C -40°F to +158°F		
Operating Altitude	-200-10,000ft -61m-3,000m		
Shipping Altitude	-200-40,000ft -61m-12,192m		
Operating Humidity	10% to 80% noncondensing		
Non-operating Humidity	5% to 100% noncondensing		
Operating Vibration	0.21 Grms, 5-500Hz		
Non-operating Vibration	1.04 Grms, 2-200Hz		
Operating Shock	5 G, 10ms, half sine		
Non-operating Shock	20 G, 10ms, half sine		
Maximum Exhaust Air Flow (CFM)	165	142	143
Thermal (BTU)	6337	5425	5483

Notes:

- ¹ Must order quantity two with each R6Q55A
- ² Hewlett Packard Enterprise has not tested or validated the High-Density 5U84 Enclosure with any third-party racks. Before installing the SSU-M High-Density 5U84 Enclosure in a third-party rack, be sure to properly scope the limitations of the rack. Before proceeding with the installation, consider the following:
 - You must fully understand the static and dynamic load carrying capacity of the rack and be sure that it can accommodate the weight of the SSU-M High-Density 5U84 enclosure.
 - Be sure sufficient clearance exists for cabling, installation and removal of PDUs, installation and removal the enclosure and enclosure FRUs, actuation of the rack doors and full articulation of the drive drawers.
- ³ Must utilize HPE optical SAS cables to connected to R4M27A, R7K93A or R7K89A.



Technical Specifications

Data Mover		
HPE Cray Supercomputing Storage Systems Data Services Mover Node	S3J02A	
Model Name	HPE Cray Supercomputing Storage Systems Data Services Mover Node	
Processor	EPYC 9124 (16-Core, 3.0 GHz, 200W)	
Number of Processors	One processor	
Memory	32 GB RDIMM SR 1Rx4 4800 MT/s (1x 32 GB)	
Network Controller	HPE 1GbE 4-port Base-T OCP3 Adapter plus the choice of 1 or 2 PCIe cards for Lustre and NFS Networks	
Internal Storage	2x 480GB SATA M.2	
PCI-Express Slots	1 PCIe x16 Primary Riser 1 PCIe x16 Secondary Reiser	
Power Supply	2x 1000W HPE FlexSlot Power Supply	
Fans	7- standard fans	
Management	Default: HPE iLO Standard with Intelligent Provisioning, HPE OneView Standard (requires download)	
Energy Star	3.0 certified	
Form Factor	1U Rack	
Warranty	3-year parts, 3-year labor, 3-year onsite support with next business day response.	
Dimensions		
8SFF chassis	4.29 X 43.46 X 64.94 cm 1.69 X 17.11 X 25.57 In	
Package	24.2 X 60 X 91.6 cm 9.53 X 23.6 X 36.06 In	
Weight Maximum	8 SFF chassis with 1 processor, 2 power supply, 1 standard heatsink, 12 DIMM, 2 High Speed Network Cards, and 7 standard fans. o	15.54 kg o 34.27 lb
	Package	4.21 kg or 9.281 lb
Rated Line Voltage	100 to 120 VAC 200 to 240 VAC	



Technical Specifications

NFS Protocol Node		
HPE Cray Supercomputing Storage Systems Data Services NFS Protocol Node	S3J03A	
Model Name	HPE Cray Supercomputing Storage Systems Data Services NFS Protocol Node	
Processor	EPYC 9124 (16-Core, 3.0 GHz, 200W)	
Number of Processors	One processor	
Memory	32 GB RDIMM SR 1Rx4 4800 MT/s (1x 32 GB)	
Network Controller	HPE 1GbE 4-port Base-T OCP3 Adapter plus the choice of 1 or 2 PCIe cards for Lustre and NFS Networks	
Internal Storage	2x 480GB SATA M.2	
PCI-Express Slots	1 PCIe x16 Primary Riser 1 PCIe x16 Secondary Reiser	
Power Supply	2x 1000W HPE FlexSlot Power Supply	
Fans	7- standard fans	
Management	Default: HPE iLO Standard with Intelligent Provisioning, HPE OneView Standard (requires download)	
Energy Star	3.0 certified	
Form Factor	1U Rack	
Warranty	3-year parts, 3-year labor, 3-year onsite support with next business day response.	
Dimensions		
8SFF chassis	4.29 X 43.46 X 64.94 cm 1.69 X 17.11 X 25.57 In	
Package	24.2 X 60 X 91.6 cm 9.53 X 23.6 X 36.06 In	
Weight Maximum	8 SFF chassis with 1 processor, 2 power supply, 1 standard heatsink, 12 DIMM, 2 High Speed Network Cards, and 7 standard fans. o	15.54 kg o 34.27 lb
	Package	4.21 kg or 9.281 lb
Rated Line Voltage	100 to 120 VAC 200 to 240 VAC	



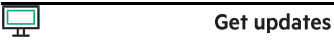
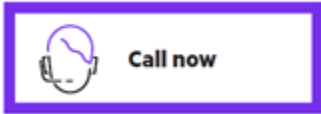
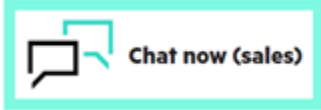
Summary of Changes

Date	Version History	Action	Description of Change
06 May 2024	Version 1	New	New QuickSpecs



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For hard drives, 1GB = 1 billion bytes. Actual formatted capacity is less.

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