Overview

Cray ClusterStor E1000 Storage System

Is your storage slowing down your HPC compute cluster?

The Cray ClusterStor E1000 storage system is purpose-engineered to meet the demanding input/output requirements of supercomputers and HPC clusters in a very efficient way. The E1000 parallel storage system typically achieves the given HPC storage performance requirements with significantly fewer storage drives than alternative storage offerings. That means for HPC users with a fixed budget for the HPC system can spend more of their budget on CPU/GPU computes nodes accelerating time-to-insight. The Cray ClusterStor E1000 storage system embeds the Lustre® open-source parallel file system to deliver this efficient performance. Hewlett Packard Enterprise provides enterprise-grade customer support in-house and scales out (nearly) linearly, without software licensing for the file storage system per terabyte capacity or per storage drive. This allows customers to reap the benefits of the open-source community while getting enterprise-grade support from Hewlett Packard Enterprise.

The ClusterStor E1000 is designed on NVMe generation 4 hardware building blocks based on the latest storage technologies to provide enhanced flexibility and resiliency. It is an I/O and storage subsystem consisting of a global POSIX single name space file system that is configured to provide access between compute clients and ClusterStor E1000 storage nodes using the Lustre parallel file system.
ClusterStor E1000 offers four basic configurations:

- All Flash
- All Disk
- Hybrid
- Tiered with both Flash and Disk

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 and Deep Learning. The base rack provides up to 1,530 GB/s read and up to 1170 GB/s write with Multi-Rail LNet. The expansion rack provides up to 1,700 GB/s read and up to 1,300 GB/s write with Multi-Rail LNet.

The all-HDD configuration is used mainly for large sequential I/O and modeling and simulation. The base rack provides up to 102 GB/s read and write up to approximately 9.4 PB of usable capacity, depending on the HDD capacity used. The expansion rack provides up to 136 GB/s read and write up to 15PB of usable capacity, depending on the HDD capacity used.

The hybrid configuration combines the best of flash and HDD performance into one configuration. The base rack provides up to 255 GB/s read and up to 195 GB/s write from flash pools with approximately 9.4 PB of usable HDD capacity, depending on the HDD capacity used. The expansion rack provides up to 340 GB/s read and up to 260 GB/s writes from flash pools with approximately 15PB of usable HDD capacity, depending on the HDD capacity used.

Customers can utilize hybrid building blocks to combine flash and disk into one filesystem or mix and match the flash and disk building blocks in a tiered configuration to tailor to their workloads.

What's New

- Data-encryption-at-rest (DEAR) and key management.
- Tiering for ClusterStor
- ClusterStor Monitoring
- Managed Gateway nodes
- Update Drive capacities for Flash and Disk
- Attaches to any supercomputer or HPC cluster that supports either HPE Slingshot, NDR/HDR InfiniBand or 200 Gigabit Ethernet.
- Inhouse, enterprise-grade support for performance-accelerating Lustre features like Data on Metadata Targets (DoM), Progressive File Layout (PFL), Self-Extending Layouts (SEL), Pool Quotas, Pool Spillover, Multi-Rail LNet, Distributed Name Space (DNE), and many more advanced Lustre features.

Overview

Cray ClusterStor E1000 – Closed

Overview

Example Cray ClusterStor E1000 – Open (doors removed)

Standard Features

Cray ClusterStor E1000 Building Blocks

ClusterStor E1000 is configured from storage building blocks along with surrounding network, rack and power infrastructure. These building blocks are:

Cray ClusterStor E1000 System Management Unit (SMU)

The ClusterStor E1000 system management unit contains a pair of embedded storage management nodes with SSDs to hold configuration and logging data, and runs the Tiering and Monitoring service, and can be configured as a data mover. The SMU delivers Lustre and ClusterStor system management services. ClusterStor system management is required for managing hardware configuration, software images, boot up of the underlying hardware system (servers, devices, software stack), monitoring system metrics and system health, reporting on system status, and advanced Lustre performance monitoring. The SMU runs a web and CLI server that allows the administrator to monitor, configure, and administer the file system, the ClusterStor management framework, and ClusterStor hardware. The SMU has APIs to allow administrators to export monitoring and health data to be consumed by existing data center monitoring tools.

Cray ClusterStor E1000 MetaData Unit (MDU)

ClusterStor E1000 MDUs stores and managers global Lustre metadata with a pair of Lustre metadata servers (MDS) and flash-based metadata targets (MDTs). An MDU is populated with 24 SSDs, two partitions with approximately half the capacity are each configured and are assigned to the two embedded controllers as MDTs using LDISKFS or OpenZFS. MDUs can be configured with multiple MDTs, with each controller configured with two high speed networks adapters.

ClusterStor E1000 configures MDUs to support Lustre DoM, which allows small files or initial portions of files to be stored with their metadata, improving small file performance, stat performance to small files, and reducing interference between small file I/O and streaming I/O. The metadata tier stores metadata and optional DoM in RAID volumes.

ClusterStor E1000 can scale additional MDUs using Lustre Distributed Name Space (DNE) to match specified performance targets.

Cray ClusterStor E1000 Scalable Storage Unit – All Flash Array (SSU-F)

ClusterStor E1000 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 committed 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).

A ClusterStor E1000 SSU-F is populated with 24 SSDs. For a throughput optimized configuration, approximately half the capacity are each configured with ClusterStor's GridRAID declustered parity using LDISKFS or OpenZFS and its parity declustering RAID support. For an IOPs optimized SSU-F configuration, a different RAID scheme with 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.

ClusterStor E1000 can be scaled to many SSU-Fs and/or combined with SSU-Ds or SSU-Ms to achieve specified performance requirements. ClusterStor SSU-D and SSU-M features are mentioned below.

Standard Features

Cray ClusterStor E1000 Scalable Storage Unit – Disk (SSU-D)

ClusterStor E1000 SSU-D provides HDD-based Lustre I/O data services and network request handling for the file system with similar OSS and OST features mentioned above for ClusterStor E1000's SSU-F building block.

ClusterStor E1000 has multiple SSU-D configurations with either one, two or four ClusterStor ultra-dense HDD enclosures. Each ultra-dense disk enclosure is configured with 106 SAS HDDs and contains two Lustre OSTs, each configured with ClusterStor's GridRAID declustered parity using LDISKFS or OpenZFS and its parity declustering RAID support. Each SSU-D controller is configured one high-speed network adapter and redundant SAS adapters to connect to one or more ClusterStor ultra-dense HDD enclosures.

ClusterStor E1000 can be scaled to many SSU-Ds and/or combined with SSU-Fs to achieve specified performance requirements.

ClusterStor's configurations with SSU-D are factory integrated with a purpose built rack to accommodate weight and serviceability. For more information about this rack contact your local HPE reprecentative.

Cray ClusterStor E1000 Scalable Storage Unit – Disk (SSU-M)

ClusterStor E1000 SSU-M provides HDD-based Lustre I/O data services and network request handling for the file system with similar OSS and OST features mentioned above for ClusterStor E1000's SSU-D and SSU-F building blocks.

ClusterStor E1000 has multiple SSU-M configurations with either one, two or four ClusterStor high-density HDD enclosures. Each high-density disk enclosure is configured with 84 SAS HDDs and contains two Lustre OSTs, each configured with ClusterStor's GridRAID declustered parity using LDISKFS or OpenZFS and its parity declustering RAID support. Each SSU-M controller is configured one high-speed network adapter and redundant SAS adapters to connect to one or more ClusterStor HDD enclosures.

ClusterStor E1000 can be scaled to many SSU-Ms and/or combined with SSU-Fs to achieve specified performance requirements.

ClusterStor's SSU-M configurations allow for factory integration with HPE G2 Enterprise and Advanced Series 42U shock racks and select HPE G2 Metered and Switched Power Distribution Units.

Cray ClusterStor E1000 Scalable Storage Unit – Hybrid (SSU-H)

ClusterStor E1000 SSU-H provides both flash-based and HDD-based Lustre I/O data services and network request handling for the file system with similar OSS and OST features mentioned above for ClusterStor E1000's SSU-F, SSU-D and SSU-M building blocks.

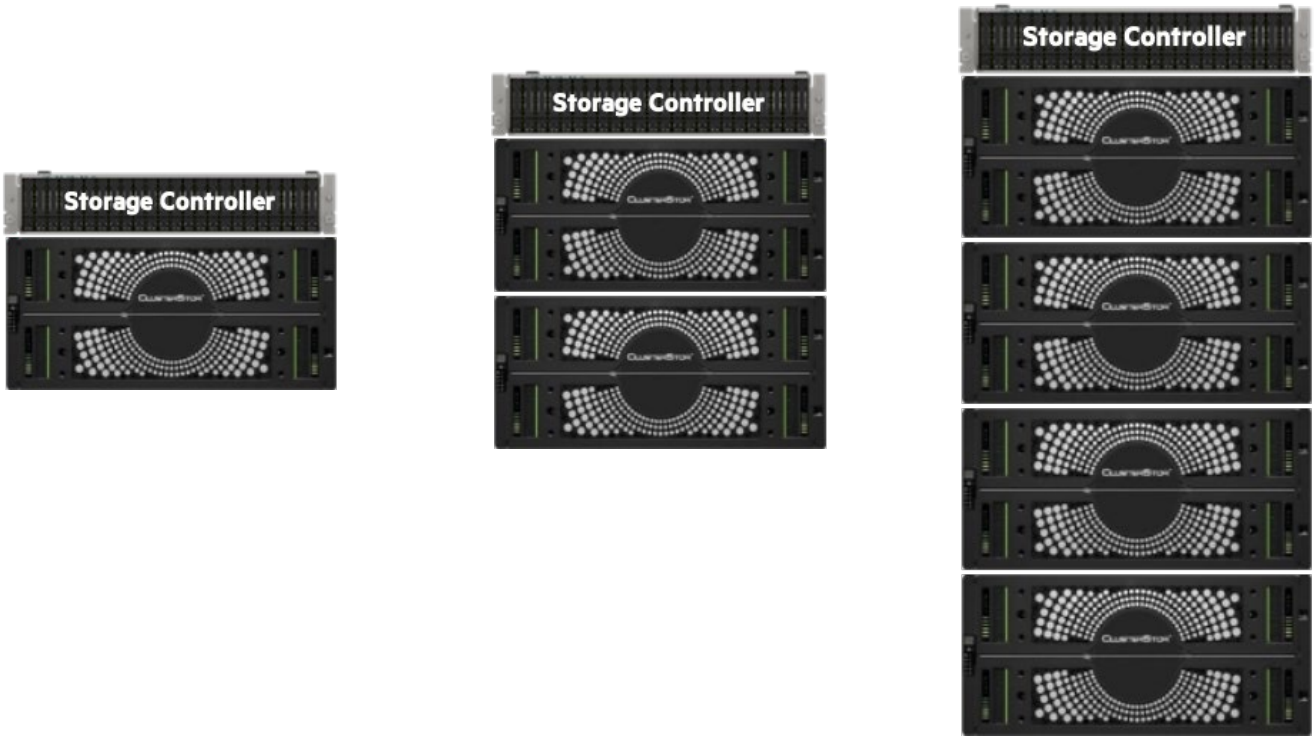
ClusterStor E1000 has two SSU-H configurations supporting either two ClusterStor ultra-dense or high-density HDD enclosures. Each SSU-H building block is configured with ClusterStor's GridRAID declustered parity using LDISKFS or OpenZFS and its parity declustering RAID support. Each SSU-H controller is configured two high-speed network adapters and redundant SAS adapters to connect to two ClusterStor HDD enclosures. Each controller can be configured Mult-Rail LNet to exploit maximum flash throughput performance per SSU-H.

ClusterStor E1000 can be scaled to many SSU-Hs to achieve specified performance requirements.

Standard Features

SSU-D1 SSU-D2 SSU-D4

ClusterStor E1000 Scalable Storage Unit – Disk (SSU-D)



SSU-M1 SSU-M2 SSU-M4

ClusterStor E1000 Scalable Storage Unit – Disk (SSU-M)

Standard Features

SSU-HD **SSU-HM**

ClusterStor E1000 Scalable Storage Unit – Disk (SSU-H)

Management Switches

ClusterStor E1000 utilizes HPE Aruba Networking switches for a private management network between all building blocks in the filesystem. The private management network is deployed as a highly-available configuration. Depending on the configuration of the filesystem, HPE Aruba Networking CX 8360 switches, HPE Aruba Networking CX 6300M switches or a combination of HPE Aruba Networking CX 8325 and CX 6300M switches will be factory integrated with each ClusterStor E1000. Only back-to-front (also called power-to-port or reverse air flow) HPE Aruba Networking switches are supported for ClusterStor E1000's private management network.

Racks and PDUs

ClusterStor E1000 storage systems are compatible with HPE G2 Advanced and Enterprise 42U and 48U Shock Racks and Cray custom racks. HPE requires racks with a minimum depth of 1200mm to best accommodate the length of ClusterStor E1000 building blocks mentioned above. For ClusterStor E1000 configurations using SSU-M and SSU-F, HPE G2 600x1200mm shock racks provide the necessary room for cabling and serviceability. For ClusterStor configurations using SSU-D, HPE G2 Enterprise 800x1200mm shock racks and Cray custom racks are required for cabling and serviceability.

ClusterStor E1000 storage systems are compatible with select rack-mounted HPE G2 PDUs and Cray PDUs. A minimum of two PDUs are required with ClusterStor E1000 for power redundancy. The desired HPE G2 or Cray custom rack and ClusterStor E1000 configuration could limit what PDU options are available.

Cray ClusterStor E1000 Software, Services, and Tools

ClusterStor E1000 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 ClusterStor

ClusterStor E1000 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 ClusterStor 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 ClusterStor is offered with OpenZFS or 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 ClusterStor is fully supported by HPE Services and ClusterStor Engineering resources guaranteeing fast and thorough responses to any issues found by our customers.

Standard Features

Tiering for ClusterStor

Tiering in ClusterStor is a set of software features that make a hybrid storage system comprised of flash and disk easier to use and manage. It is designed to monitor and maintain file layouts and free space on E1000 flash tiers and disk tiers. Tiering has multiple capabilities that can be customized by the administrator via data management policies, including fine-grained indexing controls, file migration between OSTs or pools, restriping, purging, or generating filesystem reports. These actions are invoked automatically based on timers or system conditions (e.g. capacity threshold).

Tiering uses a scale-out architecture to efficiently move large volumes of data. Tiering components utilize the SMU to perform all functions, and additional data mover nodes can be configured to increase data throughput.

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.

Transparent Tiering

Transparent migration optimizes file layouts automatically based on policies created and set by the administrator. The policy engine automates file migration between the flash and disk tiers based on triggers such as the available capacity in the flash tier or a fixed schedule, and can migrate files based on path, name, file size, modification time, or any other file metadata. This is particularly useful to help maintain a flash tier at a maximum percentage full by moving older files to disk, for example. All files remain completely available for read or write during this process.

Parallel Data Movers

Additional data mover nodes can be configured to scale out the Tiering services from the SMU, providing additional bandwidth to migrate data and index the filesystem. The additional nodes are pre-configured HPE servers that can be added and monitored by ClusterStor management nodes.

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.

Data Encryption at Rest (DEAR) with Key Manager

ClusterStor supports encrypting data at rest with key management using Secure Encrypted Drives (SED) for NVMe and SED or ClusterStor supports a key manager to encrypt data at rest using Secure Encrypted Drives (SED) for NVMe and SED or FIPs HDD drives. When enabled, ClusterStor enrolls all file system storage devices to participate in encrypting data. The key manager is used to authenticate all devices to allow access to encrypted data. After drive power loss, access to data is prohibited until the system retrieves unique keys from the key manager and uses them to unlock the devices.

Managed Exporter Nodes

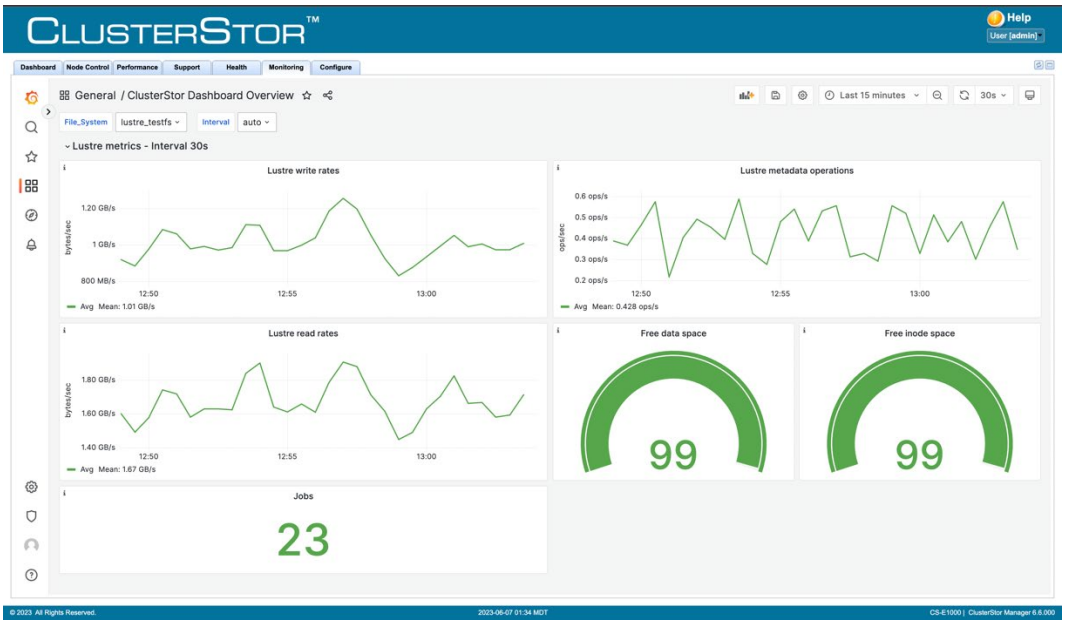
ClusterStor supports the following gateway nodes to extend the access of the Lustre parallel filesystem to additional clients using NFS and or S3. ClusterStor will manage up to 4 nodes for NFS or 4 nodes for S3 to allow NFS clients to mount the same filesystem or ingest S3 objects as Posix to perform IO and in turn export the data to S3.

Standard Features

ClusterStor Monitoring

ClusterStor monitoring provides always-on metrics to give customers the insight needed to maximize resources, optimize system throughput, and provide users with the best results and experience without impacting performance. All the information users need is available in a single view. ClusterStor monitoring software tracks job performance on Lustre file systems and enables the correlation of system events that cause job performance issues using streaming telemetry with customizable visualization enabling real-time and historical analysis. ClusterStor monitoring provides administrators with visibility to understand application performance variability, isolate problems faster, enable trend analysis, and provide alerts for hands-off monitoring.

The landing page for ClusterStor monitoring offers a quick overview of the utilization and activity on ClusterStor storage system giving administrators the ability to quickly identify potential issues and application performance problems.



Sample of the ClusterStor Monitoring Landing Page

ClusterStor monitoring provides visualization of performance data for overall storage systems and individual jobs, including throughput and metadata activity. Performance data is stored persistently and can be monitored in near real-time or historically, to enable triaging of performance problems, trend analysis, and capacity planning. It also monitors ClusterStor system logs and InfiniBand fabrics, enabling administrators to correlate system events with storage performance. ClusterStor monitoring supports customized alerts and graphs to tailor the application to each customer's needs.

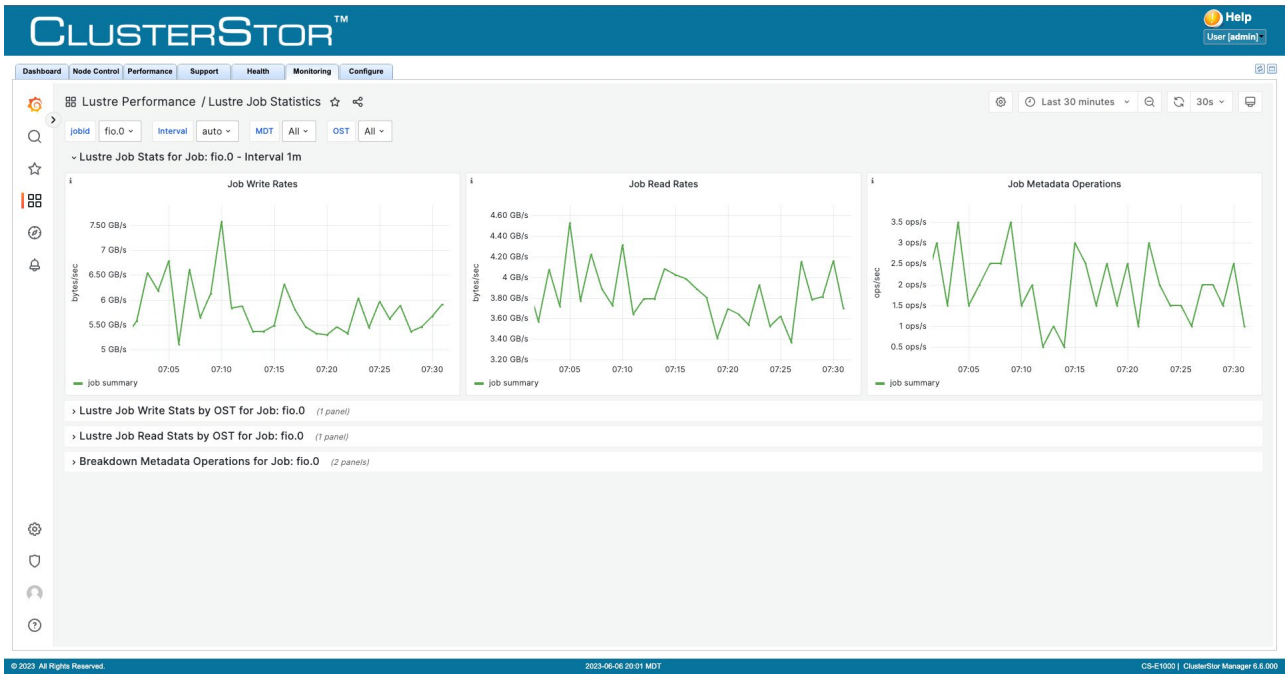
Features

- Job Runtime Variability – Real-time and historical views of data to help you understand what is impacting user jobs
- Event Correlation – A unified view of the system, providing administrators with the ability to correlate systemic events that impact performance
- Trend Analysis – Data-driven analysis and visualization from historical data can help identify trends that can then be used to shape changes to the system
- Alerting – Threshold engine enables customized alerts based on any metric

Jobs

Job performance metrics are recorded and monitored in real-time to detect inefficient utilization of resources such as issuing small I/O requests or inundating the system with metadata requests that can impact the responsiveness of the entire system. Jobs can be sorted and filtered as needed to pinpoint specific jobs by attribute, or to identify jobs running within certain timeframes.

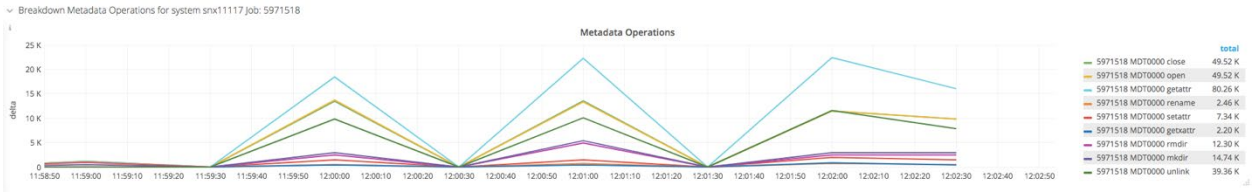
Standard Features



Sample of the Jobs Statitics

From the Jobs page, administrators can drill down to job details that enable the comparison of the job to what was occurring on the rest of the ClusterStor storage system providing context as to how busy the overall system was when the job ran.

The job details also include per-device reporting for Lustre object storage targets (OST) and metadata targets (MDT) including metadata operations.



Sample Breakdown of the Metadata Operations Per Device

Dashboards

ClusterStor monitoring also includes additional visualizations that cover the ClusterStor system overview and Lustre device metrics for complete in-depth view into the storage environment. Available dashboards include:

- ClusterStor Storage Overview – Displays an overview of performance, jobs, and capacity for one or more ClusterStor storage systems.
- ClusterStor Server Metrics – Displays CPU and memory utilization for all ClusterStor servers.
- Lustre File System Capacity, Metadata, and Performance – Separate displays covering per device capacity, performance, and metadata operations.
- Customized Dashboards - supports the creation of custom dashboards from a wealth of documented metrics.

Standard Features

For more information about Cray ClusterStor E1000, HPE and HPE Aruba Networking products mentioned in this quickspec, please visit:

- Cray ClusterStor E1000 (Technical White Paper): **https://www.hpe.com/psnow/doc/a50001954enw**
- Cray ClusterStor E1000 (Business White Paper): **https://www.hpe.com/psnow/doc/a50002042enw**
- HPE Slingshot Interconnect **https://www.hpe.com/psnow/doc/a50002546enw**
- HPE HDR InfiniBand Switches: **https://www.hpe.com/psnow/doc/a00062184enw**
- HPE Aruba Networking CX 6300M Switch: **https://www.hpe.com/psnow/doc/a00073540enw**
- HPE Aruba Networking CX 8325 Switch: **https://www.hpe.com/psnow/doc/a00056519enw**
- HPE Aruba Networking CX 8360 Switch: **https://www.hpe.com/psnow/doc/a00094643enw**
- HPE M-series 3700M Switch **https://www.hpe.com/psnow/doc/a00067749enw.pdf**
- HPE M-series 2700M 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**

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.

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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/completecare

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.

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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 quick-specs, 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

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

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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

Cray ClusterStor E1000

- **Filesystem**
  Lustre 2.15 with supported enhancements
- **Data Path**
  ClusterStor GridRAID with LDISKFS or OpenZFS and its RAID support

Scalable Storage Unit – Flash (SSU-F)

- **Storage Controller**
  High availability, dual node pair with 24 NVMe Gen 4 SSDs
- **SSD Options**
  - 1 DWPD: 1.92 / 3.84 / 7.68 / 15.36 / 30.72 TB
  - 3 DPWD: 1.6 / 3.2 / 6.4 / 12.8 TB / 25.6 TB
  - All SSD options above are self-encryption capable
- **Maximum SSUs per Rack** (dependent on type of network supported)
  - 18 per Base Rack
  - 20 per Expansion Rack
- **Maximum usable capacity per rack**
  Up to 10PB (using 30.72 TB SSDs)

Scalable Storage Unit – Disks (SSU-D)

- **Storage Controller**
  High availability, dual controller pair with two NVMe Gen 4 SSDs
- **Disk Enclosure**
  Ultra-dense 4U SAS JBOD with 106 HDDs
- **Configurations**
  - SSU-D1: Storage controller plus one 4U106 disk enclosure in 6U
  - SSU-D2: Storage controller plus two 4U106 disk enclosures in 10U
  - SSU-D4: Storage controller plus four 4U106 disk enclosures in 18U
- **HDD Options**
  - 4 / 6[1] / 10 / 12[1] / 16 / 20 TB SAS HDDs
  - 10 / 16 / 24 TB SAS SED HDDs
- **Maximum SSUs per Rack** (dependent on type of SSU-D configuration and network supported)
  - Four per Base Rack
  - Four per Expansion Rack
- **Maximum usable capacity per rack**
  Up to 15PB (using 24TB HDDs)

Notes:

– [1] Contact your sales representative about availability

Scalable Storage Unit – Disks (SSU-M)

- **Storage Controller**
  High availability, dual controller pair with two NVMe Gen 4 SSDs
- **Disk Enclosure**
  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
  - SSU-M4: Storage controller plus four 5U84 disk enclosures in 22U
- **HDD Options**
  - 4 / 6 / 8 TB SAS HDDs
  - 4 / 10 / 16 / 24 TB SAS SED HDDs

Technical Specifications

- **Maximum SSUs per Rack** (dependent on type of SSU-M configuration and network supported)
  - Three per Base Rack
  - Four per Expansion Rack
- **Maximum usable capacity per rack**
  Up to 9PB (using 24TB HDDs)

Scalable Storage Unit – Hybrid (SSU-M)

- **Storage Controller**
  High availability, dual controller pair with 24 NVMe Gen 4 SSDs
- **SSD Options**
  Same SSD options for SSU-F mentioned above
- **Disk Enclosure**
  Ultra-dense 4U SAS JBOD with 106 HDDs
  High-density 5U SAS JBOD with 84 HDDs
- **Configurations**
  - SSU-HD: Storage controller plus two 4U106 disk enclosures in 10U
  - SSU-HM: Storage controller plus two 5U84 disk enclosures in 12U
- **HDD Options**
  - For SSU-HD, same HDD options for SSU-D mentioned above
  - SSU-HM, same HDD options for SSU-M mentioned above
- **Maximum SSUs per Rack** (dependent on type of SSU-H configuration and network supported)
  - Three per Base Rack
  - Four per Expansion Rack

MetaData Unit (MDU)

- **Base Configuration**
  High-availability, dual controller pair with 24 NVMe Gen 4 SSDs RAID protected
- **Number of files**
  Up to eight billion per MDU in standard configuration with LDISKFS[1]
- **SSD Options**
  - 1 DWPD: 1.92 / 3.84 / 7.68 TB
  - 3 DPWD: 1.6 / 3.2 / 6.4 TB
  - All SSD options above are self-encryption capable
- **Expansion Option**
  Up to 10 MDUs per file system configured with Lustre Distributed Namespace functionality

System Management Unit (SMU)

High-availability, dual controller pair with NVMe Gen 4 SSDs RAID protected for system management, logging, and boot services

Client High-Speed Network Options[2]

HPE Slingshot, NDR-200 / HDR / EDR InfiniBand, HPE M-series 200/100 GbE Switches
It is highly recommended that ClusterStor E1000 utilize a high-speed network that is deployed in a highly-available configuration.

Notes:

– [1] 1.92 TB or higher capacity SSD required to achieve eight billion files per MDU
– [2] Contact your sales representative about E1000 network compatibility

Technical Specifications

E1000 Building Blocks	SMU	MDU	SSU-F	SSU-D/M Controller
HPE SKU(s) [1,2] **(includes common options)**	R7K91A	R7K90A	R7K92A	R7K93A[3]
Dimensions	87.2mm x 438mm x 966mm (H x W x D)			
Weight	25.5kg | 56.3 lbs.	27.4kg | 60.5 lbs.	27.4kg | 60.5 lbs.	25.3kg | 56 lbs.
AC Power Input	200-240VAC			
AC Power Input Frequency	50-60Hz			
Typical Power	824 | 0.916kVA	1210 | 1.344kVA	1254 | 1.393kVA	800 | 0.889kVA
Max Power	1001 | 1.112kVA	1465 | 1.628kVA	1465 | 1.628kVA	963 | 1.070kVA
Power Cables[4]	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)	89	130	130	86
Thermal (BTU)	3416	4999	4999	3286
Management network cables	Default of four 10ft (3m) CAT6 Ethernet cables. Lengths may vary when built and shipped in a datacenter rack by HPE.			
Cable Management Arm (CMA)	Included and required for serviceability. CMA will consume up to 1.5m of cable length for all cables connected.			

Notes:

- [1] Primary building-blocks for HPE Slingshot client high-speed network connectivity.
- [2] Must utilize active optical cables for client high-speed network connectivity.
- [3] Must utilize HPE optical SAS cables to connect to E1000 SSU-D or SSU-M enclosures.
- [4] 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.

Technical Specifications

E1000 Building Blocks	SSU-H Controller
HPE SKU(s)[1] (includes common options)	R7K89A
Dimensions	87.2mm x 438mm x 966mm (H x W x D)
Weight	28.6kg | 63.2 lbs.
AC Power Input	200-240VAC
AC Power Input Frequency	50-60Hz
Typical Power	1325 | 1.472kVA
Max Power	1543 | 1.714kVA
Power Cables[4]	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
Thermal (BTU)	5265
Management network cables	Default of four 10ft (3m) CAT6 Ethernet cables. Lengths may vary when built and shipped in a datacenter rack by HPE.
Cable Management Arm (CMA)	Included and required for serviceability. CMA will consume up to 1.5m of cable length for all cables connected.

Notes:

- [1] Must utilize active optical cables for client high-speed network connectivity.
- [3] Must utilize HPE optical SAS cables to connect to E1000 SSU-H enclosures.
- [4] 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.

Technical Specifications

E1000 SSU-D Ultra-Dense 4U106 Enclosure[1,2]	4TB	6TB[3]	10TB (Non-SED and SED)
HPE SKU(s)	R4M24A	R4M25A	R4M18A (Non-SED) R6Q53A (SED)
Dimensions	176.4mm x 441mm x 1139mm (H x W x D)		
Weight	135.1 kg | 298.5 lbs.	139.6 kg | 308.5 lbs.	137.2 kg | 303.2 lbs.
AC Power Input	200-240VAC		
AC Power Input Frequency	50-60Hz		
Typical Power	1317W | 1.463kVA	1398W | 1.553kVA	1227W | 1.363kVA
Max Power	1834W | 2.038 kVA	1918W | 2.131kVA	1706W | 1.896kVA
Power Cables	Two 3m C19/C20		
Operating Temperature	5°C to 35°C | 41°F to 95°F - derate 1°C for every 300m above 900m		
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	0.18 Grms, 5-500Hz, 30 min per axis		
Non-operating Vibration	0.54 Gs rms (in Z) 0.25 Grms (in X & Y), 6-200Hz		
Operating Shock	3 G, 11ms (per axis)		
Non-operating Shock	15 G, 7ms, 10 shock pulse		
Maximum Exhaust Air Flow (CFM)	163	174	152
Thermal (BTU)	6255	6653	5821
Cable Management Arm (CMA)	Included and required for serviceability. CMA will consume up to 1.5m of cable length for all cables connected.		

Notes:

- [1] Hewlett Packard Enterprise has not tested or validated the E1000 SSU-D Ultra-Dense 4U106 Enclosure with any third-party racks. Before installing the E1000 SSU-D Ultra-Dense 4U106 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 E1000 SSU-D Ultra-Dense 4U106 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.
- [2] Must utilize HPE optical SAS cables to connected to R4M27A, R7K93A or R7K89A.
- [3] Contact your sales representative about availability.

Technical Specifications

E1000 SSU-D Ultra-Dense 4U106 Enclosure[1,2]	16TB (Non-SED and SED)
HPE SKU(s)	R4M21A (Non-SED) R6Q54A (SED)
Dimensions	176.4mm x 441mm x 1139mm (H x W x D)
Weight	137.2 kg | 303.2 lbs.
AC Power Input	200-240VAC
AC Power Input Frequency	50-60Hz
Typical Power	1242W | 1.380kVA
Max Power	1728W | 1.920kVA
Power Cables	Two 3m C19/C20
Operating Temperature	5°C to 35°C | 41°F to 95°F - derate 1°C for every 300m above 900m
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	0.18 Grms, 5-500Hz, 30 min per axis
Non-operating Vibration	0.54 Gs rms (in Z) 0.25 Grms (in X & Y), 6-200Hz
Operating Shock	3 G, 11ms (per axis)
Non-operating Shock	15 G, 7ms, 10 shock pulse
Maximum Exhaust Air Flow (CFM)	152
Thermal (BTU)	5821
Cable Management Arm (CMA)	Included and required for serviceability. CMA will consume up to 1.5m of cable length for all cables connected.

Notes:

- [1] Hewlett Packard Enterprise has not tested or validated the E1000 SSU-D Ultra-Dense 4U106 Enclosure with any third-party racks. Before installing the E1000 SSU-D Ultra-Dense 4U106 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 E1000 SSU-D Ultra-Dense 4U106 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.
- [2] Must utilize HPE optical SAS cables to connected to R4M27A, R7K93A or R7K89A.
- [3] Contact your sales representative about availability.

Technical Specifications

E1000 SSU-D Ultra-Dense 4U106 Enclosure[1,2]	20TB	24TB
HPE SKU(s)	R4M22A	S1H97A
Dimensions	176.4mm x 441mm x 1139mm (H x W x D)	
Weight	137.2 kg | 303.2 lbs.	
AC Power Input	200-240VAC	
AC Power Input Frequency	50-60Hz	
Typical Power	1213W | 1.348kVA	1358W| 1.509kVA
Max Power	1685W | 1.873kVA	1685W | 1.873kVA
Power Cables	Two m C19/C20	
Operating Temperature	5°C to 35°C | 41°F to 95°F - derate 1°C for every 300m above 900m	
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	0.18 Grms, 5-500Hz, 30 min per axis	
Non-operating Vibration	0.54 Gs rms (in Z) 0.25 Grms (in X & Y), 6-200Hz	
Operating Shock	3 G, 11ms (per axis)	
Non-operating Shock	15 G, 7ms, 10 shock pulse	
Maximum Exhaust Air Flow (CFM)	150	150
Thermal (BTU)	5749	5749
Cable Management Arm (CMA)	Included and required for serviceability. CMA will consume up to 1.5m of cable length for all cables connected.	

Notes:

- [1] Hewlett Packard Enterprise has not tested or validated the E1000 SSU-D Ultra-Dense 4U106 Enclosure with any third-party racks. Before installing the E1000 SSU-D Ultra-Dense 4U106 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 E1000 SSU-D Ultra-Dense 4U106 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.
- [2] Must utilize HPE optical SAS cables to connected to R4M27A, R7K93A or R7K89A.
- [3] Contact your sales representative about availability.

Technical Specifications

E1000 SSU-M High-Density 5U84 Enclosure[2,3]	4TB[4]	4TB SED	8TB
HPE Cray Supercomputing Storage Systems SAS 12G 5U 84-disk LFF Drive Enclosure	R6Q55A		
HPE HDD Bundle SKU[1]	R6Q46A	R6Q49A	R6Q55A
Dimensions	220mm x 483mm x 933mm (H x W x D)		
Weight	129.3 kg | 285.8 lbs.		135 kg | 298 lbs.
AC Power Input	200-240VAC		
AC Power Input Frequency	50-60Hz		
Typical Power	1222W | 1.358kVA		1338 W | 1.487kVA
Max Power	1691W / 1.879kVA		1857W | 2.063kVA
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		
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)	150		165
Thermal (BTU)	5769		6337

Notes:

- [1] Must order quantity two with each R6Q55A
- [2] Hewlett Packard Enterprise has not tested or validated the E1000 SSU-M High-Density 5U84 Enclosure with any third-party racks. Before installing the E1000 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 E1000 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.
- [4] Contact your sales representative about availability

Technical Specifications

E1000 SSU-M High-Density 5U84 Enclosure[2,3]	10TB[4]	16TB SED	24TB SED
HPE Cray Supercomputing Storage Systems SAS 12G 5U 84-disk LFF Drive Enclosure	R6Q55A		
HPE HDD Bundle SKU[1]	R6Q50A	R6Q51A	S1H94A
Dimensions	176.4mm x 441mm x 1139mm (H x W x D)		
Weight	131 kg | 289.5 lbs.		
AC Power Input	200-240VAC		
AC Power Input Frequency	50-60Hz		
Typical Power	1151W | 1.279kVA	1163W / 1.292kVA	1254W / 1.394kVA
Max Power	1590W | 1.767kVA	1607W / 1.786kVA	1573W / 1.748kVA
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)	142	143	140
Thermal (BTU)	5425	5483	5368

Notes:

- [1] Must order quantity two with each R6Q55A
- [2] Hewlett Packard Enterprise has not tested or validated the E1000 SSU-M High-Density 5U84 Enclosure with any third-party racks. Before installing the E1000 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 E1000 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.
- [4] Contact your sales representative about availability

Technical Specifications

Data Mover		
SKU Number	**S3J02A** **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.	
Diminensions		
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 Protcol Node		
SKU Number	**S3J02A** **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.	
Diminensions		
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
03-Sep-2024	Version 19	Changed	Overview , Standard Features and Technical Specifications sections were updated.
04-Mar-2024	Version 18	Changed	Technical Specifications section was updated
12-Feb-2024	Version 17	Changed	Networking product names were updated.
05-Feb-2024	Version 16	Changed	Standard Features and Technical Specifications sections were updated.
06-Jun-2022	Version 15	Changed	Overview section was updated
02-May-2022	Version 14	Changed	Added new SSU-H configuration. Overview, Standard Features and Technical Specifications sections were updated Minor improvements throughout
07-Feb-2022	Version 13	Changed	Minor improvements throughout Overview, Standard Features and Technical Specifications sections were updated
17-Jan-2022	Version 12	Changed	Minor changes to Overview and Standard Features Updated Technical Specifications section Overview, Standard Features and Technical Specifications sections were updated
06-Dec-2021	Version 11	Changed	Technical Specifications section was updated Minor improvements throughout
01-Nov-2021	Version 10	Changed	Overview, Standard Features, Service and Support and Technical Specifications sections were updated
02-Aug-2021	Version 9	Changed	Minor changes to ClusterStor data services and technical specifications section
04-May-2021	Version 8	Changed	Added ClusterStor software overview Added new SSD capacities Added SSU-M4 Added SSU-M Technical Specifications Overview, Standard Features and Technical Specifications sections were updated
01-Feb-2021	Version 7	Changed	Added 18TB
07-Dec-2020	Version 6	Changed	Overview, Configuration Information and Technical Specifications sections were updated. Added SSU-M building block Added additional technical specifications Updated product pictures
05-Oct-2020	Version 5	Changed	Overview, Standard Features, sections were updated
14-Sep-2020	Version 4	Changed	Standard Features section was updated
08-Sep-2020	Version 3	Changed	Overview and Service and Support sections were updated. Minor improvements/changes
03-Aug-2020	Version 2	Changed	Overview, Standard Features, Service and Support and Technical Specifications sections were updated Added new HDD and SSD options Minor improvements throughout
06-Jul-2020	Version 1	New	New QuickSpecs

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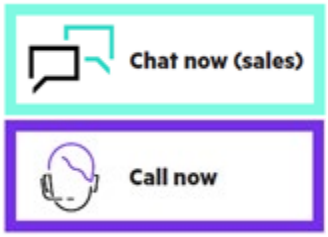

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For hard drives, 1GB = 1 billion bytes. Actual formatted capacity is less.

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