OceanStor Dorado V3 Series V300R002

Product Description

Issue	03
Date	2019-02-20

HUAWEI TECHNOLOGIES CO., LTD.

Trademarks and Permissions


and other Huawei trademarks are trademarks of Huawei Technologies Co., Ltd.
All other trademarks and trade names mentioned in this document are the property of their respective holders.

Notice

The purchased products, services and features are stipulated by the contract made between Huawei and the customer. All or part of the products, services and features described in this document may not be within the purchase scope or the usage scope. Unless otherwise specified in the contract, all statements, information, and recommendations in this document are provided "AS IS" without warranties, guarantees or representations of any kind, either express or implied.

The information in this document is subject to change without notice. Every effort has been made in the preparation of this document to ensure accuracy of the contents, but all statements, information, and recommendations in this document do not constitute a warranty of any kind, express or implied.

Huawei Technologies Co., Ltd.

Address: Huawei Industrial Base
Bantian, Longgang
Shenzhen 518129
People's Republic of China

Website: http://e.huawei.com

About This Document

This document describes the orientation, features, architecture, technical specifications, product configuration, environment requirements, standards compliance and granted certifications of the OceanStor Dorado V3 series storage system.

Intended Audience

This document is intended for: All readers

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol Conventions

Symbol	Description
DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
NOTICE	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results. NOTICE is used to address practices not related to personal injury.
NOTE	Calls attention to important information, best practices and tips. NOTE is used to address information not related to personal injury, equipment damage, and environment deterioration.

Change History

Changes between document issues are cumulative. The latest document issue contains all the changes made in earlier issues.

Issue 03 (2019-02-20)

This issue is the third official release.

Added the Dorado3000 V3.

Issue 02 (2019-01-15)

This issue is the second official release.

Updated the specification.

Issue 01 (2018-10-30)

This issue is the first official release.

Contents

1 Product Positioning

OceanStor Dorado V3 series storage system is a Huawei brand-new all-flash storage product designed for medium- and large-sized storage environments. It provides mass data storage, fast data access, high availability, and excellent utilization in the energy saving and ease-of-use way.

Business development leads to a great amount of service data, which poses ever high demands on storage systems. Traditional storage systems fail to meet these demands and encounter the following bottlenecks: inflexible storage performance expansion, complex management of various devices, failure to utilize legacy devices, and increasing maintenance costs occupying a large part of total cost of ownership (TCO). To overcome those bottlenecks, Huawei launches the next-generation all-flash storage product: OceanStor Dorado V3 series storage system.

With its industry-leading performance and multiple efficiency improving mechanisms, OceanStor Dorado V3 series storage system provides customers with comprehensive high-performance storage solutions, helping to maximize customer ROI. The product is applicable to a variety of services such as online transaction processing/online analytical processing (OLTP/OLAP), high-performance computing (HPC), and virtual desktop infrastructure (VDI).

In addition to providing enterprise users with high-performance and efficient storage services, OceanStor Dorado V3 series storage system supports advanced data backup and disaster recovery technologies, ensuring secure and smooth operation of data services. Furthermore, the storage system also offers easy-to-use management and convenient local/remote maintenance, greatly decreasing the management and maintenance costs.

Figure 1-1, **Figure 1-2**, **Figure 1-3**, and **Figure 1-4** show the OceanStor Dorado V3 series storage systems, including Dorado3000 V3, Dorado5000 V3, Dorado6000 V3, and Dorado18000 V3.

Figure 1-1 OceanStor Dorado3000 V3 storage system

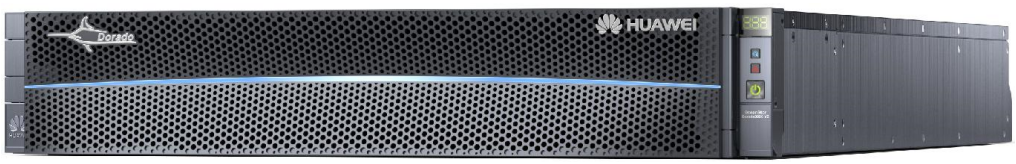


Figure 1-2 OceanStor Dorado5000 V3 storage system

Figure 1-3 OceanStor Dorado6000 V3 storage system

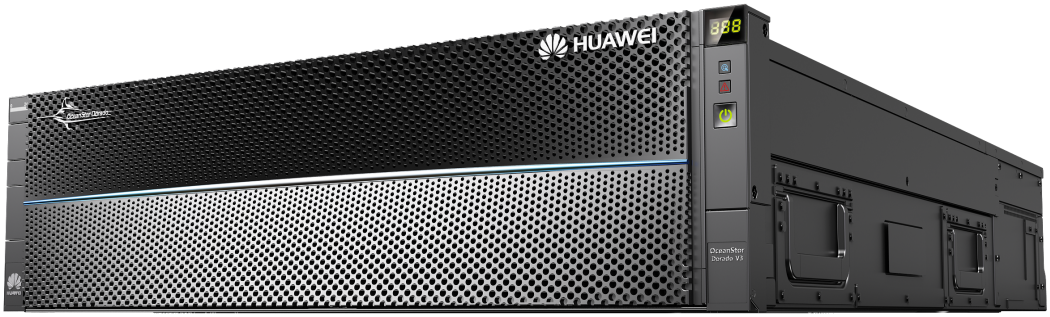


Figure 1-4 OceanStor Dorado18000 V3 storage system

2 Product Highlights

OceanStor Dorado V3 series storage system combines a superior hardware structure and an all-flash software architecture with advanced data application and protection technologies, meeting medium- and large-sized enterprises' storage requirements for excellent performance, flexible scalability, proven reliability, and high availability.

High Performance

OceanStor Dorado V3 series storage system uses the flash-dedicated FlashLink® technique to optimize SSDs and storage controllers from end to end and provide million-level IOPS at a stable low latency.

- FlashLink®

  FlashLink® associates controller CPUs with SSD CPUs to coordinate SSD algorithms between these CPUs, thereby achieving high system performance and reliability. FlashLink® has the following advantages:

  - Industry's fastest SSD

    Huawei-developed SSDs use the built-in Flash Translation Layer (FTL) algorithm for CPU acceleration. The latency is far lower than that of other SSDs, improving read/write performance.

  - Optimized controller for flash media

    The controller software of OceanStor Dorado V3 series storage system uses dedicated cores for specific services, reducing the scheduling overhead between multiple CPU cores and between controller CPUs and SSD CPUs. This improves the insertion and search efficiency and enhances overall system performance.

  - Huawei's proprietary SSD-controller algorithm

    Controller CPUs collaborate with SSD CPUs. The large-block sequential write technique reduces the frequency of disk access. Using separate blocks for user data and metadata improves garbage collection efficiency and system performance in various scenarios.

- Superior hardware acceleration

  OceanStor Dorado V3 series storage system is equipped with 64-bit multi-core processors, high-speed and large-capacity caches, various high-speed host interface modules, and back-end disk interface modules. It offers better storage performance than traditional storage systems.

- Huawei-developed SSD

  OceanStor Dorado V3 series storage system uses Huawei-developed SSDs that perfectly work with the OceanStor OS to maximize their capabilities and boost the storage system performance.

  In addition, OceanStor Dorado5000 V3 (NVMe) supports non-volatile memory express SSDs (NVMe SSDs) that provide even lower read/write latency than common SSDs, maximizing the storage system's data transmission speed.

- Full-stripe write

  OceanStor Dorado V3 series storage system uses redirect-on-write (ROW) for full-stripe write to reduce CPU usage and ensure optimal write performance.

Flexible Scalability

OceanStor Dorado V3 series storage system supports both scale-up and scale-out, achieving flexible scalability while maintaining high performance.

- Scale-up

  Increases storage capacity and improves processing capabilities of existing controllers.

- Scale-out

  Enables performance to increase linearly as the number of controllers increases.

High Reliability

OceanStor Dorado V3 series storage system offers protection measures against component and power failures, and uses advanced technologies to minimize risks of disk failures and data loss.

- Component failure protection

  Storage system components are in 1+1 redundancy. Normally, the two redundant components are working simultaneously and share loads. Once one component fails or is offline, the other one takes over all loads without affecting ongoing services.

- RAID 2.0+

  The storage system uses RAID 2.0+ underlying virtualization to balance loads across disks automatically. If a disk encounters a fault, all the other disks in the same disk domain help reconstruct the faulty disk's service data, achieving a 20-fold faster reconstruction speed than traditional RAID and significantly reducing the possibility of multi-disk failure. In addition, RAID 2.0+ supports dynamic RAID and flexible data layout, accelerating SSD reconstruction.

- Power failure protection

  Built-in backup battery units (BBUs) supply power to controller enclosures in the event of unexpected power failures. This enables the storage system to write cache data to disks to prevent data loss.

- Global wear leveling and anti-wear leveling
  - Global wear leveling: If data is unevenly distributed to SSDs, certain SSDs may be used more frequently and wear faster than others. As a result, they may fail much earlier than expected, increasing the maintenance costs. OceanStor Dorado V3 series storage system addresses this problem by using global wear leveling that levels the wear degree among all SSDs, improving SSD reliability.
  - Global anti-wear leveling: When the wear degree of multiple SSDs is reaching the threshold, the system preferentially writes data to certain SSDs. In this way, these

SSDs wear faster than the others. This prevents multiple SSDs from failing at a time.

- Disk data pre-copy

  Disk data pre-copy enables the storage system to routinely check its hardware status and migrate data from any failing disk to minimize the risk of data loss.

High Availability (HA)

OceanStor Dorado V3 series storage system uses TurboModule, online capacity expansion, and disk roaming to ensure service continuity during routine maintenance. These technologies have the following functions:

- TurboModule enables hot swap of controllers, fans, power supplies, interface modules, BBUs, and disks. All these modules can be operated online.
- Online capacity expansion allows you to add disks to disk domains online.
- Disk roaming enables the storage system to automatically identify relocated disks and resume their services.

OceanStor Dorado V3 series storage system provides multiple advanced data protection technologies to protect data against catastrophic disasters and ensure continuous system running. These include HyperSnap (snapshot), HyperReplication (remote replication), HyperClone (clone), HyperCopy, HyperCDP, CloudReplication, and CloudBackup.

- HyperSnap supports writable snapshots. Snapshot creation and activation have no impact on performance.
- HyperReplication backs up local data onto a remote storage system for disaster recovery.
- HyperClone preserves a real-time physical copy of a source LUN for the high availability of local data.
- HyperCopy supports incremental synchronization and restoration, and allows data copy across engines, disk domains, and consistency groups, ensuring local data availability.
- HyperCDP achieves continuous data protection at an interval of several seconds, generating more intensive recovery points on storage devices.
- CloudReplication provides cloud DR for storage systems, implementing data protection on the cloud.
- CloudBackup allows storage systems to back up data to the cloud without the backup server or gateway, ensuring data security.

OceanStor Dorado V3 series storage system also uses multiple resource application technologies to flexibly manage resources and maximize customers' return on investment (ROI). Typical technologies include SmartVirtualization, SmartMigration, and SmartQoS.

- SmartVirtualization enables a local storage system to centrally manage storage resources of third-party storage systems, simplifying storage system management and reducing maintenance costs.
- SmartMigration migrates LUNs in or between storage systems, adjusting and allocating resources along with business development.
- SmartQoS categorizes service data based on its characteristics (each category represents a type of application) and sets a priority and performance objective for each category. In this way, resources can be preferentially allocated to services with high priorities to guarantee their performance.

High System Security

- Storage Network Security
  - Management channel security

    All management operations from physical ports are controlled by the access authentication mechanism of the storage system, and only authorized users are allowed to manage the storage system.
  - Anti-attack protection for protocols and interfaces

    The storage system provides necessary external communication connections for system operations and maintenance. All the ports used are listed in the *Communication Matrix*. Dynamic listening ports are functioning in the proper scope, and no unopened ports exist.
  - Service and management ports isolation

    The Access Control List (ACL) mechanism is used to isolate Ethernet ports from internal heartbeat network ports, management network ports, and maintenance ports. Service ports and management ports are isolated from each other.

NOTE

Internal heartbeat links exist between the controllers in a storage system and are used to check the operating status of the controllers. No additional links are required.

- Storage management security

  Users can be disabled and enabled. All management operations are logged.

Virtualization, Intelligence, and Efficiency

OceanStor Dorado V3 series storage system achieves higher storage space utilization, faster data reconstruction, smarter performance allocation, and finer service quality control in comparison to traditional storage systems. To achieve these advancements, the following technologies contribute:

- RAID 2.0+ underlying virtualization

  RAID 2.0+ divides disk storage space into small-sized data blocks and uses them to create RAID groups for fine-grained resource management. This enables automatic load balancing, higher storage performance, better storage space utilization, faster disk reconstruction, and granular storage space management. It is the basis for many other advanced storage features.
- Intelligent thin provisioning (SmartThin)

  SmartThin allocates storage space on demand rather than pre-allocating all storage space at the initial stage. It is more cost-effective because customers can start business with a few disks and add disks based on site requirements. In this way, the initial purchase cost and TCO are reduced.
- Deduplication and compression (SmartDedupe and SmartCompression)

  OceanStor Dorado V3 series storage system uses global and inline SmartDedupe and SmartCompression to reduce space occupation and I/Os on SSDs. This improves storage space utilization, extends the SSDs' service life, and reduces the investment and O&M costs.

Economy and Ease-of-Use

OceanStor Dorado V3 series storage system employs intelligent CPU frequency control, fan speed control, SmartDedupe, and SmartCompression to ensure cost effectiveness. It also

provides a series of management and maintenance tools to simplify operation and maintenance tasks.

- Cost-effectiveness
  - Intelligent CPU frequency control

    This technology changes the CPU frequency automatically based on system loads. For example, it decreases the CPU frequency and power consumption during off-peak hours for a low operation cost and long CPU service life.
  - Intelligent fan speed control

    This technology dynamically adjusts the fan speed based on storage system temperature, lowering the noise and power consumption while saving device operation costs.
- Ease-of-use
  - DeviceManager

    A tool that is developed based on HTML5 and provides the graphical user interface (GUI) for storage management. It helps you to easily manage storage systems through wizard-instructed operations.
  - Integrated management

    VMware vCenter Plug-in and Hyper-V System Center are integrated for management. In addition, the storage system supports VMware vStorage APIs for Storage Awareness (VASA), vStorage APIs for Array Integration (VAAI), and Volume Shadow Copy Service (VSS) Provider to facilitate management.
  - Management on tablets

    The storage system can be managed using a tablet.
  - Various alarm notification methods

    The storage system supports alarm notification by sound, indicator, short message service (SMS), and email. Critical information is sent to users in a timely manner.
  - Simple point-and-click upgrade tool

    Controllers support point-and-click upgrade without suspending services.
  - Cloud O&M (Call Home service)

    Huawei provides the Call Home service to connect the OceanStor Dorado V3 storage system to the eService cloud platform for centralized, remote, and intelligent O&M of the storage system. The Big Data analytics technology is used to prevent faults and locate faults quickly. In addition, it provides the optimal configuration, performance optimization suggestions, and troubleshooting solutions based on user service characteristics.

3 Typical Applications

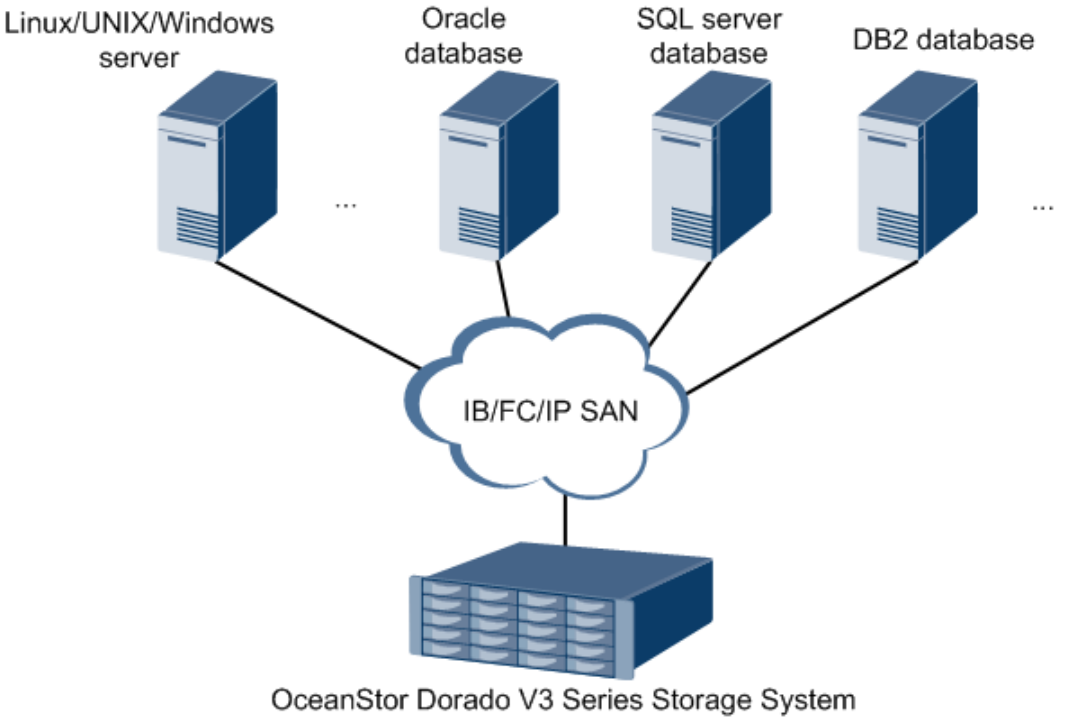
OceanStor Dorado V3 series storage system is a professional storage system dedicated to medium- and large-sized data centers of enterprises. It provides storage resources for critical service storage, virtual environment storage, and virtual desktops.

Storage of Critical Services

OceanStor Dorado V3 series storage system boasts the innovative flash-oriented software architecture, leading hardware specifications, and 100% component redundancy. These advantages enable the storage system to provide unparalleled levels of performance, consistently low latency, and 24/7 services for critical service storage. In addition, features such as writable snapshot and SmartDedupe and SmartCompression are used to improve the storage space utilization and cut down the total cost of ownership (TCO) without any loss of performance. These features are perfect for data processing of service systems such as OLTP/OLAP databases and HPC.

Figure 3-1 illustrates an example of critical service storage.

Figure 3-1 Storage of critical services

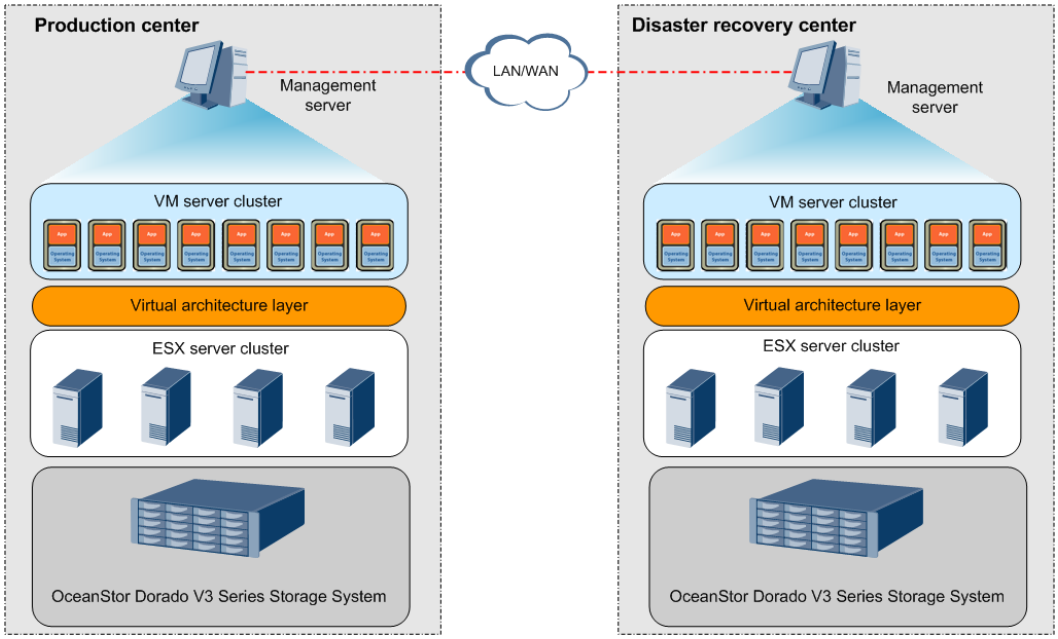


Storage for Virtual Environments

OceanStor Dorado V3 series storage system incorporates server virtualization optimization technologies such as vStorage APIs for Array Integration (VAAI), VMware vStorage APIs for Storage Awareness (VASA), and Site Recovery Manager (SRM). It also employs numerous key technologies in virtual machines (VMs) to deploy VMs fast, enhance VMs' bearing capability and operation efficiency, and streamline storage management in virtual environments, removing the worry of complicated storage systems in virtual environments.

Figure 3-2 illustrates an example of storage for virtual environments.

Figure 3-2 Storage for virtual environments

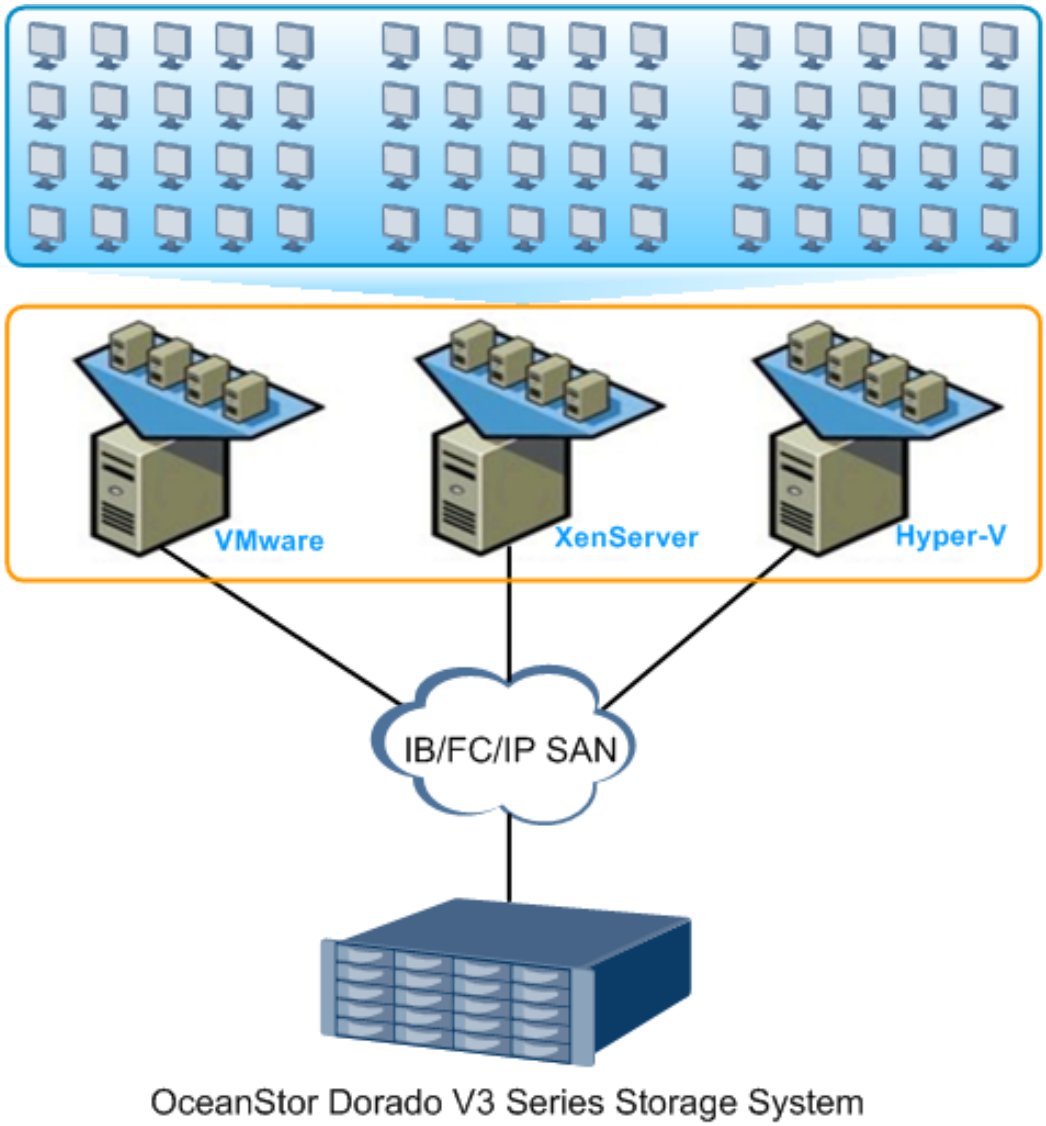


Virtual Desktop Service

OceanStor Dorado V3 series storage system can easily meet large-scale virtual desktop deployment and performance requirements while reducing TCO with minimal SSDs in comparison to traditional storage systems. In addition, OceanStor Dorado V3 series storage system provides inline deduplication and compression to increase space usage and maximize ROI. Performance-lossless snapshots and remote replication of OceanStor Dorado V3 series storage system improve data backup and disaster recovery capabilities without affecting normal use of virtual desktops.

Figure 3-3 illustrates an example of virtual desktop services.

Figure 3-3 Virtual desktop service



4 Hardware Architecture

Hardware of the OceanStor Dorado V3 series storage system is the basis of data storage. A storage unit typically consists of a controller enclosure or a controller enclosure plus disk enclosures.

4.1 Device Composition (Applicable to Dorado3000 V3, Dorado5000 V3 and Dorado6000 V3)

A storage system consists of a controller enclosure and one or more disk enclosures, and it provides an intelligent storage platform that features robust reliability, high performance, and large capacity.

Table 4-1 lists the device composition of storage systems.

NOTE

When the PCIe Scale-out is implemented for adding controllers of a storage system, data switches are used for the connection between PCIe ports of controllers.

Table 4-1 Device composition

Product Model	Controller Enclosure	Disk Enclosure	(Optional) Data Switch	(Optional) Dorado NAS Unit
OceanStor Dorado3000 V3	2 U SAS all-flash controller enclosure with 25 disk slots	2 U SAS disk enclosure with 25 disk slots	Supported	Not supported

Product Model	Controller Enclosure	Disk Enclosure	(Optional) Data Switch	(Optional) Dorado NAS Unit
OceanStor Dorado5000 V3	● 2 U NVMe all-flash controller enclosure with 25 disk slots ● 2 U SAS all-flash controller enclosure with 25 disk slots	● 2 U NVMe disk enclosure with 25 disk slots ● 2 U SAS disk enclosure with 25 disk slots	Supported	Supported
OceanStor Dorado6000 V3	● 3 U NVMe all-flash controller enclosure ● 3 U SAS all-flash controller enclosure	● 2 U NVMe disk enclosure with 25 disk slots ● 2 U SAS disk enclosure with 25 disk slots	Supported	Supported

The following figures show the appearances of the storage devices.

Figure 4-1 2 U controller enclosure with 25 disk slots

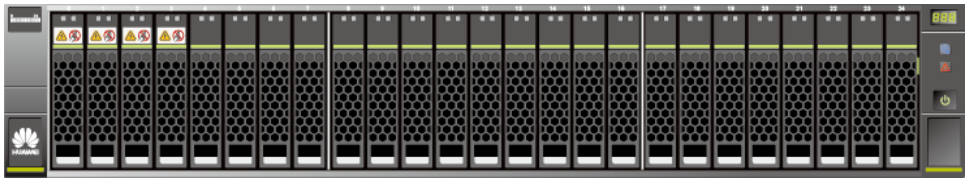


Figure 4-2 3 U controller enclosure

Figure 4-3 2 U SAS disk enclosure

Figure 4-4 2 U NVMe disk enclosure

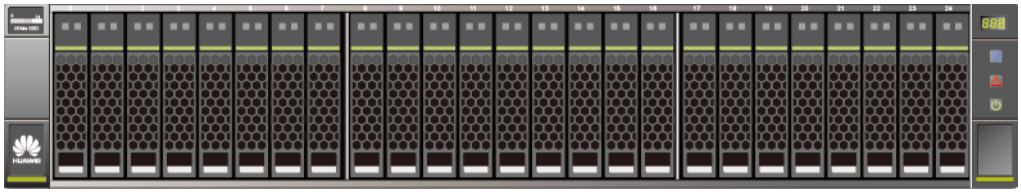


Figure 4-5 Data switch

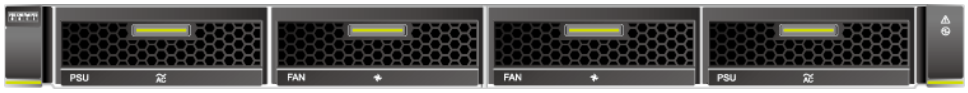


Figure 4-6 Dorado NAS unit

4.2 Device Composition (Applicable to Dorado18000 V3)

A storage system consists of system bays. A system bay consists of a controller enclosure, disk enclosures, and data switches.

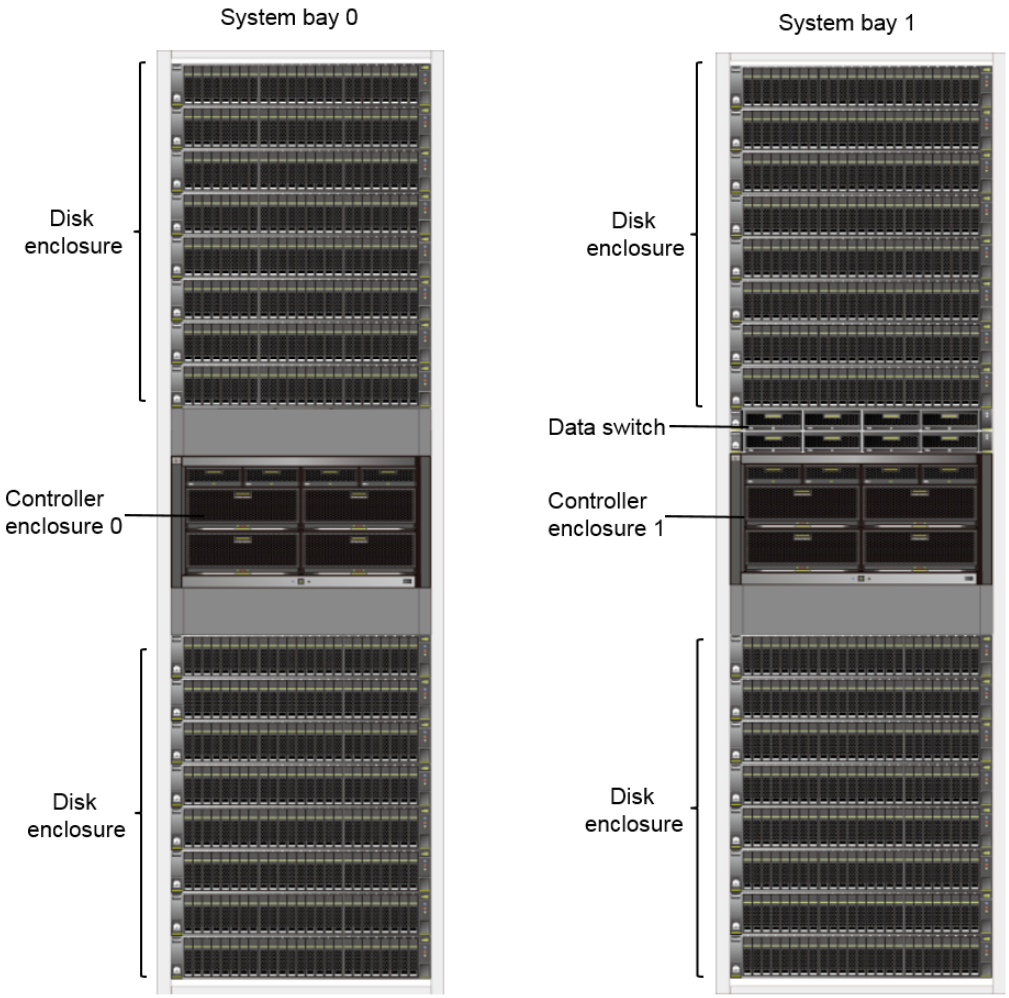
Dorado18000 V3 (SAS)

The storage system supports up to two system bays as system bay 0 and system bay 1.

- System bay 0 houses disk enclosures (up to sixteen 2 U disk enclosures), and a controller enclosure.
- System bay 1 houses disk enclosures (up to sixteen 2 U disk enclosures), two data switches, and a controller enclosure.

Figure 4-7 shows the front view of system bays.

Figure 4-7 Front view of system bays



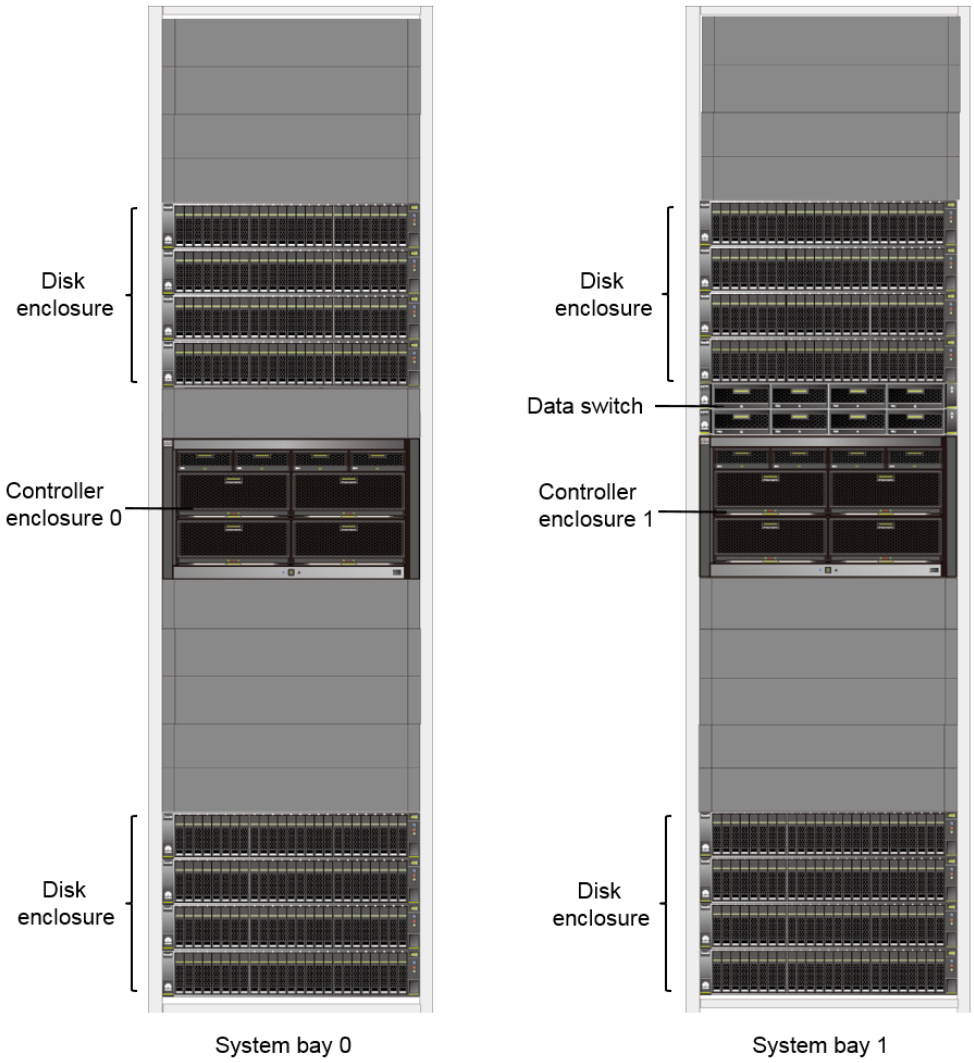
Dorado18000 V3 (NVMe)

The storage system supports up to two system bays as system bay 0 and system bay 1.

- System bay 0 houses disk enclosures (up to eight 2 U NVMe disk enclosures), and a controller enclosure.
- System bay 1 houses disk enclosures (up to eight 2 U NVMe disk enclosures), two data switches, and a controller enclosure.

Figure 4-8 shows the front view of system bays.

Figure 4-8 Front view of system bays



4.3 Components (Applicable to Dorado3000 V3, Dorado5000 V3 and Dorado6000 V3)

This section describes the components of OceanStor Dorado3000 V3, Dorado5000 V3 and Dorado6000 V3 storage system.

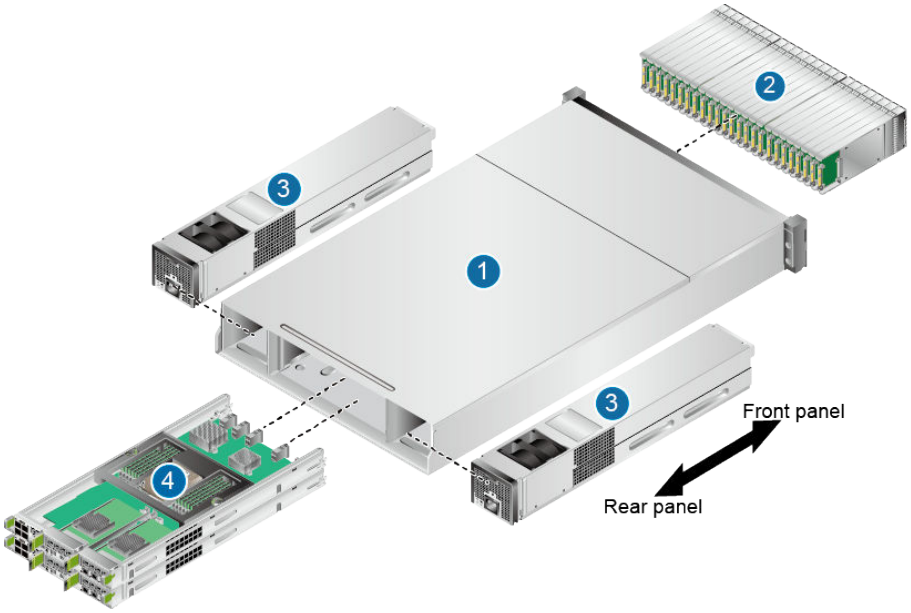
2 U Controller Enclosure (Supported by OceanStor Dorado3000 V3, Dorado5000 V3)

The controller enclosure adopts a modular design and consists of a system subrack, controllers, power-BBU modules, and disk modules. **Figure 4-9** shows the overall structure and components of a 2 U 25-disk controller enclosure.

NOTE

A2 U controller enclosure of OceanStor Dorado3000 V3, Dorado5000 V3 supports both AC and DC power modules. The following figure uses the AC power module as an example.

Figure 4-9 Overall structure of a 2 U 25-disk controller enclosure (OceanStor Dorado3000 V3, Dorado5000 V3)



1	System subrack	2	Disk module
3	Power-BBU module	4	Controller

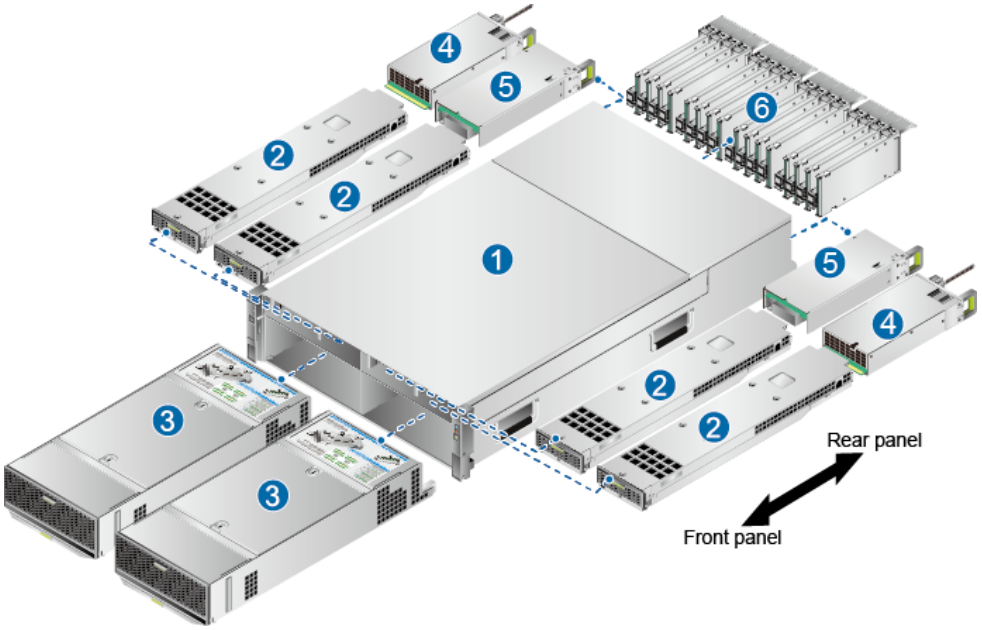
NOTE

In the rear view of a controller enclosure, controller A is above controller B.

3 U Controller Enclosure (Supported by OceanStor Dorado6000 V3)

The controller enclosure consists of a system subrack, controllers, BBU module, power modules, management modules, and interface modules. **Figure 4-10** shows the overall structure of a controller enclosure.

Figure 4-10 Overall structure of a controller enclosure

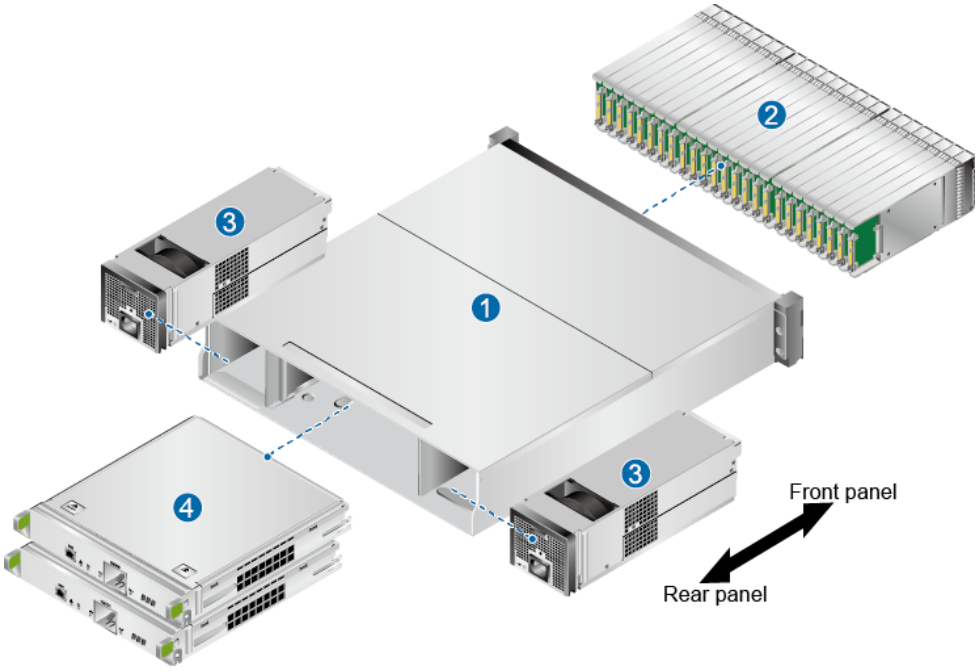


1	System subrack	2	BBU module
3	Controller	4	Power module
5	Management module	6	Interface module

2 U NVMe Disk Enclosure

The disk enclosure consists of a system subrack, expansion modules, disk modules, and power modules. **Figure 4-11** shows the overall structure of a 2 U NVMe disk enclosure.

Figure 4-11 Overall structure of a 2 U NVMe disk enclosure

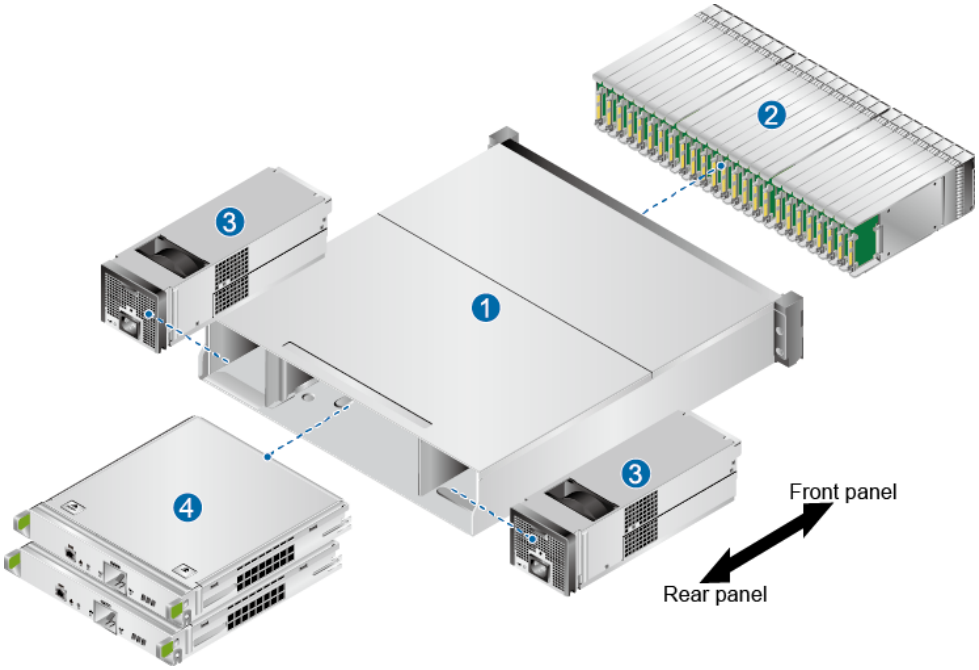


1	System subrack	2	Disk module
3	Power module	4	Expansion module

2 U SAS Disk Enclosure

The disk enclosure consists of a system subrack, expansion modules, disk modules, and power modules. **Figure 4-12** shows the overall structure of a 2 U SAS disk enclosure.

Figure 4-12 Overall structure of a 2 U SAS disk enclosure

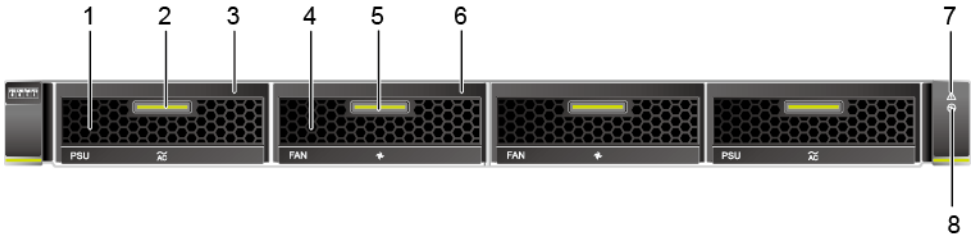


1	System subrack	2	Disk module
3	Power module	4	Expansion module

(Optional) Data Switch

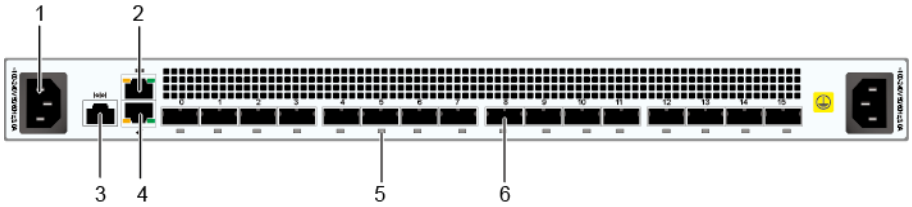
When the PCIe Scale-out is implemented for adding controllers of a storage system, data switches are used for the connection between PCIe ports of controllers.

Figure 4-13 Front view of a data switch



1	AC power module	2	Latch of an AC power module
3	Handle of an AC power module	4	Fan module
5	Fan module latch	6	Fan module handle
7	Alarm indicator of a data switch	8	Data switch Power indicator

Figure 4-14 Rear view of a data switch



1	Power socket	2	Management network interface
3	Serial port	4	Management network interface
5	PCIe port Link/ Speed indicator	6	PCIe port

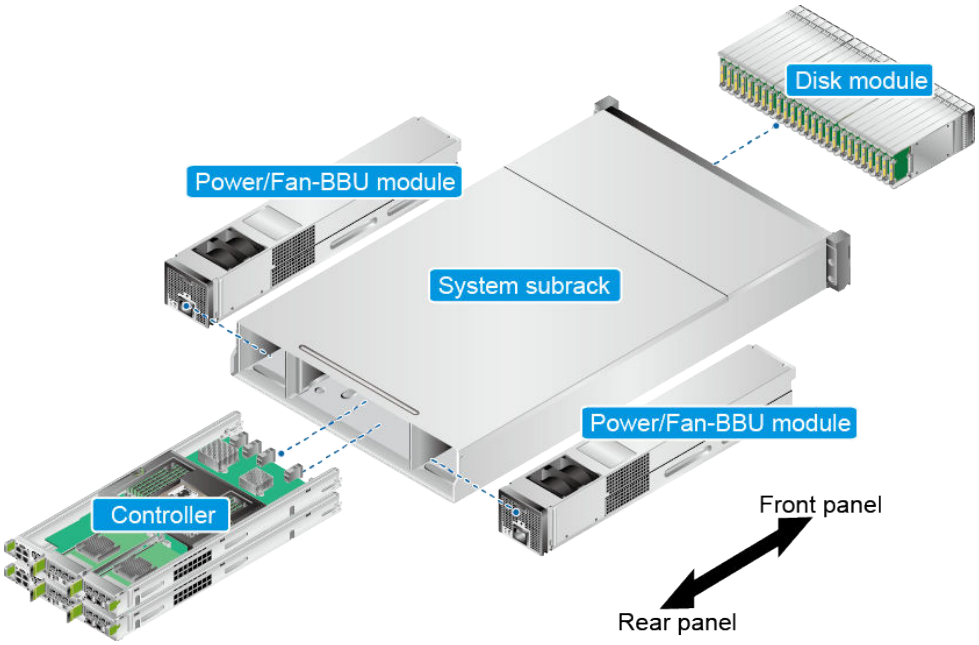
(Optional) Dorado NAS Unit

The Dorado NAS unit adopts a modular design and consists of a system subrack, controllers, Power-Fan/BBU modules, and disk modules. **Figure 4-15** shows the overall structure and components of a Dorado NAS unit.

NOTE

The Dorado NAS unit supports both AC and DC power modules. The following figure uses the AC power module as an example.

Figure 4-15 Overall structure of a Dorado NAS unit



NOTE

Controller A is above controller B. Controllers communicate with each other using internal heartbeat links and do not need cable connections.

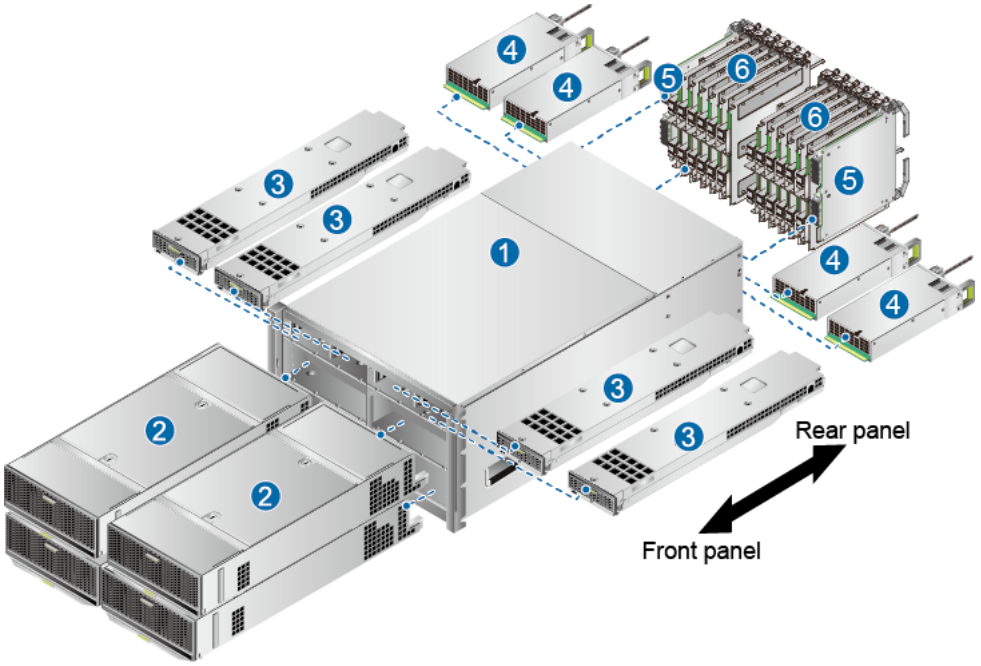
4.4 Components (Applicable to Dorado18000 V3)

This section describes the components of OceanStor Dorado18000 V3 storage system.

6 U Controller Enclosure

The controller enclosure consists of a system subrack, controllers, BBU module, power modules, management modules, and interface modules. **Figure 4-16** shows the overall structure of a 6 U controller enclosure.

Figure 4-16 Overall structure of a controller enclosure

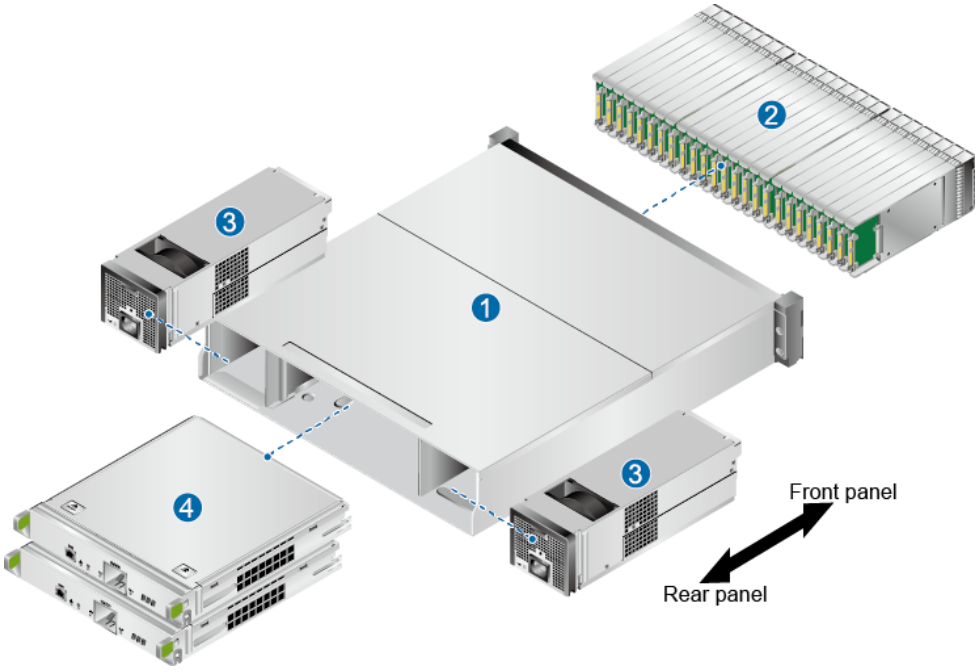


1	System subrack	2	Controller
3	BBU	4	Power module
5	Management module	6	Interface module

2 U NVMe Disk Enclosure

The disk enclosure consists of a system subrack, expansion modules, disk modules, and power modules. **Figure 4-17** shows the overall structure of a 2 U NVMe disk enclosure.

Figure 4-17 Overall structure of a 2 U NVMe disk enclosure

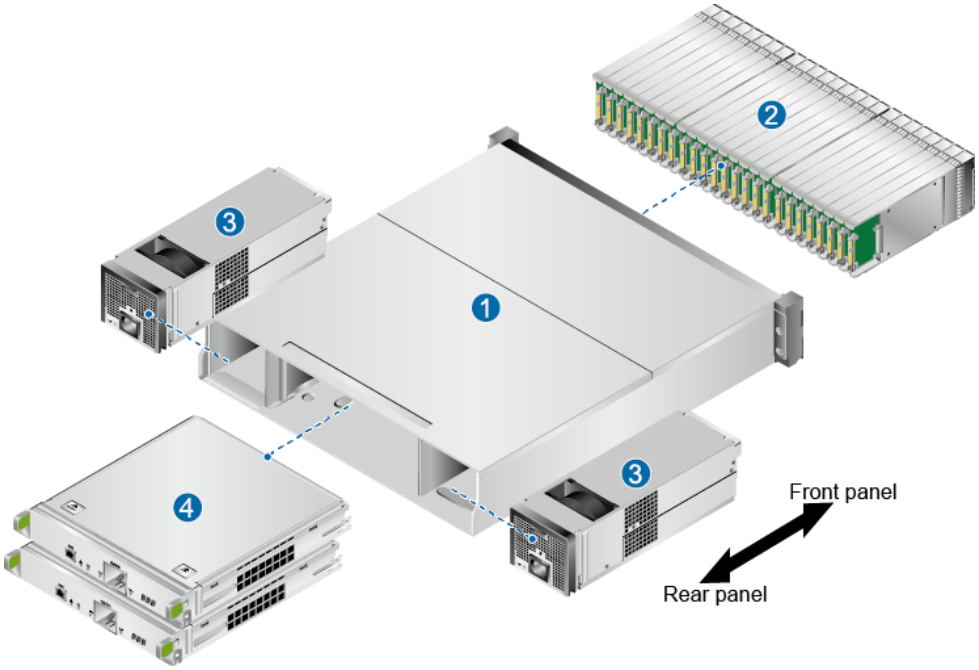


1	System subrack	2	Disk module
3	Power module	4	Expansion module

2 U SAS Disk Enclosure

The disk enclosure consists of a system subrack, expansion modules, disk modules, and power modules. **Figure 4-18** shows the overall structure of a 2 U SAS disk enclosure.

Figure 4-18 Overall structure of a 2 U SAS disk enclosure

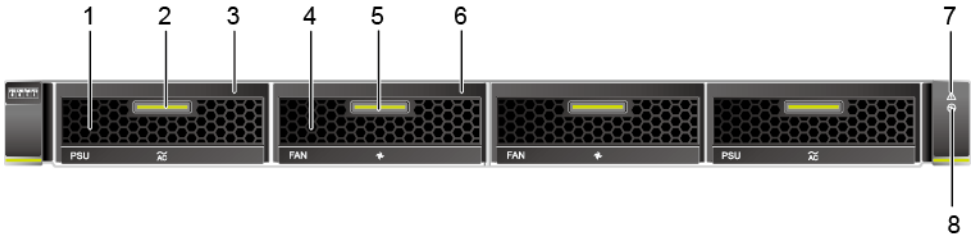


1	System subrack	2	Disk module
3	Power module	4	Expansion module

(Optional) Data Switch

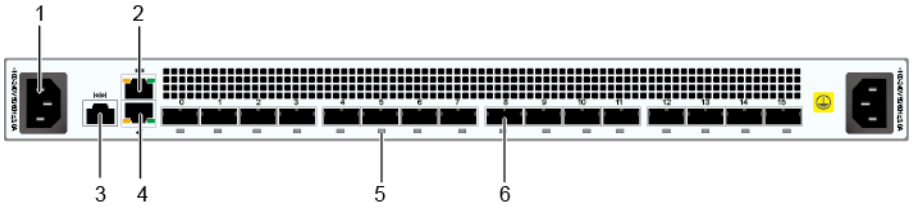
When the PCIe Scale-out is implemented for adding controllers of a storage system, data switches are used for the connection between PCIe ports of controllers.

Figure 4-19 Front view of a data switch



1	AC power module	2	Latch of an AC power module
3	Handle of an AC power module	4	Fan module
5	Fan module latch	6	Fan module handle
7	Alarm indicator of a data switch	8	Data switch Power indicator

Figure 4-20 Rear view of a data switch



1	Power socket	2	Management network interface
3	Serial port	4	Management network interface
5	PCIe port Link/ Speed indicator	6	PCIe port

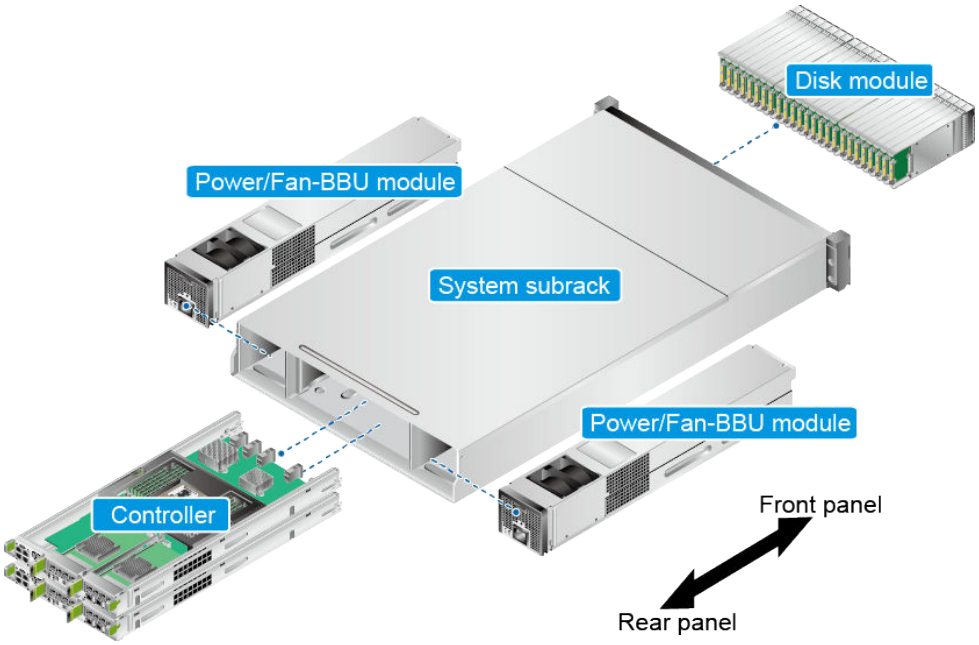
(Optional) Dorado NAS Unit

The Dorado NAS unit adopts a modular design and consists of a system subrack, controllers, power-fan/BBU modules, and disk modules. **Figure 4-21** shows the overall structure and components of a Dorado NAS unit.

NOTE

The Dorado NAS unit supports both AC and DC power modules. The following figure uses the AC power module as an example.

Figure 4-21 Overall structure of a Dorado NAS unit



NOTE

Controller A is above controller B. Controllers communicate with each other using internal heartbeat links and do not need cable connections.

5 Software Architecture

Storage system software manages storage devices and stored data, and assists application servers in data operations.

The software suite provided by OceanStor Dorado V3 series storage system consists of software running on a storage system, software running on a maintenance terminal, and software running on an application server. These three types of software work jointly to deliver storage, backup, and disaster recovery services in a smart, efficient, and cost-effective manner.

Figure 5-1 shows the storage system software architecture.

Figure 5-1 Storage system software architecture

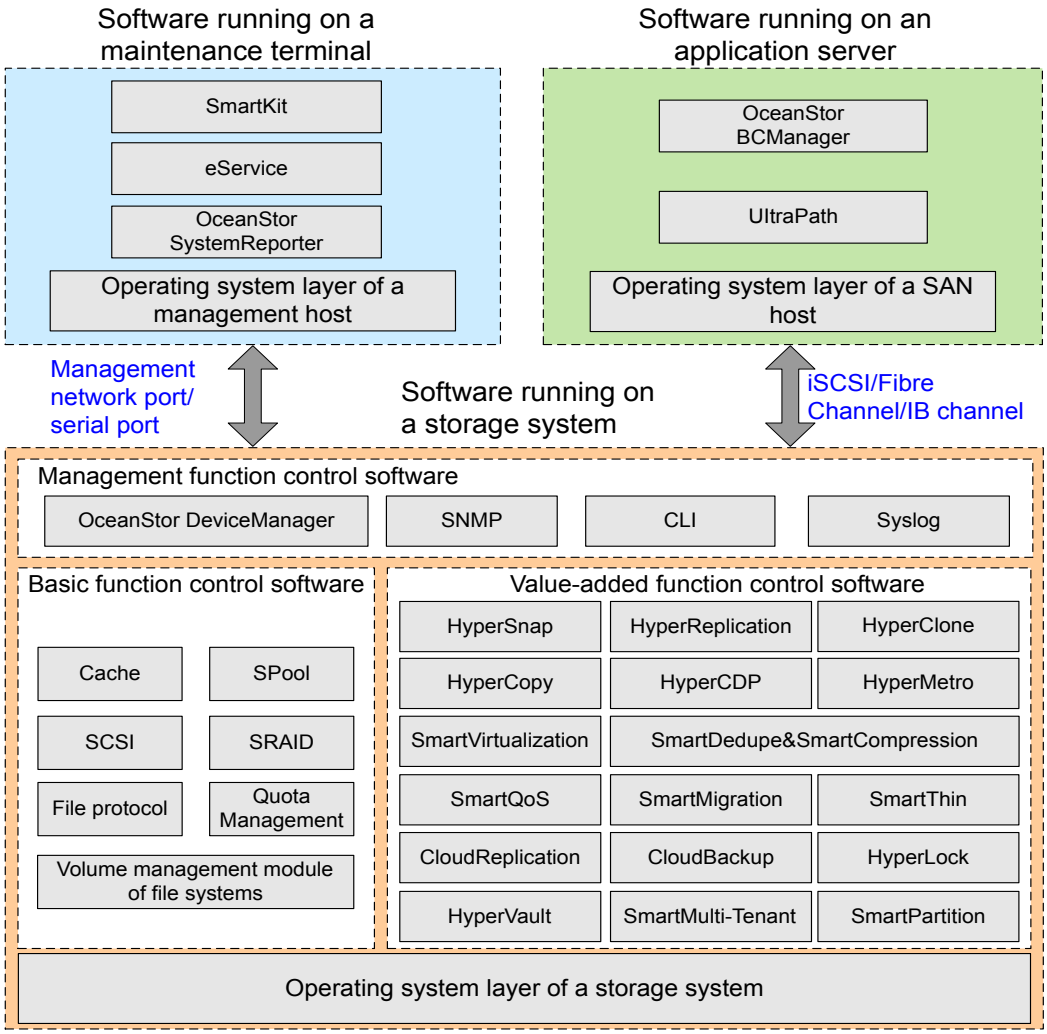


Table 5-1 describes the storage system software architecture.

Table 5-1 Storage system software architecture

Software	Function
Table 5-2	The dedicated operating system OceanStor OS manages storage system hardware and supports the running of storage service software. ● The basic function control software provides basic data storage and access functions. ● The value-added function control software provides advanced functions such as backup, disaster recovery, and performance tuning. ● The management function control software provides the management utilities to the storage system.
Table 5-3	Configures and maintains the storage system. The software includes SmartKit, OceanStor SystemReporter and eService.

Software	Function
Table 5-4	On a SAN network, software running on an application server enables the application server to communicate and cooperate with the storage system. The software includes OceanStor BCManager and UltraPath.

Table 5-2 describes the software running on a storage system.

Table 5-2 Software running on a storage system

Software Set	Software	Function
Storage system operating system	-	Manages storage system hardware and supports the running of storage service software.
Management function control software	OceanStor DeviceManager	OceanStor DeviceManager is an integrated storage management platform developed by Huawei. It provides easy configuration, management, and maintenance of storage devices.
	SNMP[a, b]	The storage system can be connected to third-party management software using the SNMP protocol. In addition, the storage system provides the functions supported by the third-party management software using the MIB interface. A variety of network management software supports SNMP. Users can choose desired software based on their requirements.
	CLI[c]	The storage system supports CLI-based management and configuration. Users can use a third-party terminal software to log in to the storage system through its serial port or management network port (over SSH), and manage the storage system on the CLI.
	Syslog	The storage system can send alarm information to a third party. Syslog software is used to receive and save the information. Among various types of third-party Syslog software, and users can choose one based on site requirements.
Basic function control software	SCSI software module	Manages the status of SCSI commands, and dispatches, resolves, and processes SCSI commands.

Software Set	Software	Function
	SRAID software module	Uses data stripping and redundancy to provide high performance, large capacity, and high reliability for data storage. A wide range of RAID levels are provided for diversified data reliability and access performance.
	SPool software module	Logically combines disks from different disk enclosures into a disk domain, in which storage pools are created to provide storage resources for services.
	Cache software module	Converts a high-speed and small-capacity memory to a buffer for improving system performance. Its major functions include data caching.
	File protocol module	Provides file system sharing and backup functions. It supports CIFS and NFS file sharing protocols.
	Quota management module	Provides quota management for file system sharing. A shared file system allows you to specify the maximum storage capacity available to a specific directory.
	Volume management module of file system	Implements virtualized management based on volumes.
Value-added function control software	HyperSnap software module	Provides the snapshot function. Snapshot does not provide a complete physical duplicate but only an image of the source data, and locates the image through a mapping table.
	HyperReplication software module	Provides the remote replication function. Remote replication creates an available data duplicate almost in real time on a storage system that resides in a different region from the local storage system. The duplicate can be used immediately without data recovery, protecting service continuity and data availability to the maximum. A consistency group manages remote replication tasks in batches. Any operation to the consistency group is also applied to the remote replication tasks in the group, ensuring data consistency throughout those remote replication tasks.
	HyperMetro software module	Provides the HyperMetro function. HyperMetro enables real-time data synchronization and access between two storage systems, improving resource utilization. When data access fails, HyperMetro implements seamless service switchover, ensuring data security and service continuity.

Software Set	Software	Function
	HyperClone software module	Provides the clone function. Clone generates a full data copy of the source data in the local storage system.
	HyperCopy software module	HyperCopy supports incremental synchronization and restoration, and allows data copy across engines, disk domains, and consistency groups, ensuring local data availability.
	HyperCDP software module	HyperCDP achieves continuous data protection at an interval of several seconds, generating more intensive recovery points on storage devices.
	SmartQoS software module	Provides the SmartQoS function. SmartQoS controls the storage performance of LUNs, and prioritizes the quality of service (QoS) of critical applications.
	SmartThin software module	Provides the SmartThin function. SmartThin achieves the on-demand space allocation. It allocates free storage space in quota to application servers only as needed, increasing the storage space usage.
	SmartMigration software module	Provides the SmartMigration function. SmartMigration migrates services on a source LUN transparently to a target LUN without interrupting host services. After the migration, the target LUN can replace the source LUN to carry the services.
	SmartVirtualization software module	Provides the SmartVirtualization function. SmartVirtualization enables a local storage system to centrally manage storage resources of third-party storage systems, simplifying storage system management and reducing maintenance costs.
	SmartDedupe and SmartCompression software module	Provides deduplication and compression. The deduplication function is used to analyze and delete duplicate data in a storage system. The compression function is used to minimize space occupied by data.
	CloudBackup software module	CloudBackup allows storage systems to back up data to the cloud without the backup server or gateway, ensuring data security.
	CloudReplication software module	CloudReplication provides cloud DR for storage systems, implementing data protection on the cloud.
	HyperLock software module	Implements WORM to set critical data to read-only state, preventing unauthorized data change and deletion during a specified period of time.
	HyperVault software module	Provides the HyperVault function. HyperVault enables storage systems to protect their data.

Software Set	Software	Function
	SmartMulti-Tenant software module	Provides the SmartMulti-Tenant function. SmartMulti-Tenant enables a storage system to provide different tenants with shared storage resources and to separate tenant access and management.
	SmartPartition software module	Provides the SmartPartition function. SmartPartition allocates the cache resources from storage system engines on demand to improve QoS for mission-critical applications and high-level users.
a: Simple Network Management Protocol b: The supported character encoding is UTF-8. c: Command Line Interface		

Table 5-3 describes the software running on a maintenance terminal.

Table 5-3 Software running on a maintenance terminal

Software	Function
SmartKit	SmartKit helps service engineers and O&M engineers deploy, maintain, and upgrade devices.
eService	eService is a piece of remote maintenance and management software used for device monitoring, alarm reporting, and device inspection.
OceanStor SystemReporter	OceanStor SystemReporter is a dedicated performance and capacity report analysis tool for storage systems.

Table 5-4 describes the software running on an application server.

Table 5-4 Software running on an application server

Software	Function
OceanStor BCManager	Provides data protection and disaster recovery for application servers using related storage system value-added features (asynchronous remote replication and snapshot). It centrally manages the requirements for data protection and disaster recovery between storage systems and application servers.
UltraPath	A storage system driver program installed on application servers. When multiple data channels are set up between an application server and a storage system, the UltraPath selects an optimal channel for the application server to access the storage system. UltraPath provides an easy and efficient path management solution for proven data transmission reliability and high path security.

6 Product Specifications

This chapter describes the hardware specifications and software specifications of the storage system.

6.1 Hardware Specifications (Applicable to Dorado3000 V3, Dorado5000 V3 and Dorado6000 V3)

Hardware specifications cover the hardware configuration, port specifications, disk specifications, dimensions, weight, electrical specifications, and reliability specifications.

Table 6-1 describes the hardware specification categories to help you quickly find out the specification information you need.

Table 6-1 Description of hardware specification categories

Category	Description
Hardware Configuration	Describes the configuration of major hardware components, such as memory capacity, hard disks, and ports.
Port Specifications	Describes the port specifications, such as the maximum number of ports provided by each type of interface module and the maximum number of interface modules supported by each controller.
Disk Specifications	Describes the dimensions, rotational speed, capacity, and weight of each type of disks.

Category	Description
Dimensions and Weight (Unpackaged)	Describes the dimensions and weight of controller enclosures and disk enclosures.
Electrical Specifications	Describes the electrical specifications of controller enclosures and disk enclosures.
Reliability Specifications	Describes the reliability specifications of storage systems.

Hardware Configuration

Item	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
Form factor of enclosures	SAN: disk-controller integration (2 U 25 disk slots)	● SAN: disk-controller integration (2 U 25 disk slots) ● NAS: disk-controller integration (2 U 25 disk slots)	● SAN: disk and controller separation (3 U independent controller enclosure) ● NAS: disk-controller integration (2 U 25 disk slots)
Maximum number of controllers per controller enclosure	2	2	2
Maximum number of controllers*	16	16	16
Maximum number of disks*	800 (100 per dual controllers)	1400 (9600)	2400 (9600)
Memory per controller	SAN: 96 GB	● SAN: 128 GB and 256 GB ● NAS: 64 GB	● SAN: 256 GB, 512 GB, and 1 TB ● NAS: 64 GB
Controller enclosure	SAN: 2 U, disk-controller integration, 25 x 2.5-inch SAS SSDs	SAN: 2 U, disk-controller integration, 25 x 2.5-inch NVMe or SAS SSDs NAS: 2 U, disk-controller integration	SAN: 3 U independent controller enclosure without disks NAS: 2 U, disk-controller integration

Item	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
Disk enclosure	Independent SAS model: A controller enclosure (with two controllers) supports a maximum of three SAS disk enclosures. Each disk enclosure can house 25 x 2.5-inch SAS SSDs.	● Independent NVMe model: A controller enclosure (with two controllers) supports a maximum of one NVMe disk enclosure. Each disk enclosure can house 25 x 2.5-inch NVMe SSDs. ● Independent SAS model: A controller enclosure (with two controllers) supports a maximum of six SAS disk enclosures. Each disk enclosure can house 25 x 2.5-inch SAS SSDs. ● Intermixing of SAS and NVMe SSDs: A controller enclosure (with two controllers) supports a maximum of two SAS disk enclosures + two NVMe disk enclosures.	● Independent NVMe model: A controller enclosure (with two controllers) supports a maximum of four NVMe disk enclosures. Each disk enclosure can house 25 x 2.5-inch NVMe SSDs. ● Independent SAS model: A controller enclosure (with two controllers) supports a maximum of 12 SAS disk enclosures. Each disk enclosure can house 25 x 2.5-inch SAS SSDs. ● Intermixing of SAS and NVMe SSDs: A controller enclosure (with two controllers) supports a maximum of eight SAS disk enclosures + four NVMe disk enclosures.
Maximum number of disk enclosures connected to back-end channels (ports)	Single-uplink networking. Each SAS port connects to only one SAS disk enclosure. Cascading is not supported.	● NVMe: single-uplink networking. Each port only connects to one disk enclosure. Cascading is not supported. ● SAS: single-uplink networking. Each port only connects to one disk enclosure. Cascading is not supported.	● NVMe: single-uplink networking. Each port only connects to one disk enclosure. Cascading is not supported. ● SAS: single-uplink networking. Each port only connects to one disk enclosure. Cascading is not supported.

Item	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
Length of back-end cables	SAS cable: 1 m (electrical), 2 m (electrical), 3 m (electrical), 5 m (electrical), and 15 m (optical)	● SAS cable: 1 m (electrical), 2 m (electrical), 3 m (electrical), 5 m (electrical), and 15 m (optical) ● NVMe cable: 1 m (electrical) and 3 m (electrical)	● SAS cable: 1 m (electrical), 2 m (electrical), 3 m (electrical), 5 m (electrical), and 15 m (optical) ● NVMe cable: 1 m (electrical) and 3 m (electrical)
Redundancy of main components	SAN/dual-controller: BBUs (1+1), power modules (1+1), and fans (3+1)	● SAN/dual-controller: BBUs (1+1), power modules (1+1), and fans (3+1) ● NAS/dual-controller: BBUs (1+1), power modules (1+1), and fans (3+1)	● SAN: BBUs (2+1), power modules (1+1), fans (5+1), and management modules (1+1) ● NAS/dual-controller: BBUs (1+1), power modules (1+1), and fans (3+1)
System bus bandwidth	SAN/dual-controller: 192 GB/s	● SAN/dual-controller: 192 GB/s ● NAS/dual-controller: 192 GB/s	● SAN/dual-controller: 384 GB/s ● NAS/dual-controller: 192 GB/s
Maximum number of hot-swappable I/O interface modules per controller	SAN: 2	● SAN: 2 ● NAS: 2	● SAN: 8 ● NAS: 2
Onboard I/O ports (per controller) for disk connections	2 x 4 x 12 Gbit/s SAS ports	● Independent NVMe model: 1 x 8 x 8 Gbit/s PCIe port ● Mixed NVMe +SAS model: 2 x 4 x 12 Gbit/s SAS ports	-

Item	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
Onboard I/O ports (per controller) for host connections	Four front-end SmartIO ports are used. Each module supports four optical ports (adjustable): 8 Gbit/s Fibre Channel, 16 Gbit/s Fibre Channel, and 10 Gbit/s ETH.	Four front-end SmartIO ports are used. Each module supports four optical ports (adjustable): 8 Gbit/s Fibre Channel, 16 Gbit/s Fibre Channel, and 10 Gbit/s ETH or FCoE.	-
Hot-swappable front-end interface modules	● 4-port SmartIO module ● 2-port 40GE/ 100GE I/O module ● 4-port 10GE (Base-T) I/O module	● 2-port 56 Gbit/s InfiniBand I/O module ● 4-port SmartIO module ● 2-port 40GE/ 100GE I/O module ● 4-port 10GE (Base-T) I/O module	● 2-port 56 Gbit/s InfiniBand I/O module ● 4-port SmartIO module ● 2-port 40GE/ 100GE I/O module ● 4-port 10GE (Base-T) I/O module
Maximum number of front-end ports (SAN)	● Dual-controller: 24 (each controller supports 3 x four-port 8 Gbit/s Fibre Channel I/O modules.) ● Four-controller: 32 (each controller supports 2 x four-port 8 Gbit/s Fibre Channel I/O modules.)	● Dual-controller: 24 (each controller supports 3 x four-port 8 Gbit/s Fibre Channel I/O modules.) ● Four-controller: 32 (each controller supports 2 x four-port 8 Gbit/s Fibre Channel I/O modules.)	● Dual-controller: 56 (each controller supports 7 x four-port 8 Gbit/s Fibre Channel I/O modules.) ● Four-controller: 96 (each controller supports 6 x four-port 8 Gbit/s Fibre Channel I/O modules.) ● Eight-controller: 192 (each controller supports 6 x four-port 8 Gbit/s Fibre Channel I/O modules.)
Maximum number of front-end ports (NAS)	-	● GE ports: 8 ● 10GE ports: 12 (including onboard ports) ● 25GE ports: 8 ● 40GE ports: 4 ● 100GE ports: 4	● GE ports: 8 ● 10GE ports: 12 (including onboard ports) ● 25GE ports: 8 ● 40GE ports: 4 ● 100GE ports: 4

Item	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
Maximum number of back-end ports	● Dual-controller: 12 (4 x 12 Gbit/s SAS) ● Four-controller: 20 (4 x 12 Gbit/s SAS)	● Dual-controller: 12 (4 x 12 Gbit/s SAS) ● Four-controller: 20 (4 x 12 Gbit/s SAS)	● Dual-controller: 48 (4 x 12 Gbit/s SAS) ● Four-controller: 96 (4 x 12 Gbit/s SAS) ● Eight-controller: 192 (4 x 12 Gbit/s SAS)
Hot-swappable back-end interface modules	4-port 4 x 12 Gbit/s SAS module	● 2-port 8 x 8 Gbit/s PCIe scale-up module ● 4-port 4 x 12 Gbit/s SAS module	● 2-port 8 x 8 Gbit/s PCIe scale-up module ● 4-port 4 x 12 Gbit/s SAS module
* If you require the specifications marked with *, contact Huawei sales personnel.			

Port Specifications

Maximum Number of Ports on Each Interface Module	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
56 Gbit/s InfiniBand interface module	-	2-port front-end interface module for SAN	
GE electrical interface module	4-port interface module used in HyperMetro quorum networking	4-port interface module, used in HyperMetro quorum networking and NAS front-end	
10GE electrical interface module	4-port front-end interface module for SAN	4-port front-end interface module for SAN and NAS	
40GE or 100GE interface module	Front-end interface module for SAN, each with two 40GE or 100GE optical ports	Front-end interface module for SAN and NAS, each with two 40GE or 100GE optical ports	

Maximum Number of Ports on Each Interface Module	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
SmartIO interface module	Front-end interface module for SAN, each with four optical ports. The port type can be 8 Gbit/s, 16 Gbit/s, or 32 Gbit/s Fibre Channel, 10GE, or 25GE.	• Front-end interface module for SAN, each with four optical ports. The port type can be 8 Gbit/s, 16 Gbit/s, or 32 Gbit/s Fibre Channel, 10GE, 25GE, or 10 Gbit/s FCoE (VN2VF, front end only). • Front-end interface module for NAS, each with four optical ports. The port type can be 10GE, 25GE, or 10 Gbit/s FCoE (VN2VF, front end only). • Used for connecting NAS and SAN storage. Each module has four optical ports. The port type can be 16 Gbit/s Fibre Channel or 10GE.	
12 Gbit/s SAS expansion module	Back-end module, each with four 4 x 12 Gbit/s SAS electrical or optical ports.		
PCIe 3.0 scale-up module	-	Used for the scale-up connection between a controller enclosure and an NVMe disk enclosure. Each module has two 8 x 8 Gbit/s PCIe ports.	
PCIe 3.0 scale-out module	Used for the scale-out connection between controller enclosures. Each module has two 4 x 8 Gbit/s PCIe ports.		

Maximum Number of SAN Front-End Ports on Each Controller	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
8 Gbit/s Fibre Channel port	12 (including onboard ports)	12 (including onboard ports)	28
16 Gbit/s Fibre Channel port	12 (including onboard ports)	12 (including onboard ports)	28
32 Gbit/s Fibre Channel port	8	8	28
10GE port	12 (including onboard ports)	12 (including onboard ports)	28
25GE port	8	8	28
40GE port	4	4	14

Maximum Number of SAN Front-End Ports on Each Controller	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
100GE port	4	4	14
56 Gbit/s InfiniBand port	-	4	14
10 Gbit/s FCoE port	-	12 (including onboard ports)	28

Maximum Number of NAS Front-End Ports on Each Controller	Dorado5000 V3	Dorado6000 V3
GE port	8	8
10GE port	12 (including onboard ports)	12 (including onboard ports)
25GE port	8	8
40GE port	4	4
100GE port	4	4

Disk Specifications

Disk Type[a]	Dimensions	Weight	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
SSD in a 25-slot controller enclosure	2.5-inch	0.25 kg (0.55 lb)	1.92 TB, 3.84 TB and 7.68 TB SAS SSD	● 960 GB, 1.92 TB, 3.84 TB, 7.68 TB, and 15.36 TB NVMe SSD ● 960 GB, 1.92 TB, 3.84 TB, 7.68 TB, 15.36 TB, and 30.72 TB SAS SSD	-

Disk Type[a]	Dimensions	Weight	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
SSD in a 25-slot disk enclosure			1.92 TB, 3.84 TB and 7.68 TB SAS SSD	● 960 GB, 1.92 TB, 3.84 TB, 7.68 TB, and 15.36 TB NVMe SSD ● 960 GB, 1.92 TB, 3.84 TB, 7.68 TB, 15.36 TB, and 30.72 TB SAS SSD	● 960 GB, 1.92 TB, 3.84 TB, 7.68 TB, and 15.36 TB NVMe SSD ● 960 GB, 1.92 TB, 3.84 TB, 7.68 TB, 15.36 TB, and 30.72 TB SAS SSD
a: SSDs that have no data can be preserved for a maximum of 12 months while powered off. SSDs that have data can be preserved for a maximum of 3 months while powered off. If the maximum preservation time expires, data loss or SSD failures may occur.					

Dimensions and Weight (Unpackaged)

Hardware	Item	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
NVMe all-flash controller enclosure	Dimensions	-	● Depth: 748 mm (29.45 in.) ● Width: 447 mm (17.60 in.) ● Height: 86.1 mm (3.39 in.)	● Depth: 750 mm (29.53 in.) ● Width: 447 mm (17.60 in.) ● Height: 130.5 mm (5.14 in.)
	Weight (without disks)	-	33 kg (72.75 lb)	58.9 kg (129.85 lb)
	Weight (with disks)	-	39.3 kg (86.64 lb)	-
SAS all-flash controller enclosure	Dimensions	● Depth: 748 mm (29.45 in.) ● Width: 447 mm (17.60 in.) ● Height: 86.1 mm (3.39 in.)		● Depth: 750 mm (29.53 in.) ● Width: 447 mm (17.60 in.) ● Height: 130.5 mm (5.14 in.)
	Weight (without disks)	31.8 kg (70.11 lb)		58.9 kg (129.85 lb)
	Weight (with disks)	38.1 kg (84 lb)		-

Hardware	Item	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
2 U NVMe disk enclosure	Dimensions	-	● Depth: 488 mm (19.21 in.) ● Width: 447 mm (17.60 in.) ● Height: 86.1 mm (3.39 in.)	
	Weight (without disks)	-	17.5 kg (38.58 lb)	
	Weight (with disks)	-	23.75 kg (52.36 lb)	
2 U SAS disk enclosure	Dimensions	● Depth: 488 mm (19.21 in.) ● Width: 447 mm (17.60 in.) ● Height: 86.1 mm (3.39 in.)		
	Weight (without disks)	13.3 kg (29.32 lb)		
	Weight (with disks)	19.6 kg (43.21 lb)		
Dorado NAS unit	Dimensions	-	● Depth: 748 mm (29.45 in.) ● Width: 447 mm (17.60 in.) ● Height: 86.1 mm (3.39 in.)	
	Weight	-	34 kg (74.96 lb)	

Electrical Specifications

Item		Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
Power consumption	NVMe all-flash controller enclosure	-	● Max: 863 W ● Typical: 700 W ● Min: 570 W	● Max: 1270 W ● Typical: 1002 W ● Min: 640 W
	SAS all-flash controller enclosure	● Max: 750 W ● Typical: 567 W ● Min: 420 W	● Max: 908 W ● Typical: 716 W ● Min: 410 W	● Max: 1270 W ● Typical: 1002 W ● Min: 640 W
	2 U NVMe disk enclosure	-	● Max: 440 W ● Typical: 291.5 W ● Min: 264 W	

Item		Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
	2 U SAS disk enclosure	● Max: 320 W ● Typical: 240 W ● Min: 150 W		
	Dorado NAS unit	-	● Max: 560 W ● Typical: 415 W ● Min: 312 W	
Power voltage and rated current	NVMe all-flash controller enclosure SAS all-flash controller enclosure	Supports only the SAS all-flash controller enclosure. AC: ● 100 V to 240 V, ±10%, 10 A to 6 A, single-phase, 50/60 Hz ● Dual-live wire input (2W+PE) High-voltage DC (not supported in North America and Canada): ● 240 V, ±20%, 6.5 A Low-voltage DC (not supported in India, Taiwan, and South Korea): ● -48 V/-60 V, ±20%, 30 A	AC: ● 100 V to 240 V, ±10%, 10 A to 6 A, single-phase, 50/60 Hz ● Dual-live wire input (2W+PE) High-voltage DC (not supported in North America and Canada): ● 240 V, ±20%, 6.5 A Low-voltage DC (not supported in India, Taiwan, and South Korea): ● -48 V/-60 V, ±20%, 30 A	AC: ● 200 V to 240 V, ±10%, 10 A, single-phase, 50/60 Hz ● Dual-live wire input (2W+PE) High-voltage DC (not supported in North America and Canada): ● 240 V, ±20%, 10 A Low-voltage DC (not supported in India, Taiwan, and South Korea): ● -48 V/-60 V, ±20%, 50 A

Item		Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
	2 U NVMe disk enclosure 2 U SAS disk enclosure	Supports only the 2 U SAS disk enclosure. AC: ● 100 V to 240 V, ±10%, 10 A to 5 A, single-phase, 50/60 Hz ● 110 V single/dual-live wire input High-voltage DC (not supported in North America and Canada): ● 240 V, ±20%, 5 A Low-voltage DC (not supported in India and Taiwan): ● -48 V/-60 V, ±20%, 18.5 A	AC: ● 100 V to 240 V, ±10%, 10 A to 5 A, single-phase, 50/60 Hz ● 110 V single/dual-live wire input High-voltage DC (not supported in North America and Canada): ● 240 V, ±20%, 5 A Low-voltage DC (not supported in India and Taiwan): ● -48 V/-60 V, ±20%, 18.5 A	
	Dorado NAS unit	-	AC: ● 100 V to 240 V, ±10%, 10 A to 6 A, single-phase, 50/60 Hz ● Dual-live wire input (2W+PE) High-voltage DC (not supported in North America and Canada): ● 240 V, ±20%, 6.5 A	
	AC power input type (socket type)	● AC: IEC60320-C14 ● High-voltage DC: IEC60320-C14 ● Low-voltage DC: OT-M6		
BBU capacity		16 Wh		32 Wh

Reliability Specifications

Item	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
Solution-level reliability	99.9999%		

Item	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
MTBF[a]	700,000 hours		
MTTR[b]	2 hours		
a: Mean Time Between Failures b: Mean Time To Repair			

6.2 Hardware Specifications (Applicable to Dorado18000 V3)

Hardware specifications cover the hardware configuration, port specifications, disk specifications, dimensions, weight, electrical specifications, and reliability specifications.

Table 6-2 describes the hardware specification categories to help you quickly find out the specification information you need.

Table 6-2 Hardware specification categories

Category	Description
Hardware Configuration	Describes the configuration of major hardware components, such as memory, disks, and ports.
Port Specifications	Describes the port specifications, such as the maximum number of ports provided by each type of interface module and the maximum number of interface modules supported by each controller.
Disk Specifications	Describes the dimensions, rotational speed, capacity, and weight of each type of disks.
Bay Specifications	Describes the configuration of bay.
Dimensions and Weight	Describes the dimensions and weight of controller enclosures and disk enclosures.
Electrical Specifications	Describes the electrical specifications of controller enclosures and disk enclosures.
Reliability Specifications	Describes the reliability specifications of storage systems.

Hardware Configuration

Item	Dorado18000 V3
Form factor of enclosures	● SAN: 6 U independent controller enclosure without disks, multi-controller Scale-out architecture ● NAS: disk-controller integration (2 U 25 disk slots)
Maximum number of controllers per controller enclosure	4
Maximum number of controllers*	16
Maximum number of disks*	3200 (9600)
Memory per controller	● SAN: 256 GB, 512 GB, or 1 TB ● NAS: 64 GB
Mirror channel	SAN ● Between controllers A and B: 2 x PCIe 3.0 x 8 ● Between controllers A and C, or A and D: 1 x PCIe 3.0 x 8 NAS: PCIe 3.0 x 8
Controller enclosure	● SAN: 6 U independent controller enclosure without disks ● NAS: 2 U, disk-controller integration
Disk enclosure	● A 2 U PCIe 3.0 x8 NVMe disk enclosure houses 25 2.5-inch NVMe SSDs. A dual-controller system supports a maximum of four NVMe disk enclosures, and a four-controller system supports a maximum of eight NVMe disk enclosures. ● A 2 U 12 Gbit/s SAS disk enclosure houses 25 2.5-inch SAS SSDs. A dual-controller system supports a maximum of eight SAS disk enclosures, and a four-controller system supports a maximum of 16 SAS disk enclosures. ● A dual-controller system supports a maximum of eight NVMe and SAS mixed disk enclosures, and a four-controller system supports a maximum of 16 NVMe and SAS mixed disk enclosures.
Maximum number of disk enclosures connected to back-end channels (ports)	● NVMe: single-uplink networking. Each NVMe port only connects to one NVMe disk enclosure. Cascading is not supported. ● SAS: dual-uplink networking. Each SAS port only connects to one SAS disk enclosure. Cascading is not supported.

Item	Dorado18000 V3
Length of back-end cables	● SAS cable: 1 m (electrical), 2 m (electrical), 3 m (electrical), 5 m (electrical), and 15 m (optical) ● NVMe cable: 1 m (electrical) and 3 m (electrical)
Redundancy of main components	● SAN/four-controller: BBUs (3+1), 2 x power modules (1+1), fans (11+1), and management modules (1+1) ● NAS/dual-controller: BBUs (1+1), power modules (1+1), and fans (3+1)
System bus bandwidth	● SAN/four-controller: 768 GB/s ● NAS/dual-controller: 192 GB/s
Maximum number of hot-swappable I/O interface modules per controller	● SAN: 6 ● NAS: 2
Onboard I/O ports (per controller) for disk connections	-
Onboard I/O ports (per controller) for host connections	-
Hot-swappable front-end interface modules	● 2-port 56 Gbit/s InfiniBand I/O module ● 4-port SmartIO module ● 2-port 40GE/100GE I/O module ● 4-port 10GE (Base-T) I/O module
Maximum number of front-end ports (SAN)	● Dual-controller: 40 (each controller supports 5 x four-port 8 Gbit/s Fibre Channel I/O modules.) ● Four-controller: 64 (each controller supports 4 x four-port 8 Gbit/s Fibre Channel I/O modules.) ● Eight-controller: 128 (each controller supports 4 x four-port 8 Gbit/s Fibre Channel I/O modules.)
Maximum number of front-end ports (SAN and NAS unified storage)	● Dual-controller: 56 (8/16 Gbit/s Fibre Channel) ● Four-controller: 80 (8/16 Gbit/s Fibre Channel) ● Eight-controller: 144 (8/16 Gbit/s Fibre Channel)
Maximum number of back-end ports	● Dual-controller: 32 (4 x 12 Gbit/s SAS) ● Four-controller: 64 (4 x 12 Gbit/s SAS) ● Eight-controller: 128 (4 x 12 Gbit/s SAS)
Hot-swappable back-end interface modules	● 2-port 8 x 8 Gbit/s PCIe Scale-up module ● 4-port 4 x 12 Gbit/s SAS I/O module
* If you require the specifications marked with *, contact Huawei sales personnel.	

Port Specifications

Maximum Number of Ports on Each Interface Module	Dorado18000 V3
56 Gbit/s InfiniBand interface module	2-port front-end interface module for SAN
GE electrical interface module	4-port interface module, used in HyperMetro quorum networking and NAS front-end
10GE electrical interface module	4-port front-end interface module for SAN and NAS
40GE or 100GE interface module	Front-end interface module, each with two 40GE or 100GE optical ports
SmartIO interface module	● Front-end interface module for SAN, each with four optical ports. The port type can be 8 Gbit/s, 16 Gbit/s, or 32 Gbit/s Fibre Channel, 10GE, 25GE, or 10 Gbit/s FCoE (VN2VF, front end only). ● Front-end interface module for NAS, each with four optical ports. The port type can be 10GE, 25GE, or 10 Gbit/s FCoE (VN2VF, front end only). ● Used for connecting NAS and SAN storage. Each module has four optical ports. The port type can be 16 Gbit/s Fibre Channel or 10GE.
12 Gbit/s SAS expansion module	Back-end module, each with four 4 x 12 Gbit/s SAS electrical or optical ports.
PCIe 3.0 scale-up module	Used for the scale-up connection between a controller enclosure and an NVMe disk enclosure. Each module has two 8 x 8 Gbit/s PCIe ports.
PCIe 3.0 scale-out module	Used for the scale-out connection between controller enclosures. Each module has two 4 x 8 Gbit/s PCIe ports.

Maximum Number of SAN Front-End Ports on Each Controller	Dorado18000 V3
8 Gbit/s Fibre Channel port	20
16 Gbit/s Fibre Channel port	20
32 Gbit/s Fibre Channel port	20
10GE port	20
25GE port	20
40GE port	10

Maximum Number of SAN Front-End Ports on Each Controller	Dorado18000 V3
100GE port	10
56 Gbit/s InfiniBand port	10
10 Gbit/s FCoE port	20

Maximum Number of NAS Front-End Ports on Each Controller	Dorado18000 V3
GE port	8
10GE port	12 (including onboard ports)
25GE port	8
40GE port	4
100GE port	4

Disk Specifications

Disk Type[a]	Dimensions	Weight	Capacity
SSD in a 25-slot disk enclosure	2.5-inch	0.25 kg (0.55 lb)	● 960 GB, 1.92 TB, 3.84 TB, 7.68 TB, and 15.36 TB NVMe SSD ● 960 GB, 1.92 TB, 3.84 TB, 7.68 TB, 15.36 TB, and 30.72 TB SAS SSD
a: SSDs that have no data can be preserved for a maximum of 12 months while powered off. SSDs that have data can be preserved for a maximum of 3 months while powered off. If the maximum preservation time expires, data loss or SSD failures may occur.			

Bay Specifications

Item	Dorado18000 V3
System bay	Each system bay houses the following components: ● Power distribution unit (PDU) ● 6 U controller enclosure (one per system bay, each with four controllers) ● Up to 16 x 2 U disk enclosures (2.5-inch disks) ● One system switch matrix in system bay 1
System switch matrix	Two PCIe data switches (2 U) in system bay 1
Bay display	System bay 0 provides alarm indicators.
Shipment as an integrated bay	Supported
Third-party bay	Bays that meet the requirements of Huawei storage products
Huawei modular data center	IDS1000 and IDS2000

Dimensions and Weight

Item	Dorado18000 V3
Full bay dimensions (system bay)	● Depth: 1232 mm (48.50 in.) ● Width: 600 mm (23.62 in.) ● Height: 2000 mm (78.74 in.)
Package dimensions (system bay)	● Depth: 1456 mm (57.32 in.) ● Width: 1000 mm (39.37 in.) ● Height: 2176 mm (85.67 in.)
Fully loaded weight (system bay 0)	● NVMe: 527.5 kg (1162.94 lb) ● SAS: 657.3 kg (1449.10 lb)
Weight with packages (system bay 0)	● NVMe: 725.7 kg (1599.89 lb) ● SAS: 857.3 kg (1890.02 lb)
Fully loaded weight (system bay 1)	● NVMe: 551.2 kg (1215.19 lb) ● SAS: 682.8 kg (1505.32 lb)
Weight with packages (system bay 1)	● NVMe: 751.2 kg (1656.11 lb) ● SAS: 882.8 kg (1946.24 lb)
Unloaded bay weight	● NVMe: 140 kg (308.65 lb) ● SAS: 140 kg (308.65 lb)

Item	Dorado18000 V3
Dimensions of an NVMe all-flash controller enclosure Dimensions of a SAS all-flash controller enclosure	● Depth: 750 mm (29.53 in.) ● Width: 447 mm (17.60 in.) ● Height: 263.9 mm (10.39 in.)
Dimensions of a 2 U SAS disk enclosure Dimensions of a 2 U NVMe disk enclosure	● Depth: 488 mm (19.21 in.) ● Width: 447 mm (17.60 in.) ● Height: 86.1 mm (3.39 in.)
Dimensions of a Dorado NAS unit	● Depth: 748 mm (29.45 in.) ● Width: 447 mm (17.60 in.) ● Height: 86.1 mm (3.39 in.)

Electrical Specifications

Item	Dorado18000 V3 (NVMe)	Dorado18000 V3 (SAS)
System bay 0	● Max: 6404 W 1 x 6 U controller enclosure (with four controllers) and 8 x 2 U disk enclosures ● Typical: 4093 W ● Min: 3275 W	● Max: 7713 W 1 x 6 U controller enclosure (with four controllers) and 16 x 2 U disk enclosures ● Typical: 4983 W ● Min: 3691 W
System bay 1	● Max: 6617 W 1 x 6 U controller enclosure (with four controllers), 8 x 2 U disk enclosures, and 2 x PCIe switches ● Typical: 4285 W ● Min: 3435 W	● Max: 7926 W 1 x 6 U controller enclosure (with four controllers), 16 x 2 U disk enclosures, and 2 x PCIe switches ● Typical: 5175 W ● Min: 3691 W
Controller enclosure power consumption (with four controllers)	● Max: 2668 W ● Typical: 1761 W ● Min: 1163 W	
2 U disk enclosure power consumption	● Max: 440 W ● Typical: 291.5 W ● Min: 264 W	● Max: 320 W ● Typical: 240 W ● Min: 150 W
Dorado NAS unit	● Max: 560 W ● Typical: 415 W ● Min: 312 W	

Item	Dorado18000 V3 (NVMe)	Dorado18000 V3 (SAS)
PDU power voltage, rated current, and socket type	● 220 V single-phase AC: 200 V to 240 V, AC±10%, IEC60309 32A-6h (2P+G) ● 380 V three-phase AC: 346 V to 415 V, AC±10%, IEC60309 32A-6h (3W+N+PE) ● 240 V high voltage DC: 240 V, DC±20%, IEC60309 32A-6h (2P+G) ● North America 208 V three-phase AC: 200 V to 240 V, AC±10%, CS8365C (3W+PE)	
BBU capacity	32 Wh	

Reliability Specifications

Item	Value
Solution-level reliability	99.9999%
MTBF[a]	800,000 hours
MTTR[b]	1 hour
a: Mean Time Between Failures b: Mean Time To Repair	

6.3 Software Specifications (Applicable to Dorado3000 V3, Dorado5000 V3 and Dorado6000 V3)

The software specifications include the basic specifications, feature specifications, performance specifications, supported operating systems, and license control.

Table 6-3 describes the categories of storage software specifications to help you quickly find out the specification information you need.

Table 6-3 Description of software specification categories

Category	Description
Basic Specifications	Describes the basic software specifications of storage systems, including the maximum number of connected application servers, maximum number of LUNs, and maximum number of mapping views.
Feature Specifications	Describes the feature specifications of storage systems, such as snapshot, remote replication, and SmartMigration.
License Control	Describes whether software features of storage systems are controlled by licenses.

Basic Specifications

Item	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
RAID level	RAID 10*, RAID 5, RAID 6, and RAID-TP (able to tolerate three faulty disks)		
Maximum number of disk domains per dual-controller system	SAN: 2	SAN: 4 NAS: 64	
Maximum number of storage pools per dual-controller system	SAN: 2	SAN: 4 NAS: 64	
Maximum capacity per dual-controller system	500 TB	1 PB	2 PB
Maximum number of LUNs (including snapshots) in a storage pool	16,384 The total number of LUNs and their writable snapshots cannot exceed 16,384.		32,768 The total number of LUNs and their writable snapshots cannot exceed 32,768.
Maximum number of disks in a disk domain	200	350	600
Minimum number of disks in a disk domain	SAN: 8	SAN: 8 NAS: 4	
Maximum number of logical ports per controller	-	128	
Maximum number of VLANs per controller	-	128	
Maximum number of built-in DNS zones	-	1024	
Maximum number of LIFs listening to DNS requests	-	256	
Maximum number of hosts	8192		
Maximum number of LUNs (including snapshots)	16,384		32,768
Maximum number of LUN groups	8192		
Maximum number of host LUNs	512		

Item	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
Minimum capacity of a LUN	512 KB		
Maximum capacity of a LUN	256 TB		
Maximum number of host connections	8192		
Maximum number of file systems	-	The number of clone file systems and file systems cannot exceed 2048.	
Minimum capacity of a file system	-	1 GB	
Maximum capacity of a file system	-	16 PB	
Maximum number of files per file system (no limit in software)	-	2 billion	
Maximum capacity of a file (no limit in software)	-	256 TB	
Maximum number of subdirectories and files per directory (no limit in software)	-	30 million	
Maximum number of SMB shares	-	12,000	
Maximum number of NFS shares	-	10,000	
Maximum number of CIFS and NFS connections per controller	-	16,000	
Maximum number of FTP connections per controller	-	64	
Maximum number of HTTP connections per controller	-	64	

Item	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
Maximum number of NDMP streams per controller (maximum number of concurrent NDMP backup and recovery tasks allowed by the backup software)	-	8	
Maximum number of local users (no limit in software)	-	2000	
Maximum number of local user groups	-	50,000	
Maximum number of group members (total number of members in all groups)	-	150,000	
Maximum full file path length	-	4096 bytes	
Maximum length of a single file name or directory name	-	256 bytes	
Maximum directory depth of a file system (no limit in software)	-	256	
Maximum number of files that can be opened at a time per controller	-	150,000	
* If you require the specifications marked with *, contact Huawei sales personnel.			

Feature Specifications

Feature	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
Snapshot	HyperSnap		
HyperCopy	HyperCopy		
HyperCDP	HyperCDP		
Clone	HyperClone		
Remote replication	HyperReplication		
All-in-one backup	-	HyperVault	

Feature	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
Cloud backup	CloudBackup		
Active-active arrays	HyperMetro		
WORM	-	HyperLock	
Intelligent thin provisioning	SmartThin		
LUN migration	SmartMigration		
Intelligent heterogeneous virtualization	SmartVirtualization		
Intelligent cache partitioning	-	SmartPartition	
Multi-tenant	-	SmartMulti-Tenant	
Quota	-	SmartQuota	
Inline deduplication and compression	SmartDedupe and SmartCompression		
VMware VAAI	SAN: certified by vSphere 5.0, 5.1, 5.5, 6.0, 6.5, and 6.7	SAN: certified by vSphere 5.0, 5.1, 5.5, 6.0, 6.5, and 6.7 NAS: certified by vSphere 5.0, 5.1, 5.5, 6.0, and 6.5	
VMware VASA	SAN: certified by VASA 1.0 (vSphere 5.0, 5.1, and 5.5) and VASA 2.0 (vSphere 6.0, 6.5, and 6.7)	SAN: certified by VASA 1.0 (vSphere 5.0, 5.1, and 5.5) and VASA 2.0 (vSphere 6.0, 6.5, and 6.7) NAS: certified by VASA 1.0 (vSphere 5.0, 5.1, and 5.5)	
VMware SRM (SRM plug-in included)	SAN: certified by VMware SRM 5.1, 5.5, 5.8, 6.0, 6.1, 6.5, and 8.1		
VMware VVol 1.0	SAN: certified by vSphere 6.0, 6.5, and 6.7		
vCenter	SAN: support for vCenter 5.0, 5.1, 5.5, 6.0, and 6.5		
System Center	SAN: support for System Center 2016		
System management software	OceanStor DeviceManager		
Host proxy	OceanStor BCManager		
Host multipathing software	UltraPath and ALUA		

License Control

Function	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
Basic software package (out-of-box software functions)	Control system software package: DeviceManager, SmartThin, SmartVirtualization, SmartMigration, SmartDedupe, SmartCompression, SmartQoS, HyperSnap, HyperClone, HyperCopy, HyperCDP, HyperReplication, HyperMetro, CloudBackup, SystemReporter, eService	Control system software package: DeviceManager, SmartThin, SmartMigration, SmartDedupe, SmartCompression, SmartQoS, SystemReporter, eService	
The NAS unit provides built-in software functions	-	CIFS, NFS, NDMP, SmartVirtualization, SmartMulti-tenant, SmartThin, SmartQuota, SmartQoS, SmartPartition, HyperSnap, HyperClone, HyperReplication, HyperMetro, HyperVault, HyperLock	

Feature	Requiring a License or Not
HyperSnap	Yes
HyperCopy	Yes
HyperCDP	Yes
HyperReplication	Yes
HyperClone	Yes
HyperMetro	Yes
SmartThin	Yes
SmartMigration	Yes
SmartVirtualization	Yes
SmartDedupe and SmartCompression	Yes
SmartQoS	Yes

Feature	Requiring a License or Not
CloudBackup	Yes

Interoperability

Use the **Huawei Storage Interoperability Navigator** to check the interoperability of storage systems.

6.4 Software Specifications (Applicable to Dorado18000 V3)

The software specifications include the basic specifications, feature specifications, performance specifications, supported operating systems, and license control.

Table 6-4 describes the categories of storage software specifications to help you quickly find out the specification information you need.

Table 6-4 Software specification categories

Category	Description
Basic Specifications	Describes the basic software specifications of storage systems, including the maximum number of connected application servers, maximum number of LUNs, and maximum number of mapping views.
Value-Added Features	Describes the feature specifications of storage systems, such as snapshot, remote replication, and SmartMigration.
License Control	Describes whether software features of storage systems are controlled by licenses.

Basic Specifications

Item	Dorado18000 V3
RAID level	RAID 10*, RAID 5, RAID 6, and RAID-TP (able to tolerate three faulty disks)
Maximum number of disk domains per dual-controller system	SAN: 4 NAS: 64
Maximum number of storage pools per dual-controller system	SAN: 4 NAS: 64
Maximum capacity per dual-controller system	2 PB

Item	Dorado18000 V3
Maximum number of LUNs (including snapshots) in a storage pool	65,536 The total number of LUNs and their writable snapshots cannot exceed 65,536.
Maximum number of disks in a disk domain	400
Minimum number of disks in a disk domain	SAN: 8 NAS: 4
Maximum number of logical ports per controller	128
Maximum number of VLANs per controller	128
Maximum number of built-in DNS zones	1024
Maximum number of LIFs listening to DNS requests	256
Maximum number of hosts	8192
Maximum number of LUNs (including snapshots)	65,536
Maximum number of LUN groups	8192
Maximum number of host LUNs	512
Minimum capacity of a LUN	512 KB
Maximum capacity of a LUN	256 TB
Maximum number of host connections	8192
Maximum number of file systems	The number of clone file systems and file systems cannot exceed 2048.
Minimum capacity of a file system	1 GB
Maximum capacity of a file system	16 PB
Maximum number of files per file system (no limit in software)	2 billion
Maximum capacity of a file (no limit in software)	256 TB
Maximum number of subdirectories and files per directory (no limit in software)	30 million
Maximum number of SMB shares	12,000

Item	Dorado18000 V3
Maximum number of NFS shares	10,000
Maximum number of CIFS and NFS connections per controller	16,000
Maximum number of FTP connections per controller	64
Maximum number of HTTP connections per controller	64
Maximum number of NDMP streams per controller (maximum number of concurrent NDMP backup and recovery tasks allowed by the backup software)	8
Maximum number of local users (no limit in software)	2000
Maximum number of local user groups	50,000
Maximum number of group members (total number of members in all groups)	150,000
Maximum full file path length	4096 bytes
Maximum length of a single file name or directory name	256 bytes
Maximum directory depth of a file system (no limit in software)	256
Maximum number of files that can be opened at a time per controller	150,000
* If you require the specifications marked with *, contact Huawei sales personnel.	

Value-Added Features

Feature	Dorado18000 V3
Snapshot	HyperSnap
HyperCopy	HyperCopy
HyperCDP	HyperCDP
Clone	HyperClone
Remote replication	HyperReplication

Feature	Dorado18000 V3
All-in-one backup	HyperVault
Cloud backup	CloudBackup
Active-active arrays	HyperMetro
WORM	HyperLock
Intelligent thin provisioning	SmartThin
LUN migration	SmartMigration
Intelligent heterogeneous virtualization	SmartVirtualization
Intelligent cache partitioning	SmartPartition
Multi-tenant	SmartMulti-Tenant
Quota	SmartQuota
Inline deduplication and compression	SmartDedupe and SmartCompression
VMware VAAI	SAN: certified by vSphere 5.0, 5.1, 5.5, 6.0, 6.5, and 6.7 NAS: certified by vSphere 5.0, 5.1, 5.5, 6.0, and 6.5
VMware VASA	SAN: certified by VASA 1.0 (vSphere 5.0, 5.1, and 5.5) and VASA 2.0 (vSphere 6.0, 6.5, and 6.7) NAS: certified by VASA 1.0 (vSphere 5.0, 5.1, and 5.5)
VMware SRM (SRM plug-in included)	SAN: certified by VMware SRM 5.1, 5.5, 5.8, 6.0, 6.1, 6.5, and 8.1
VMware VVol 1.0	SAN: certified by vSphere 6.0, 6.5, and 6.7
vCenter	SAN: support for vCenter 5.0, 5.1, 5.5, 6.0, and 6.5
System Center	SAN: support for System Center 2016
System management software	OceanStor DeviceManager
Host proxy	OceanStor BCManager
Host multipathing software	UltraPath and ALUA

License Control

Function	Description
Basic software package (out-of-box software functions)	Control system software package: OceanStor OS, DeviceManager, SmartThin, SmartMigration, SmartDedupe, SmartCompression, SmartQoS, SystemReporter, eService
The NAS unit provides built-in software functions	CIFS, NFS, NDMP, SmartVirtualization, SmartMulti-tenant, SmartThin, SmartQuota, SmartQoS, SmartPartition, HyperSnap, HyperClone, HyperReplication, HyperMetro, HyperVault, HyperLock

Feature	Requiring a License or Not
HyperSnap	Yes
HyperCopy	Yes
HyperCDP	Yes
HyperReplication	Yes
HyperClone	Yes
HyperMetro	Yes
SmartThin	Yes
SmartMigration	Yes
SmartVirtualization	Yes
SmartDedupe and SmartCompression	Yes
SmartQoS	Yes
CloudBackup	Yes

Interoperability

Use the **Huawei Storage Interoperability Navigator** to check the interoperability of storage systems.

7 Environmental Requirements

Environmental requirements cover the following aspects: temperature, humidity, particle contaminants, corrosive airborne contaminants, heat dissipation, and noise.

7.1 Temperature, Humidity, and Altitude

Temperature, humidity, and altitude requirements must be met so that storage systems can correctly work or be properly preserved.

Table 7-1 lists the temperature, humidity, and altitude requirements of OceanStor Dorado3000 V3, Dorado5000 V3 and Dorado6000 V3 storage system.

Table 7-1 Temperature, humidity, and altitude requirements

Parameter	Condition	Requirement
Temperature	Operating temperature	● 5°C to 40°C (41°F to 104°F) when the altitude is between -60 m and +1800 m (-196.85 ft. and +5905.51 ft.) ● When the altitude is between 1800 m and 3000 m (5905.51 ft. and 9842.52 ft.), the temperature drops by 1ºC when the altitude increases by 220 m (721.78 ft.).
	Temperature variation in the operating environment	20ºC/h
	Storage temperature	-40ºC to +70ºC (-40°F to +158°F)

Parameter	Condition	Requirement
	Non-operating ambient temperature	-40ºC to +70ºC (-40°F to +158°F)
	Temperature variation in the non-operating environment	30ºC/h
Humidity	Operating humidity	10% RH[a] to 90% RH
	Non-operating ambient humidity	5% RH to 95% RH
	Storage humidity	5% RH to 95% RH
	Max. humidity variation	25%/h
Altitude	Operating altitude of disks	-305 m to +3048 m (-1000.66 ft. to 10000 ft.)
	Non-operating altitude of disks	-305 m to +12192 m (-1000.66 ft. to 40000 ft.)
a: relative humidity (RH)		

Table 7-2 lists the temperature, humidity, and altitude requirements of OceanStor Dorado18000 V3 storage system.

Table 7-2 Requirements on ambient temperature and humidity

Parameter	Condition	Requirement
Temperature	Operating temperature	● 5°C to 35°C when the altitude is lower than 1800 m ● 5°C to 30°C when the altitude is between 1800 m and 3000 m
	Temperature variation in the operating environment	20°C/H
	Non-operating ambient temperature	-40°C to +60°C
	Temperature variation in the non-operating environment	30°C/H
	Storage temperature (during transportation and storage with packages)	-40°C to +60°C
Humidity	Operating humidity	10% RH[a] to 90% RH

Parameter	Condition	Requirement
	Storage humidity (during transportation and storage with packages)	5% RH to 95% RH
	Non-operating ambient humidity	5% RH to 95% RH
	Max. humidity variation	25%/H
a: Relative Humidity		

7.2 Vibration and Shock

Vibration and shock requirements must be met so that storage systems can correctly work or be properly preserved.

Table 7-3 lists the vibration and shock requirements of OceanStor Dorado3000 V3, Dorado5000 V3 and Dorado6000 V3 storage system.

Table 7-3 Vibration and shock requirements

Parameter	Requirement
Operating vibration	5 to 350 Hz: 0.0002 g^2/Hz, 350 to 500 Hz: -3 dB, 0.3 Grms, 3 axes, 15 min/axis
Non-operating vibration	10 to 500 Hz, 2.0 Grms, 3 axes, 30 min/axis, PSD: 0.008 g^2/Hz
Operating shock	50 Gs/2 ms, 1 time/face
Non-operating shock	110 Gs/2 ms, 1 shock/face, total of 6 faces

Table 7-4 lists the vibration and shock requirements of OceanStor Dorado18000 V3 storage system.

Table 7-4 Vibration and shock requirements of the bay

Parameter	Requirement
Operating vibration	● SAN 5 to 10 Hz: +12 dB/Oct; 10 to 50 Hz: 0.000416 g^2/Hz; 50 to 100 Hz: -12 dB/Oct, 3 axes, 15 min/axis ● NAS 5 to 350 Hz: 0.0002 g^2/Hz, 350 to 500 Hz: -3 dB, 0.3 Grms, 3 axes, 15 min/axis

Parameter	Requirement
Non-operating vibration	● SAN 5 to 30 Hz: 0.00052 g^2/Hz; 100 to 500 Hz: 0.0001 g^2/Hz, 3 axes, 15 min/axis ● NAS 10 to 500 Hz, 2.0 Grms, 3 axes, 30 min/axis, PSD: 0.008 g^2/Hz
Operating shock	SAN: 3 Gs/11 ms, 3 shocks/face, total of 6 faces NAS: 50 Gs/2 ms, 1 time/face
Non-operating shock	SAN: 8 Gs/15 ms, 3 shocks/face, total of 6 faces NAS: 110 Gs/2 ms, 1 shock/face, total of 6 faces

7.3 Particle Contaminants

Particle contaminants and other negative environmental factors (such as abnormal temperature and humidity) may expose IT equipment to a higher risk of corrosive failure. This section specifies the limitation on particle contaminants with the aim at avoiding such risks.

The concentration level of particle contaminants in a data center should meet the requirements listed in the white paper entitled *Gaseous and Particulate Contamination Guidelines for Data Centers published in 2011* by American Society of Heating Refrigerating and Air-conditioning Engineers (ASHRAE) Technical Committee (TC) 9.9.

ASHRAE, affiliated to International Organization for Standardization (ISO), is an international organization operated for the exclusive purpose of advancing the arts and sciences of heating, ventilation, air-conditioning, and refrigeration (HVAC & R). The *Gaseous and Particulate Contamination Guidelines for Data Centers* is widely accepted, which is prepared by the members of ASHRAE TC 9.9, AMD, Cisco, Cray, Dell, EMC, Hitachi, HP, IBM, Intel, Seagate, SGI, and Sun.

According to the Guidelines, particle contaminants in a data center shall reach the cleanliness of ISO 14664-1 Class 8:

- Each cubic meter contains not more than 3,520,000 particles that are greater than or equal to 0.5 μm.
- Each cubic meter contains not more than 832,000 particles that are greater than or equal to 1 μm.
- Each cubic meter contains not more than 29,300 particles that are greater than or equal to 5 μm.

It is recommended that you use an effective filter to process air flowing into the data center as well as a filtering system to periodically clean the air already in the data center.

ISO 14644-1, Cleanrooms and Associated Controlled Environments - Part 1: Classification of Air Cleanliness, is the primary global standard on air cleanliness classification. **Table 7-5** gives the air cleanliness classification by particle concentration.

Table 7-5 Air cleanliness classification by particle concentration of ISO 14664-1

ISO Class	Maximum allowable concentrations (particles/m^3) for particles equal to and greater than the considered sizes shown below					
-	≥ 0.1 μm	≥ 0.2 μm	≥ 0.3 μm	≥ 0.5 μm	≥ 1 μm	≥ 5 μm
Class 1	10	2	-	-	-	-
Class 2	100	24	10	4	-	-
Class 3	1000	237	102	35	8	-
Class 4	10,000	2370	1020	352	83	-
Class 5	100,000	23,700	10,200	3520	832	29
Class 6	1,000,000	237,000	102,000	35,200	8320	293
Class 7	-	-	-	352,000	83,200	2930
Class 8	-	-	-	3,520,000	832,000	29,300
Class 9	-	-	-	-	8,320,000	293,000

7.4 Corrosive Airborne Contaminants

Corrosive airborne contaminants and other negative environmental factors (such as abnormal temperature and humidity) may expose IT equipment to higher risks of corrosive failure. This article specifies the limitation on corrosive airborne contaminants with an aim at avoiding such risks.

Table 7-6 lists common corrosive airborne contaminants and their sources.

Table 7-6 Common corrosive airborne contaminants and their sources

Symbol	Source
H_2S	Geothermal emissions, microbiological activities, fossil fuel processing, wood rot, sewage treatment
SO_2, SO_3	Coal combustion, petroleum products, automobile emissions, ore smelting, sulfuric acid manufacture
S	Foundries, sulfur manufacture, volcanoes
HF	Fertilizer manufacture, aluminum manufacture, ceramics manufacture, steel manufacture, electronics device manufacture
NO_X	Automobile emissions, fossil fuel combustion, chemical industry
NH_3	Microbiological activities, sewage, fertilizer manufacture, geothermal emissions, refrigeration equipment

Symbol	Source
C	Incomplete combustion (aerosol constituent), foundry
CO	Combustion, automobile emissions, microbiological activities, tree rot
Cl_2, ClO_2	Chlorine manufacture, aluminum manufacture, zinc manufacture, refuse decomposition
HCl	Automobile emissions, combustion, forest fire, oceanic processes, polymer combustion
HBr, HI	Automobile emissions
O_3	Atmospheric photochemical processes mainly involving nitrogen oxides and oxygenated hydrocarbons
C_NH_N	Automobile emissions, animal waste, sewage, tree rot

The concentration level of corrosive airborne contaminants in a data center should meet the requirements listed in the white paper entitled *Gaseous and Particulate Contamination Guidelines for Data Centers published in 2011* by the American Society of Heating Refrigerating and Air-conditioning Engineers (ASHRAE) Technical Committee (TC) 9.9.

According to the Guidelines, corrosive airborne contaminants in a data center should meet the following requirements:

- Copper corrosion rate

  Less than 300 Å/month per ANSI/ISA-71.04-1985 severity level G1.
- Silver corrosion rate

  Less than 200 Å/month.

NOTE

Å, or angstrom, is a unit of length. One Å is equal to 1/10,000,000,000 meter.

According to ANSI/ISA-71.04-1985 Environmental Conditions for Process Measurement and Control Systems: Airborne Contaminants, the gaseous corrosivity levels are G1 (mild), G2 (moderate), G3 (harsh), and GX (severe), as described in **Table 7-7**.

Table 7-7 Gaseous corrosivity levels per ANSI/ISA-71.04-1985

Severity Level	Copper Reactivity Level	Description
G1 (mild)	300 Å/month	An environment sufficiently well-controlled such that corrosion is not a factor in determining equipment reliability.
G2 (moderate)	300 Å/month to 1000 Å/month	An environment in which the effects of corrosion are measurable and may be a factor in determining equipment reliability.

Severity Level	Copper Reactivity Level	Description
G3 (harsh)	1000 Å/month to 2000 Å/month	An environment in which there is high probability that corrosion will occur.
GX (severe)	> 2000 Å/month	An environment in which only specially designed and packaged equipment would be expected to survive.

See **Table 7-8** for the copper and silver corrosion rate requirements.

Table 7-8 Concentration limitation of corrosive airborne contaminants in a data center

Group	Gas	Unit	Concentration
Group A	H_2S	ppb[a]	< 3
	SO_2	ppb	< 10
	Cl_2	ppb	< 1
	NO_2	ppb	< 50
Group B	HF	ppb	< 1
	NH_3	ppb	< 500
	O_3	ppb	< 2
a: Part per billion (ppb) is the number of units of mass of a contaminant per billion units of total mass.			

Group A and group B are common gas groups in a data center. The concentration limits of Group A or group B that correspond to copper reactivity level G1 are calculated based on the premise that relative humidity in the data center is lower than 50% and that the gases in the group interact with each other. A 10% of increase in the relative humidity will heighten the gaseous corrosivity level by 1.

Corrosion is not determined by a single factor, but by comprehensive environmental factors such as temperature, relative humidity, corrosive airborne contaminants, and ventilation. Any of the environmental factors may affect the gaseous corrosivity level. Therefore, the concentration limitation values specified in the previous table are for reference only.

7.5 Heat Dissipation and Noise

A storage system can run steadily using the heat dissipation system carried in its own fan modules. An external device is necessary to remove the hot air discharged from a storage system into the equipment room to ensure proper air circulation.

Heat Dissipation

Traditional heat dissipation modes are as follows:

- Controller enclosure

  Cooling air enters from the front end through small holes on the interface modules. After dissipating the heat of interface modules, controllers, and power modules, the air is discharged out of its back end by fans. The controller enclosure dynamically adjusts rotational speed of the fans based on the operational temperature of the storage system.

- Disk enclosure

  Cooling air enters from the front end through the space between disks, passing the midplane, into the power modules and expansion modules. After dissipating the heat, the air is discharged out of its back end by fans. The disk enclosure dynamically adjusts rotational speed of the fans based on the operational temperature of the storage system.

For better maintenance, ventilation, and heat dissipation, pay attention to the following when installing the storage system in the cabinet:

- To ensure smooth ventilation, the cabinet should be at least 100 cm (39.4 inches) away from the equipment room walls and at least 120 cm (47.24 inches) away from other cabinets (that are in front of or behind).
- To keep air convection between the cabinet and the equipment room, no enclosed space is allowed in the cabinet. 1 U (44.45 mm, 1.75 inches) space should be left above and below each device.

Table 7-9 lists the airflow parameters of OceanStor Dorado3000 V3, Dorado5000 V3 and Dorado6000 V3.

Table 7-9 Airflow parameters

System Airflow	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
NVMe all-flash controller enclosure	-	● 190 CFM[a] (at max. fan speed) ● 70 CFM (25ºC)	● 404 CFM (at max. fan speed) ● 102 CFM (25ºC)
SAS all-flash controller enclosure	● 183 CFM (at max. fan speed) ● 83 CFM (25ºC)		● 404 CFM (at max. fan speed) ● 102 CFM (25ºC)
2 U NVMe disk enclosure	-	● 115 CFM (at max. fan speed) ● 35 CFM (25ºC)	
2 U SAS disk enclosure	● 117 CFM (at max. fan speed) ● 38 CFM		
Dorado NAS unit	-	● 183 CFM (at max. fan speed) ● 83 CFM (25ºC)	
a: cubic feet per minute (CFM)			

Table 7-10 lists the heat dissipation parameters of OceanStor Dorado3000 V3, Dorado5000 V3 and Dorado6000 V3.

Table 7-10 Heat dissipation parameters

Maximum Heat Dissipation (in Running)	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
NVMe all-flash controller enclosure	-	2942.83 BTU[a]/h	4330.7 BTU/h
SAS all-flash controller enclosure	2557 BTU/h	3096.28 BTU/h	4330.7 BTU/h
2 U NVMe disk enclosure	-	2013 BTU/h	
2 U SAS disk enclosure	1091.2 BTU/h		
Dorado NAS unit	-	1555.2 BTU/h	
a: British thermal unit (BTU)			

Table 7-11 lists the airflow parameters of OceanStor Dorado18000 V3.

Table 7-11 Airflow parameters

System Airflow	Dorado18000 V3
NVMe all-flash controller enclosure SAS all-flash controller enclosure	● 808 CFM[a] (at max. fan speed) ● 204 CFM (25ºC)
2 U NVMe disk enclosure	● 115 CFM (at max. fan speed) ● 35 CFM (25ºC)
2 U SAS disk enclosure	● 117 CFM (at max. fan speed) ● 38 CFM (25ºC)
Dorado NAS unit	● 183 CFM (at max. fan speed) ● 83 CFM (25ºC)
a: cubic feet per minute (CFM)	

Table 7-12 lists the heat dissipation parameters of OceanStor Dorado18000 V3.

Table 7-12 Heat dissipation parameters

Parameter	Dorado18000 V3
Heat dissipation (system bay)	NVMe: 22564 BTU/H SAS: 27027.66 BTU/H
Heat dissipation airflow (system bay)	NVMe ● Typical: 484 CFM ● Max: 1728 CFM SAS ● Typical: 821 CFM ● Max: 2680 CFM

Noise

The disks and fans make noise when in operation, with fans being the major noise source. The intensity of fan rotation is associated with the temperature. A higher temperature leads to greater rotational speed by the fans, which in return creates greater noise. Therefore, there is a direct correlation between the noise made by a storage system and the ambient temperature in the equipment room.

When the temperature is 25°C, the parameters of the noise generated by OceanStor Dorado3000 V3, Dorado5000 V3 and Dorado6000 V3 storage system are listed in **Table 7-13**.

Table 7-13 Noise parameters

Device	Dorado3000 V3	Dorado5000 V3	Dorado6000 V3
NVMe all-flash controller enclosure	-	63.1 dB	69.4 dB
SAS all-flash controller enclosure	63.1 dB		69.4 dB
2 U NVMe disk enclosure	-	67.5 dB	
2 U SAS disk enclosure	67.5 dB		
Dorado NAS unit	-	63.1 dB	

When the temperature is 25°C, the parameters of the noise generated by OceanStor Dorado18000 V3 storage system are listed in **Table 7-14**.

Table 7-14 Noise parameters of storage systems

Parameter	Value
Operating noise	73.4 dB (A)

8 Standards Compliance

The chapter describes the protocol standards, the safety specifications and electromagnetic compatibility (EMC) standards, the industry standards that the storage system complies with.

Protocol Standards

Table 8-1 lists the protocol standards that the storage system complies with.

Table 8-1 Protocol standards

Name	Standard No.
SCSI system	FC-PH: ANSI X3.230
	FC-PH2: ANSI X3.297
	SCSI-FCP: ANSI X.269
	FC-AL: ANSI X.272
	FC-AL-2: ANSI NCITS 332-1999
	FC-SW: ANSI NCITS 321
	FC-SW-2: ANSI NCITS 355-2001
	FC-GS: ANSI X.288 (for FC switch)
	FC-GS2: ANSI NCITS 288 (for FC switch)
	SAS Serial Attached SCSI-1.1 (SAS-1.1)
	SAS Serial Attached SCSI-2.0 (SAS-2.0)
	SAS Serial Attached SCSI-3.0 (SAS-3.0)
	T10/1562D Rev.05 Serial Attached SCSI (SAS)
	T10/1601D Rev.07 Serial Attached SCSI Model-1.1 (SAS-1.1)

Name	Standard No.
	T10/1601D Rev.07 Serial Attached SCSI Model-1.1 (SAS-2.0)
	T10/1601D Rev.07 Serial Attached SCSI Model-1.1 (SAS-3.0)
	SFF 8301 form factor of 3.5' disk drive
	SFF 8323 3.5' disk drive form factor with serial connector
	SFF 8482 SAS plug connector
	SCSI 3 SAM-2: ANSI INCITS 366-2003
	SPC-2: ANSI INCITS 351-2001
	SBC: ANSI INCITS 306-1998
	PICMG3.0 Advanced Telecommunications Computing Architecture
	PICMG3.1 Ethernet/fiber Channel Over PICMG3.0
	iSCSI RFC 3720/7143
TCP/IP system	SNMP v1
	SNMP v2c
	SNMP v3
PCIe system	PCI Express Base Specification R1.1
	PCI Express to PCI or PCI-X Bridge Specification v1.0
	PCI Express Base Specification v2.0
	PCI Express Base Specification v3.0

Interface Standards

Table 8-2 describes the interface standards that the storage systems comply with.

Table 8-2 Interface standards that the storage systems comply with

Name	Description
VAAI	An application programming interface (API) framework from VMware. It enables some storage-related tasks (such as thin provisioning) to be offloaded from a VMware server to a storage array.

Name	Description
VASA	An API used for VMware vSphere ESXi hosts to communicate with storage devices. It enables vCenter to manage storage arrays in a unified manner.
SRA	An interface between VMware Site Recovery Manager (SRM) and a storage system. It enables SRM to perform the following operations: discovery of storage systems, non-disruptive failover test, emergency or planned failover, reverse replication, backup, and restoration.
SMI-S	A storage standard developed and maintained by the Storage Networking Industry Association (SNIA). It aims to simplify the management of a storage area network (SAN) that contains devices from various manufacturers. It provides a universal management interface for all types of network elements and simplifies the management of a heterogeneous SAN environment. **NOTE** Log in to **http://support.huawei.com/enterprise/**, in the search field, enter eSDK Storage, and select a path from the paths that are automatically displayed to go to the document page. Search, browse, and download the SMI-S Provider documents of the corresponding version to get more information (such as information about monitored components).
ODX	Offloaded data transfer (ODX) is a feature of Windows 2012 server. The feature unloads files into storage arrays for transmission. High transmission bandwidth between storage arrays largely shortens the data transmission delay and improves the data copy speed, as well as reduces host resource occupation.

Safety Specifications and EMC Standards

Table 8-3 lists the safety specifications and EMC standards that the storage system complies with.

Table 8-3 Safety specifications and EMC standards

Name	Standard No.
China safety standard	GB 4943
North America safety standard	UL 60950-1
European safety directive	2014/35/EU
European safety standard	EN 60950-1
China EMC standard	GB9254-2008

Name	Standard No.
	GB17625.1-2012
Canada EMC standard	ICES-003
	CAN/CSA-CEI/IEC CISPR 22:02
North America EMC standard	FCC, CFR 47 Part 15, Subpart B
European EMC directive	EMC Directive 2004/108/EC
European EMC standard	EN 55032
	EN 55024

Industry Standards

Table 8-4 lists the industry standards that the storage system complies with.

Table 8-4 Industry standards

Name	Standard No.
Ethernet	IEEE 802.3
Fast Ethernet	IEEE 802.3u
Gigabit Ethernet	IEEE 802.3z
	IEEE 802.3ab
10-Gigabit Ethernet	IEEE 802.3ae
VLAN	IEEE 802.1q
IEEE standard test access port and boundary-scan architecture	IEEE 1149.1-2001
Procedure for failure modes and effects analysis (FMEA)	IEC 812
Presentation of reliability, maintainability and availability predictions	IEC 863
ETSI standard (environment)	ETS 300 019
ETSI standard (power)	ETS 300 132
ETSI standard (noise)	ETS 300 753

Name	Standard No.
ETSI standard (environment)	ETS 300 119
ETSI standard (grounding)	ETS 300 253
ITUT standard (grounding)	ITUT K.27
Environmental protection	ECMA TR/70
Reliability	GR-929, Telcordia SR-332
Clean room and related controlled environments	ISO 14664-1 Class8
Airborne contaminants and environment standards	ANSI/ISA-71.04-1985 severity level G1

9 Certifications

The chapter describes the certifications of the storage system.

Table 9-1 lists the certifications that the storage system obtains.

Table 9-1 Certifications

Name	Description
CB	The IEC System for Conformity Testing and Certification of Electrical Equipment (IECEE) is based on the use of specific IEC standards for electrical equipment. The Certification Bodies (CB) Scheme is applicable to electrical equipment within the scope of IEC standards for safety, accepted for use in the IECEE. The Scheme becomes operative for such standards as soon as at least one National Certification Body has declared their recognition of CB Test Certificates. The CB scheme is designed for eliminating the international commerce barriers resulted from the compliance with certifications and approval guidelines of different countries. The IEC System for Conformity Testing to Standards for Safety of Electrical Equipment (referred to as the IECEE) is based on the use of specific IEC standards for electrical equipment. The CB Scheme is applicable to electrical equipment within the scope of IEC standards for safety, accepted for use in the IECEE. The Scheme becomes operative for such standards as soon as at least one National Certification Body has declared their recognition of CB Test Certificates.
CCC	China Compulsory Certification (CCC) is a three-in-one authoritative certification incorporating the Conformity Certification of Electrical Equipment (CCEE), the certificate for the safe license of import granted by China Commodity Inspection Bureau (CCIB), and Safety and Electro Magnetic Compatibility (EMC). The China Compulsory Certificate (CCC) mainly involves the products related to human health and security, animal and plant life and health, environmental protection, and public security.

Name	Description
FCC	Federal Communications Commission (FCC) authorizes and manages all RF transmission facilities and devices except for those used by the federal government. It is also responsible for the environmental damages generated by the facilities and devices it approves.
IC	Industry Canada (IC) sets up the test standards for analog and digital terminal devices and specifies corresponding EMC certificates that all import electronic products must obtain.
UL	Underwriters Laboratories Inc. (UL): The UL is a non-profit agency engaged in product safety testing. UL has its own certification system for the entire system, components, and materials. All electric products that are exported to the USA must pass the UL certification. The UL safety certification is classified into the following three methods: ● Labeling The UL labeling service is the best known service of the UL safety certification. The UL label on the product indicates that UL has tested the sample of the product according to the safety standards approved by the USA. The sample does not cause fire, creepage, or other dangers if predictable. ● Classification UL tests the product according to different features, in the specified danger range, or under specific cases. In general, the classified products are mostly construction materials or industrial instruments. The classified products include industrial or commercial products. Some specified features must be tested, such as inflammability, hazardous performance, or specifications specified by the government. ● Approval UL tests parts of the product or unfinished product. These parts will be used in the UL labeled product list. This service covers millions of plastics, wires, circuit boards, various finished products, and even some large components, such as motorcycles or power supplies.
CE	Conformite Europeenne (CE): Products marked with CE conform to EMC (2014/30/EU) and low-voltage (2014/35/EU) specifications published by EU. If this product has telecommunication functionality, the R_TTE Directive (2014/53/EU) that complies with the directives mentioned previously implies conformity to the following European norms (in parentheses are the equivalent international standards and regulations): ● EN 55032 (CISPR 32)-Electro Magnetic Interference ● EN 55024 (IEC61000-4-2, 3, 4, 5, 6, 8, 11)-Electro Magnetic Immunity ● EN 60950 (IEC 60950)-Product Safety
REACH	REACH is a set of comprehensive regulations that require all chemical products that are both imported and produced in Europe must be registered, assessed, authorized, and restricted. In this way, customers can easily recognize the chemical elements. As a result, both humans and environment are protected.

Name	Description
RoHS	The restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) is the directive that restricts the use of certain hazardous substances in the electrical, electronic equipment. RoHS is the European Union (EU) compulsory standard that is designed to regulate the materials and the technical standard of the electrical and electronic products. In this way, it does good to human health and environment protection. That is, the six hazardous substances of lead (Pb), mercury (Hg), cadmium (Cd), hexavalent chromium (Cr6+), polybrominated biphenyl (PBB), polybrominated diphenyl ethers (PBDE) cannot exceed the specified limits.
WEEE	The EU Directive on Waste of Electric and Electronic Equipment. Electrical and electronic products sold in the EU market must comply with this directive and have the mark of cross out wheeled bin.
CU-TR	Russia, Kazakhstan, and Belarus have integrated their own certification technology requirements and formulated a unified Customs Union (CU) certification. The products within the scope of control are subject to mandatory certification of customs union technical regulations (CU-TR), unified technical regulations and evaluation modes, product qualification directories, certificate forms, and technical supervision and registration.
RCM	The Australian & New Zealand Regulatory Compliance Mark (RCM) is the mandatory compliance for selling electrical equipment products in the market.
SONCAP	A certification issued by Standards Organization of Nigeria. The products in the certification item list must acquire SONCAP for the entrance to Nigeria market.

Security Symbol (CCC)

The product is a Class A device based on the CCC. Use of it in a residential area is likely to cause radio interference. Users may be required to prevent the interference by taking protective measures.

FCC-DOC

Supplier's Declaration of Conformity (SDoC)

Unique Identifier: trade name: HUAWEI; product name: Storage System; model number: OceanStor Dorado5000 V3, Dorado6000 V3

Responsible Party- U.S. Contact Information

Huawei Technologies USA Inc.

5700 Tennyson Parkway, Suite 500

Plano, Texas 75024

Main: 214-919-6000 / TAC Hotline: 877-448-2934

FCC Compliance Statement (for products subject to Part 15)

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

10 Operation and Maintenance

The storage systems can be operated and maintained by using DeviceManager and the command-line interface (CLI), adapting to different environments and user habits.

Introduction to DeviceManager

Figure 10-1 shows the DeviceManager main window. The information displayed on the interface is only for reference and is subject to the actual situation.

Figure 10-1 DeviceManager main window

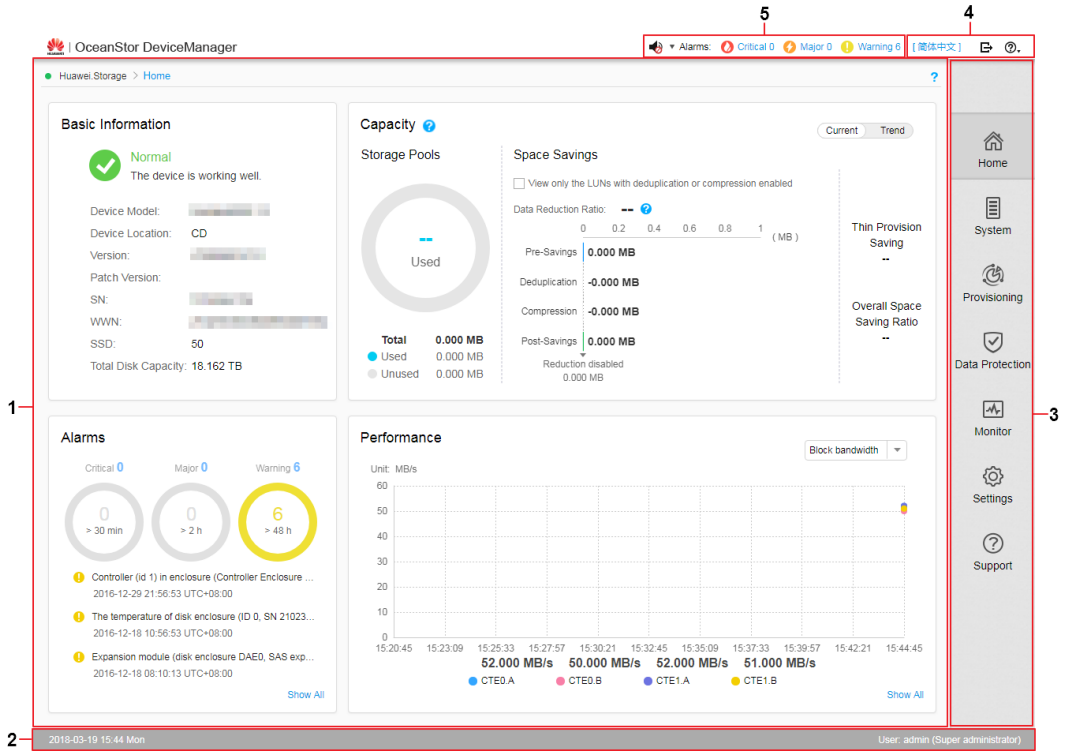


Table 10-1 describes the components of the DeviceManager main window.

Table 10-1 Components of the DeviceManager main window

No.	Name	Description
1	Function pane	The function pane shows a page associated with the current operation.
2	Status bar	The status bar shows information such as the user name currently logged in and the login time.
3	Navigation bar	The navigation bar shows the function modules of a storage system. Users can click a function module to configure the corresponding functions.
4	Exit, help, and language selection area	This area displays an exit button, a help button, and a language selection button. DeviceManager supports two languages: simplified Chinese and English.
5	Fault statistics area	The fault statistics area shows the number of each level of system faults, providing information about the running status of a storage system.

You can log in to DeviceManager using a common browser.

Introduction to the CLI

The CLI enables users to manage and maintain the storage systems using command lines.

Users need to log in to the CLI by using terminal software, such as the HyperTerminal provided by Windows, or PuTTY.

There are two ways to log in to the CLI.

- Log in through a serial port of a storage system. To connect to a serial port, the maintenance terminal must be located next to the storage system. Therefore, this login mode is applicable to users who do not know the management IP address of a storage system or a storage system is faulty.
- Log in through a management network port of a storage system. When there are reachable routes, a user can log in to the CLI by entering the IP address of the management network port of a storage system in the terminal software. IP networks are easily accessible. Therefore, a user can log in to a storage system remotely, and this login mode is more popular.

11 Privacy Statement on Personal Data Collection

Service Type (System/ Application Name/ Function/Product)	System alarm	System alarm	System management
Personal Data Collection Item	Mobile phone number	Email address and account	LDAP user name and LDAP user group name
Data Meaning (Data Description)	Mobile phone number set by the system administrator for receiving alarm notification	Email address and account set by the system administrator for receiving alarm notification	● LDAP user name: user name registered by an enterprise or user for device management ● LDAP user group name: user group allocated for an enterprise or user during the registration
Mandatory or Optional (Forced or Not/Provided by Users by Default)	Optional	Optional	Optional
Personal Data Collection Source, Method, and Basis	Configured by the system administrator	Configured by the system administrator	Configured by the system administrator
Personal Data Collection Purpose and Application Scenario	To notify users of the system alarm	To notify users of the system alarm	To manage and maintain the system
Transfer Mode	Transferred to the server through HTTPS/SSH	Transferred to the server through HTTPS/SSH	Transferred to the server through HTTPS/SSH
Storage Mode	Plaintext	Plaintext	Plaintext
Storage Period	Determined by customers	Determined by customers	Determined by customers

A How to Obtain Help

If a tough or critical problem persists in routine maintenance or troubleshooting, contact Huawei for technical support.

A.1 Preparations for Contacting Huawei

To better solve the problem, you need to collect troubleshooting information and make debugging preparations before contacting Huawei.

A.1.1 Collecting Troubleshooting Information

You need to collect troubleshooting information before troubleshooting.

You need to collect the following information:

- Name and address of the customer
- Contact person and telephone number
- Time when the fault occurred
- Description of the fault phenomena
- Device type and software version
- Measures taken after the fault occurs and the related results
- Troubleshooting level and required solution deadline

A.1.2 Making Debugging Preparations

When you contact Huawei for help, the technical support engineer of Huawei might assist you to do certain operations to collect information about the fault or rectify the fault directly.

Before contacting Huawei for help, you need to prepare the boards, port modules, screwdrivers, screws, cables for serial ports, network cables, and other required materials.

A.2 How to Use the Document

Huawei provides guide documents shipped with the device. The guide documents can be used to handle the common problems occurring in daily maintenance or troubleshooting.

To better solve the problems, use the documents before you contact Huawei for technical support.

A.3 How to Obtain Help from Website

Huawei provides users with timely and efficient technical support through the regional offices, secondary technical support system, telephone technical support, remote technical support, and onsite technical support.

Contents of the Huawei technical support system are as follows:

- Huawei headquarters technical support department
- Regional office technical support center
- Customer service center
- Technical support website: **http://support.huawei.com/enterprise/**

You can query how to contact the regional offices at **http://support.huawei.com/enterprise/**.

A.4 Ways to Contact Huawei

Huawei Technologies Co., Ltd. provides customers with comprehensive technical support and service. For any assistance, contact our local office or company headquarters.

Huawei Technologies Co., Ltd.

Address: Huawei Industrial Base Bantian, Longgang Shenzhen 518129 People's Republic of China

Website: **http://enterprise.huawei.com/**

B Glossary

A

AC power module	The module that transfers the external AC power supply into the power supply for internal use.
Application server	A service processing node (a computer device) on the network. Application programs of data services run on the application server.
Asynchronous remote replication	A kind of remote replication. When the data at the primary site is updated, the data does not need to be updated synchronously at the mirroring site to finish the update. In this way, performance is not reduced due to data mirroring.

B

Backup	Process of copying data to another storage area so that it can be used to restore the data when the source data is damaged or lost.
Backup window	An interval of time during which a set of data can be backed up without seriously affecting applications that use the data.
Bandwidth	The numerical difference between the upper and lower frequencies of a band of electromagnetic radiation. A deprecated synonym for data transfer capacity that is often incorrectly used to refer to throughput.
Baud rate	The number of times per second the signal can change on a transmission line. Typically, the transmission line uses only two signal states, making the baud rate equal to the number of bits per second that can be transferred.
Bit error	An incompatibility between a bit in a transmitted digital signal and the corresponding bit in the received digital signal.

Bit error rate	The probability that a transmitted bit will be erroneously received. The BER is measured by counting the number of bits in error at the output of a receiver and dividing by the total number of bits in the transmission. BER is typically expressed as a negative power of 10.
Boundary scan	A test methodology that uses shift registers in the output connections of integrated circuits (ICs). One IC is often connected to the next IC. A data pattern is passed through the chain and the observed returned data stream affected by the circuit conditions gives an indication of any faults present. The system is defined under IEEE standard 1149.1 and is also known as Joint Test Action Group (JTAG).
Browser/Server	Architecture that defines the roles of the browser and server. The browser is the service request party and the server is the service provider.

C

Cache hit ratio	The ratio of the number of cache hits to the number of all I/Os during a read task, usually expressed as a percentage.
Captive screw	Specially designed to lock into place on a parent or motherboard, allowing for easy installation and removal of attached pieces without release of the screw.
Challenge Handshake Authentication Protocol	A password-based authentication protocol that uses a challenge to verify that a user has access rights to a system. A hash of the supplied password with the challenge is sent for comparison so the cleartext password is never sent over the connection.
Coffer	A technology for ensuring data security and integrity in a storage system. It is used to store the mission-critical data of the system.
Coffer disk	Disks that build up the coffer.
Controller	The control logic in a disk or tape that performs command decoding and execution, host data transfer, serialization and deserialization of data, error detection and correction, and overall management of device operations. The control logic in a storage subsystem that performs command transformation and routing, aggregation (RAID, mirroring, striping, or other), high-level error recovery, and performance optimization for multiple storage devices.
Controller enclosure	An enclosure that accommodates controllers and provides storage services. It is the core component of a storage system and generally consists of components, such as controllers, power supplies, and fans.
Copying	A pair state. The state indicates that the source LUN data is being synchronized to the target LUN.

D

Data compression	The process of encoding data to reduce its size. Lossy compression (i.e., compression using a technique in which a portion of the original information is lost) is acceptable for some forms of data (e.g., digital images) in some applications, but for most IT applications, lossless compression (i.e., compression using a technique that preserves the entire content of the original data, and from which the original data can be reconstructed exactly) is required.
Data flow	A process that involves processing data extracted from the source system. These processes include: filtering, integration, calculation, and summary, finding and solving data inconsistency, and deleting invalid data so that the processed data meets the requirements of the destination system for the input data.
Data migration	Data migration refers to that data is migrated from one data space to another. During migration, both the data format and size do not change.
Data source	A system, database (database user; database instance), or file that can make BOs persistent.
Deduplication	Deduplication is a specialized data compression technique for eliminating coarse-grained redundant data, typically to improve storage utilization. In the deduplication process, duplicate data is deleted, leaving only one copy of the data to be stored, along with references to the unique copy of data. Deduplication is able to reduce the required storage capacity since only the unique data is stored.
Dirty data	Data that is stored temporarily on the cache and has not been written onto disks.
disaster recovery	A system deployment solution aiming at reducing loss in disasters. A set of disaster recovery system that is the same as the production system is deployed as a backup to store the production data when a fault occurs in the production system. The applications are switched over to the disaster recovery system before the production system recovers. After the production system recovers, the applications are switched back to the production system.
Disk arrays	Groups of multiple disk devices that make up the typical SAN disk storage device. These arrays vary in design, capacity, performance, and other features.
Disk domain	A disk domain consists of the same type or different types of disks. Disk domains are isolated from each other. Therefore, services carried by different disk domains do not affect each other in terms of performance and faults (if any).

Disk enclosure	Consists of the following parts in redundancy: expansion module, disk, power module, and fan module. System capacity can be expanded by cascading multiple disk enclosures.
Disk location	The process of locating a disk in the storage system by determining the enclosure ID and slot ID of the disk.
Disk utilization	The percentage of used capacity in the total available capacity.

E

Engine	An engine is a core component that provides storage services for external applications. Hosted in a controller enclosure, the engine usually consists of one pair of controllers, disk modules, interface modules, power modules, fan modules, and batteries.
Expander module	A component used for expanding.
Expansion	Connecting a storage system to more disk enclosures through connection cables, expanding the capacity of the storage system.

F

Field replaceable unit	A unit or component of a system that is designed to be replaced in the field, i.e., without returning the system to a factory or repair depot. Field replaceable units may either be customer-replaceable or their replacement may require trained service personnel.
Firmware	Low-level software for booting and operating an intelligent device. Firmware generally resides in read-only memory (ROM) on the device.
Flash Translation Layer	Flash Translation Layer (FTL) organizes and manages host data, enables host data to be allocated to NAND flash chips of SSDs in an orderly manner, mains the mapping relationship between logical block addresses (LBAs) and physical block addresses (PBAs), and implements garbage collection, wear leveling, and bad block management.
Front-end host port	The port that connects the controller enclosure to the service side and transfers service data. There are three types of front-end host ports: SAS, Fibre Channel, and iSCSI.

G

garbage collection	The process of reclaiming resources that are no longer in use. Garbage collection has uses in many aspects of computing and storage. For example, in flash storage, background garbage collection can improve write performance by reducing the need to perform whole block erasures prior to a write.
Gateway	A device that receives data via one protocol and transmits it via another.
global garbage collection	With a view to defragmentation of storage arrays and garbage collection of disks, global garbage collection reduces garbage of disks by enabling storage arrays to inform disks of not implementing invalid data relocation and of controlling space release so that disks and controllers consume less space, reducing costs and prolonging the useful life of storage arrays.
Global system for mobile communications	The second-generation mobile networking standard defined by the European Telecommunications Standards Institute (ETSI). It is aimed at designing a standard for global mobile phone networks. GSM consists of three main parts: mobile switching subsystem (MSS), base station subsystem (BSS), and mobile station (MS).
global wear leveling	With a view to individual characteristics of a single disk, Global wear leveling uses space allocation and write algorithms to achieve wear leveling among disks, preventing a disk from losing efficacy due to excessive writes and prolonging the useful life of the disk.

H

Hard disk tray	The tray that bears the hard disk.
Heartbeat	Heartbeat supports node communication, fault diagnosis, and event triggering. Heartbeats are protocols that require no acknowledgement. They are transmitted between two devices. The device can judge the validity status of the peer device.
Hit ratio	The ratio of directly accessed I/Os from the cache to all I/Os.
Hot swap	The substitution of a replacement unit (RU) in a system for a defective unit, where the substitution can be performed while the system is performing its normal functioning normally. Hot swaps are physical operations typically performed by humans.

I

In-band management	The management control information of the network and the carrier service information of the user network are transferred through the same logical channel. In-band management enables users to manage storage arrays through commands. Management commands are sent through service channels, such as I/O write and read channels. The advantages of in-band management include high speed, stable transfer, and no additional management network ports required.
initiator	A system component that initiates an I/O operation on an I/O bus or on a network.
input/output	Shorthand for input/output. I/O is the process of moving data between a computer system's main memory and an external device or interface such as a storage device, display, printer, or network connected to other computer systems. This encompasses reading, or moving data into a computer system's memory, and writing, or moving data from a computer system's memory to another location.
Interface module	A replaceable field module that accommodates the service or management ports.

L

Load balance	A method of adjusting the system, application components, and data to averagely distribute the applied I/Os or computing requests to physical resources of the system.
Logical unit	The addressable entity within a SCSI target that executes I/O commands.
Logical unit number	The SCSI identifier of a logical unit within a target. Industry shorthand, when phrased as LUN, for the logical unit indicated by the logical unit number.
LUN formatting	The process of writing 0 bits in the data area of the logical drive and generating related parity bits so that the logical drive can be in the ready state.
LUN mapping	A storage system maps LUNs to application servers so that application servers can access storage resources.
LUN migration	A method for the LUN data to migrate between different physical storage spaces while ensuring data integrity and uninterrupted operation of host services.
LUN snapshot	A type of snapshot created for a LUN. This snapshot is both readable and writable and is mainly used to provide a snapshot LUN from point-in-time LUN data.

M

Maintenance terminal	A computer connected through a serial port or management network port. It maintains the storage system.

Management interface module	The module that integrates one or more management network ports.
Management network	An entity that provides means to transmit and process network management information.
Management network port	The network port on the controller enclosure connected to the maintenance terminal. It is provided for the remote maintenance terminal. Its IP address can be modified with the change of the customer's environment.

N

NVM Express	A host controller interface with a register interface and command set designed for PCI Express-based SSDs.
NVMe SSD	A solid state disk (SSD) with a non-volatile memory express (NVMe) interface. Compared with other SSDs, such SSDs can deliver higher performance and shorter latency.

O

Out-of-band management	A management mode used during out-of-band networking. The management and control information of the network and the bearer service information of the user network are transmitted through different logical channels.
Owning controller	The controller that can prior access a certain LUN.

P

PCIe switch	A PCIe switch interconnects multiple devices using the PCIe protocol to forward data among the devices.
Power failure protection	When an external power failure occurs, the AC PEM depends on the battery for power supply. This ensures the integrity of the dirty data in the cache.
Pre-copy	When the system monitors a failing member disk in a RAID group, the system copies the data from the disk to a hot spare disk in advance.
Primary storage controller	The controller that plays a leading role in controlling management. It can perform relevant management operations on the controller enclosure.
Primary/Secondary switchover	A process for the conversion of the primary/secondary relationship.
Prior controller	For the application server LUN, prior controller means the working controller is the owner controller of the corresponding LUN array.

R

RAID level	The application of different redundancy types to a logical drive. A RAID level improves the fault tolerance or performance of the logical drive but reduces the available capacity of the logical drive. You must specify a RAID level for each logical drive.
Reconstruction	The regeneration and writing onto one or more replacement disks of all of the user data and check data from a failed disk in a mirrored or RAID array. In most arrays, a rebuild can occur while applications are accessing data on the array's virtual disks.
Redundancy	The inclusion of extra components of a given type in a system (beyond those required by the system to carry out its function) for the purpose of enabling continued operation in the event of a component failure.
Remote replication	A core technology for disaster recovery and a foundation that implements remote data synchronization and disaster recovery. This technology remotely maintains a set of data mirrors through the remote data connection function of the storage devices that are separated in different places. Even when a disaster occurs, the data backup on the remote storage device is not affected. Remote replication can be divided into synchronous remote replication and asynchronous remote replication.
Reverse synchronization	The process of restoring data from the redundancy machine (RM) when the services of the production machine (PM) are recovering.
Route	The path that network traffic takes from its source to its destination. On a TCP/IP network, each IP packet is routed independently. Routes can change dynamically.

S

Script	A collection of data statements used to perform an operation.
Secondary controller	(1) A controller that backs up service and management data of the primary controller in a clustered system. When the primary controller fails, the secondary controller is upgraded to the primary controller and takes over the management and services of the controller enclosure. (2) A controller that backs up the management data of the primary controller in a block-level array. When the primary controller fails, the secondary controller is upgraded to the primary controller and takes over the management of the system.
Serial port	An input/output location (channel) that sends and receives data (one bit at a time) to and from the CPU of a computer or a communications device. Serial ports are used for serial data communication and as interfaces for some peripheral devices, such as mouse devices and printers.

Service data	The user and/or network information required for the normal functioning of services.
Service network port	The network port that is used to store services.
Simple network management protocol	An IETF protocol for monitoring and managing systems and devices in a network. The data being monitored and managed is defined by a MIB. The functions supported by the protocol are the request and retrieval of data, the setting or writing of data, and traps that signal the occurrence of events.
Single point of failure	One component or path in a system, the failure of which would make the system inoperable.
Slot	A position defined by an upper guide rail and the corresponding lower guide rail in a frame. A slot houses a board.
Small computer system interface	A collection of ANSI standards and proposed standards that define I/O interconnects primarily intended for connecting storage subsystems or devices to hosts through host bus adapters. Originally intended primarily for use with small (desktop and desk-side workstation) computers, SCSI has been extended to serve most computing needs, and is arguably the most widely implemented I/O interconnect in use today."
Snapshot	A point in time copy of a defined collection of data.
Snapshot copy	A copy of a snapshot LUN.
Source LUN	The LUN where the original data is located.
Storage pool shrinking	A method of shrinking the total storage pool capacity.
Storage system	An integrated system that consists of the following parts: controller, storage array, host bus adapter, physical connection between storage units, and all control software.
Storage unit	An abstract definition of backup storage media for storing backup data. The storage unit is connected to the actual storage media used to back up data.
Streaming media	Streaming media is media continuously streamed over the network. Combining technologies concerning streaming media data collection, compression, encoding, storage, transmission, playback, and network communications, streaming media can provide high-quality playback effects in real time at low bandwidth.
Subnet	A type of smaller network that forms a larger network according to a rule, such as, forming a network according to different districts. This facilitates the management of a large network.

T

Target	The endpoint that receives a SCSI I/O command sequence.
Target LUN	The LUN on which target data resides.
Thin LUN	A logic disk that can be accessed by hosts. It dynamically allocates storage resources from the thin pool according to the actual capacity requirements of users.
Timing snapshot	Creates virtual snapshots periodically to continuously protect data.
Topology	The logical layout of the components of a computer system or network and their interconnections. Topology deals with questions of what components are directly connected to other components from the standpoint of being able to communicate. It does not deal with questions of physical location of components or interconnecting cables. The communication infrastructure that provides Fibre Channel communication among a set of PN_Ports (e.g., a Fabric, an Arbitrated Loop, or a combination of the two).
trim	A method by which the host operating system may inform a storage device of data blocks that are no longer in use and can be reclaimed.

U

User interface	The space where users interact with a machine.

W

wear leveling	A set of algorithms utilized by a flash controller to distribute writes and erases across the cells in a flash device. Cells in flash devices have a limited ability to survive write cycles. The purpose of wear leveling is to delay cell wear out and prolong the useful life of the overall flash device.
Working controller	The controller that reads data from and writes data onto LUNs or file systems in storage arrays.
Write Amplification	Increase in the number of write operations by the device beyond the number of write operations requested by hosts.
write amplification factor	The ratio of the number of write operations on the device to the number of write operations requested by the host.

Write back	A caching technology in which the completion of a write request is signaled as soon as the data is in the cache. Actual writing to non-volatile media occurs at a later time. Write back includes inherent risks: an application will take action predicated on the write completion signal, and a system failure before the data is written to non-volatile media will cause media contents to be inconsistent with that subsequent action. For these reasons, sufficient write back implementations include mechanisms to preserve cache contents across system failures (including power failures) and a flushed cache at system restart time.
Write Once Read Many	A type of storage, designed for fixed content, that preserves what is written to it in an immutable fashion. Optical disks are an example of WORM storage.
Write through	A caching technology in which the completion of a write request is not signaled until data is safely stored on non-volatile media. Write performance equipped with the write through technology is approximately that of a non-cached system. However, if the written data is also held in a cache, subsequent read performance may be dramatically improved.

Z

Zone	A Fibre Channel switch function that is similar to the VLAN function for Ethernet switches. It logically allocates the devices including hosts and storage systems on a SAN to different zones. In this way, the devices in different zones cannot directly access each other over a Fibre Channel network, implementing device isolation on the SAN.

C Acronyms and Abbreviations

B	
BBU	Backup Battery Unit
C	
CLI	Command Line Interface
F	
FC	Fibre Channel
H	
HBA	Host Bus Adapter
HPC	High-performance Computing
I	
IOPS	Input/Output Operations Per Second
iSCSI	Internet Small Computer Systems Interface
L	
LUN	Logical Unit Number
N	
NVMe	Non-volatile Memory Express
O	
ODX	Offloaded Data Transfer
OLTP	Online Transaction Processing
OLAP	Online Analytical Processing

R	
RAID	Redundant Array of Independent Disks
ROW	Redirect-On-Write
S	
SAS	Serial Attached SCSI
SNMP	Simple Network Management Protocol
SRM	Site Recovery Manager
SSD	Solid-State Drive
T	
TCO	Total Cost of Ownership
V	
VAAI	vSphere Storage APIs for Array Integration
VDI	Virtual Desktop Infrastructure
VSS	Volume Shadow Copy Service

