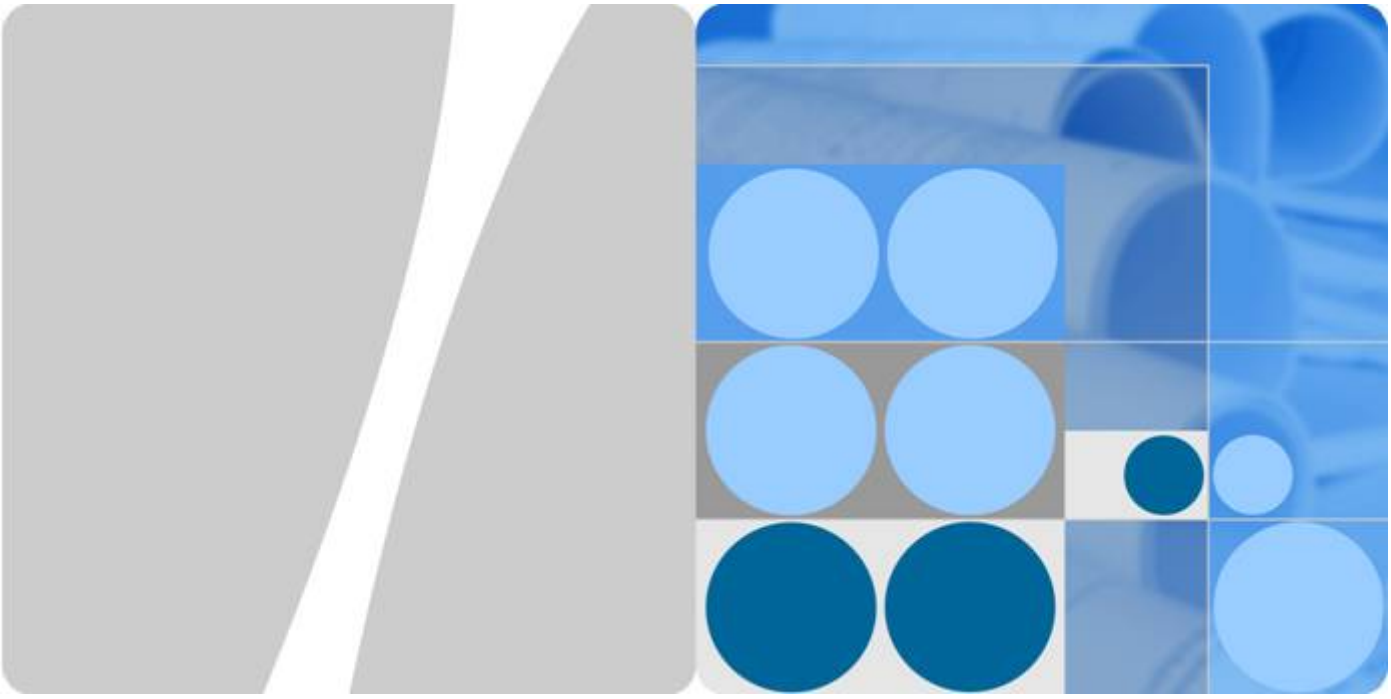

OceanStor 2200 V3 Storage System

V300R006

Product Description

Issue 01

Date 2017-02-28

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About This Document

Purpose

This document describes the orientation, features, architecture, technical specifications, product configuration, environment requirements, standard compliance and granted certifications of the OceanStor 2200 V3 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	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.

Symbol	Description
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 01 (2017-02-28)

This issue is the first official release.

Contents

About This Document.....ii

1 Product Positioning.....1

2 Product Features.....3

3 Typical Applications.....9

3.1 High-Performance Applications.....10
3.2 High-Availability Applications.....11
3.3 High-Density and Multi-Service Applications.....13

4 Hardware Architecture.....16

4.1 Device Composition.....17
4.2 2 U Controller Enclosure.....17
4.2.1 Overview.....17
4.2.2 Component Description.....21
4.2.2.1 System Enclosure.....21
4.2.2.2 Controller.....22
4.2.2.3 Power Module.....25
4.2.2.4 Disk Module.....27
4.2.2.5 10GE Electrical Interface Module.....28
4.2.2.6 GE Electrical Interface Module.....30
4.2.2.7 SmartIO Interface Module.....31
4.2.3 Indicator Introduction.....33
4.3 2 U Disk Enclosure (2.5-Inch Disks).....39
4.3.1 Overview.....39
4.3.2 Component Description.....40
4.3.2.1 System Enclosure.....40
4.3.2.2 Expansion Module.....41
4.3.2.3 Power Module.....43
4.3.2.4 Disk Module.....44
4.3.3 Indicator Introduction.....45
4.4 4 U Disk Enclosure (3.5-Inch Disks).....48
4.4.1 Overview.....48
4.4.2 Component Description.....50
4.4.2.1 System Enclosure.....50

4.4.2.2 Expansion Module....51
4.4.2.3 Power Module....52
4.4.2.4 Fan Module....53
4.4.2.5 Disk Module....54
4.4.3 Indicator Introduction....56
4.5 Device Cables....58
4.5.1 Power Cables....59
4.5.2 Ground Cables....60
4.5.3 Network Cables....60
4.5.4 Serial Cables....61
4.5.5 Mini SAS HD Cables....61
4.5.5.1 Mini SAS HD Electrical Cables....61
4.5.5.2 Mini SAS HD optical cables....62
4.5.6 Optical Fibers....63
5 Software Architecture....64
6 Product Specifications....71
6.1 Hardware Specifications....72
6.2 Software Specifications....77
7 Environmental Requirements....83
7.1 Temperature, Humidity, and Altitude....84
7.2 Vibration and Shock....85
7.3 Particle Contaminants....85
7.4 Corrosive Airborne Contaminants....86
7.5 Heat Dissipation and Noise....89
8 Standards Compliance....91
9 Certifications....96
10 Operation and Maintenance....99
A How to Obtain Help....101
A.1 Preparations for Contacting Huawei....102
A.1.1 Collecting Troubleshooting Information....102
A.1.2 Making Debugging Preparations....102
A.2 How to Use the Document....102
A.3 How to Obtain Help from Website....102
A.4 Ways to Contact Huawei....103
B Glossary....104
C Acronyms and Abbreviations....105

1 Product Positioning

The OceanStor 2200 V3 storage system is storage product newly developed by Huawei Technologies Co., Ltd (Huawei for short). This series is ideal for processing existing storage applications and follows the development trend of storage technologies. It meets medium- and large-sized enterprises' storage requirements for massive data storage, fast data access, high availability, high utilization, energy saving, and ease-of-use.

Business development leads to a great amount of service data, which poses 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 eliminate these bottlenecks, Huawei has launched the OceanStor 2200 V3 storage system.

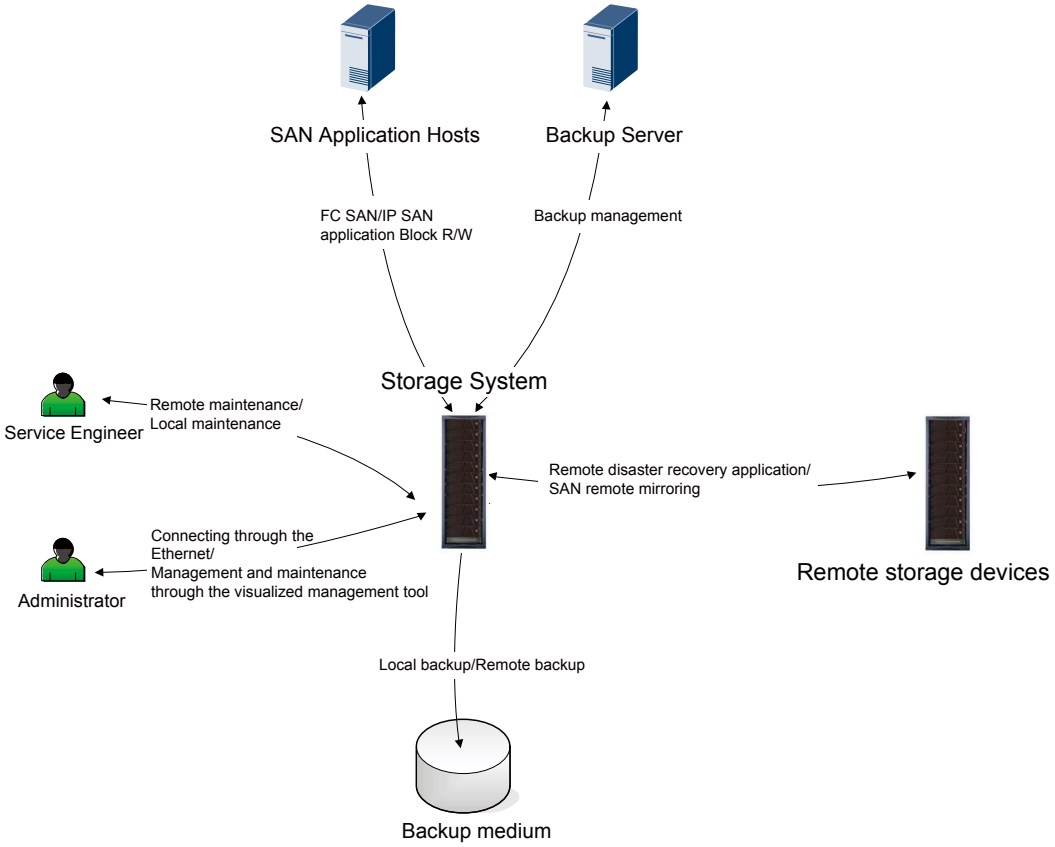
The OceanStor 2200 V3 storage system offers comprehensive and superb solutions by providing industry-leading performance, diverse efficiency boost mechanisms, as well as file-level and block-level data storage and various storage protocols on a single platform. Those solutions help customers maximize their return on investment (ROI) and meet the requirements of different application scenarios such as Online Transaction Processing (OLTP) and Online Analytical Processing (OLAP) of large databases, high-performance computing (HPC), digital media, Internet operation, centralized storage, backup, disaster recovery, and data migration.

In addition to providing high-performance storage services for application servers, the OceanStor 2200 V3 storage system supports advanced data backup and disaster recovery technologies, ensuring the secure and smooth running of data services. Also, the OceanStor 2200 V3 storage system offers easy-to-use management modes and convenient local/remote maintenance modes, greatly decreasing the management and maintenance costs.

Position and Application of the Storage System on a SAN Network

Figure 1-1 shows the position and application of the OceanStor 2200 V3 storage system on a SAN network.

Figure 1-1 Position and application of the storage system on a SAN network



2 Product Features

Powered by a superior hardware structure, an integrated block and file software architecture, as well as advanced data applications and protection technologies, the OceanStor 2200 V3 storage system provides high performance, superb scalability, robust reliability, and high availability, meeting medium- and large-sized enterprises' different storage requirements.

High Performance

The OceanStor 2200 V3 storage system offers a three-level performance acceleration technology, and delivers hierarchical performance for different applications. The three levels are:

1. Superior hardware

   The OceanStor 2200 V3 storage system is equipped with multi-core processors, high-speed and large-capacity caches, and various high-speed interface modules. The superior hardware allows the OceanStor 2200 V3 storage system to offer better storage performance than tradition storage systems.

2. SmartTier

   The SmartTier technology identifies hotspot data and periodically promotes them to high-performance storage medium for a performance boost. In addition, SmartTier supports solid state drive (SSD) data caching, accelerating access to hotspot data.

3. SSDs

   The OceanStor 2200 V3 storage system can be fully configured with SSDs to provide peak performance for the most-demanding applications.

Flexible Scalability

The OceanStor 2200 V3 storage system has an outstanding scalability. It supports various types of disks and host interface modules. Also, the interface modules have a high density. The supported multiple types and high-density interface modules bring a high system scalability.

The OceanStor 2200 V3 storage system supports the following types of disks and interface modules:

- Types of disks:

  SAS disks, NL-SAS disks, and SSDs.

- Types of host interface modules:

  GE, 10GE and SmartIO.

  NOTE

  SmartIO interface modules support various ports including 16 Gbit/s Fibre Channel ports, 8 Gbit/s Fibre Channel ports, 10 Gbit/s FCoE (VN2VF) ports, 10 Gbit/s Ethernet ports, and iWARP (interconnection between Scale-out nodes).

Proven Reliability

The OceanStor 2200 V3 storage system offers protection measures against component failures and power failure, and uses advanced technologies to minimize risks of disk failures and data loss. This ensures the proven reliability of the storage system.

- Against component failures

  The storage system components are in 1+1 redundancy and work in active-active mode. Normally, every two components work simultaneously and share loads. If one component fails or gets offline, the other one takes over all loads and speeds up to compensate. The whole process is transparent to applications.
- RAID 2.0+ underlying virtualization

  The storage system employs innovative RAID 2.0+ underlying virtualization technology for automatic load balancing. If a disk encounters a fault, all the other disks in the same disk domain help construct the faulty disk's service data, achieving a 20-fold faster reconstruction speed than traditional RAID technology. In addition, RAID 2.0+ significantly reduces the possibility of multi-disk failure.
- Against unexpected downtime

  The storage system is equipped with backup power modules that provide power for the controller enclosure in the event of a power failure. This protects the data in the cache and dumps it to the build-in disks of the controllers to avoid data loss.
- Bad sector repair

  The storage system is prone to bad sectors of disks. The OceanStor 2200 V3 storage system adopts the bad sector repair technology to proactively detect and repair bad sectors, reduce the disk failure rate by 50%, and prolong the service life of disks.
- Disk pre-copy

  The disk pre-copy technology enables the storage system to routinely check the hardware status and migrate data from any failing disk to minimize the risks of data loss.

High Availability

The OceanStor 2200 V3 storage system uses TurboModule, online capacity expansion, and disk roaming technologies to provide high availability for applications and nonstop system running during maintenance. The functions of TurboModule, online capacity expansion, and disk roaming are as follows:

- TurboModule enables controllers, fans, power modules, interface modules, BBUs, and disks to be hot-swapped without restarting the storage system, allowing online operations.
- Dynamic capacity expansion enables users to add disks to a disk domain in an online and easy manner.
- Disk roaming enables a storage system to automatically identify relocated disks and resume their services.

The OceanStor 2200 V3 storage system provides multiple advanced data protection technologies to protect data integrity and continuous system running even when catastrophic disasters happen. Advanced data protection technologies of the OceanStor storage system are snapshot, LUN copy, remote replication, clone and HyperMirror:

- Snapshot generates multiple point-in-time images for the source LUN (Logical Unit Number) or source file system data. The snapshot images can be used to recover data quickly when needed.
- LUN copy backs up data among heterogeneous storage systems for data protection.
- Remote replication backs up local data onto a remote storage system for disaster recovery.
- Clone preserves a real-time physical copy of a source LUN for the high availability of local data.
- HyperMirror backs up data in real time. If the source data becomes unavailable, applications can automatically use the data copy, ensuring high data security and application continuity.

The OceanStor 2200 V3 storage system employs multiple resource application technologies and provides flexible resource management to protect customers' storage investments. The resource application technologies include SmartVirtualization, and SmartMigration.

- 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.

The OceanStor 2200 V3 storage system supports memory upgrade so that storage performance matches service development.

High System Security

Storage Network Security

- Security of management channels

  The 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 ports

  The storage system provides only necessary ports to the external 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 port exists.

- Service ports are isolated from management ports

  The Access Control List (ACL) mechanism is adopted to isolate Ethernet ports from internal heartbeat network ports, management network ports, and maintenance network ports.

  NOTE

  Internal heartbeat links are established between controllers for these controllers to detect each other's working status. You do not need to separately connect cables.

Storage Service Security

- Security of the operating system

The storage system uses a dedicated operating system. Security of the operating system has been hardened before the storage system is delivered. The storage systems update security patches for their operating systems and open-source software based on site requirements, safeguarding users' data.

- Data storage encryption

  The storage system supports data encryption by using a network password manager. The network password manager employs the standard cryptographic algorithm supported by the State Encryption Administration of China. It allows only the hosts that comply with security policies to access storage system data by auditing access control policies and controlling access attempts from hosts. After the network password manager is deployed, all mutual information between the hosts and storage system will pass the network password manager to enable read/write data encryption and decryption and ensure data security of the storage system.

- Data destruction

  When deleting unwanted data, the system erases the specified LUN to make the deleted data unable to be restored, preventing critical data leaks.

Storage Management Security

The operations of users can be allowed and denied. All management operations are logged by the system.

Virtualization, Intelligence, and Efficiency

The OceanStor 2200 V3 storage system absorbs the concept of "Virtualization, Intelligence, and Efficiency", which fits the up-to-date storage design idea and wins a leading position for the storage system. Compared with traditional storage systems, the OceanStor 2200 V3 storage system achieves a higher storage space usage, faster data reconstruction speed, smarter performance allocation technology, and finer service quality control. To obtain the previous achievements, the following technologies contribute:

- RAID 2.0+ underlying virtualization

  RAID 2.0+ underlying virtualization technology divides disk storage space into small-sized data blocks and uses the blocks to create RAID groups for fine-grained resource management. The technology realizes automatic load balancing, higher storage performance, better storage space utilization, faster disk reconstruction, and delicate storage space management. RAID 2.0+ serves as a basis for a number of other advanced storage technologies.

- SmartTier (intelligent storage tiering)

  Enables a storage system to automatically analyze data access frequency per unit time and relocate data to disks of different performance levels based on the analysis result. (High-performance disks store hot data, performance disks store warm data, and large-capacity disks store cold data.) In this way, the optimal overall performance is achieved and the IOPS cost is reduced.

- SmartQoS (intelligent service quality control)

  Enables a storage system to categorize service data based on data characteristics (each category represents a type of application) and set a priority and performance objective for each category. In this way, resources are provided for services properly, ensuring mission-critical services' performance.

- Thin provisioning

  Allows on-demand allocation of storage space rather than the traditional method of pre-allocating all storage space at the initial stage. It is more efficient because the amount of

resources used is close to the amount of resources allocated. In this way, the initial purchase cost and total cost of ownership are reduced.

- SmartCache (intelligent storage cache)

  Uses SSDs as cache resources to significantly promote system read performance when random, small I/Os with hot data require more read operations than write operations.

Economy and Ease-of-Use

The OceanStor 2200 V3 storage system employs intelligent CPU frequency control, delicate fan speed control, deduplication and compression to improve economy. It also provides a series of management and maintenance tools to simplify operation and maintenance tasks.

- Economy
  - Intelligent CPU frequency control

    Automatically changes the CPU frequency based on the system loads. It decreases the CPU frequency and power consumption during off-peak hours for a low operation cost and long CPU service life.
  - Delicate fan speed control

    Dynamically adjusts the fan speed based on the storage system's temperature. It lowers the noise and power consumption and cuts the operation cost.
  - Deduplication and compression

    Checks and processes duplicate data in disks based on deduplication, and minimizes space occupied by data based on compression to improve disk utilization.
  - OceanStor 2200 V3 storage system can be configured with one controller, meeting customers' requirements for low-cost storage systems.
- Ease-of-use
  - DeviceManager

    DeviceManager is a storage system management tool based on a graphical user interface (GUI) and enables you to efficiently manage storage systems by wizard-based operations in batch.
  - Storage resource configuration tool: SmartConfig

    Installed on application servers, SmartConfig is a piece of software providing easy management of storage systems. With this tool, only three steps are needed to easily, flexibly, and effectively divide storage resources into disks and mount them to servers.
  - Integrated management

    Implements convenient device management by integrating a management plug-in into mainstream management software such as VMware vCenter plug-in, Hyper-V System Center, vSphere API for Storage Awareness (VASA), vSphere Storage APIs for Array Integration (VAAI), and Volume Shadow Copy Service (VSS) Provider.
  - Pad management

    Supports flexible storage system management on a pad.
  - Various alarm notification methods

    Provides alarm notification by sound, indicator, short message service (SMS), or email.
  - One-click upgrade tool

Provides one-click upgrade for controllers. It simplifies the upgrade operation and makes the procedure transparent to users.

3 Typical Applications

About This Chapter

The OceanStor 2200 V3 storage system offers industry-leading hardware specifications, a flexible and reliable hardware design, a virtualized underlying architecture, and a variety of data protection technologies, addressing the needs of differentiated storage applications. The typical applications of the OceanStor 2200 V3 storage system include but are not limited to high-performance, high-availability, or multi-service applications.

3.1 High-Performance Applications
The OceanStor 2200 V3 storage system incorporates various technologies to boost the system performance. Its high-performance hardware delivers outstanding data access performance. The virtualization technology can improve the storage performance continuously and it shatters performance bottlenecks caused by data explosion. The intelligent data tiering technology SmartTier automatically detects and prioritizes hotspot data. Therefore, the OceanStor 2200 V3 storage system is a great choice for the high-performance applications.

3.2 High-Availability Applications
The OceanStor 2200 V3 storage system has a highly reliable design, achieving a long mean time between failures (MTBF), and ensuring high availability of storage applications. It also incorporates a variety of data protection technologies, and protects data integrity and service continuity against catastrophic disasters.

3.3 High-Density and Multi-Service Applications
The OceanStor 2200 V3 storage system delivers industry-leading density of interface modules in an enclosure and a flexible configuration of interface modules and hard disks of different types. This design makes the OceanStor 2200 V3 storage system suitable for high-density and multi-service applications.

3.1 High-Performance Applications

The OceanStor 2200 V3 storage system incorporates various technologies to boost the system performance. Its high-performance hardware delivers outstanding data access performance. The virtualization technology can improve the storage performance continuously and it shatters performance bottlenecks caused by data explosion. The intelligent data tiering technology SmartTier automatically detects and prioritizes hotspot data. Therefore, the OceanStor 2200 V3 storage system is a great choice for the high-performance applications.

On-Demand System Performance Boost

The performance of a storage system was provisioned to meet the initial application requirements. However, the future growth of applications is always beyond expectation, and the performance of a traditional storage system is gradually consumed up and finally restricts the system functionality. The virtualization technology of the OceanStor 2200 V3 storage system can address this issue. It dynamically increases storage performance based on the application requirement. This prolongs the system service life and lowers customers' total cost of ownership (TCO).

After the initial purchase, the storage system is equipped with affordable hard disk drives (HDDs) to deliver data storage services. As the service requirements increase and the storage system performance becomes insufficient, administrators can add HDDs of high speeds or SSDs to boost the system performance. When the service requirements reach a new peak and are starved of storage system performance, administrators can replace all the existing HDDs with SSDs to further adapt the system performance to the new requirements.

This on-demand system performance boost brings the following benefits:

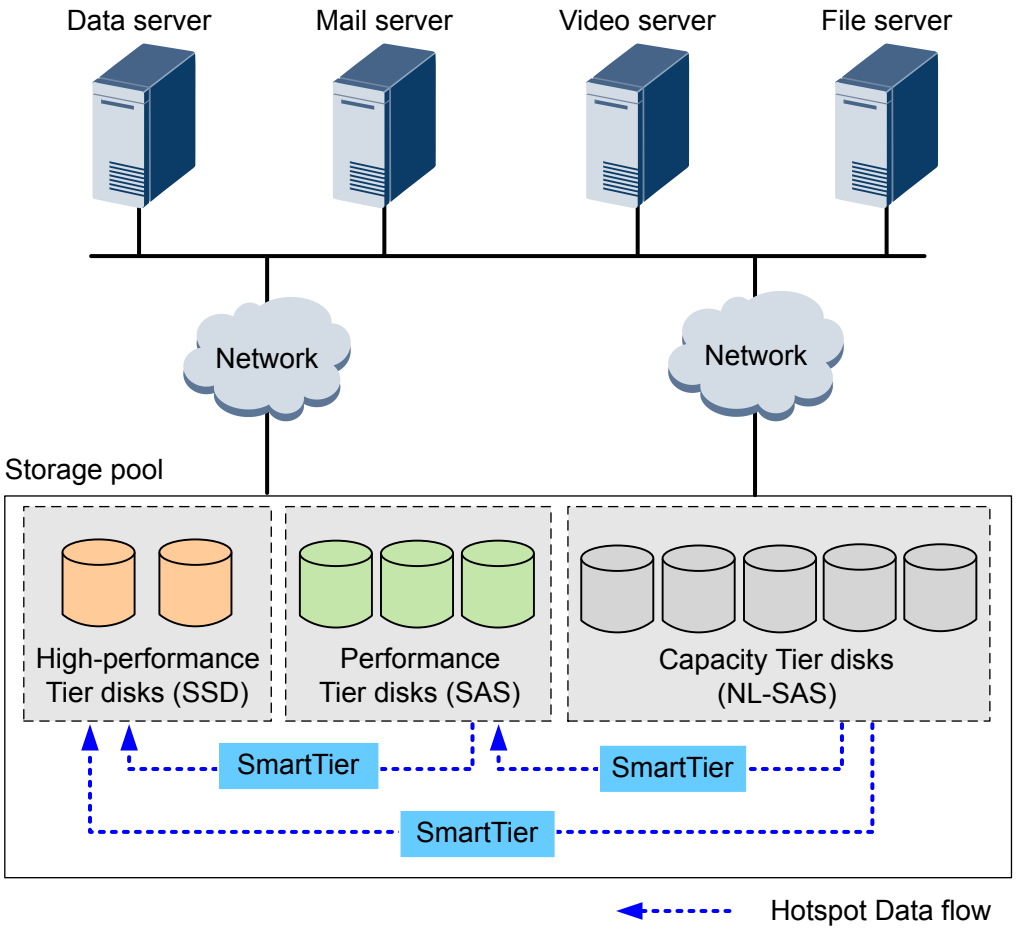
- The system performance is improved gradually, balancing the return on investment (ROI) and the system service life.
- Components for upgrade are available, following the Moore's Law to reduce the purchase cost and the TCO.

Dynamic Storage Tiering for Hotspot Data

In media and website applications, the hot news are of high access frequency and generate hotspot data. Those hotspot data receive simultaneous read and write requests from a large number of servers, and pose a demanding requirement on storage system performance. Traditional storage systems fail to address such a storage requirement.

The OceanStor 2200 V3 storage system uses its resident intelligent data tiering technology, SmartTier, to identify hotspot data and promote them to high-performance SAS disks or SSDs. If SmartTier later finds out that the hotspot data becomes cold (receiving less access requests), it demotes the data to low-performance disks and clear storage space for new hotspot data. **Figure 3-1** depicts the working principle of the SmartTier.

Figure 3-1 SmartTier working principle



3.2 High-Availability Applications

The OceanStor 2200 V3 storage system has a highly reliable design, achieving a long mean time between failures (MTBF), and ensuring high availability of storage applications. It also incorporates a variety of data protection technologies, and protects data integrity and service continuity against catastrophic disasters.

In-Service Routine Maintenance

In traditional storage systems, routine maintenance tasks, such as component replacement and capacity expansion, must be implemented in offline mode. The OceanStor 2200 V3 storage system, however, assembles advanced technologies for in-service routine maintenance:

- TurboModule

  Enables online replacement of components and requires no system restart.

- Online capacity expansion

  Allows online addition of disks and expansion of storage pools.

Tolerance of Single Points of Failures

The OceanStor 2200 V3 storage system incorporates a hierarchical redundancy design to eliminate the impact of single points of failure:

- Hardware redundancy

  All components of the OceanStor 2200 V3 storage system are in redundancy and work in active-active mode. If one component fails, the other speeds up to compensate so that the storage system can continue operating.

- Link redundancy

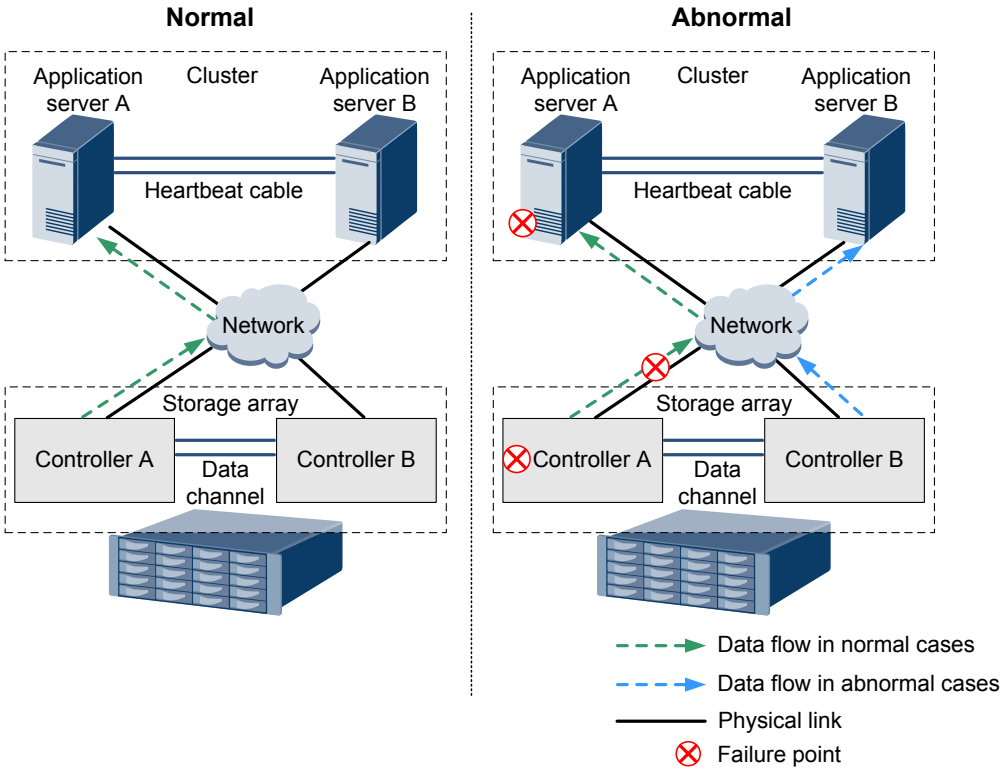
  If there is only one link between the storage system and an application server, the disconnection of the link terminates their communication in between. To eliminate this failure, the OceanStor 2200 V3 storage system uses two or more links to communicate with the application server. Therefore, if one link is down, the other links take over the services to continue the data transmission.

- Application server clustering

  If the storage system cooperates with only one application server, the failure of the application server interrupts services. Application server clustering can address this issue. A cluster consists of two or more application servers that share loads. If one application server in the cluster fails, the other application servers take over its loads, and the whole process is transparent to users. Application server clustering supported by the OceanStor 2200 V3 storage system ensures business continuity.

Based on the previous protection mechanisms, the OceanStor 2200 V3 storage system has proven tolerance of single points of failure, as shown in **Figure 3-2**.

Figure 3-2 Tolerance of single points of failure



In the example in **Figure 3-2**, application server A and controller A are faulty, so a link between the cluster and the storage system is down. Under this circumstance, the redundant components and links compensate for the failed ones. This ensures the nonstop system operations and greatly improves the service availability.

Resilience Against Disasters

The OceanStor 2200 V3 storage system compliments various data protection methods for backup and disaster recovery. Those methods eliminate the risks of unexpected downtime and data loss caused by natural disasters, serious device failures, or man-made misoperations.

The supported data protection methods include:

- Backup

  The storage system processes a huge amount of data, and the loss of any data can lead to a disastrous result. Therefore, enterprises are used to periodically backing up their critical data. The following backup technologies are most commonly used because they complete data backup in a hitless manner:

  - Snapshot: locally generates a virtual duplicate for a source LUN at a specified point in time. The duplicate is immediately usable and any access to it will have no impact on the source LUN data.
  - Clone: locally generates a complete copy for a source LUN at a specified point in time. After the clone task, the destination LUN stores the same data as the source LUN, and their relationship can be split. Then any access to the destination LUN has no impact on the source LUN data.
  - LUN copy: replicates data from the source LUN to the destination LUN at block level. A LUN copy task can be performed within a storage system or among storage systems (even if they are heterogeneous).
  - HyperMirror: backs up data in real time. If the source data becomes unavailable, applications can automatically use the data copy, ensuring high data security and application continuity.

- Disaster recovery

  Disaster recovery is essential for critical applications that must continue operating even during catastrophic disasters. Disaster recovery technologies involve many aspects such as storage systems, application servers, application software, and technicians. From the storage system aspect, the remote replication technology is usually used for disaster recovery because it backs up data in real time.

  The remote replication technology duplicates backup data in real time across sites, and utilizes the long distance between sites to eliminate data loss. This ensures that data is readily available on other sites if one site is destroyed.

3.3 High-Density and Multi-Service Applications

The OceanStor 2200 V3 storage system delivers industry-leading density of interface modules in an enclosure and a flexible configuration of interface modules and hard disks of different types. This design makes the OceanStor 2200 V3 storage system suitable for high-density and multi-service applications.

High-Density Virtual Machine Applications

The virtual machine technology greatly improves application servers' utilization, and lowers services' deployment and operating expense. Therefore, it is popular in many application

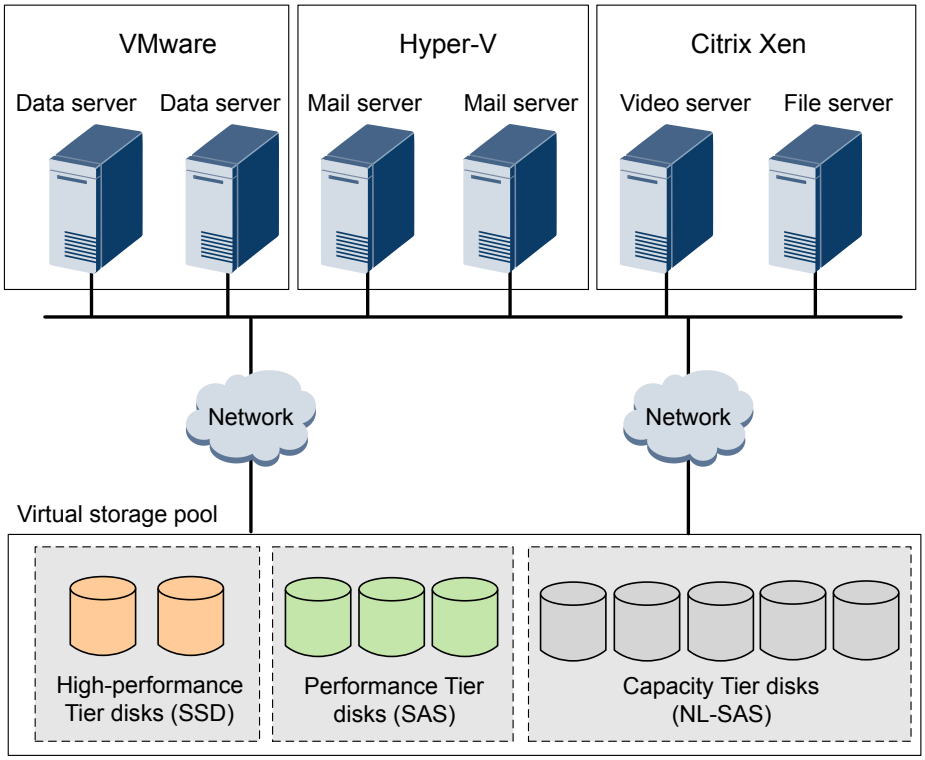
scenarios. However, virtual machines are now facing a challenge, that is, they are equipped with an increasing number of application systems and virtual desktops, leading to the high density of virtual machines. Compared with a single server, high-density virtual machines generate more service data, consume more bandwidth, and pose more demanding requirements on performance and scalability.

Excellent in both performance and compatibility, the OceanStor 2200 V3 storage system is ideal for high-density virtual machine applications:

- The three-level performance acceleration technology provides robust storage performance for high-density virtual machine applications.
- The proprietary TurboModule technology significantly improves the density of interface modules in a single enclosure. This high-density design translates into a capability to support hundreds of virtual machines.
- Various virtual machine applications are supported, including VMware, Hyper-V, and Citrix Xen.

Figure 3-3 shows a high-density virtual machine application scenario.

Figure 3-3 High-density virtual machine application scenario



Multi-Service Applications

It is a tendency nowadays for one storage system to process diversified applications. However, those applications have differentiated requirements on storage. Therefore, the storage system must have high flexibility in performance and networking.

Each type of services has its specific requirements for storage system:

- Database servers (featuring unstructured data): high requirements on storage performance, data integrity, and system stability.
- Mail servers (featuring high randomicity of concurrent accesses): high requirements on storage performance, data integrity, and system stability.
- Video servers: high requirements on storage capacity, data access continuity, and continuous bandwidths.
- Backup servers: low requirements on performance and bandwidths.

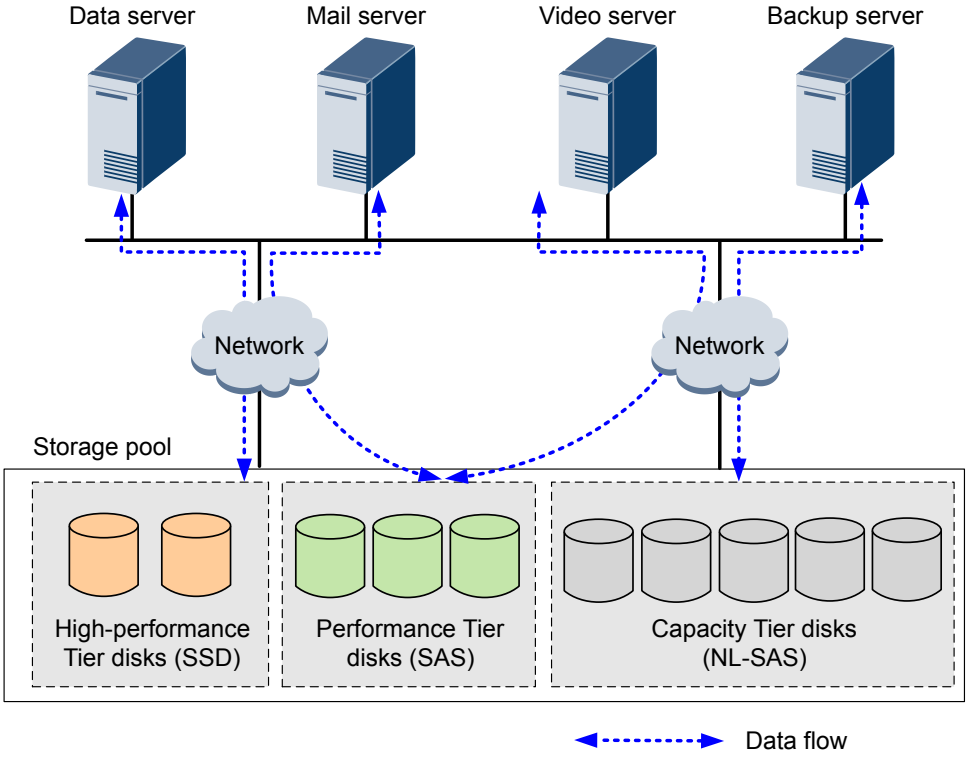
The OceanStor 2200 V3 storage system supports an intermixed configuration of SSDs, SAS disks, and NL-SAS disks to deliver optimal performance.

- SSDs: deliver the highest performance among these three types of disk, and are suitable for application servers such as busy database servers and mail servers that require superior storage performance.
- SAS disks: deliver performance lower than SSDs but higher than NL-SAS disks, and are suitable for application servers such as common database servers, mail servers, and high-definition (HD) video servers that have a moderate storage performance requirement.
- NL-SAS disks: deliver the lowest performance among these three types of disk, and are suitable for application servers such as low-end video servers and backup servers that have a low storage performance requirement.

The OceanStor 2200 V3 storage system has a flexible configuration of front-end interface modules with customizable transmission rates, respectively addressing the storage requirements in Fibre Channel networks and Ethernet networks, or of Fibre Channel data transmission in Ethernet networks.

Figure 3-4 shows a multi-service application scenario.

Figure 3-4 Multi-service application scenario



4 Hardware Architecture

About This Chapter

The storage system hardware 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
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.

4.2 2 U Controller Enclosure
This chapter describes a controller enclosure in terms of its hardware structure, component functions, front and rear views, and indicators.

4.3 2 U Disk Enclosure (2.5-Inch Disks)
This chapter describes a disk enclosure in terms of its hardware structure, component functions, front and rear views, and indicators.

4.4 4 U Disk Enclosure (3.5-Inch Disks)
This chapter describes a disk enclosure in terms of its hardware structure, component functions, front and rear views, and indicators.

4.5 Device Cables
Device cables used in the storage system include power cables, ground cables, and signal cables. This chapter displays the views and describes the functions and specifications of various cables.

4.1 Device Composition

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.

Different product models are configured with different types of controller enclosures and disk enclosures. **Table 4-1** lists the controller enclosures and disk enclosures used by different product models.

Table 4-1 Controller enclosures and disk enclosures used by different product models

Product Model	Controller Enclosure	Disk Enclosure
OceanStor 2200 V3	● 2 U controller enclosure with 12 disk slots  ● 2 U controller enclosure with 25 disk slots 	● 2 U disk enclosure with 25 disk slots  ● 4 U disk enclosure with 24 disk slots 

4.2 2 U Controller Enclosure

This chapter describes a controller enclosure in terms of its hardware structure, component functions, front and rear views, and indicators.

4.2.1 Overview

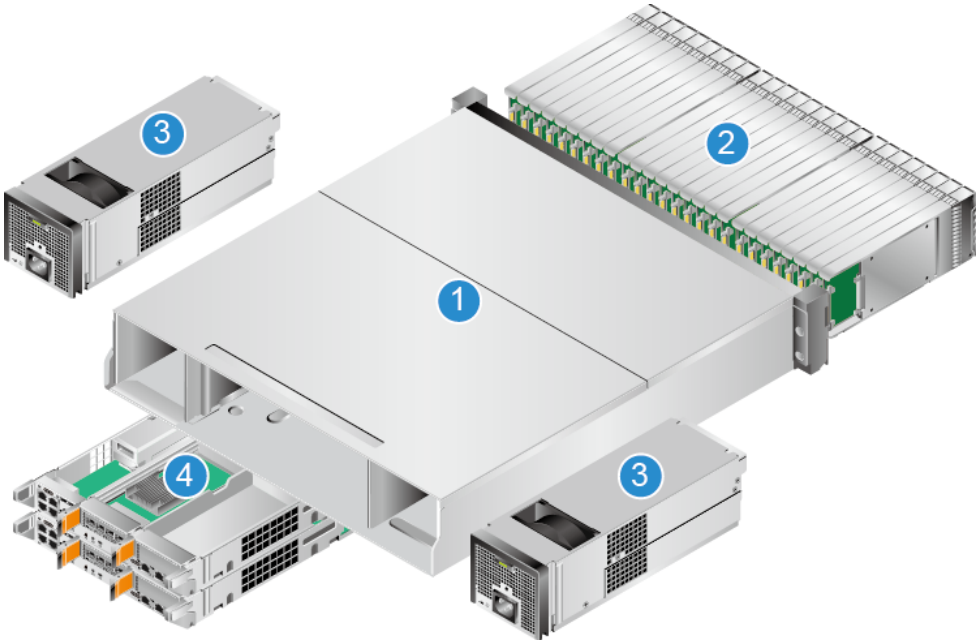
The controller enclosure adopts a modular design and consists of a system enclosure, controllers, power modules, and disk modules.

The 2 U controller enclosure of 2200 V3 supports AC power modules only, and a 2 U controller enclosure supports a single controller and dual controllers. The following figure shows the structure of 2200 V3 with dual controllers and AC power modules.

Overall Structure

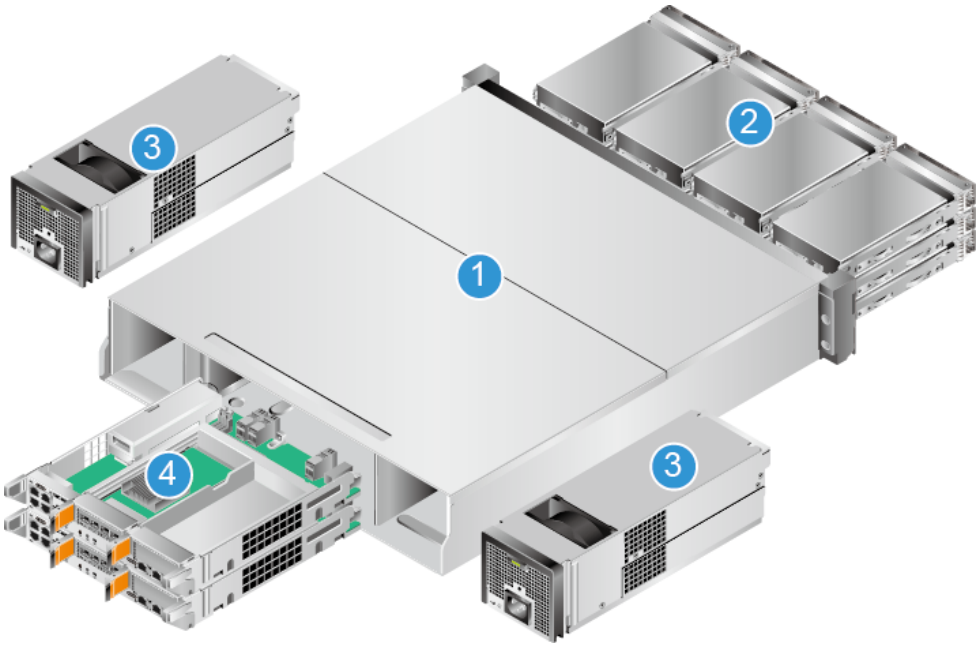
Figure 4-1 shows the overall structure of a 2 U 25-disk controller enclosure, **Figure 4-2** shows the overall structure of a 2 U 12-disk controller enclosure.

Figure 4-1 Overall structure of a 2 U 25-disk controller enclosure



1	System enclosure	2	Disk module
3	Power module	4	Controller

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



1	System enclosure	2	Disk module
3	Power module	4	Controller

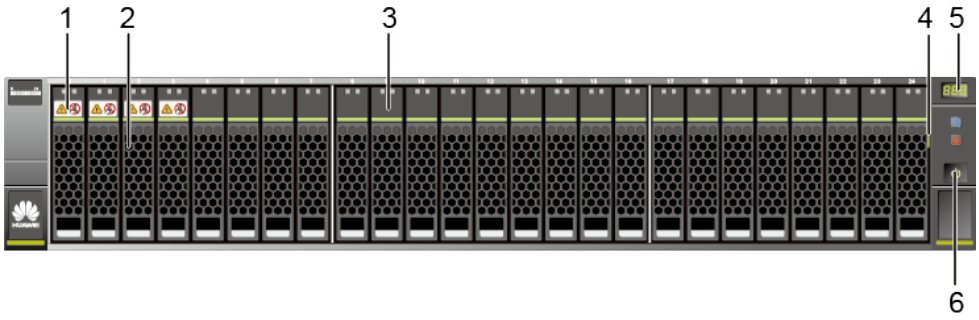
NOTE

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

Front View

Figure 4-3 shows the front view of a 2 U 25-disk controller enclosure, Figure 4-4 shows the front view of a 2 U 12-disk controller enclosure.

Figure 4-3 Front view of a 2 U 25-disk controller enclosure



1 Coffer disk label
2 Disk module handle
3 Disk module latch
4 Information plate (with ESN)
5 ID display of the controller enclosure
6 Power indicator/Power button

Figure 4-4 Front view of a 2 U 12-disk controller enclosure

1 Disk module handle
2 Coffer disk label
3 Information plate (with ESN)
4 ID display of the controller enclosure
5 Power indicator/Power button
6 Disk module latch

NOTE

- The disk slots of a 2 U 25-disk controller enclosure are numbered 0 to 24 from left to right. The four coffer disks are located in slot 0 to slot 3.
- The disk slots of a 2 U 12-disk controller enclosure are numbered 0 to 11 from left to right and from top to bottom. The four coffer disks are located in slot 0 to slot 3.
- SAS, NL-SAS, and SSD disks can be used as coffer disks. The type of the four coffer disks must be the same.
- Slots are used to accommodate and secure disks, interface modules, controller modules, fan modules, and power modules.
- The information plate records device information.

Rear View

Figure 4-5 and **Figure 4-6** show the rear view of a controller enclosure.

NOTICE

Do not connect the management network port and maintenance network port to the same switch.

NOTE

- 2200 V3 supports a single controller and dual controllers. Each controller can house one interface module.
- 2200 V3 provides onboard GE and mini SAS HD ports.
- The controller enclosure of 2200 V3 supports GE electrical interface modules, 10GE electrical interface modules, and SmartI/O interface modules.
- When the maintenance network port is used for management and maintenance, the maintenance network port can only be used by Huawei technical support for emergency maintenance and cannot be connected to the same network with the management network port. Otherwise, a network loopback may occur, causing a network storm. The initial value for the IP address of the maintenance network port is 172.31.128.101 or 172.31.128.102. The default subnet mask is 255.255.0.0. You are advised to only connect the management network port to the network.
- **Figure 4-5** shows the 2 U controller enclosure of 2200 V3, with a single controller, AC power supply, and SmartIO interface modules. **Figure 4-6** shows the 2 U controller enclosure of OceanStor 2200 V3, with dual controllers, AC power supply, and SmartIO interface modules.

Figure 4-5 Rear view of the 2200 V3 controller enclosure (with AC power modules and a single controller)

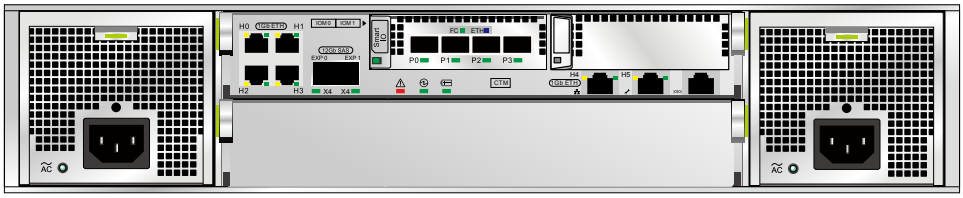
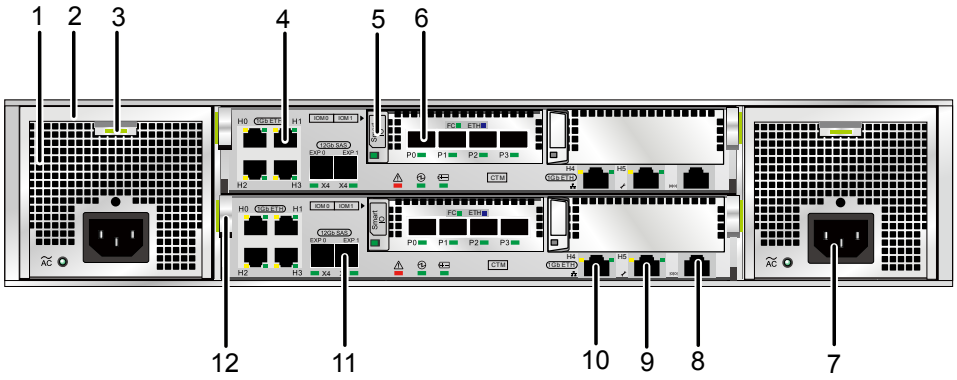


Figure 4-6 Rear view of the 2200 V3 controller enclosure (with AC power modules and dual controllers)



1	Power module	2	Power module handle
3	Power module latch	4	GE electrical port
5	Interface module handle	6	SmartIO port
7	Power socket	8	Serial port
9	Maintenance network port	10	Management network port
11	Mini SAS HD expansion port	12	Controller handle

4.2.2 Component Description

This section provides the illustration and description of each component of the storage system.

4.2.2.1 System Enclosure

The system enclosure integrates a midplane in order to provide reliable connections for interface modules and to distribute power and signals to inner modules.

Appearance

Figure 4-7 shows the appearance of a system enclosure.

Figure 4-7 System enclosure

4.2.2.2 Controller

A controller is the core component of a storage system. It processes storage services, receives configuration management commands, saves configuration data, connects to disk enclosures, and saves critical data onto coffer disks.

NOTE

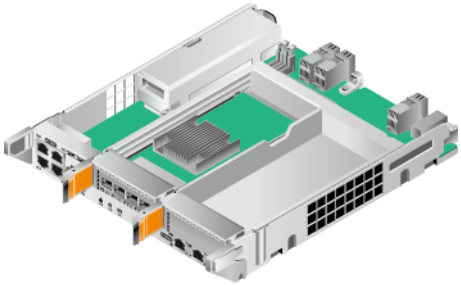
Each controller has one in-house disk. The disk is used to store the configuration data of the storage system, data in cache after a power failure, and OceanStorOS data. The disks in controller and those in another are redundant for each other.

Appearance

Each controller supports one interface module.

Figure 4-8 shows the appearance of a controller.

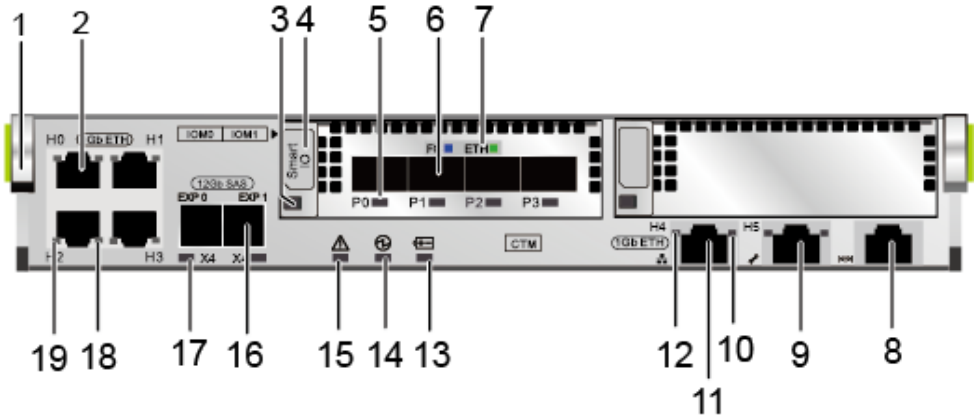
Figure 4-8 Controller



Ports

Figure 4-9 describes the ports of a controller.

Figure 4-9 Ports of a controller



1	Controller handle	2	GE electrical port
3	Power indicator of the interface module/Hot Swap button of the module	4	Interface module handle
5	Link/Active/Mode indicator of the SmartIO port	6	SmartIO port
7	Port mode silkscreen of SmartIO port	8	Serial port
9	Maintenance network port	10	Link/Active indicator of the management network port
11	Management network port	12	Speed indicator of the management network port
13	Running/Alarm indicator of the backup power module	14	Power indicator of the controller
15	Alarm indicator of the controller	16	Mini SAS HD expansion port
17	Indicator of the mini SAS HD expansion port	18	Link/Active indicator of the GE electrical port
19	Speed indicator of the GE electrical port		

Indicators

Table 4-2 describes the states and corresponding meanings of indicators on a controller after it is powered on.

Table 4-2 Checklist for indicators on a controller

No.	Indicator	Status and Description
3	Power indicator of the interface module/Hot Swap button of the module	● Steady green: The interface module is running properly. ● Blinking green: The interface module receives a hot swap request. ● Steady red: The interface module is faulty. ● Off: The interface module is powered off or can be hot-swapped.
5	Link/Active/Mode indicator of the SmartIO port	● Blinking blue slowly: The interface module is working in FC mode, and the port link is down. ● Blinking blue quickly: The interface module is working in FC mode, and data is being transmitted. ● Steady blue: The interface module is working in FC mode, the port link is up, and no data is being transmitted. ● Blinking green slowly: The interface module is working in ETH mode, and the port link is down. ● Blinking green quickly: The interface module is working in ETH mode, and data is being transmitted. ● Steady green: The interface module is working in ETH mode, the port link is up, and no data is being transmitted. ● Steady red: The port is faulty. ● Blinking red: The port is being located. ● Off: The port is not powered on.
10	Link/Active indicator of the management network port	● Steady green: The port is connected properly. ● Blinking green: Data is being transferred. ● Off: The port is connected abnormally.
12	Speed indicator of the management network port	● Steady orange: Data is being transferred at the highest rate. ● Off: The data transfer speed is lower than the highest speed.
13	Running/Alarm indicator of the backup power module	● Steady green: The backup power module is fully charged. ● Blinking green (1 Hz): The backup power module is being charged. ● Blinking green (4 Hz): The backup power module is being discharged. ● Steady red: The backup power module is faulty.

No.	Indicator	Status and Description
14	Power indicator of the controller	● Steady green: The controller is powered on. ● Blinking green (0.5 Hz): The controller enclosure is powered on and in the BIOS boot process. ● Blinking green (2 Hz): The controller is in the operating system boot process, or the controller is in the power-off process. ● Off: The controller is absent or powered off.
15	Alarm indicator of the controller	● Steady red: An alarm is generated on the controller. ● The Alarm indicator blinking red and the Power indicator blinking green: The controller is being located. ● Off: The controller is working correctly.
17	Indicator of the mini SAS HD expansion port	● Steady blue: Data is transferred to the upstream disk enclosure at the rate of 4 x 12 Gbit/s. ● Blinking blue: Data is being transferred to the upstream disk enclosure at the rate of 4 x 12 Gbit/s. ● Steady green: Data is transferred to the downstream disk enclosure at the rate of 4 x 6 Gbit/s or 4 x 3 Gbit/s. ● Blinking green: Data is being transferred to the upstream disk enclosure at the rate of 4 x 6 Gbit/s or 4 x 3 Gbit/s. ● Steady red: The port is faulty. ● Off: The link to the port is down.
18	Link/Active indicator of the GE electrical port	● Steady green: The link to the application server is normal. ● Blinking green: Data is being transferred. ● Off: The link to the application server is down or no link exists.
19	Speed indicator of the GE electrical port	● Steady orange: The data transfer rate between the storage system and the application server is 1 Gbit/s. ● Off: The data transfer rate between the storage system and the application server is less than 1 Gbit/s.

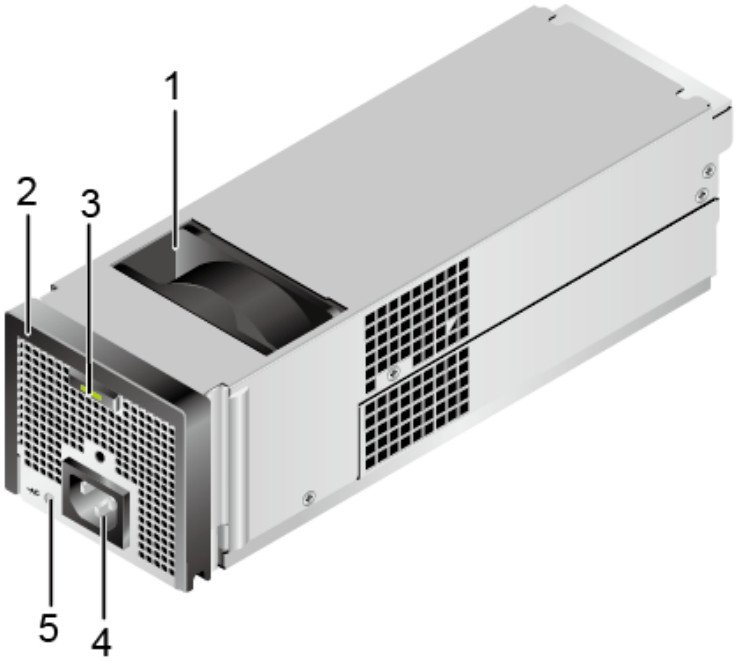
4.2.2.3 Power Module

Power modules can ensure that the controller enclosure works correctly in maximum power consumption mode.

Appearance

Figure 4-10 shows the front view of an AC power module.

Figure 4-10 Front view of an AC power module



1 Fan built in the power module
2 Power module handle
3 Power module latch
4 Power module socket
5 Running/Alarm indicator of the power module

Indicators

Table 4-3 describes indicators on a power module of a powered-on storage system.

Table 4-3 Indicators on a power module

No.	Indicator	Status and Description
5	Running/Alarm indicator of the power module	● Steady green: The power supply is correct. ● Green blinking: The power input is normal but the enclosure is powered off. ● Steady red: The power supply is faulty. ● Off: No external power input is found.

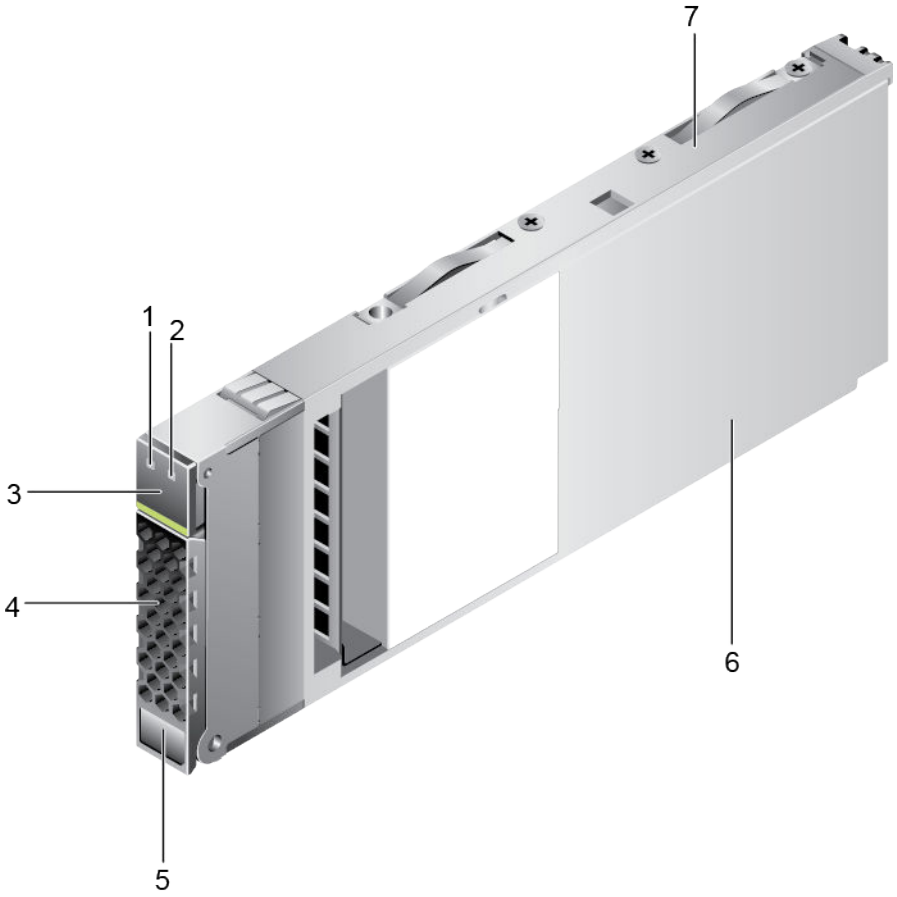
4.2.2.4 Disk Module

Disk modules provide storage capacity for a storage system. Disk modules can be used as a system safe disk, and can save service data, system data, and cache data.

Appearance

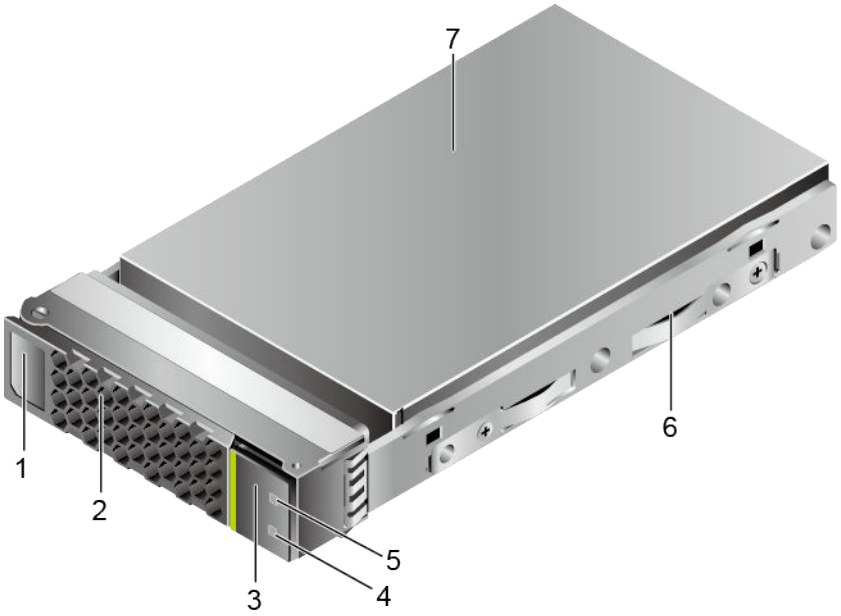
Figure 4-11 shows the appearance of a 2.5-inch disk module. **Figure 4-12** shows the appearance of a 3.5-inch disk module.

Figure 4-11 2.5-inch disk module



1 Running indicator of the disk module
2 Alarm/Location indicator of the disk module
3 Disk module latch
4 Disk module handle
5 Disk module label
6 Disk
7 Disk tray

Figure 4-12 3.5-inch disk module



1 Disk module label
2 Disk module handle
3 Disk module latch
4 Alarm/Location indicator of the disk module
5 Running indicator of the disk module
6 Disk tray
7 Disk

Indicators

Table 4-4 describes indicators on a disk module of a powered-on storage system.

Table 4-4 Indicators on a disk module

No.	Indicator	Status and Description
1 (for a 2.5-inch disk module) 5 (for a 3.5-inch disk module)	Running indicator of the disk module	● Steady green: The disk module is working correctly. ● Blinking green: Data is being read and written on the disk module. ● Off: The disk module is powered off or powered on incorrectly.
2 (for a 2.5-inch disk module) 4 (for a 3.5-inch disk module)	Alarm/Location indicator of the disk module	● Steady red: The disk module is faulty. ● Blinking red: The disk module is being located. ● Off: The disk module is working correctly or hot swappable.

4.2.2.5 10GE Electrical Interface Module

Interface modules connect storage devices to application servers.

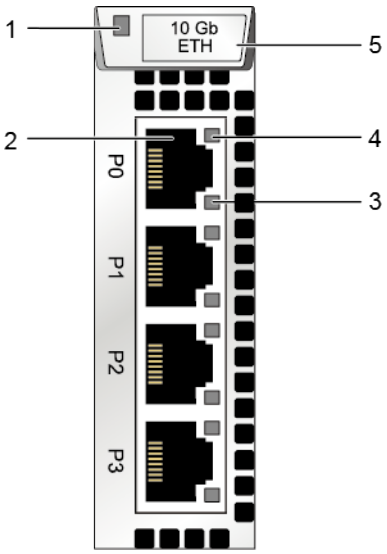
Function

A 10GE electrical interface module has four 10 Gbit/s electrical ports. These ports are the service ports used to connect the storage system to application servers and to receive data read/write requests from application servers.

Ports

Figure 4-13 shows the appearance of a 10GE electrical interface module. 10GE electrical interface modules of the storage system support GE/10GE auto-sensing.

Figure 4-13 10GE electrical interface module



1 Power indicator/Hot Swap button on the interface module
2 10GE electrical port
3 Link/Active indicator of the 10GE electrical port
4 Speed indicator of the 10GE electrical port
5 Interface module handle

Indicators

Table 4-5 describes indicators on a 10GE electrical interface module of a powered-on storage system.

Table 4-5 Indicators on a 10GE electrical interface module

No.	Indicator	Status and Description
1	Power indicator/Hot Swap button on the interface module	● Steady green: The interface module is working correctly. ● Blinking green: There is a hot swap request to the module. ● Steady red: The module is faulty. ● Off: The module is powered off or hot swappable.

No.	Indicator	Status and Description
3	Link/Active indicator of the 10GE electrical port	● Steady green: The link to the application server is normal. ● Blinking green: Data is being transferred. ● Off: The link to the application server is down or no link exists.
4	Speed indicator of the 10GE electrical port	● Steady orange: The data transfer rate between the storage system and the application server is 10 Gbit/s. ● Off: The data transfer rate between the storage system and the application server is less than 10 Gbit/s.

4.2.2.6 GE Electrical Interface Module

Interface modules connect storage devices to application servers.

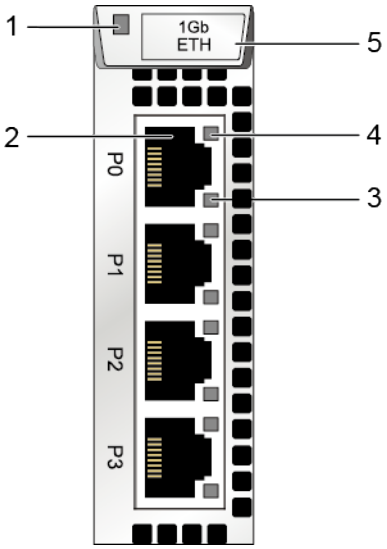
Function

A GE electrical interface module has four 1 Gbit/s electrical ports. These ports are the service ports used to connect the storage system to application servers and to receive data read/write requests from application servers.

Ports

Figure 4-14 shows the appearance of a GE electrical interface module.

Figure 4-14 GE electrical interface module



1 Power indicator/Hot Swap button on the interface module
2 GE electrical port
3 Link/Active indicator of the GE electrical port
4 Speed indicator of the GE electrical port

5 Interface module handle

Indicators

Table 4-6 describes indicators on a GE electrical interface module of a powered-on storage system.

Table 4-6 Indicators on a GE electrical interface module

No.	Indicator	Status and Description
1	Power indicator/Hot Swap button on the interface module	● Steady green: The interface module is working correctly. ● Blinking green: There is a hot swap request to the module. ● Steady red: The module is faulty. ● Off: The interface module is powered off or hot swappable.
3	Link/Active indicator of the GE electrical port	● Steady green: The link to the application server is normal. ● Blinking green: Data is being transferred. ● Off: The link to the application server is down or no link exists.
4	Speed indicator of the GE electrical port	● Steady orange: The data transfer rate between the storage system and the application server is 1 Gbit/s. ● Off: The data transfer rate between the storage system and the application server is less than 1 Gbit/s.

4.2.2.7 SmartIO Interface Module

Interface modules are mainly used to connect storage devices to application servers.

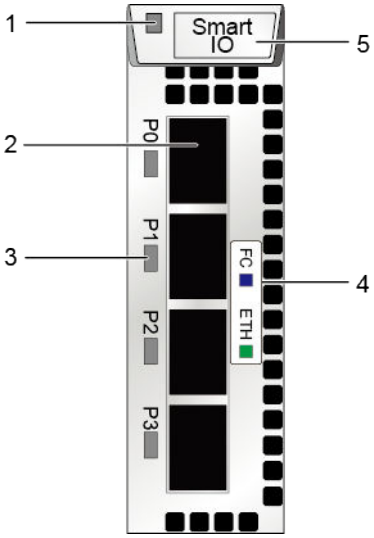
Function

A SmartIO interface module provides 16 Gbit/s, 8 Gbit/s and 10 Gbit/s optical transceiver. They are the service ports used to connect to application servers and to receive data read/write requests from application servers.

Interface

Figure 4-15 shows the components of a SmartIO interface module.

Figure 4-15 SmartIO interface module



1 Module Power/Hot Swap indicator
2 SmartIO port
3 Port Link/Active/Mode indicator
4 Port mode silkscreen
5 Module handle

Indicators

Table 4-7 describes the states of indicators and their meanings on a SmartIO interface module after the storage device is powered on.

Table 4-7 Indicator status description for a SmartIO interface module

No.	Indicator	Status Description
1	Module Power/Hot Swap button	● Steady green: The interface module is running properly. ● Blinking green: The interface module receives a hot swap request. ● Steady red: The interface module is faulty. ● Off: The interface module is not powered on or can be hot-swapped.

No.	Indicator	Status Description
3	Port Link/Active/Mode indicator	● Blinking blue slowly: The interface module is working in FC mode, and the port link is down. ● Blinking blue quickly: The interface module is working in FC mode, and data is being transmitted. ● Steady blue: The interface module is working in FC mode, the port link is up, and no data is being transmitted. ● Blinking green slowly: The interface module is working in ETH mode, and the port link is down. ● Blinking green quickly: The interface module is working in ETH mode, and data is being transmitted. ● Steady green: The interface module is working in ETH mode, the port link is up, and no data is being transmitted. ● Steady red: The port is faulty. ● Blinking red: The port is being located. ● Off: The port is not powered on.

NOTE

- If the mode of the SmartIO port is set to **FCoE/iSCSI** or **Cluster** on the software interface, the port indicator is in ETH mode. The SmartIO port need to configure with 10 Gbit/s optical modules.
- If the mode of the SmartIO port is set to **FC** on the software interface, the port indicator is in FC mode. The SmartIO port need to configure with 8 Gbit/s or 16 Gbit/s optical modules.
- Connect a network only through FCoE switches when the SmartIO interface module is set to **FCoE/iSCSI** and the host uses the FCoE protocol. The SmartIO port need to configure with 10 Gbit/s optical modules.

4.2.3 Indicator Introduction

After a controller enclosure is powered on, you can check the current operating status of the controller enclosure by viewing its indicators.

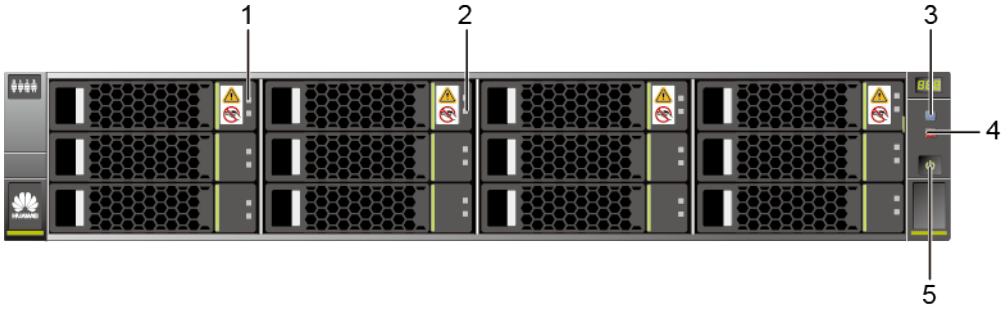
Indicators on the Front Panel

Figure 4-16 shows the indicators on the front panel of a 2 U 25-disk controller enclosure and **Figure 4-17** shows the indicators on the front panel of a 2 U 12-disk controller enclosure.

Figure 4-16 Indicators on the front panel of a 2 U 25-disk controller enclosure

1 Running indicator of the disk module
2 Location/Alarm indicator of the disk module
3 Location indicator of the controller enclosure
4 Alarm indicator of the controller enclosure
5 Power indicator/Power button of the controller enclosure

Figure 4-17 Indicators on the front panel of a 2 U 12-disk controller enclosure



1 Running indicator of the disk module
2 Location/Alarm indicator of the disk module
3 Location indicator of the controller enclosure
4 Alarm indicator of the controller enclosure
5 Power indicator/Power button of the controller enclosure

Table 4-8 describes the indicators on the front panel of the controller enclosure.

Table 4-8 Description of the indicators on the front panel of a controller enclosure

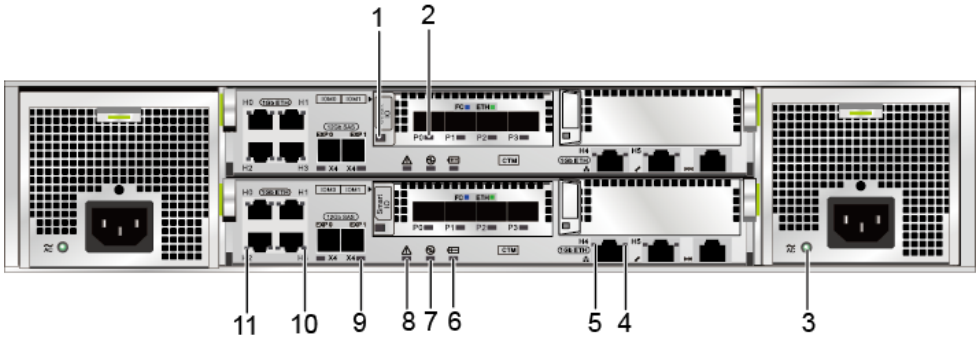
Module	No.	Indicator	Status and Description
Disk module	1	Running indicator of the disk module	● Steady green: The disk module is working correctly. ● Blinking green: Data is being read and written on the disk module. ● Off: The disk module is powered off or powered on incorrectly.

Module	No.	Indicator	Status and Description
	2	Location/Alarm indicator of the disk module	● Steady red: The disk module is faulty. ● Blinking red: The disk module is being located. ● Off: The disk module is working correctly or hot swappable.
System enclosure	3	Location indicator of the controller enclosure	● Blinking blue: The controller enclosure is being located. ● Off: The controller enclosure is not located.
	4	Alarm indicator of the controller enclosure	● Steady red: An alarm is generated on the controller enclosure. ● Off: The controller enclosure is working correctly.
	5	Power indicator/Power button of the controller enclosure	● Steady green: The controller enclosure is powered on. ● Blinking green (0.5 Hz): The controller enclosure is being powered on. ● Blinking green (1 Hz): The controller enclosure is in the burn-in test. ● Blinking green (2 Hz): The controller enclosure is in the operating system boot process, or is being powered off. ● Off: The controller enclosure is powered off or powered by the BBUs.

Indicators on the Rear Panel

Figure 4-18 shows the indicators on the rear panel of a controller enclosure.

Figure 4-18 Indicators on the rear panel of a controller enclosure



1 Power indicator of the interface module/Hot Swap button of the module
2 Link/Active/Mode indicator of the SmartIO port
3 Running/Alarm indicator of the power module
4 Link/Active indicator of the management network port
5 Speed indicator of the management network port
6 Running/Alarm indicator of the backup power module
7 Power indicator of the controller
8 Alarm indicator of the controller
9 Indicator of the mini SAS HD expansion port
10 Link/Active indicator of the GE electrical port
11 Speed indicator of the GE electrical port

Table 4-9 describes the indicators on the rear panel of the controller enclosure.

Table 4-9 Description of the indicators on the rear panel of a controller enclosure

Module	No.	Indicator	Status and Description
Interface module	1	Power indicator of the interface module/Hot Swap button of the module	● Steady green: The interface module is running properly. ● Blinking green: The interface module receives a hot swap request. ● Steady red: The interface module is faulty. ● Off: The interface module is powered off or can be hot-swapped.

Module	No.	Indicator	Status and Description
	2	Link/Active/ Mode indicator of the SmartIO port	● Blinking blue slowly: The interface module is working in FC mode, and the port link is down. ● Blinking blue quickly: The interface module is working in FC mode, and data is being transmitted. ● Steady blue: The interface module is working in FC mode, the port link is up, and no data is being transmitted. ● Blinking green slowly: The interface module is working in ETH mode, and the port link is down. ● Blinking green quickly: The interface module is working in ETH mode, and data is being transmitted. ● Steady green: The interface module is working in ETH mode, the port link is up, and no data is being transmitted. ● Steady red: The port is faulty. ● Blinking red: The port is being located. ● Off: The port is not powered on.
Power module	3	Running/ Alarm indicator of the power module	● Steady green: The power supply is correct. ● Blinking green: The power input is normal but the disk enclosure is powered off. ● Steady red: The power module is faulty. ● Off: No external power input is found.
Controller	4	Link/Active indicator of the management network port	● Steady green: The port is connected properly. ● Blinking green: Data is being transferred. ● Off: The port is connected abnormally.
	5	Speed indicator of the management network port	● Steady orange: Data is being transferred at the highest rate. ● Off: The data transfer speed is lower than the highest speed.
	6	Running/ Alarm indicator of the backup power module	● Steady green: The backup power module is fully charged. ● Blinking green (1 Hz): The backup power module is being charged. ● Blinking green (4 Hz): The backup power module is being discharged. ● Steady red: The backup power module is faulty.

Module	No.	Indicator	Status and Description
	7	Power indicator of the controller	● Steady green: The controller is powered on. ● Blinking green (0.5 Hz): The controller enclosure is powered on and in the BIOS boot process. ● Blinking green (2 Hz): The controller is in the operating system boot process, or the controller is in the power-off process. ● Off: The controller is absent or powered off.
	8	Alarm indicator of the controller	● Steady red: An alarm is generated on the controller. ● The Alarm indicator blinking red and the Power indicator blinking green: The controller is being located. ● Off: The controller is working correctly.
	9	Indicator of the mini SAS HD expansion port	● Steady blue: Data is transferred to the downstream disk enclosure at the rate of 4 x 12 Gbit/s. ● Blinking blue: Data is being transferred to the downstream disk enclosure at the rate of 4 x 12 Gbit/s. ● Steady green: Data is transferred to the downstream disk enclosure at the rate of 4 x 6 Gbit/s or 4 x 3 Gbit/s. ● Blinking green: Data is being transferred to the downstream disk enclosure at the rate of 4 x 6 Gbit/s or 4 x 3 Gbit/s. ● Steady red: The port is faulty. ● Off: The link to the port is down.
	10	Link/Active indicator of the GE electrical port	● Steady green: The link to the application server is normal. ● Blinking green: Data is being transferred. ● Off: The link to the application server is down or no link exists.
	11	Speed indicator of the GE electrical port	● Steady orange: The data transfer rate between the storage system and the application server is 1 Gbit/s. ● Off: The data transfer rate between the storage system and the application server is less than 1 Gbit/s.

4.3 2 U Disk Enclosure (2.5-Inch Disks)

This chapter describes a disk enclosure in terms of its hardware structure, component functions, front and rear views, and indicators.

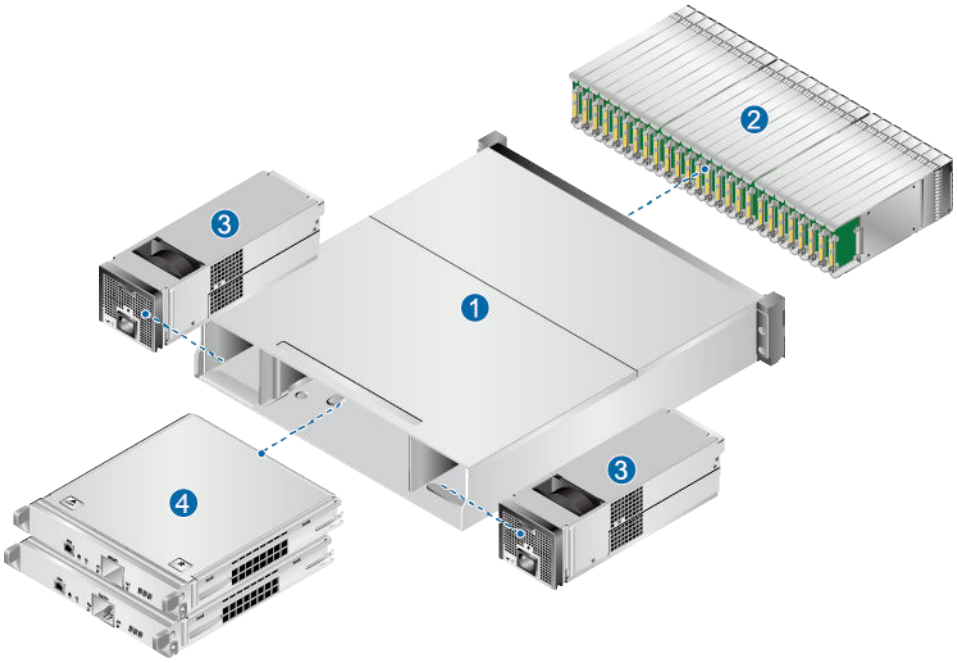
4.3.1 Overview

The disk enclosure consists of a system enclosure, expansion modules, disk modules, and power modules.

Overall Structure

Figure 4-19 shows the overall structure of a 2 U SAS disk enclosure.

Figure 4-19 Overall structure of a 2 U SAS disk enclosure with AC power modules

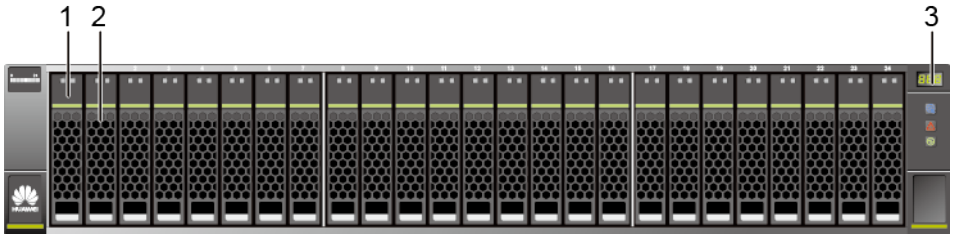


1	System enclosure	2	Disk module
3	Power module	4	Expansion module

Front view

Figure 4-20 shows the front view of a 2 U disk enclosure.

Figure 4-20 Front view of a 2 U disk enclosure



1 Disk module latch
2 Disk module handle
3 ID display of the disk enclosure

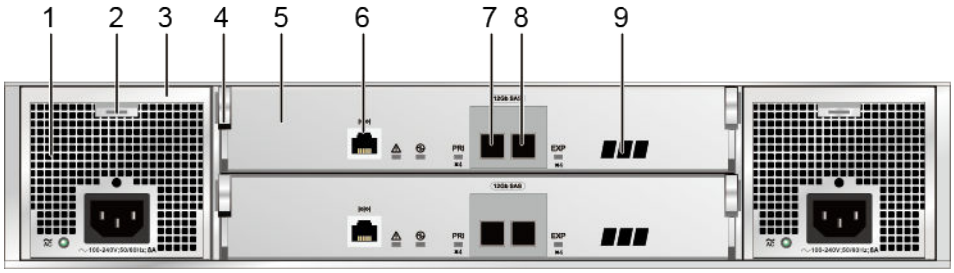
NOTE

The disk slots are numbered 0 to 24 from left to right.

Rear View

Figure 4-21 shows the rear view of a disk enclosure with the AC power module.

Figure 4-21 Rear view of a disk enclosure with the AC power module



1 Power module
2 Power module latch
3 Power module handle
4 Expansion module handle
5 Expansion module
6 Serial port
7 Mini SAS HD PRI expansion port
8 Mini SAS HD EXP expansion port
9 Disk enclosure ID display

4.3.2 Component Description

This section provides the illustration and description of each component of the storage system.

4.3.2.1 System Enclosure

The system enclosure integrates a midplane in order to provide reliable connections for interface modules and to distribute power and signals to inner modules.

Appearance

Figure 4-22 shows the appearance of a system enclosure.

Figure 4-22 System enclosure

4.3.2.2 Expansion Module

An expansion module provides expansion ports for communication between the disk enclosure and the controller enclosure. Each expansion module provides a PRI expansion port and an EXP expansion port.

Appearance

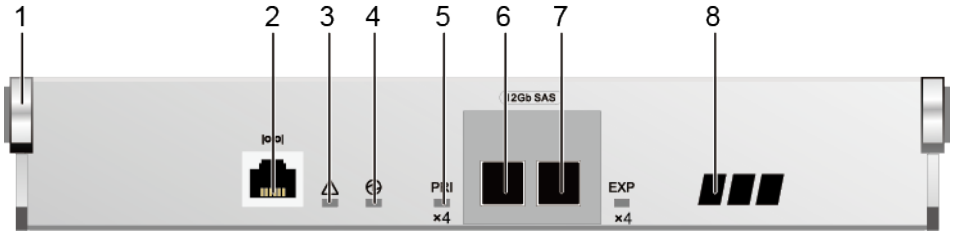
Figure 4-23 shows the appearance of an expansion module.

Figure 4-23 Expansion module

Ports

Figure 4-24 shows the ports of an expansion module.

Figure 4-24 Interfaces of an expansion module



1 Expansion module handle
2 Serial port
3 Alarm indicator of the expansion module
4 Power indicator of the expansion module
5 Indicator of the mini SAS HD expansion port
6 Mini SAS HD PRI expansion port
7 Mini SAS HD EXP expansion port
8 Disk enclosure ID display

Indicators

Table 4-10 describes indicators on an expansion module of a powered-on storage system.

Table 4-10 Indicators on an expansion module

No.	Indicator	Status and Description
3	Alarm indicator of the expansion module	● Steady red: An alarm is generated in the expansion module. ● Off: The expansion module is working correctly.
4	Power indicator of the expansion module	● Steady green: The expansion module is powered on. ● Off: The expansion module is powered off.
5	Indicator of the mini SAS HD expansion port	● Steady blue: Data is transferred to the downstream disk enclosure at the rate of 4 x 12 Gbit/s. ● Blinking blue: Data is being transferred to the downstream disk enclosure at the rate of 4 x 12 Gbit/s. ● Steady green: Data is transferred to the downstream disk enclosure at the rate of 4 x 6 Gbit/s or 4 x 3 Gbit/s. ● Blinking green: Data is being transferred to the downstream disk enclosure at the rate of 4 x 6 Gbit/s or 4 x 3 Gbit/s. ● Steady red: The port is faulty. ● Off: The link to the port is down.

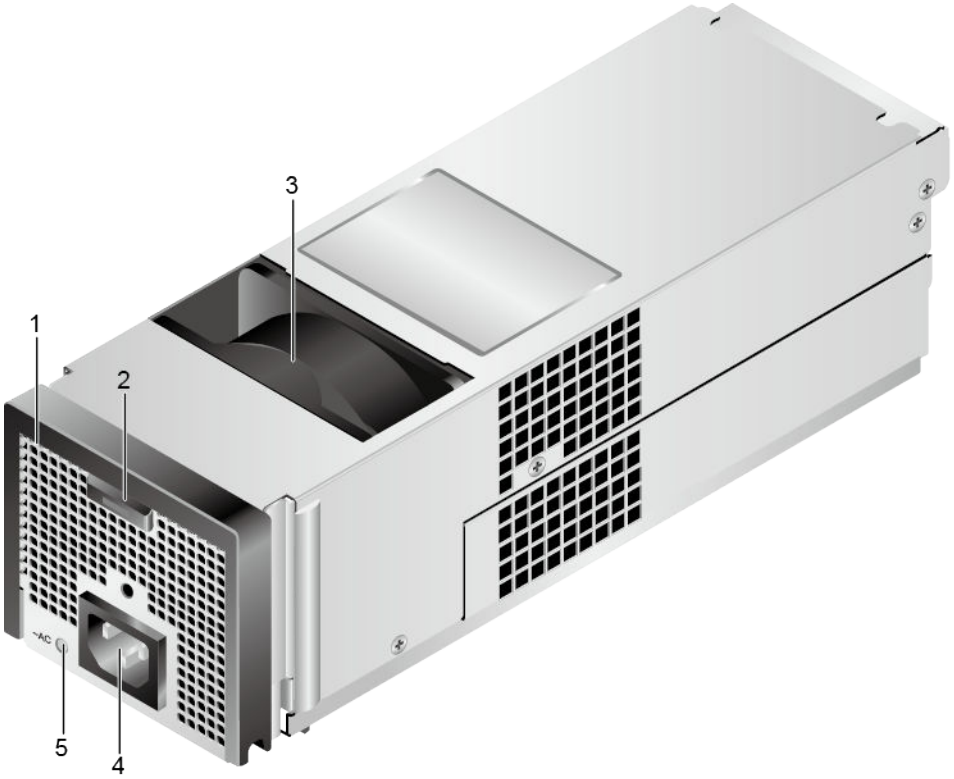
4.3.2.3 Power Module

Power modules can ensure that the disk enclosure works correctly in maximum power consumption mode.

Appearance

Figure 4-25 shows the appearance of an AC power module.

Figure 4-25 AC power module



1 Power module handle
2 Power module latch
3 Fan built in the power module
4 Power module socket
5 Running/Alarm indicator of the power module

Indicators

Table 4-11 describes indicators on a power module of a powered-on storage system.

Table 4-11 Indicators on a power module

No.	Indicator	Status and Description
5	Running/Alarm indicator of the power module	● Steady green: The power supply is correct. ● Blinking green: The power input is normal but the disk enclosure is powered off. ● Steady red: The power module is faulty. ● Off: No external power input is found.

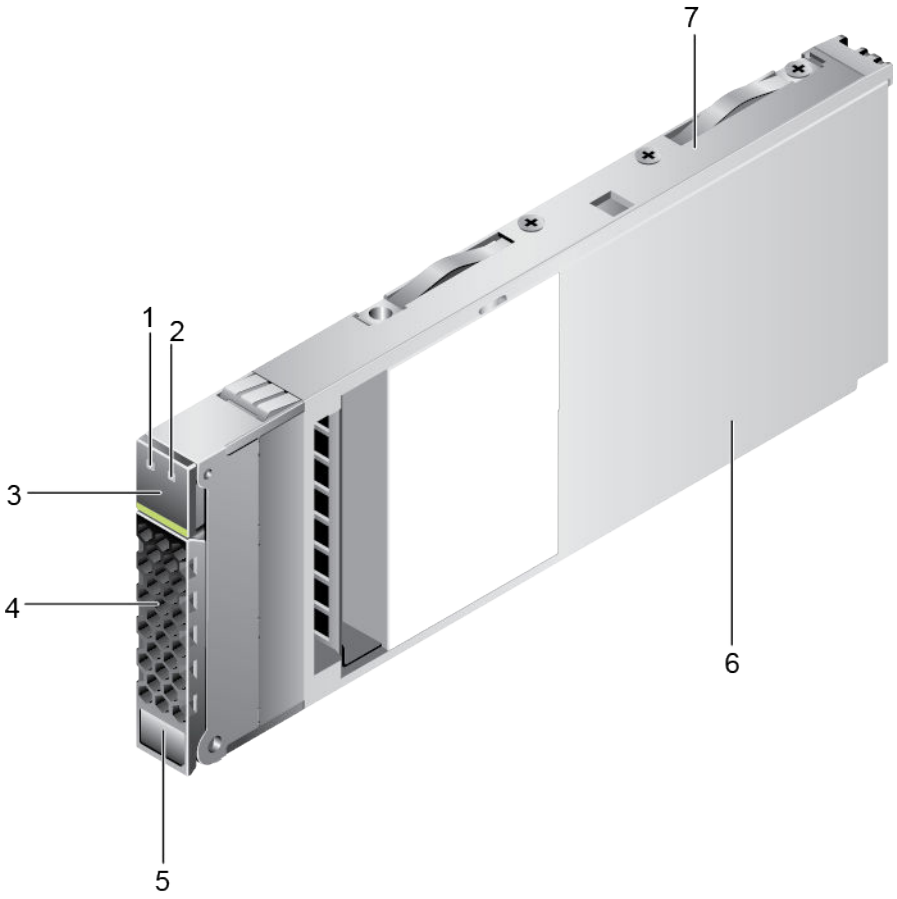
4.3.2.4 Disk Module

Disk modules provide storage capacity for a storage system. Disk modules can be used as a system safe disk, and can save service data, system data, and cache data.

Appearance

Figure 4-26 shows the appearance of a disk module.

Figure 4-26 Disk module



1 Running indicator of the disk module 2 Alarm/Location indicator of the disk module

3 Disk module latch
4 Disk module handle
5 Disk module label
6 Disk
7 Disk tray

Indicators

Table 4-12 describes indicators on a disk module of a powered-on storage system.

Table 4-12 Indicators on a disk module

No.	Indicator	Status and Description
1	Running indicator of the disk module	● Steady green: The disk module is working correctly. ● Blinking green: Data is being read and written on the disk module. ● Off: The disk module is powered off or powered on incorrectly.
2	Alarm/Location indicator of the disk module	● Steady red: The disk module is faulty. ● Blinking red: The disk module is being located. ● Off: The disk module is working correctly or hot swappable.

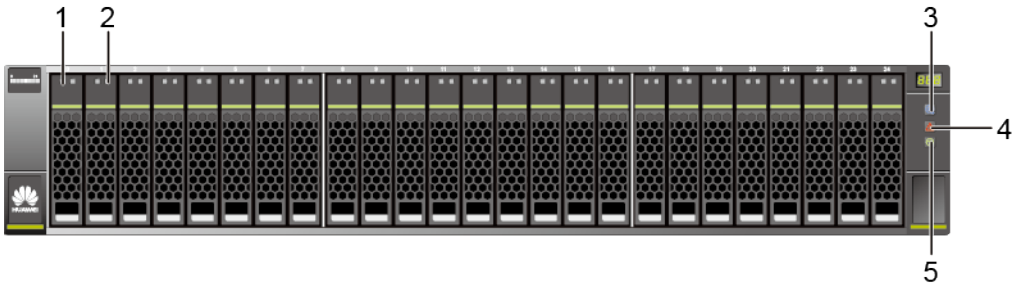
4.3.3 Indicator Introduction

After a disk enclosure is powered on, you can check the current operating status of the disk enclosure by viewing its indicators.

Indicators on the Front Panel

Figure 4-27 shows the indicators on the front panel of a disk enclosure.

Figure 4-27 Indicators on the front panel of a disk enclosure



1 Running indicator of the disk module
2 Location/Alarm indicator of the disk module
3 Location indicator of the disk enclosure
4 Alarm indicator of the disk enclosure

5 Power indicator of the disk enclosure

Table 4-13 describes the indicators on the front panel of the disk enclosure.

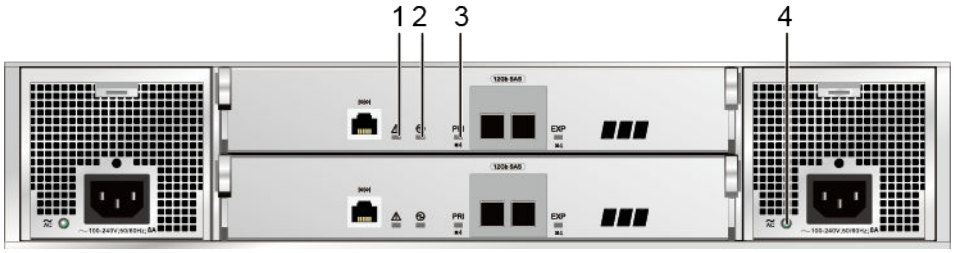
Table 4-13 Description of the indicators on the front panel of a disk enclosure

Module	No.	Indicator	Status and Description
Disk module	1	Running indicator of the disk module	● Steady green: The disk module is working correctly. ● Blinking green: Data is being read and written on the disk module. ● Off: The disk module is powered off or powered on incorrectly.
	2	Alarm/Location indicator of the disk module	● Steady red: The disk module is faulty. ● Blinking red: The disk module is being located. ● Off: The disk module is working correctly or hot swappable.
System enclosure	3	Location indicator of the disk enclosure	● Blinking blue: The disk enclosure is being located. ● Off: The disk enclosure is not located.
	4	Alarm indicator of the disk enclosure	● Steady red: An alarm is generated in the disk enclosure. ● Off: The disk enclosure is working correctly.
	5	Power indicator of the disk enclosure	● Steady green: The disk enclosure is powered on. ● Off: The disk enclosure is powered off.

Indicators on the Rear Panel

Figure 4-28 shows the indicators on the rear panel of a disk enclosure.

Figure 4-28 Indicators on the rear panel of a disk enclosure



1 Alarm indicator of the expansion module
2 Power indicator of the expansion module
3 Indicator of the mini SAS HD expansion port
4 Running/Alarm indicator of the power module

Table 4-14 describes the indicators on the rear panel of the disk enclosure.

Table 4-14 Description of the indicators on the rear panel of a disk enclosure

Module	No.	Indicator	Status and Description
Expansion module	1	Alarm indicator of the expansion module	● Steady red: An alarm is generated on the expansion module. ● Off: The expansion module is working correctly.
	2	Power indicator of the expansion module	● Steady green: The expansion module is powered on. ● Off: The expansion module is powered off.
	3	Indicator of the mini SAS HD expansion port	● Steady blue: Data is transferred to the downstream disk enclosure at the rate of 4 x 12 Gbit/s. ● Blinking blue: Data is being transferred to the downstream disk enclosure at the rate of 4 x 12 Gbit/s. ● Steady green: Data is transferred to the downstream disk enclosure at the rate of 4 x 6 Gbit/s or 4 x 3 Gbit/s. ● Blinking green: Data is being transferred to the downstream disk enclosure at the rate of 4 x 6 Gbit/s or 4 x 3 Gbit/s. ● Steady red: The port is faulty. ● Off: The link to the port is down.

Module	No.	Indicator	Status and Description
Power module	4	Running/ Alarm indicator of the power module	● Steady green: The power supply is correct. ● Blinking green: The power input is normal but the disk enclosure is powered off. ● Steady red: The power supply is faulty. ● Off: No external power input is found.

4.4 4 U Disk Enclosure (3.5-Inch Disks)

This chapter describes a disk enclosure in terms of its hardware structure, component functions, front and rear views, and indicators.

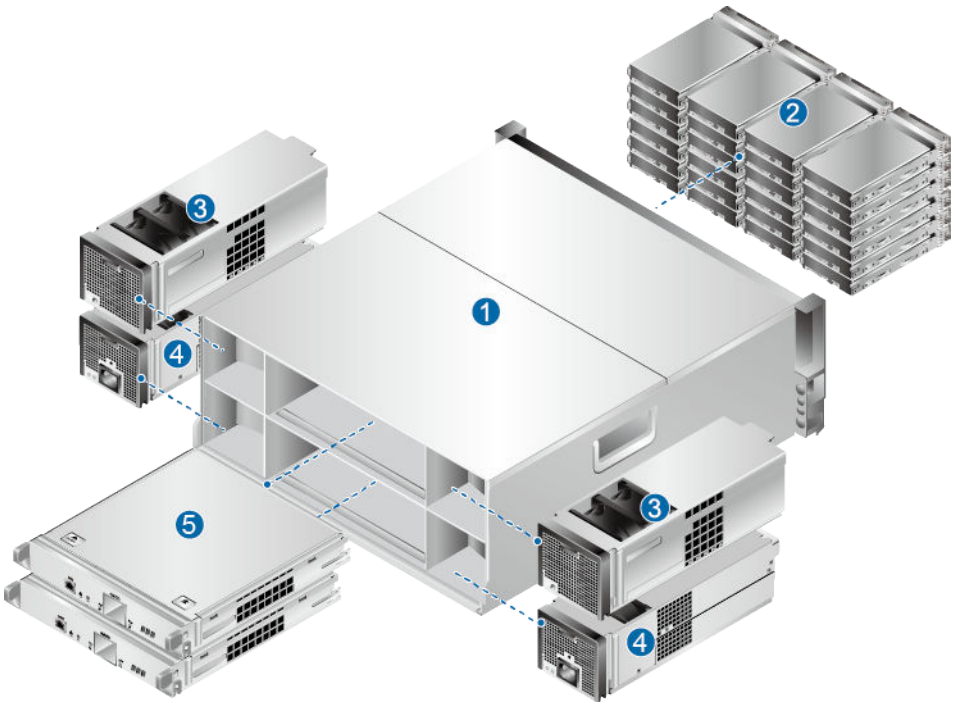
4.4.1 Overview

The disk enclosure consists of a system enclosure, expansion modules, disk modules, and power modules.

Overall Structure

Figure 4-29 shows the overall structure of a 4 U disk enclosure.

Figure 4-29 Overall structure of a 4 U disk enclosure



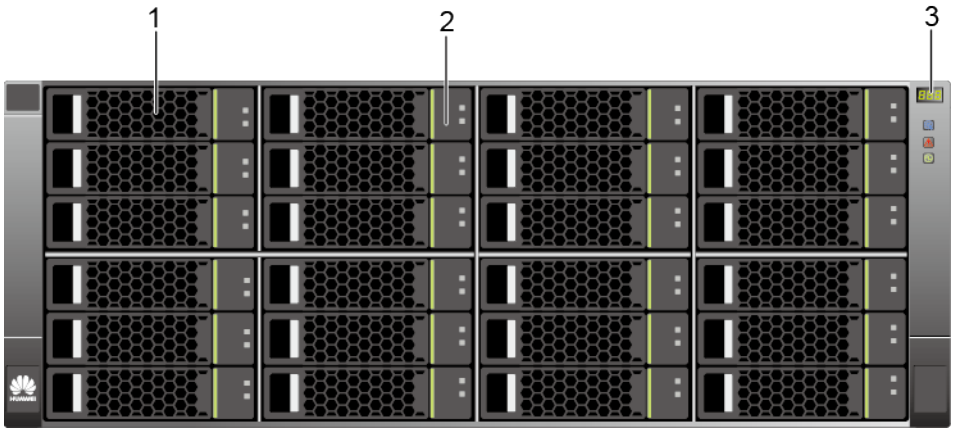
1	System enclosure	2	Disk module
3	Fan module	4	Power module

5 Expansion module

Front View

Figure 4-30 shows the front view of a 4 U SAS disk enclosure.

Figure 4-30 Front view of a 4 U SAS disk enclosure



1 Disk module handle
2 3.5-Inch disk module latch
3 ID display of the disk enclosure

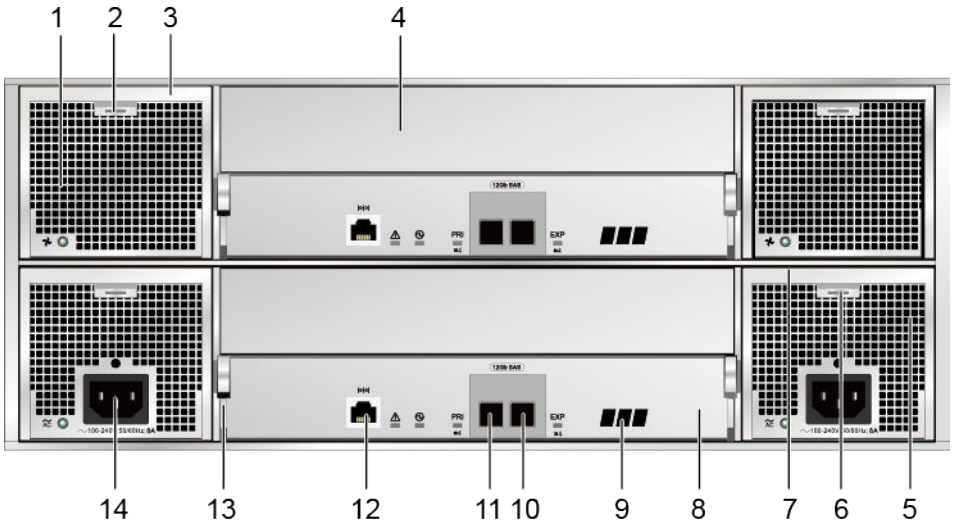
NOTE

The disk slots of a 4 U SAS disk enclosure are numbered 0 to 23 from left to right and from top to bottom.

Rear View

Figure 4-31 shows the rear view of a disk enclosure with the AC power module.

Figure 4-31 Rear view of a disk enclosure with the AC power module



1 Fan module
2 Fan module latch

3	Fan module handle	4	Filler panel
5	Power module	6	Power module latch
7	Power module handle	8	Expansion module
9	Disk enclosure ID display	10	Mini SAS HD EXP expansion port
11	Mini SAS HD PRI expansion port	12	Serial port
13	Expansion module handle	14	Power socket

4.4.2 Component Description

This section provides the illustration and description of each component of the storage system.

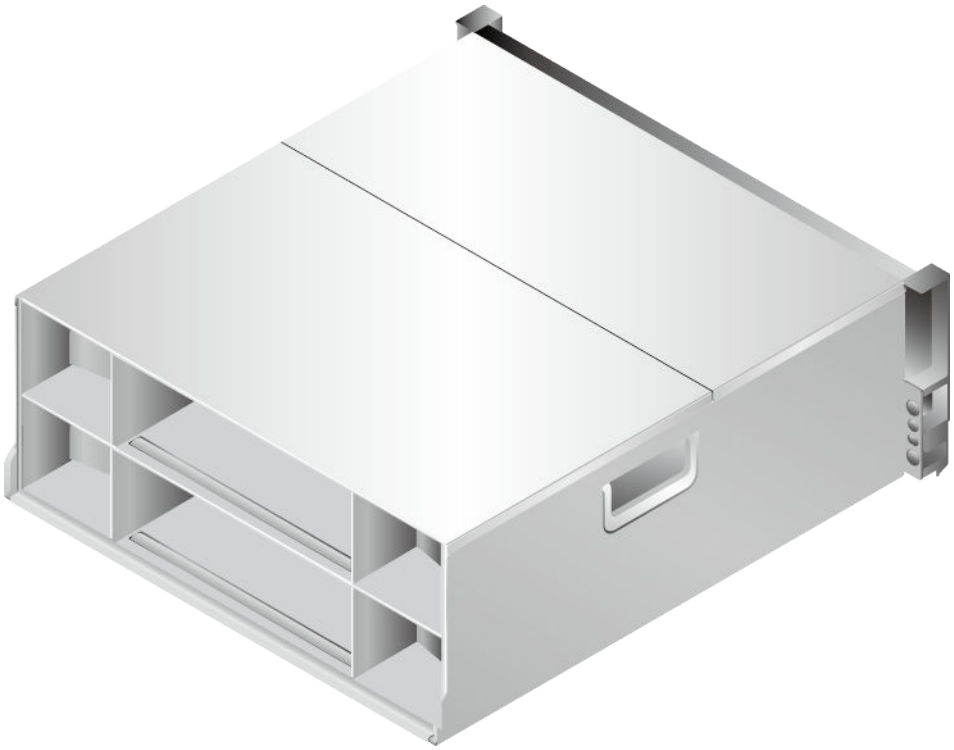
4.4.2.1 System Enclosure

The system enclosure integrates a midplane in order to provide reliable connections for interface modules and to distribute power and signals to inner modules.

Appearance

Figure 4-32 shows the appearance of a system enclosure.

Figure 4-32 System enclosure



4.4.2.2 Expansion Module

An expansion module provides expansion ports for communication between the disk enclosure and the controller enclosure. Each expansion module provides a PRI expansion port and an EXP expansion port.

Appearance

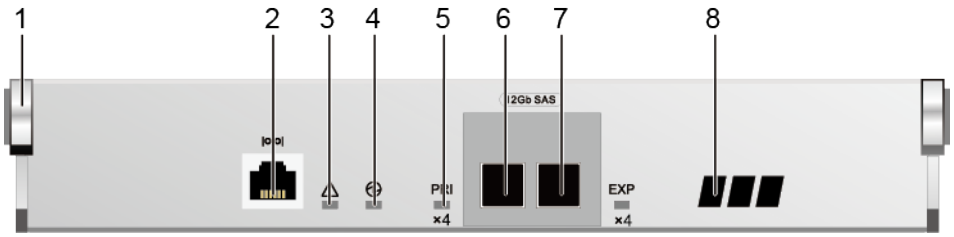
Figure 4-33 shows the appearance of an expansion module.

Figure 4-33 Expansion module

Ports

Figure 4-34 shows the ports of an expansion module.

Figure 4-34 Interfaces of an expansion module



1 Expansion module handle
2 Serial port
3 Alarm indicator of the expansion module
4 Power indicator of the expansion module
5 Indicator of the mini SAS HD expansion port
6 Mini SAS HD PRI expansion port
7 Mini SAS HD EXP expansion port
8 Disk enclosure ID display

Indicators

Table 4-15 describes indicators on an expansion module of a powered-on storage system.

Table 4-15 Indicators on an expansion module

No.	Indicator	Status and Description
3	Alarm indicator of the expansion module	● Steady red: An alarm is generated in the expansion module. ● Off: The expansion module is working correctly.
4	Power indicator of the expansion module	● Steady green: The expansion module is powered on. ● Off: The expansion module is powered off.
5	Indicator of the mini SAS HD expansion port	● Steady blue: Data is transferred to the downstream disk enclosure at the rate of 4 x 12 Gbit/s. ● Blinking blue: Data is being transferred to the downstream disk enclosure at the rate of 4 x 12 Gbit/s. ● Steady green: Data is transferred to the downstream disk enclosure at the rate of 4 x 6 Gbit/s or 4 x 3 Gbit/s. ● Blinking green: Data is being transferred to the downstream disk enclosure at the rate of 4 x 6 Gbit/s or 4 x 3 Gbit/s. ● Steady red: The port is faulty. ● Off: The link to the port is down.

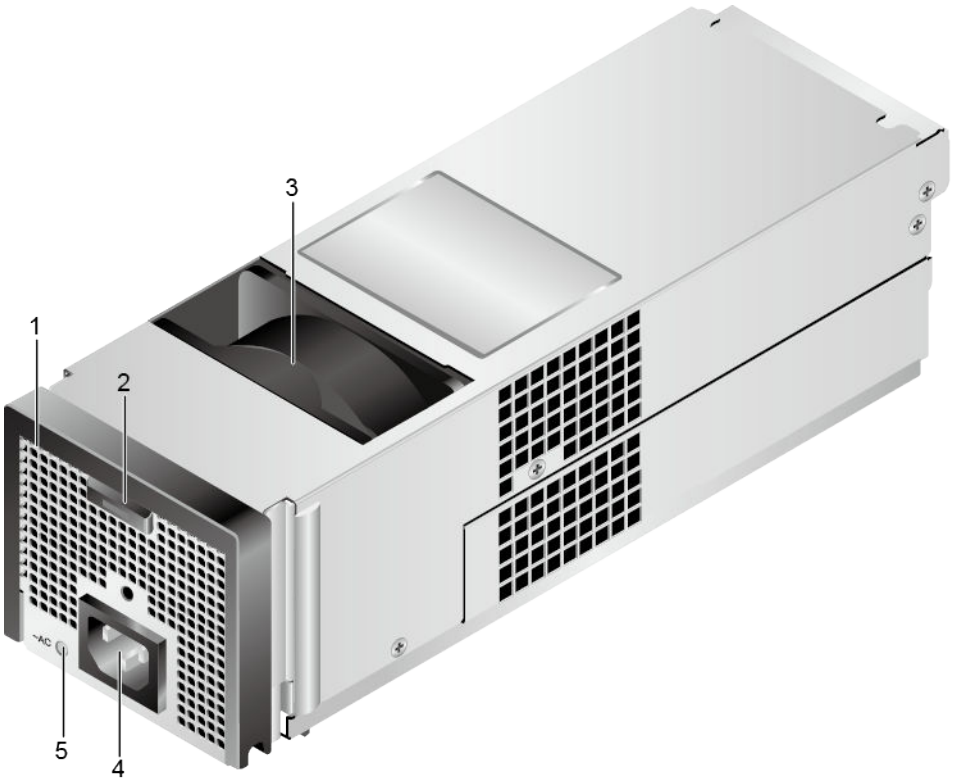
4.4.2.3 Power Module

Power modules can ensure that the disk enclosure works correctly in maximum power consumption mode.

Appearance

Figure 4-35 shows the appearance of an AC power module.

Figure 4-35 AC power module



1 Power module handle
2 Power module latch
3 Fan built in the power module
4 Power module socket
5 Running/Alarm indicator of the power module

Indicators

Table 4-16 describes indicators on a power module of a powered-on storage system.

Table 4-16 Indicators on a power module

No.	Indicator	Status and Description
5	Running/Alarm indicator of the power module	● Steady green: The power supply is correct. ● Blinking green: The power input is normal but the disk enclosure is powered off. ● Steady red: The power module is faulty. ● Off: No external power input is found.

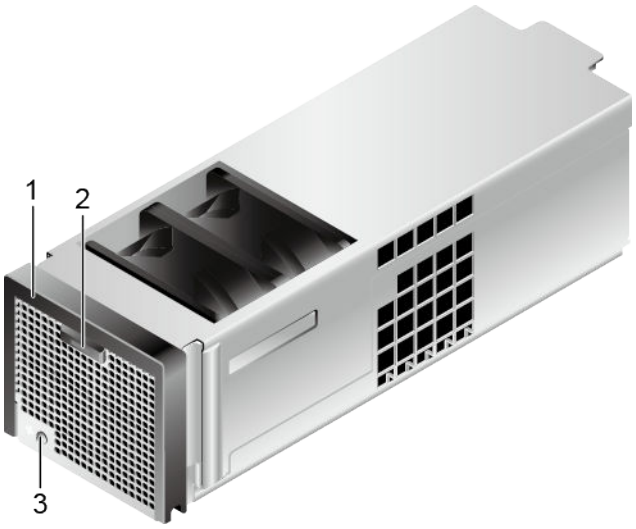
4.4.2.4 Fan Module

A fan module provides heat dissipation and supports the normal running of the disk enclosure in maximum power consumption mode.

Appearance

Figure 4-36 shows the appearance of a fan module.

Figure 4-36 Fan module



1 Fan module handle
2 Fan module latch
3 Running/Alarm indicator of the fan module

Indicators

Table 4-17 describes indicators on a fan module of a powered-on storage system.

Table 4-17 Indicators on a fan module

No.	Indicator	Status and Description
3	Running/Alarm indicator of the fan module	● Steady green: The fan module is working correctly. ● Steady red: The fan module is faulty. ● Off: The fan module is powered off.

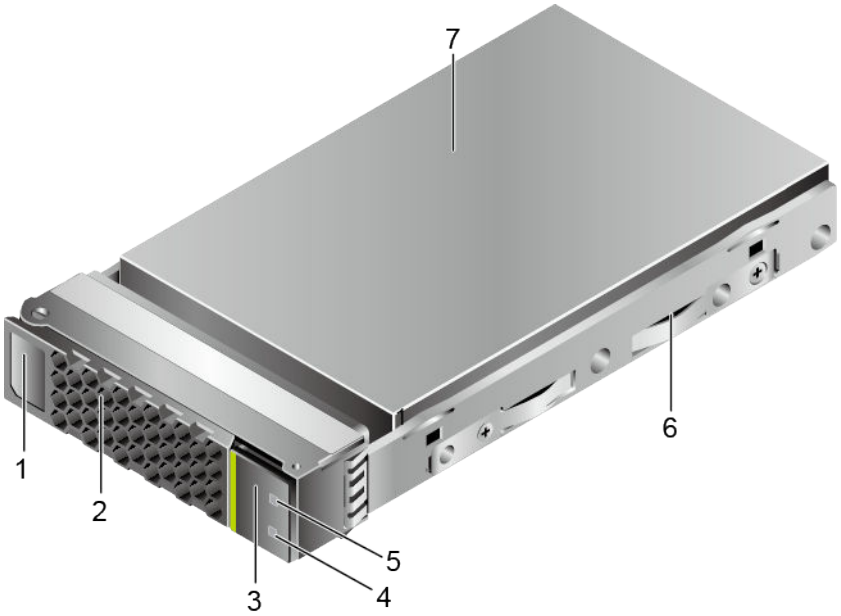
4.4.2.5 Disk Module

Disk modules provide storage capacity for a storage system to store service data.

Appearance

Figure 4-37 shows the appearance of a disk module.

Figure 4-37 Disk module



1 Disk module label
2 Disk module handle
3 Disk module latch
4 Alarm/Location indicator of the disk module
5 Running indicator of the disk module
6 Disk tray
7 Disk

Indicators

Table 4-18 describes indicators on a disk module of a powered-on storage system.

Table 4-18 Indicators on a disk module

No.	Indicator	Status and Description
4	Alarm/Location indicator of the disk module	● Steady red: The disk module is faulty. ● Blinking red: The disk module is being located. ● Off: The disk module is working correctly or hot swappable.
5	Running indicator of the disk module	● Steady green: The disk module is working correctly. ● Blinking green: Data is being read and written on the disk module. ● Off: The disk module is powered off or powered on incorrectly.

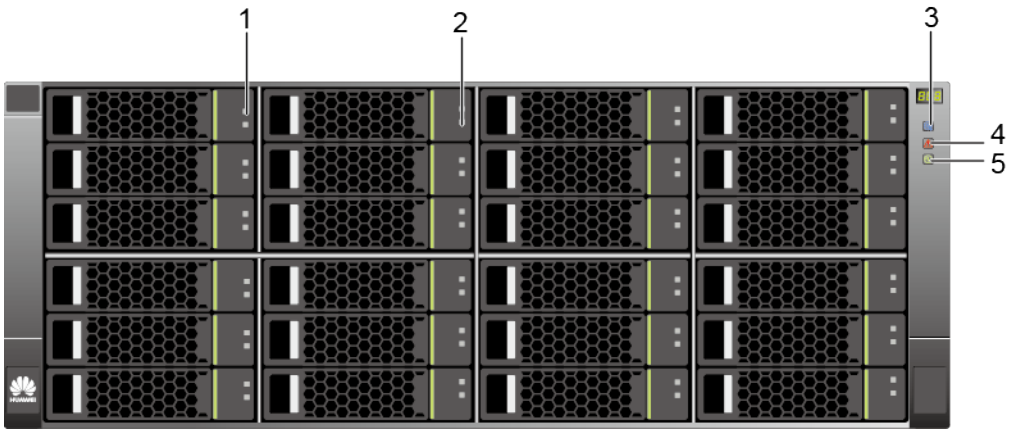
4.4.3 Indicator Introduction

After a disk enclosure is powered on, you can check the current operating status of the disk enclosure by viewing its indicators.

Indicators on the Front Panel

Figure 4-38 shows the indicators on the front panel of a disk enclosure.

Figure 4-38 Indicators on the front panel of a disk enclosure



1 Running indicator of the disk module
2 Location/Alarm indicator of the disk module
3 Location indicator of the disk enclosure
4 Alarm indicator of the disk enclosure
5 Power indicator of the disk enclosure

Table 4-19 describes the indicators on the front panel of the disk enclosure.

Table 4-19 Description of the indicators on the front panel of a disk enclosure

Module	No.	Indicator	Status and Description
Disk module	1	Running indicator of the disk module	● Steady green: The disk module is working correctly. ● Blinking green: Data is being read and written on the disk module. ● Off: The disk module is powered off or powered on incorrectly.
	2	Alarm/Location indicator of the disk module	● Steady red: The disk module is faulty. ● Blinking red: The disk module is being located. ● Off: The disk module is working correctly or hot swappable.

Module	No.	Indicator	Status and Description
System enclosure	3	Location indicator of the disk enclosure	● Blinking blue: The disk enclosure is being located. ● Off: The disk enclosure is not located.
	4	Alarm indicator of the disk enclosure	● Steady red: An alarm is generated in the disk enclosure. ● Off: The disk enclosure is working correctly.
	5	Power indicator of the disk enclosure	● Steady green: The disk enclosure is powered on. ● Off: The disk enclosure is powered off.

Indicators on the Rear Panel

Figure 4-39 shows the indicators on the rear panel of a disk enclosure.

Figure 4-39 Indicators on the rear panel of a disk enclosure

1 Running/Alarm indicator of the fan module
2 Running/Alarm indicator of the power module
3 Mini SAS HD expansion port indicator
4 Power indicator of the expansion module
5 Alarm indicator of the expansion module

Table 4-20 describes the indicators on the rear panel of the disk enclosure.

Table 4-20 Description of the indicators on the rear panel of a disk enclosure

Module	No.	Indicator	Status and Description
Fan module	1	Running/ Alarm indicator of the fan module	● Steady green: The fan module is working correctly. ● Steady red: The fan module is faulty. ● Off: The fan module is powered off.
Power module	2	Running/ Alarm indicator of the power module	● Steady green: The power supply is correct. ● Blinking green: The power input is normal but the disk enclosure is powered off. ● Steady red: The power supply is faulty. ● Off: No external power input is found.
Expansion module	3	Indicator of the mini SAS HD expansion port	● Steady blue: Data is transferred to the downstream disk enclosure at the rate of 4 x 12 Gbit/s. ● Blinking blue: Data is being transferred to the downstream disk enclosure at the rate of 4 x 12 Gbit/s. ● Steady green: Data is transferred to the downstream disk enclosure at the rate of 4 x 6 Gbit/s or 4 x 3 Gbit/s. ● Blinking green: Data is being transferred to the downstream disk enclosure at the rate of 4 x 6 Gbit/s or 4 x 3 Gbit/s. ● Steady red: The port is faulty. ● Off: The link to the port is down.
	4	Power indicator of the expansion module	● Steady green: The expansion module is powered on. ● Off: The expansion module is powered off.
	5	Alarm indicator of the expansion module	● Steady red: An alarm is generated on the expansion module. ● Off: The expansion module is working correctly.

4.5 Device Cables

Device cables used in the storage system include power cables, ground cables, and signal cables. This chapter displays the views and describes the functions and specifications of various cables.

4.5.1 Power Cables

Power cables are classified into DC power cables, AC power cables and PDU power cables. Power cables supply power to devices in a cabinet. One end of a power cable is connected to the power socket of the storage system, and the other end to an external power supply.

DC power scenario

Each DC power module is equipped with two DC power cables. Power cables supply power to devices in a cabinet. One end of a power cable is connected to the power socket of a device, and the other end to an external power supply. **Figure 4-40** shows the appearance of DC power cables.

Figure 4-40 DC power cable

NOTE

Connect the black cable to the positive pole of the battery (+) and the blue cable to the negative pole (-).

AC power scenario

- Each AC power module is equipped with one AC power cable. Power cables supply power to devices in a cabinet. One end of a power cable is connected to the power socket of a device, and the other end to an external power supply. **Figure 4-41** shows the appearance of an AC power cable.

  Figure 4-41 AC power cable

- If a cabinet is equipped with power distribution units (PDUs), use PDU power cables to supply power to devices in the cabinet. **Figure 4-42** shows the appearance of a PDU power cable.

Figure 4-42 PDU power cable

4.5.2 Ground Cables

Ground cables are used for device grounding to improve the security when you perform operations on a storage device.

Appearance

Figure 4-43 shows the appearance of a ground cable.

Figure 4-43 Ground cable

4.5.3 Network Cables

The storage system uses network cables for its management network ports, service network ports, and other ports to connect to other devices or servers for communication.

Appearance

The storage system communicates with the external network using network cables. One end of the network cable connects to the management network port, service network port, or other maintenance network port of the storage system, and the other end connects to the network switch, application server or others.

Figure 4-44 shows the appearance of a network cable.

NOTE

GE electrical ports employ CAT5 network cables or CAT6A shielded network cables. 10GE electrical ports employ 1 m to 3 m CAT6A shielded network cables.

Figure 4-44 Network cable

4.5.4 Serial Cables

Serial cables are used to connect the serial ports of the storage system to other devices.

Appearance

A serial cable connects the serial port of the storage system to the port of the maintenance terminal.

One end of a serial cable is the RJ-45 port used to connect to the serial port of a storage system. The other end is a DB-9 port used to connect to the port of the maintenance terminal.

Figure 4-45 shows the appearance of a serial cable.

Figure 4-45 Serial cable

4.5.5 Mini SAS HD Cables

Mini SAS HD cables are used to connect expansion ports. Mini SAS HD cables are divided into mini SAS HD electrical cables and mini SAS HD optical cables.

4.5.5.1 Mini SAS HD Electrical Cables

Mini SAS HD electrical cables are used to connect a controller enclosure to a disk enclosure or connect two disk enclosures.

Figure 4-46 shows the appearance of a mini SAS HD electrical cable.

Figure 4-46 mini SAS HD electrical cable

4.5.5.2 Mini SAS HD optical cables

Mini SAS HD optical cables are used to connect a controller enclosure to a disk enclosure or connect two disk enclosures.

Figure 4-47 shows the appearance of a mini SAS HD optical cable.

Figure 4-47 mini SAS HD optical cable

NOTE

The optical connector of a mini SAS HD optical cable has an O/E conversion module built in and provides electrical ports.

4.5.6 Optical Fibers

The storage system communicates with Fibre Channel switches through optical fibers. One end of the optical fiber connects to the Fibre Channel host bus adapter (HBA), and the other end connects to the Fibre Channel switch or the application server. The two ends of the optical fiber are LC connectors.

Figure 4-48 shows the appearance of optical fiber.

NOTE

When connecting cables, select proper cables according to site requirements and label information.

Figure 4-48 Optical Fiber

5 Software Architecture

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

The software suite provided by OceanStor 2200 V3 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

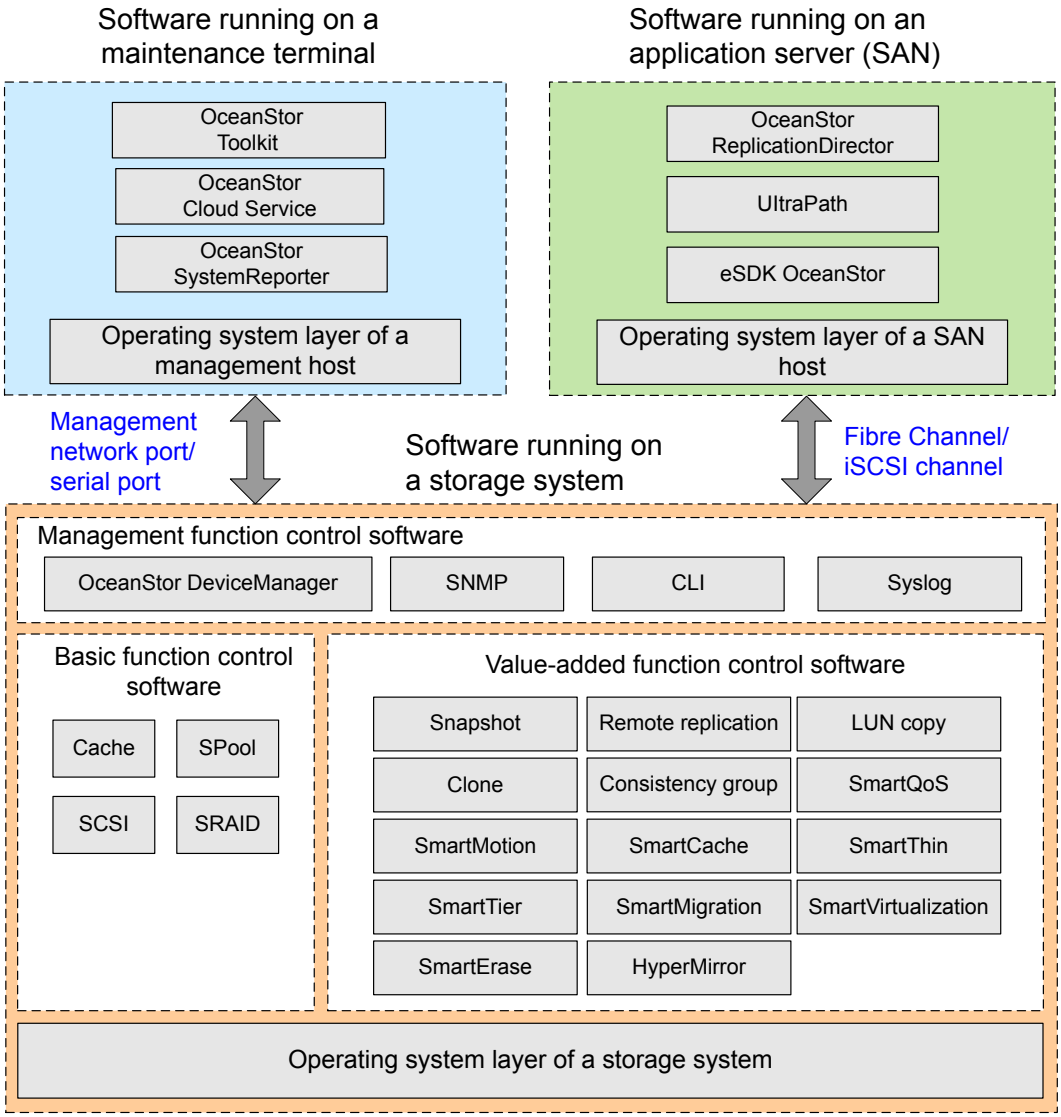


Table 5-1 describes the storage system software architecture.

Table 5-1 Description of storage system software architecture

Software	Function
Software running on a storage system	The dedicated operating system 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.

Software	Function
Software running on a maintenance terminal	Configures and maintains the storage system. The software includes OceanStor Toolkit, OceanStor SystemReporter and OceanStor Cloud Service.
Software running on an application server (SAN)	On a SAN network, software running on an application server enables the application server to communicate and cooperate with the storage system. This software category includes BCManager, UltraPath, and eSDK OceanStor.

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

Table 5-2 Description of 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	DeviceManager	The DeviceManager is an integrated storage management platform developed by Huawei. The DeviceManager provides easy configuration, management, and maintenance of storage devices.
	SNMP[ab]	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 the software based on their requirements.
	CLI[c]	The OceanStor 2200 V3 storage system supports CLI-based management and configuration. Users can use a third-party terminal software to log in to the OceanStor 2200 V3 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. There are a variety of third-party Syslog software, and users can choose one based on site requirements.

Software Set	Software	Function
Basic function control software	SCSI software module	Manages the status of SCSI commands, and dispatches, resolves, and processes SCSI commands.
	Cache software module	Converts a high-speed and small-capacity memory to a buffer of low-speed and large-capacity disks for tiered storage and improved system performance. Its major functions include data caching, delayed writes, and prefetch.
	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.
Value-added function control software	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.
	SmartErase software module	Provides the SmartErase function. SmartErase erases unnecessary data on a specified LUN several times so that the data on the LUN cannot be recovered in case of leakage.
	SmartCache software module	Provides SmartCache function, which uses SSDs as cache resources to significantly promote system read performance when random, small I/Os with hot data require more read operations than write operations.
	SmartQoS software module	Provides the SmartQoS function. SmartQoS controls the storage performance of one or more LUNs, and prioritizes the quality of service (QoS) of critical applications.
	SmartMotion software module	Provides the SmartMotion function. Based on the analysis on service status, SmartMotion dynamically balances capacity and performance by evenly distributing data across storage media of the same type.

Software Set	Software	Function
	SmartThin software module[d]	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.
	SmartTier software module[d]	Provides the SmartTier function. SmartTier periodically detects hotspot data per unit time, and promotes them from low-speed storage media to high-speed one, boosting the system performance at an affordable cost.
	SmartMigration software module[d]	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.
	HyperMirror module[d]	Provides the HyperMirror function. HyperMirror backs up data in real time. If the source data becomes unavailable, applications can automatically use the data copy, ensuring high data security and application continuity.
	Snapshot software module[d]	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.
	Remote replication software module[d]	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.
	LUN copy software module[d]	Provides the LUN copy function. LUN copy copies the source LUN data onto the target LUN, addressing the requirements of applications such as tiered storage, application upgrade, and remote backup.
	Clone software module[d]	Provides the clone function. Clone generates a full data copy of the source data in the local storage system.

Software Set	Software	Function
	Consistency group software module[d]	Provides the consistency group function. 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.
a: Simple Network Management Protocol b: The supported character encoding is UTF-8. c: Command Line Interface d: The single-controller OceanStor 2200 V3 not supported		

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

Table 5-3 Description of software running on a maintenance terminal

Software	Function
OceanStor Toolkit	OceanStor Toolkit helps service engineers and O&M engineers deploy, maintain, and upgrade devices.
OceanStor Cloud Service	OceanStor Cloud Service 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 the storage system.

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

Table 5-4 Description of software running on an application server (SAN)

Software	Function
BCManager	Provides data protection and disaster recovery for application servers based on the related storage system value-added features (synchronous/asynchronous remote replication, snapshot, LUN copy, clone, HyperMetro, and HyperVault). It centrally manages the requirements for data protection and disaster recovery between the storage system and application servers.

Software	Function
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. Therefore, UltraPath is an easy and efficient path management solution for proven data transmission reliability and high path security.
eSDK OceanStor	eSDK OceanStor is a Huawei-developed integration platform for storage devices. It has open capabilities and provides standard interfaces and preinstalled plug-ins. The plug-ins and providers of eSDK OceanStor enable the storage system to interconnect with vCenter and System Center so that customers can use their existing network management systems to manage Huawei's storage devices.

6 Product Specifications

About This Chapter

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

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

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

6.1 Hardware Specifications

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 processors, 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 disk.
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 the storage system.

Hardware Configuration

Item	Value
Processors per controller	1 x 16-core processor
Cache size per controller	● 8 GB ● 16 GB
Maximum number of controllers per enclosure	2 (single controller is available)
Maximum number of IP Scale-out controllers	2
Maximum number of disks	300
Controller enclosure configuration	● 2 U controller enclosure with twenty-five 2.5-inch disks ● 2 U controller enclosure with twelve 3.5-inch disks

Item	Value
Supported disk enclosure types	● 2 U SAS disk enclosure with twenty-five 2.5-inch disks ● 4 U SAS disk enclosure with twenty-four 3.5-inch disks
Maximum number of expansion disk enclosures	13
Maximum number of disk enclosures that can be connected to back-end channels (ports)	Up to 8 disk enclosures can be connected a SAS expansion port. Five is recommended.
Number of onboard SAS ports per controller	4 x 12 Gbit/s SAS ports: 2
Maximum number of back-end SAS disk ports per controller	4 x 12 Gbit/s SAS ports: 2
Supported disk types	SSD, SAS, NL-SAS
Supported hot-swappable interface module types	● GE ● 10GE (electrical) ● SmartIO
Maximum number of hot-swappable I/O interface modules per controller	1
Length of expansion SAS cables	Controller enclosure ● Electrical cables: 1 m and 3 m Disk enclosure ● Electrical cables: 1 m, 3 m, and 5 m ● Optical cable: 15 m
Redundancy degree of main components	● Power modules: 1+1 ● Fans: 1+1

Port Specifications

Interface Module Type	Maximum Number of Ports Per Interface Module
4-port 8 Gbit/s Fibre Channel interface module	-
8-port 8 Gbit/s FC interface module	-
GE electrical interface module	Four ports for each front-end module
10GE electrical interface module	Four ports for each front-end module

Interface Module Type	Maximum Number of Ports Per Interface Module
SmartIO interface module	Four ports per module for each front-end or nodes-interconnection module [a]
a: SmartIO interface modules support various ports including 16 Gbit/s Fibre Channel ports, 8 Gbit/s Fibre Channel ports, 10 Gbit/s FCoE (VN2VF) ports, 10 Gbit/s Ethernet ports, and iWARP (interconnection between scale-out nodes).	

Port Type	Max. Number of Ports Per Controller
8 Gbit/s Fibre Channel port	8
16 Gbit/s Fibre Channel port	4
GE port[a]	10[b]
10GE port	4
12 Gbit/s SAS expansion port	2
a: Onboard ports of the 2200 V3 are GE ports. b: includes two ports that can function as maintenance and service network ports, four onboard front-end host ports, and four hot-swappable front-end host ports.	

Disk Specifications

Disk Type[a]	Dimensions	Rotational Speed	Weight	Capacity
SAS	2.5-inch	10,000 rpm	0.21 kg (0.46 lb)	● 600 GB ● 900 GB ● 1.2 TB ● 1.8 TB
		15,000 rpm	0.21 kg (0.46 lb)	● 600 GB
NL-SAS	3.5-inch	7200 rpm	0.72 kg (1.59 lb)	● 2 TB ● 4 TB ● 6 TB ● 8 TB
SSD	2.5-inch	-	0.19 kg (0.42 lb)	● 600 GB ● 900 GB
	3.5-inch		0.38 kg (0.84 lb)	● 1.8 TB ● 3.6 TB

Disk Type[a]	Dimensions	Rotational Speed	Weight	Capacity
a: Restricted by the storage principles, SSDs and mechanical disks such as NL-SAS and SAS disks cannot be preserved for a long term while they are powered off. ● SSDs where no data is stored can be preserved for a maximum of 12 months while they are powered off. SSDs where data has been stored can be preserved for a maximum of 3 months while they are powered off. If the maximum preservation time is exceeded, data loss or SSD failure may occur. ● Packed mechanical disks can be preserved for a maximum of six months. Unpacked mechanical disks that are powered off can be preserved for a maximum of six months too. If the maximum preservation time is exceeded, data loss or disk failure may occur. The maximum preservation time is determined based on the disk preservation specifications provided by the mechanical disk vendor. For details about the specifications, see the manual provided by the vendor.				

Dimensions and Weight (unpackaged)

Module	Parameter	Value
Controller enclosure	Dimensions	● Depth: 488 mm (19.21 in.) ● Width: 447 mm (17.60 in.) ● Height: 86.1 mm (3.39 in.)
	Weight (without disks)	15.9 kg (35.05 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)
4 U SAS disk enclosure	Dimensions	● Depth: 488 mm (19.21 in.) ● Width: 447 mm (17.60 in.) ● Height: 175 mm (6.89 in.)
	Weight (without disks)	26.5 kg (58.42 lb)

Electrical Specifications

Item		Value
Power consumption	Controller enclosure	12 disk slots ● Max: 393 W ● Typical: 305 W ● Min: 284 W 25 disk slots ● Max: 429 W ● Typical: 329 W ● Minimum: 212 W
	2 U disk enclosure	● Max: 268 W ● Typical: 215 W ● Minimum: 205 W
	4 U disk enclosure	● Max: 472 W ● Typical: 360 W ● Minimum: 340 W
Power voltage and rated currency	Controller enclosure	● AC: 100 V to 240 V, ±10%, 800 W, 10 A ● High voltage DC (N/A for North America and Canada): 240 V, 800 W, 10 A
	Disk enclosure	● AC: 100 V to 240 V, ±10%, 800 W, 10 A ● High voltage DC (N/A for North America and Canada): 240 V, 800 W, 10 A
	AC power input type (socket type)	● AC: IEC60320-C14 ● High voltage DC: IEC60320-C14

Reliability Specifications

Item	Value
Solution reliability	99.9999%
Mean Time Between Failures (MTBF)	1,000,000 hours
Mean Time To Repair (MTTR)	2 hours

6.2 Software Specifications

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

Table 6-2 describes the categories of the storage unit software specification to help you quickly find out the specification information you need.

Table 6-2 Description of software specification categories

Category	Description
Basic specifications	Describes the basic software specifications of the storage unit, 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 the storage unit, such as snapshot, remote replication, and LUN copy.
Supported operating systems	Describes the operating systems supported by the storage unit.
License control	Describes whether software features of the storage unit are controlled by licenses.

Basic Specifications

Item	Value
Maximum number of connected application servers	● Fibre Channel ports: 1024 ● iSCSI ports: 256
RAID level	0, 1, 3, 5, 6, 10, 50
Maximum number of LUNs	512[a]
Maximum number of LUN groups	512
Maximum number of host LUNs	256
Maximum number of mapping views	1024
Maximum number of disk domains	8
Maximum number of disks in a disk domain	300
Minimum number of disks in a disk domain	4

Item	Value
Maximum number of storage pools	8
Maximum number of LUNs in a storage pool	512[a]
Minimum capacity of a LUN	512 KB
Maximum capacity of a LUN	256 TB
a: the maximum number of LUNs, writable snapshots of LUNs, and VVols (PE LUNs and VVol LUNs)	

Feature Specifications

Feature	Parameter	Value
HyperSnap[a]	Maximum number of LUN snapshots	256
	Maximum number of source LUNs	128
	Maximum number of snapshots for a source LUN	64
	Maximum number of LUNs that can be batch activated	64
LUN copy	Maximum number of LUN copies	32
	Maximum number of target LUNs for each source LUN	32
HyperClone[a]	Maximum number of primary LUNs	128
	Maximum number of secondary LUNs	128
	Maximum number of secondary LUNs in a clone group	8
	Maximum number of consistent split pairs	64
HyperReplication[a]	Maximum number of pairs in a remote replication (synchronous + asynchronous)	128

Feature	Parameter	Value
	Maximum number of secondary LUNs in a pair	● Synchronous: 1:1 ● Asynchronous: 1:2
	Maximum number of connected remote storage devices	32
	Maximum number of remote replication consistency groups	32 (synchronous+asynchronous)
	Maximum number of pairs in a remote replication consistency group	32
SmartQoS	Maximum number of SmartQoS policies	128
	Maximum number of LUNs supported by a policy	64
	Number of priority levels	3
SmartTier[a]	Maximum number of tiers	3
	Migration granularity (configurable)	512 KB/1 MB/2 MB/4 MB/8 MB/16 MB/32 MB/64 MB (4 MB by default)
SmartMotion	Granularity	64 MB
SmartThin[a]	Maximum number of thin LUNs	512
	Maximum capacity of a thin LUN	256 TB
	Granularity of a thin LUN	● Without SmartDedupe&SmartCompression: 64 KB fixed ● With SmartDedupe&SmartCompression: 64 KB by default, 4 KB/8 KB/16 KB/32 KB/64 KB adjustable on CLI
SmartMigration[a]	Maximum number of LUNs that can be simultaneously migrated by a controller	8
	Maximum number of LUNs for which migration can be configured at a time	64

Feature	Parameter	Value
	Maximum number of LUNs for which consistency split can be performed	64
SmartErase	Maximum number of LUNs whose data can be simultaneously destructed by each controller	8
SmartVirtualization	Maximum number of external LUNs	256
	Maximum number of external storage arrays	32
	Maximum number of paths for each external LUN	8
	Maximum number of masqueraded external LUNs	512
	Maximum number of external links that connect to arrays	256
	Maximum number of external links that connect to arrays on a controller	128
HyperMirror[a]	Maximum number of volume mirrors	64
	Number of copies per volume mirror	2
SmartCache	Total SSD cache capacity per controller	200 GB (8 GB per controller)
	Number of SSD cache partitions for two controllers[a]	8 user partitions and a default cache partition
	Data block granularity of SSD cache	4 KB/8 KB/16 KB/32 KB/64 KB/128 KB auto-adjust
a: The single-controller OceanStor 2200 V3 not supported		

Performance Specifications

Item (For block service)	Value
Maximum IOPS (full cache read hit)	600,000
Maximum bandwidth (MB/s)	4000

Supported Operating Systems

Only the common operating systems supported by the storage systems are listed. For details, contact Huawei technical support engineers.

Operating System	Version
Windows	Mainstream Windows operating systems are supported, including but not limited to the following: ● Windows Server 2003 R2 Standard SP2 ● Windows Server 2003 R2 Datacenter SP2 ● Windows Server 2003 R2 Enterprise Edition SP2 ● Windows Server 2008 R2 Standard SP1 ● Windows Server 2008 R2 Datacenter SP1 ● Windows Server 2008 R2 Enterprise Edition SP1 ● Windows Server 2012 Standard ● Windows Server 2012 Datacenter ● Windows Server 2012 Essentials ● Windows Server 2012 Foundation X64 Edition
Linux	Mainstream Linux operating systems are supported, including but not limited to the following: ● SUSE Linux Enterprise Server 10 ● SUSE Linux Enterprise Server 11 ● Red Hat Enterprise Server AS 5 ● Red Hat Enterprise Server AS 6
Other mainstream operating systems	● HP-UX 11i v2 ● HP-UX 11i v3 ● AIX 6.1 ● AIX 7.1 ● Solaris 10 for Sparc ● Solaris 11 for Sparc ● VMware ESXi 4.1 ● VMware ESXi 5.0 ● Citrix XenServer 5.6 ● Citrix XenServer 6.0 ● MAC OS X 10.7 ● Other mainstream operating systems

License Control

Function	Requiring License Control or Not
HyperSnap (Snapshot)	√ [a]
HyperClone (Clone)	√
HyperCopy (LUN Copy)	√
HyperReplication (Remote replication)	√ [b]
SmartQoS	√
SmartTier	√
SmartMotion	√
SmartThin	√
SmartMigration	√
SmartErase	√
SmartVirtualization	√
HyperMirror	√
SmartCache	√
a: HyperSnap for block and file services requires the same license. After purchasing and importing the license file for the HyperSnap feature, a user can create snapshots for both block and file services. b: HyperReplication for block and file services requires the same license. After purchasing and importing the license file for the HyperReplication feature, a user can create remote replications for both block and file services.	

NOTE

As the OceanStor SystemReporter and OceanStor UltraPath are not deployed on a storage system, you cannot check them on the license management page of the storage system. To view purchased features, you can obtain the product authorization certificate from your dealer, which shows the purchased features.

Interoperability and Host Connectivity

You can obtain the documentation for the interoperability and host connectivity of the storage system in the following ways:

- **Interoperability Navigator**: In the **OceanStor Interoperability Navigator**, click the components which you want to query to get the compatibility information.
- **Host Connectivity Guide**: Visit the HUAWEI enterprise support website **http://support.huawei.com/enterprise** and search **Host Connectivity Guide**.

7 Environmental Requirements

About This Chapter

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.

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

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

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.

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.

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 the storage systems.

Table 7-1 Temperature, humidity, and altitude requirements of the storage systems

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.) ● At altitudes between 1800 m and 3000 m (5905.51 ft. and 9842.52 ft.), the temperature drops by 1°C (1.8°F) for 220 m (721.78 ft.) of altitude increase.
	Operating temperature change rate	1°C (1.8°F)/minute
	Non-operating ambient temperature	-40°C to +70°C (-40°F to +158°F)
	Storage temperature (during transportation and storage with packages)	-40°C to +70°C (-40°F to +158°F)
Humidity	Operating humidity	10% RH[a] to 90% RH
	Non-operating humidity	5% RH to 95% RH
	Maximum humidity change rate	10%/hour
	Storage humidity (during transportation and storage with packages)	5% RH to 95% RH
Altitude	Operating altitude of disks	● HDDs: -304.8 m to +3048 m (-999.99 ft. to +9999.99 ft.) ● SSDs: -305 m to +3048 m (-1000.64 ft. to +9999.99 ft.)
	Non-operating altitude of disks	● HDDs: -305 m to +12192 m (-1000.64 ft. to +39999.51 ft.) ● SSDs: -305 m to +12192 m (-1000.64 ft. to +39999.51 ft.)

Parameter	Condition	Requirement
a: RH, 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 7-2 shows the vibration and shock requirements of storage systems.

Table 7-2 Vibration and shock requirements of storage systems

Parameter	Requirement
Operating vibration	5 to 350 Hz, PSD: 0.0002 g^2/Hz, 350 to 500 Hz, -3 dB, 0.3 Grms, axial direction: 3 axes
Non-operating vibration	10 to 500 Hz, 1.49 Grms, 3 axes, 15 min/axis PSD: ● 10 HZ@0.1g^2/HZ ● 20 HZ@0.1g^2/HZ ● 50 HZ@0.004g^2/HZ ● 100 HZ@0.001g^2/HZ ● 500 HZ@0.001g^2/HZ
Non-operating shock	Half sine, 70 Gs/2 ms, 1 shock/face, total 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 risks of corrosive failure. This clause 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 equal to or greater than 0.5 μm.
- Each cubic meter contains not more than 832,000 particles that are equal to or greater than 1 μm.
- Each cubic meter contains not more than 29,300 particles that are equal to or greater than 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 7-3** gives the air cleanliness classification by particle concentration.

Table 7-3 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	2,370	1,020	352	83	-
Class 5	100,000	23,700	10,200	3,520	832	29
Class 6	1,000,000	237,000	102,000	35,200	8,320	293
Class 7	-	-	-	352,000	83,200	2,930
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 7-4 lists common corrosive airborne contaminants and their sources.

Table 7-4 Common corrosive airborne contaminants and their sources

Symbol	Sources
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
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 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 7-5**.

Table 7-5 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.
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 7-6** for the copper and silver corrosion rate requirements.

Table 7-6 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: Parts per billion (ppb) is the number of units of mass of a contaminant per 1000 million 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:

- Air goes into a controller enclosure from the front end and out of its back end.

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

  Cooling air enters through the space between disks, passing the midplane, into the power modules and expansion modules. After dissipating the heat, the air is discharged 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.

The airflow parameters of the storage system are shown in **Table 7-7**.

Table 7-7 Airflow parameters of storage systems

Device	System Airflow
Controller enclosure	● 75 CFM[a] (at max. fan speed) ● 24 CFM (25℃)
2 U disk enclosure	● 117 CFM (at max. fan speed) ● 38 CFM (25℃)
4 U disk enclosure	● 151 CFM (at max. fan speed) ● 52 CFM (25℃)
a: CFM, Cubic Feet per Minute	

The heat dissipation parameters of the storage system are shown in **Table 7-8**.

Table 7-8 Heat dissipation parameters of a storage system

Device	Maximum Heat Dissipation
Controller enclosure	12 disk slots: 1628 BTU[a]/h 25 disk slots: 1773 BTU/h
2 U disk enclosure	914 BTU/h
4 U disk enclosure	1610 BTU/h
a: BTU, British Thermal Unit.	

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 the storage system are shown in **Table 7-9**.

Table 7-9 Noise parameters of a storage system

Device	Noise power
800 W power configured	61.3 dB (25°C)

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/Fibre 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

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.
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.

Name	Description
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.
ODX	Offloaded data transfer (ODX) is a feature of Windows Server 2012. The feature unloads files into storage arrays for transmission. High transmission bandwidth between storage arrays to largely shorten the data transmission delay and improve the data copy speed, while reduce the host server resource utilization rate.

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	LVD 2006/95/EC
European safety standard	EN 60950-1
China EMC standard	GB9254-2008 (idt CISPR 22: 2006)
	GB17625.1-2003 (idt IEC 61000-3-2: 2001)
Canada EMC standard	ICES-003: 2004
	CAN/CSA-CEI/IEC CISPR 22:02

Name	Standard No.
North America EMC standard	FCC, CFR 47 Part 15, Subpart B
European EMC directive	EMC Directive 2004/108/EC
European EMC standard	EN 55022
	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
ETSI standard (environment)	ETS 300 119
ETSI standard (grounding)	ETS 300 253
ITUT standard (grounding)	ITUT K.27

Name	Standard No.
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 that the storage system passes.

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

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 (2004/108/EC) and low-voltage (2006/95/EC) specifications published by EU. If this product has telecommunication functionality, the R_TTE Directive (1999/5/EC) that complies with the directives mentioned previously implies conformity to the following European norms (in parentheses are the equivalent international standards and regulations): ● EN 55022 (CISPR 22)-Electro Magnetic Interference ● EN 55024 (IEC61000-4-2, 3, 4, 5, 6, 8, 11)-Electro Magnetic Immunity ● EN 60950 (IEC 60950)-Product Safety

Name	Description
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. Thus, both humans and environment are protected.
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 an 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) can not 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.
GOST	The national standard certification of Russia. Based on Russian Consumer Protection Law, certain consumable products that are sold to Russia must meet the security, Electro Magnetic Interference (EMI), and sanitation requirements. Based on the product certification and service laws, the products should be awarded the GOST certification.
C-TICK	A mandatory certification issued by Australian Communications Authority (ACA) for communication equipment, mainly concerning EMC requirements.
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.

10 Operation and Maintenance

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

Introduction to the DeviceManager

Figure 10-1 shows the DeviceManager main window.

Figure 10-1 DeviceManager main window

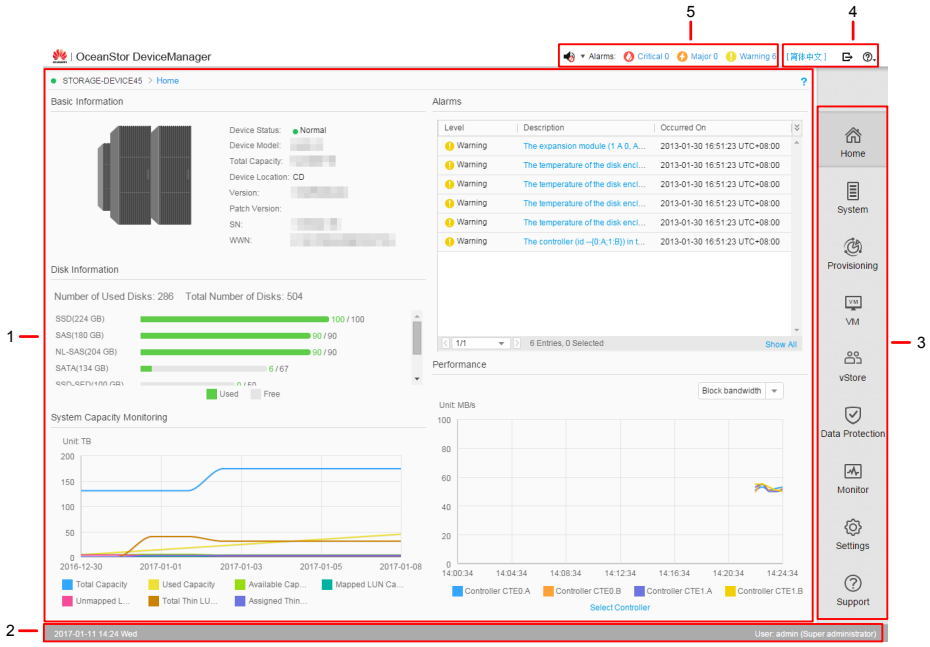


Table 10-1 describes the components of the DeviceManager main window.

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.
5	Fault statistics area	The fault statistics area shows the number of each level of system faults, helping users learn about the running status of a storage system.

Users can log in to the DeviceManager by using a common browser.

To master GUI-based operations, you are advised to read this document and practice the operations using the DeviceManager Demo. As a simulation program of storage system management software, the DeviceManager Demo simulates configuration and management operations on a storage system.

Introduction to the CLI

The CLI enables users to manage and maintain the V3 series 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 the scenario where a user does 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.

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.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.

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.

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.

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

If you want to obtain information about glossaries, visit **http://support.huawei.com/enterprise/**. In the search field, enter product model (such as 5500 V3), and select a path from the paths that are automatically displayed to go to the document page of the product. Browse or download the *OceanStor V3 Series Storage Systems V300R006 Glossary*.

C Acronyms and Abbreviations

A	
ANSI	American National Standards Institute
B	
BBU	Backup Battery Unit
C	
CLI	Command Line Interface
E	
ESN	Equipment Serial Number
F	
FC	Fiber Channel
FC-AL	Fiber Channel Arbitrated Loop
FCoE	Fibre Channel over Ethernet
G	
GUI	Graphical User Interface
GE	Gigabit Ethernet
H	
HBA	Host Bus Adapter

HD	High Density
I	
IP	Internet Protocol
ISA	Instrument Society of America
iSCSI	Internet Small Computer Systems Interface
ISO	International Organization for Standardization
L	
LUN	Logical Unit Number
M	
MTBF	Mean Time Between Failure
MTTR	Mean Time to Failure
N	
NL-SAS	Near Line Serial Attached SCSI
P	
PDU	Power Distribution Unit
U	
USB	Universal Serial Bus
R	
RAID	Redundant Array of Independent Disks
RSCN	Registered State Change Notification
S	
SAN	Storage Area Network
SAS	Serial Attached SCSI
SCSI	Small Computer System Interface

SSD	Solid State Drive
V	
VLAN	Virtual LAN
VPN	Virtual Private Network