

MacroSAN MS Series Storage Devices Virtualization Feature

GUI User Manual

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MacroSAN Technologies Co., Ltd.

www.macrosan.com

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Statement

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Manual Structure

Chapter		Description	Main content
Overview	Preface	This chapter introduces related information about the manual for your reading.	<ul style="list-style-type: none"> • Intended audiences • Manual guidance • Manual conventions • Document acquisition • Feedback
	Overview of MS series storage devices	This chapter introduces the basic functions and typical networking of MS series storage devices, making it easy for you to have a simple understanding of the devices.	<ul style="list-style-type: none"> • Introduction to MS series storage devices • Introduction to typical networking of MS series storage devices
	ODSP Scope+ console	This chapter introduces the ODSP Scope+ console to help you familiarize with management interface usage.	<ul style="list-style-type: none"> • Introduction to ODSP Scope+ • Running ODSP Scope+ • Composition of ODSP Scope+ system view interface • Composition of ODSP Scope+ tenant view interface
Virtualization feature	Introduction to virtualization	This chapter introduces related knowledge of virtualization.	<ul style="list-style-type: none"> • Introduction to virtualization • Virtualization key terms • Definitions of volume and RDV-LUN status • Precautions for virtualization
	Configuring virtualization	This chapter introduces how to configure virtualization.	<ul style="list-style-type: none"> • Preparations before configuring virtualization • Allocating resources for virtualization device • Managing external device • Managing volume • Managing RDV-LUN
	Virtualization and other features	This chapter introduces how to use virtualization and other features at the same time.	<ul style="list-style-type: none"> • Virtualization and thin provisioning • Virtualization and snapshot • Virtualization and replication
Appendixes	Device default configurations	This chapter introduces device's default configurations.	Device default configurations
	Device external ports summary	This chapter introduces the summary of device external ports.	Device external ports summary
	Glossaries	This chapter introduces the glossaries in this manual.	Glossaries
	Acronyms	This chapter introduces the acronyms in this manual.	Acronyms

Part 1: Overview

1 Preface

1.1 Intended Audiences

This manual is used to guide the configuration, management and maintenance of MacroSAN MS series storage devices. It is intended for MacroSAN employees, partners, storage architects, system administrators and maintainers. Readers are required to be familiar with the basic knowledge of storage systems.

1.2 Manual Guidance

The manual guidance contains all the documents in the *MacroSAN MS Series Storage Devices GUI User Manual*, which helps you select the required documents.

Table 1-1 List of user manual

Name	Main content
<i>MacroSAN MS Series Storage Devices Basic Configuration GUI User Manual</i>	This manual introduces the basic configuration, management and maintenance of MacroSAN MS series storage devices.
<i>MacroSAN MS Series Storage Devices Snapshot Feature GUI User Manual</i>	This manual introduces the configuration for snapshot feature of MacroSAN MS series storage devices.
<i>MacroSAN MS Series Storage Devices Replication Feature GUI User Manual</i>	This manual introduces the configuration for replication feature of MacroSAN MS series storage devices.
<i>MacroSAN MS Series Storage Devices HotCache Feature GUI User Manual</i>	This manual introduces the configuration for HotCache feature of MacroSAN MS series storage devices.
<i>MacroSAN MS Series Storage Devices Performance Statistics Feature GUI User Manual</i>	This manual introduces the configuration for performance statistics feature of MacroSAN MS series storage devices.
<i>MacroSAN MS Series Storage Devices QoS Feature GUI User Manual</i>	This manual introduces the configuration for QoS feature of MacroSAN MS series storage devices.
<i>MacroSAN MS Series Storage Devices Remote Mirror Feature GUI User Manual</i>	This manual introduces the configuration for remote mirror feature of MacroSAN MS series storage devices.
<i>MacroSAN MS Series Storage Devices Dual-Active Feature GUI User Manual</i>	This manual introduces the configuration for dual-active feature of MacroSAN MS series storage devices.
<i>MacroSAN MS Series Storage Devices Thin Provisioning Feature GUI User Manual</i>	This manual introduces the configuration for thin provisioning feature of MacroSAN MS series storage devices.
<i>MacroSAN MS Series Storage Devices Virtualization Feature GUI User Manual</i>	This manual introduces the configuration for virtualization feature of MacroSAN MS series storage devices.
<i>MacroSAN MS Series Storage Devices Local Mirror Feature GUI User Manual</i>	This manual introduces the configuration for local mirror feature of MacroSAN MS series storage devices.

<i>MacroSAN MS Series Storage Devices Local Clone Feature GUI User Manual</i>	This manual introduces the configuration for local clone feature of MacroSAN MS series storage devices.
<i>MacroSAN MS Series Storage Devices Auto-Tiering Feature GUI User Manual</i>	This manual introduces the configuration for auto-tiering feature of MacroSAN MS series storage devices.
<i>MacroSAN MS Series Storage Devices NDM Feature GUI User Manual</i>	This manual introduces the configuration for NDM feature of MacroSAN MS series storage devices.
<i>MacroSAN MS Series Storage Devices Deduplication and Compression Feature GUI User Manual</i>	This manual introduces the configuration for deduplication and compression feature of MacroSAN MS series storage devices.
<i>MacroSAN MS Series Storage Devices VVol Feature GUI User Manual</i>	This manual introduces the configuration for VVol feature of MacroSAN MS series storage devices.
<i>MacroSAN MS Series Storage Devices Clone Feature GUI User Manual</i>	This manual introduces the configuration for clone feature of MacroSAN MS series storage devices.
<i>MacroSAN MS Series Storage Devices Multi-Tenant Feature GUI User Manual</i>	This manual introduces the configuration for multi-tenant feature of MacroSAN MS series storage devices.
<i>MacroSAN MS Series Storage Devices R3DC Feature GUI User Manual</i>	This manual introduces the configuration for R3DC feature of MacroSAN MS series storage devices.

1.3 Manual Conventions

Some eye-catching signs are used in the manual to draw your attention. Please be careful during operation.

1.3.1 Conventions of Description

NOTE

A NOTE is a prompt, which is a supplementary explanation for operation.

CAUTION

- A CAUTION indicates some important information. It explains the precautions to be taken during operation and the potential impact of improper operations.
 - Please pay special attention to this part.
-

WARNING

- A WARNING indicates some vital information. Improper operation may lead to accidents, such as performance degradation, data loss or devices damage.
 - Please pay special attention to this part.
-

1.3.2 Other Conventions

In the following descriptions, "MacroSAN Technologies Co., Ltd." is also called "MacroSAN".

1.4 Document Acquisition

Please visit www.macrosan.com for the latest document.

NOTE

This manual may lag behind the latest software version and may be updated irregularly due to software upgrading or other reasons.

1.5 Feedback

MacroSAN Technologies Co., Ltd. sincerely appreciates your choice of our products. If you have any feedback or suggestions on the document, please email us at document@macrosan.com. Thanks for your support.

2 Overview of MS Series Storage Devices

2.1 Introduction to MS Series Storage Devices

MacroSAN ODSP storage devices are designed innovatively with high-performance and high-reliability hardware structure by adapting the latest chip technology. Together with the ODSP series software, these devices provide a 100G-class storage platform with large cache, high bandwidth, and high processing power for the massive concurrent applications in data centers in the era of cloud computing, and at the same time, they can also provide a safe and reliable storage platform with elastic deployment of resources for small and medium-sized data centers.

MacroSAN ODSP storage devices consist of the following modular components:

- SPU: It includes SPs, power supply modules, fan modules, battery modules, disk modules and other hardware components.
- FSU: It includes FPs, power supply modules, fan modules, battery modules, disk modules and other hardware components.
- SSU: It includes XPs, power supply modules, fan modules, battery modules, disk modules and other hardware components.
- DSU: It includes EPs, power supply modules, fan modules, battery modules, disk modules and other hardware components.

As the core module of the whole storage system, SP is used for data transmission, data processing, and data protection of storage devices. It provides multiple types of front-end business ports for connecting front-end application servers, and multiple types of back-end expansion ports

(e.g. SAS ports, PCIe ports, 25GE/100GE ports, etc.) for connecting either FSUs or SSUs or DSUs for storage expansion.

NOTE

- Please refer to the installation manual for the hardware features of MacroSAN ODSP storage devices.
- MacroSAN MS series storage device is called ODSP storage device, storage device or device in the following description. FSU, SSU and DSU are collectively called DSU. FP, XP and EP are collectively called EP unless stated otherwise.

2.2 Introduction to Typical Networking of MS Series Storage Devices

[Figure 2-1](#) shows the typical networking of MacroSAN MS series storage devices.

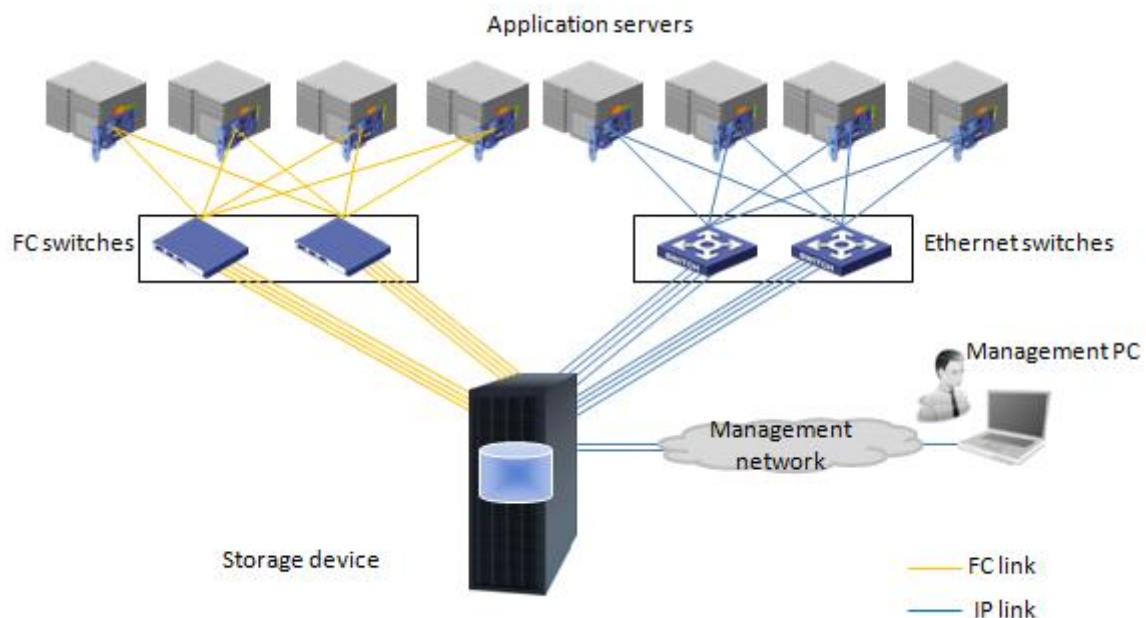


Figure 2-1 Typical networking of MS series storage devices

Networking explanation:

- Each controller of the ODSP storage device provides a dedicated management port, and the management PC can be connected to the management port of the storage device through the management network. The networks between the management PC and all controllers are required to be reachable.
- ODSP storage device can be accessed by the application server through iSCSI, FC, NVMe over RoCE and NVMe over FC. The HBA and driver software are required to be installed on the application server.
- ODSP storage devices support port aggregation in IP networks. You can either use the front-end business ports separately or bundle multiple Ethernet ports into one aggregated port.

⚠CAUTION

- The application server is required to be installed with multipath software correctly so that it can access all controllers in ODSP storage device to ensure redundancy.
 - If the client of the ODSP storage device is a multi-server application system and multiple application servers are required to have read and write permissions on the same storage resource, relevant software (such as cluster software, parallel file system software, etc.) must be correctly installed on the corresponding application server, so that multiple application servers can access the same storage area exclusively to ensure data accuracy and consistency.
-

3 ODSP Scope+ Console

3.1 Introduction to ODSP Scope+

ODSP Scope+ is also called GUI Console (GUI for short), which provides management interface on the base of Web. Enter the IP address of ODSP storage device in the address bar of browser to run ODSP Scope+ and manage ODSP storage device.

The followings are browsers that have passed compatibility testing.

- Chrome55+
- Firefox39.0+
- IE10+ and browsers based on IE kernel
- 360 Browser (Speed Mode)
- QQ Browser (Speed Mode)
- The World Browser (Speed Mode)
- Maxthon (IE10+ kernel)

📘NOTE

ODSP Scope+ compatible browser may be updated periodically. Please consult manufacturer's technical supporters to obtain the latest browsers list that have passed compatibility testing.

3.2 Running ODSP Scope+

Open the Web browser of management PC and enter the IP address of the console ETH port (e.g. <https://172.17.243.81/>) of storage device in the address bar and refresh interface to run ODSP Scope+.

The security certificate risks (as shown in [Figure 3-1](#)) may be displayed in some browsers. In this case, please click "Continue to 172.17.243.81 (unsafe)" or the entries with similar meaning to run ODSP Scope+.

NOTE

The ODSP Scope+ is carried out based on HTTPS protocol for security. However, all security certificates are the third-party authentication for the authenticity of domain name and must be issued by certificate authority. The storage devices are on the rear of server with a dedicated private network instead of a public network. Besides, the devices are managed through LAN IP address rather than domain name, so the SSL certificate cannot be applied and it is normal that the security certificate risk message is displayed on the browser. Please ignore the prompt.

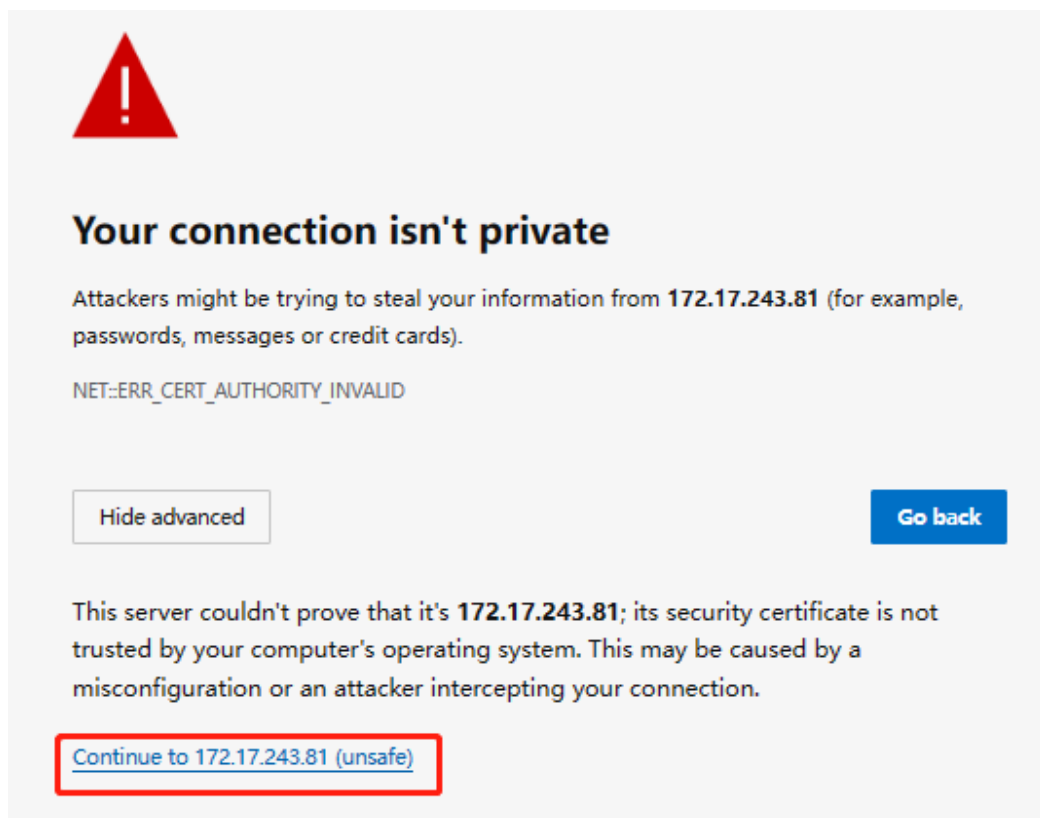


Figure 3-1 Example for prompt of certificate exception

The login interface of ODSP Scope+ is shown in [Figure 3-2](#). Local user is used by default. Click the <Advanced> button for login modes.

- LDAP user login: Enter the username, password and verification code and click the <Login> button to login system view interface.
- Tenant login: Check the "Tenant Login" option, as shown in [Figure 3-4](#), enter the tenant user's username, tenant user password, verification code and tenant name, and click the <Login> button to log in to the tenant view interface.

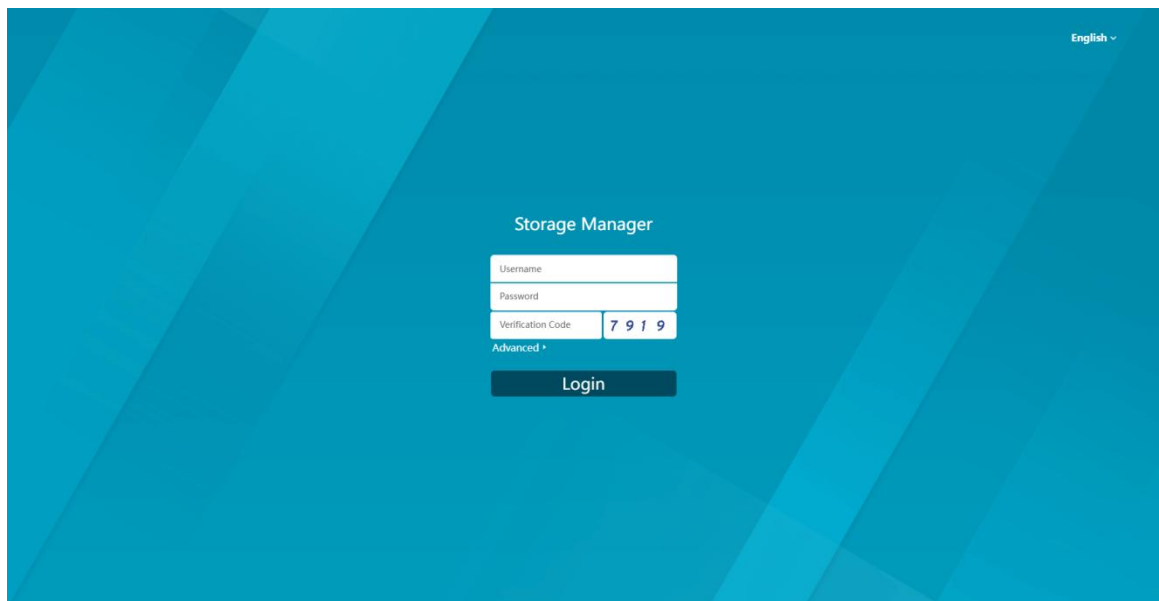


Figure 3-2 ODSP Scope+ login interface

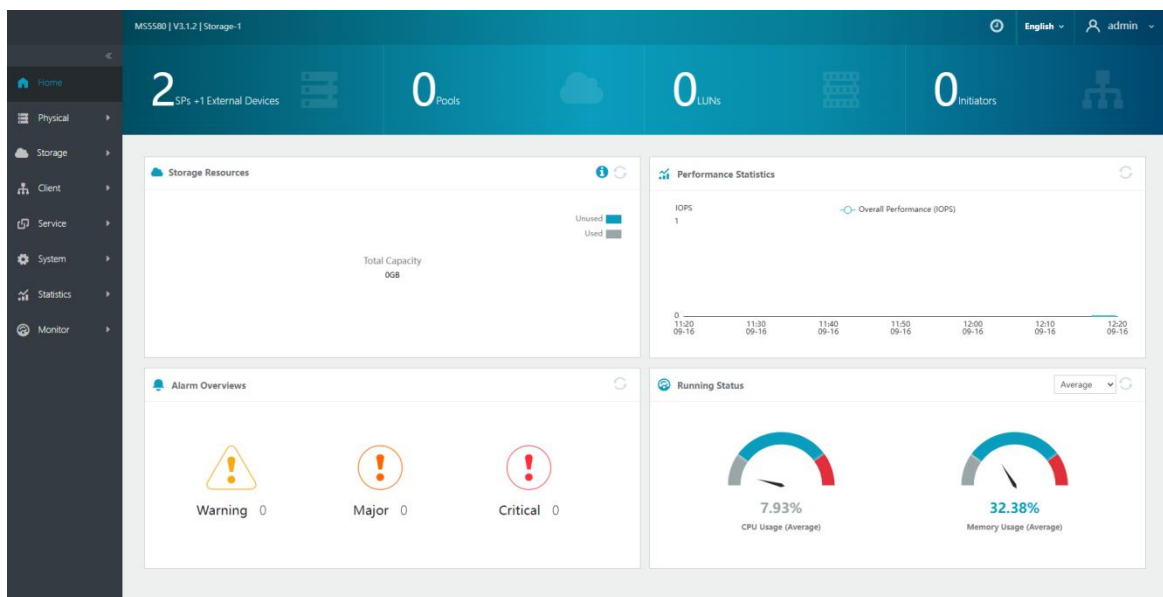


Figure 3-3 Home of ODSP Scope+ system view

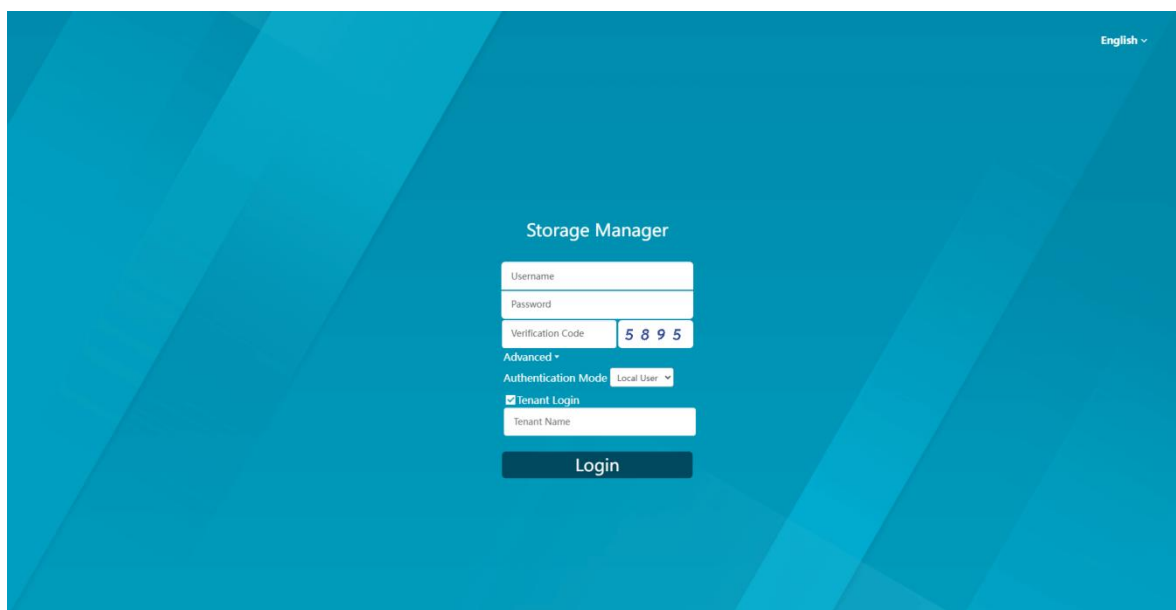


Figure 3-4 ODSP Scope+ tenant login interface

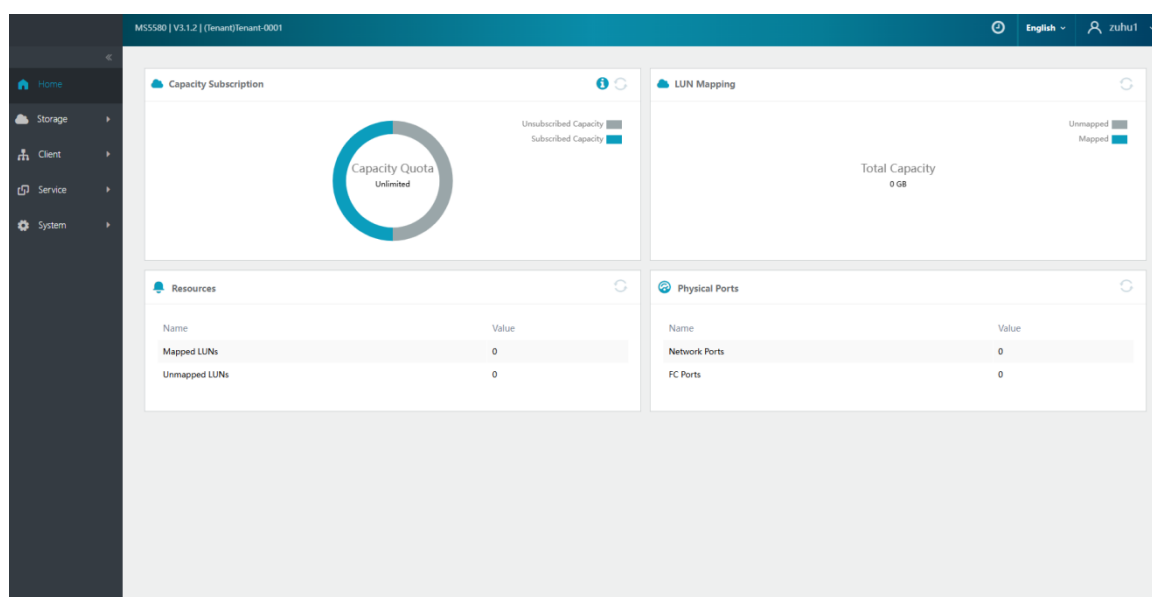


Figure 3-5 Home of ODSP Scope+ tenant view

3.3 Composition of ODSP Scope+ System View Interface

3.3.1 Interface Overview

All the information of the storage device is displayed on the typical interface of ODSP Scope+ system view interface, as shown in [Figure 3-6](#), which can be divided into five parts, including navigation tree, navigation bar, information display area, extended area and copyright display area.

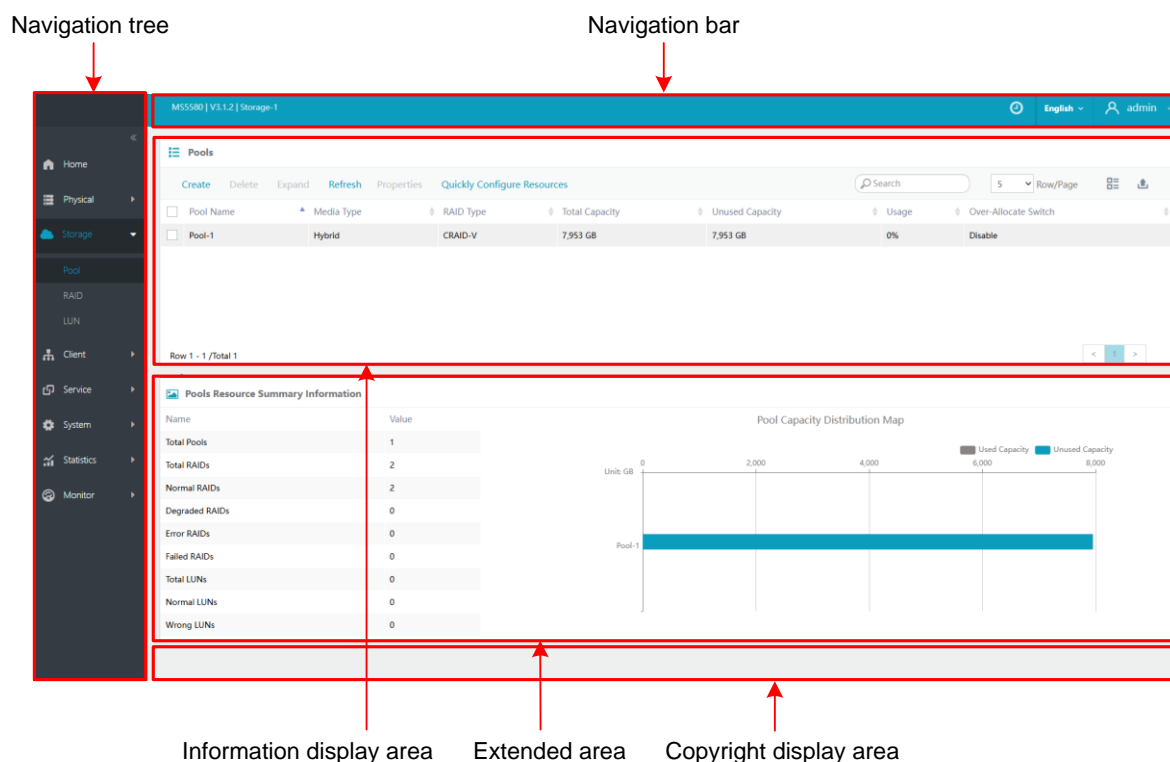


Figure 3-6 Example of ODSP Scope+ typical interface

3.3.2 Navigation Tree

The navigation tree is shown in [Figure 3-7](#), which displays the main nodes of storage devices with a tree view, including home, physical, storage, client, service, system, monitor, etc. Click any node can expand its sub-node, and click any sub-node to manage it.

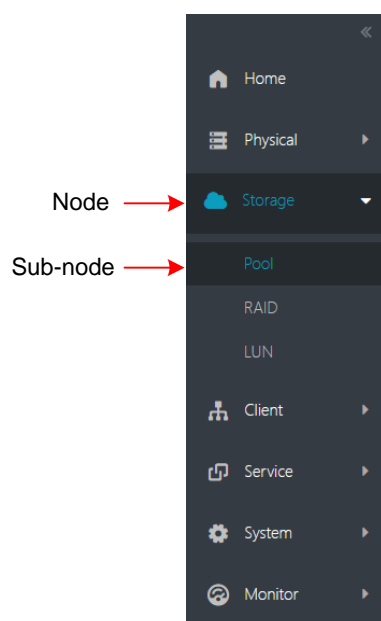


Figure 3-7 Example of ODSP Scope+ navigation tree

3.3.3 Navigation Bar

The navigation bar is shown in [Figure 3-8](#) and it mainly includes the following six parts.

- Device information: It displays the model, version number and name of the device.
- Time information: Click this icon to open the window of modifying device time to modify the device time.
- Concern information: It displays the summary of the concerns. Click this icon to view the concerns in the floating window, as shown in [Figure 3-9](#).
- Alarm information: It displays the summary of the current alarm of the device. Click this icon to expand the floating window to view the specific alarm items, as shown in [Figure 3-10](#).
- Language information: Both simplified Chinese and English are supported currently. Click this icon to switch languages.
- User information: It displays the current login user on the web interface. Click this icon to perform operations such as modifying login timeout, changing password and logging out of the login session.

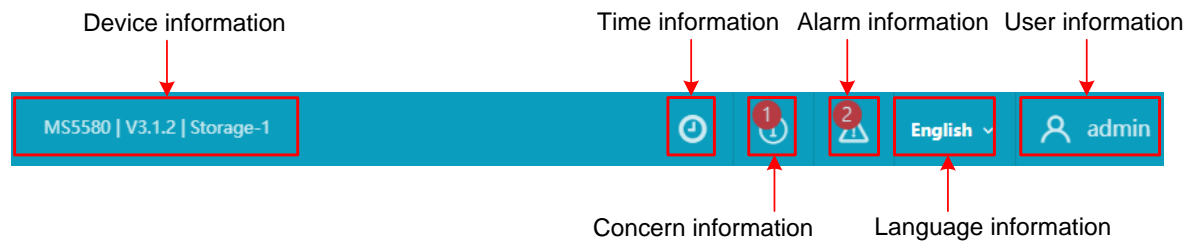


Figure 3-8 Example of ODSP Scope+ navigation bar

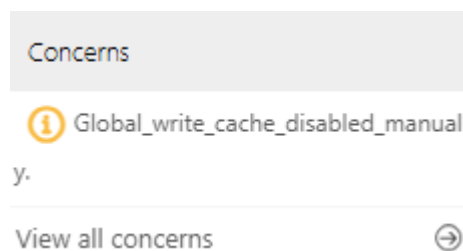


Figure 3-9 Example of ODSP Scope+ concerns

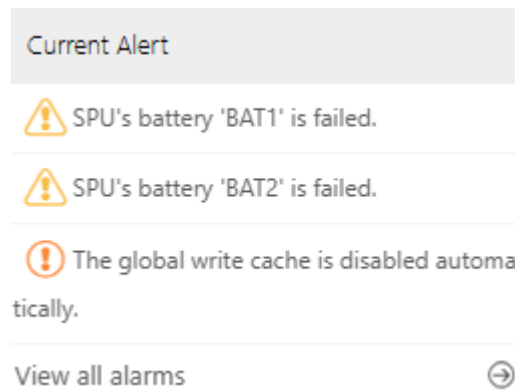


Figure 3-10 Example of ODSP Scope+ alarms

3.3.4 Information Display Area

The information display area is shown in [Figure 3-11](#), which visually displays the detailed information of the current selected navigation tree node through the table.

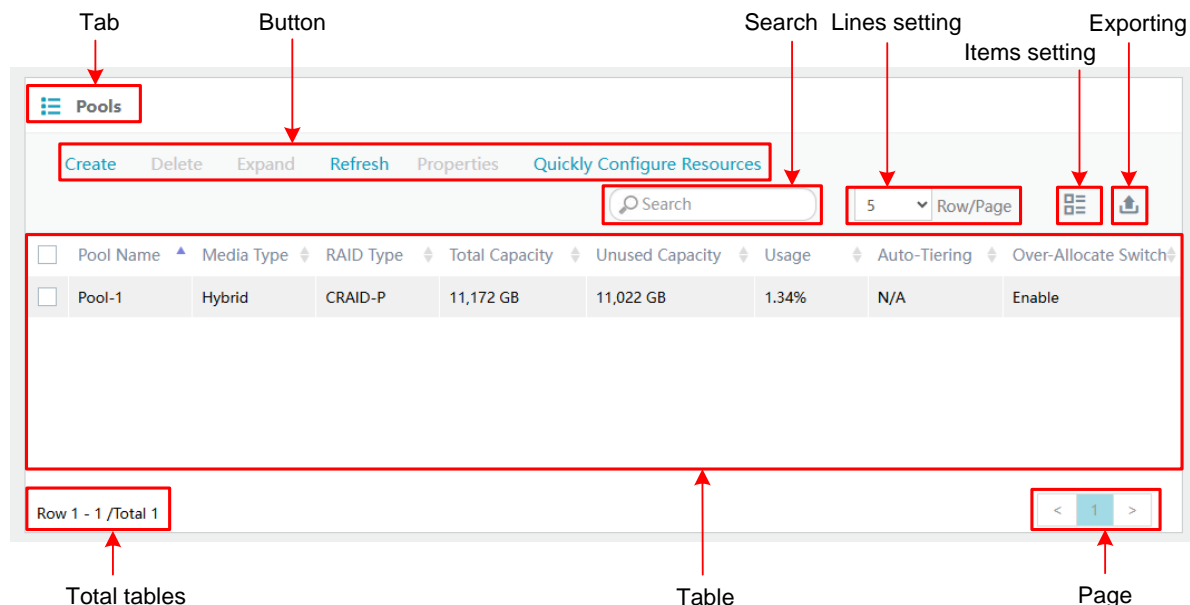


Figure 3-11 Example of ODSP Scope+ information display area

In the ODSP Scope+ information display area:

- You can click different tabs to view different tables in the case of multiple tabs.
- The supported operations will be displayed after selecting a row in the table. You can click the corresponding button to configure the operations as required. If you need to select multiple rows in the table, you can press Shift to select multiple lines at once.
- Resources can be quickly searched through the function of search. Multiple related objects including the members of Host group and consistency group are recommended to be created with the name of the same prefix for quick retrieval and usability improvement during operation.

- The display of the table can be adjusted through settings of lines and items, and the table data can also be directly exported through the export button.

3.3.5 Extended Area

Extended area displays the extension information of the selected node or line on the navigation tree or in the table respectively. The content of the extension area varies according to the selected item.

3.3.6 Copyright Display Area

The copyright display area shows the information of ODSP Scope+ copyrights.

3.4 Composition of ODSP Scope+ Tenant View Interface

3.4.1 Interface Overview

All the information of tenant is displayed on the typical interface of ODSP Scope+ tenant view interface, as shown in [Figure 3-12](#), which can be divided into four parts, including navigation tree, navigation bar, information display area and extended area.



Figure 3-12 Example of ODSP Scope+ typical interface

3.4.2 Navigation Tree

The navigation tree is shown in [Figure 3-13](#), which displays the main nodes of tenant with a tree view, including home, storage, client, service, system, etc. Click any node can expand its sub-node, and click any sub-node to manage it.

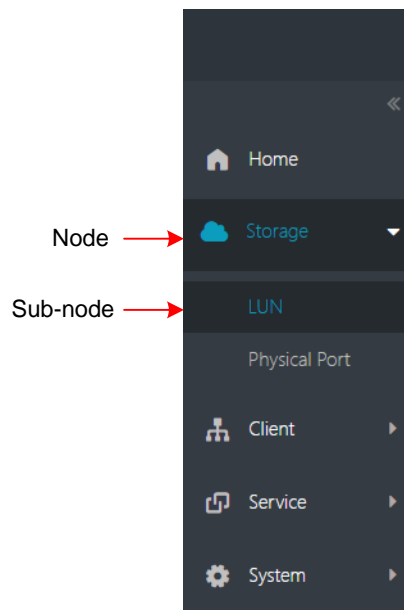


Figure 3-13 Example of ODSP Scope+ navigation tree

3.4.3 Navigation Bar

The navigation bar is shown in [Figure 3-14](#) and it mainly includes the following four parts.

- Device information: It displays the model, version number and name of the tenant.
- Time information: Click this icon to see the device time.
- Language information: Both simplified Chinese and English are supported currently. Click this icon to switch languages.
- User information: It displays the current login user on the web interface. Click this icon to perform operations such as changing password and logging out of the login session.



Figure 3-14 Example of ODSP Scope+ navigation bar

3.4.4 Information Display Area

The information display area is shown in [Figure 3-15](#), which visually displays the detailed information of the current selected navigation tree node through the table.

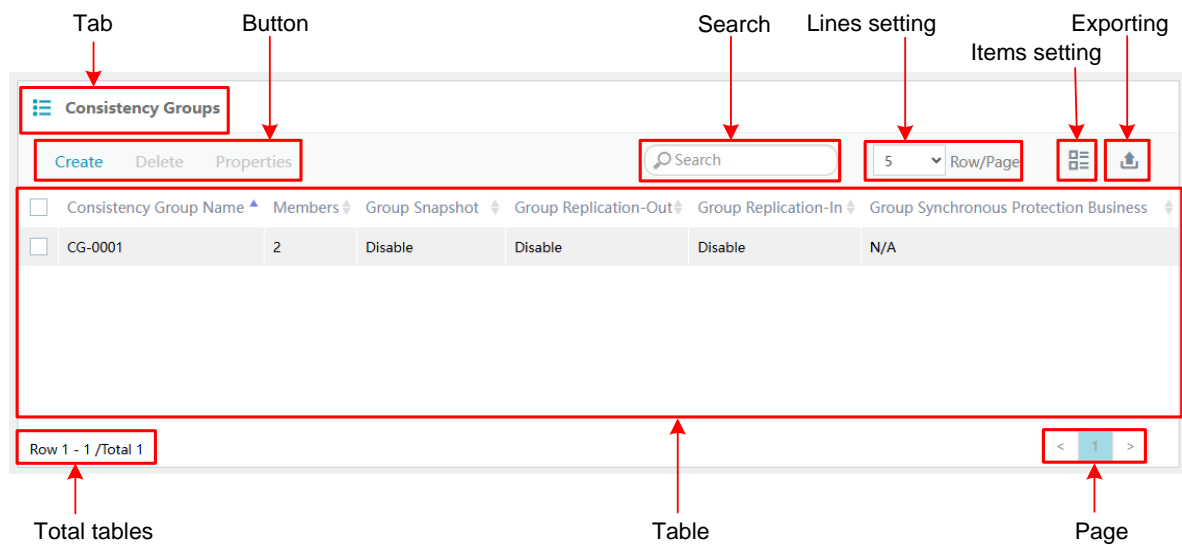


Figure 3-15 Example of ODSP Scope+ information display area

In the ODSP Scope+ information display area:

- You can click different tabs to view different tables in the case of multiple tabs.
- The supported operations will be displayed after selecting a row in the table. You can click the corresponding button to configure the operations as required. If you need to select multiple rows in the table, you can press Shift to select multiple lines at once.
- Resources can be quickly searched through the function of search. Multiple related objects including the members of consistency group are recommended to be created with the name of the same prefix for quick retrieval and usability improvement during operation.
- The display of the table can be adjusted through settings of lines and items, and the table data can also be directly exported through the export button.

3.4.5 Extended Area

Extended area displays the extension information of the selected node or line on the navigation tree or in the table respectively. The content of the extension area varies according to the selected item.

Part 2: Virtualization Feature

4 Introduction to Virtualization

4.1 Introduction to Virtualization

Nowadays, the existing storage device with diversified brands in most data centers leads to different problems such as management complexity, maintenance difficulty and business expansion limitation. Thanks to storage virtualization technology, the storage heterogeneous of different manufacturers and brands are integrated into a storage resource pool. After that, they are re-divided according to requirements, improving resource utilization and greatly simplifying the complexity of management and maintenance. At the same time, various businesses can be added to the existing storage devices based on the advanced software features on virtualized device, providing more flexible solutions on data migration and protection.

Assuming that storage devices of vendors A and B are used in the user environment, the original networking diagram is shown in [Figure 4-1](#).

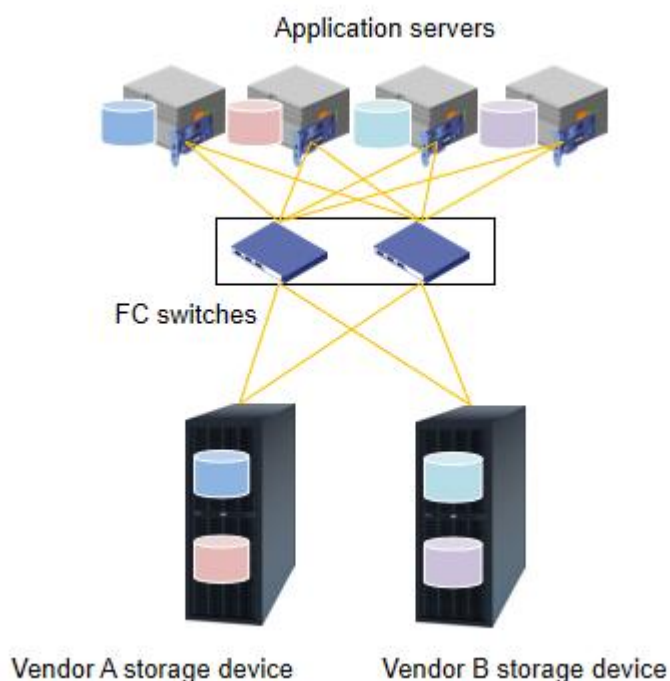


Figure 4-1 Original networking diagram

By adding a MacroSAN virtualization device, such as adding a virtualization gateway or configuring virtualization features on an existing storage device, the virtualization device can manage all or part of the resources in the back-end storage device uniformly. The networking diagram is shown in [Figure 4-2](#) and [Figure 4-3](#).

NOTE

The switches of both front-end and back-end can be the same in practical applications, and it is required to district the switch into zone to ensure there is no interference between links.

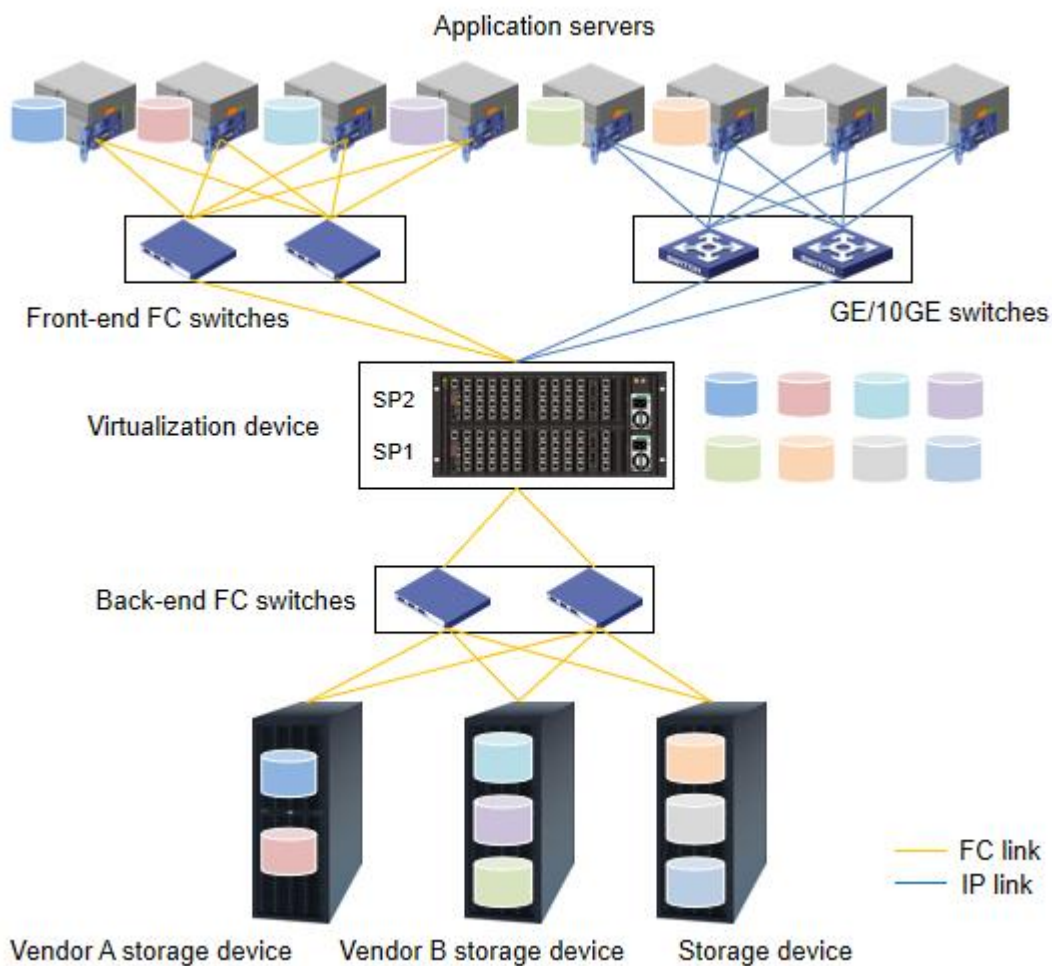


Figure 4-2 MacroSAN virtualization device (management of all resources)

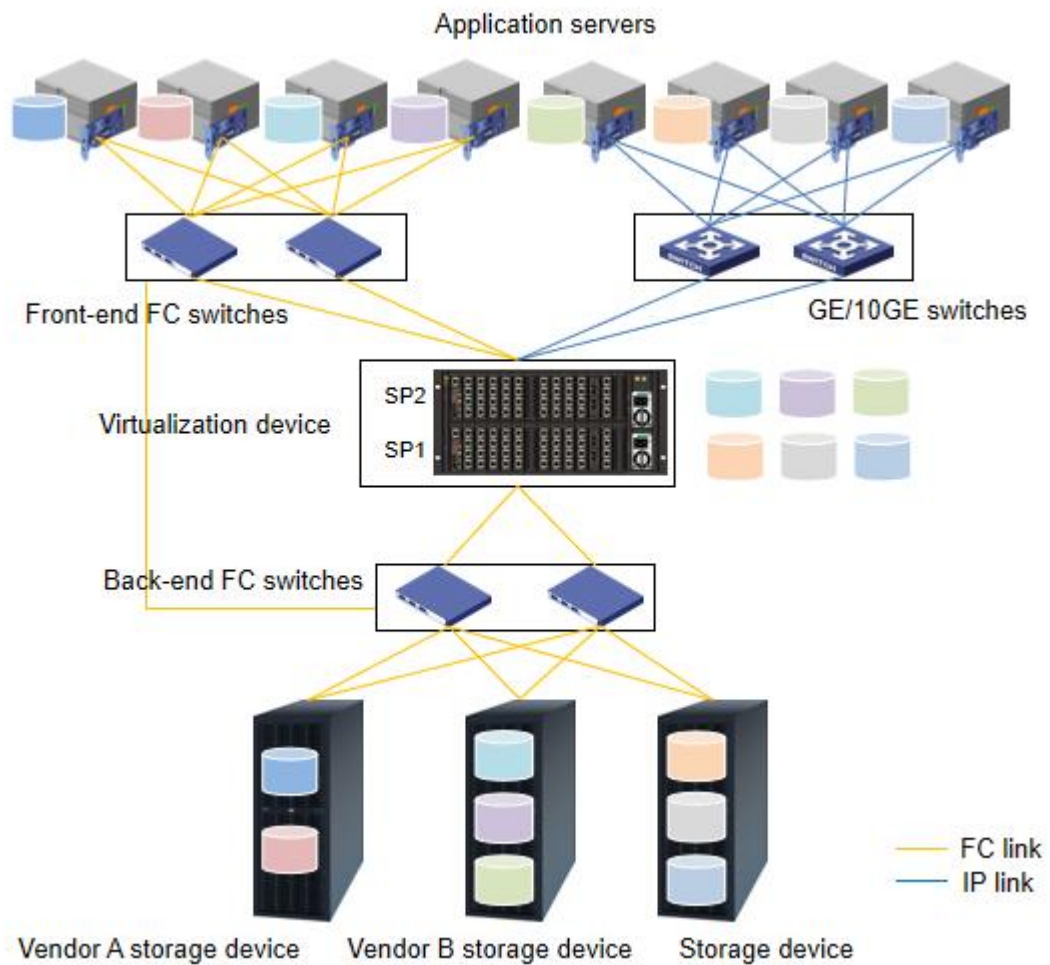


Figure 4-3 MacroSAN virtualization device (management of part resources)

Snapshot, Replication, Dual-Active and other features can be deployed for the LUN used on the front-end application server simultaneously through MacroSAN virtualization device. For details, see the user manual of relevant features.

4.2 Virtualization Key Terms

- **Virtualization device:** It refers to a storage device that provides virtualization function and centrally manages the storage space provided by the virtualized devices.
- **Virtualized device:** It is external device, also called back-end storage device, whose resources are allocated to virtualization devices for unified management of storage devices.
- **Front-end application server:** It refers to the server that uses the storage space provided by the storage device.
- **FC port work mode:** It refers to the usage of the FC port, including Initiator mode and Target mode.
- **FC adapter:** It refers to the FC port with Initiator mode.
- **Volume:** The LUN created on a back-end storage device is recognized as a volume after it is assigned to the virtualization device.

- Volume online status: It means whether the virtualization device can access the volume and is determined by the path state.
- Volume owning SP: It refers to the controller of the virtualization device that can access the volume and is determined by the path state.
- Volume attach status: The attach status of the volume is determined by user operations.
- RDV initialization: The volumes on the back-end storage device are directly provided to the front-end application server and the original data is reserved.
- RDV-LUN: It refers to the LUNs that are created based on volumes initialized in RDV mode and can be directly accessed by front-end application servers.

4.3 Definitions of Volume and RDV-LUN Status

4.3.1 Definition of Volume Online Status

- Online: There is at least 1 path to access the volume.
- Offline: There is no path to access the volume.

4.3.2 Definition of Volume Attach Status

- Attach: It indicates that the data flow on the volume is reachable.
- Detach: It indicates that the data flow on the volume is unreachable. If you need to stop writing data during maintaining the virtualized device, you can manually detach the corresponding volume on the virtualization device.

4.3.3 Definition of RDV-LUN Health Status

- Normal: It indicates that the corresponding volume is online.
- Error: It indicates that the corresponding volume is offline or detached, or there is an IO error on the back-end storage device.

4.4 Precautions for Virtualization

- Install at least one 16Gbps FC IO card on each controller with at least one FC port as an adapter.
- The FC ports on the virtualization device are used in pairs. In other words, the FC ports at the same position of each controller must be in the same work mode. Make sure to select the FC ports at the same position on each controller simultaneously when adding or removing adapters.
- It must be ensured that each controller of the virtualization device can access all the controllers of the virtualized device and virtualized LUNs to avoid HA takeover of the virtualization device and failure of related paths on the virtualized device, causing business interruption.

- Only reserved data can be virtualized. The LUN on the virtualized device is provided to the front-end application server directly and the original data is reserved.

5 Configuring Virtualization

5.1 Preparations before Configuring Virtualization

5.1.1 Activating Virtualization License

This section explains how to activate virtualization license.

NOTE

After activating successfully, the "Virtualization" sub-node will be displayed under the "Physical" node on the navigation tree.

Steps

Step 1: Select "System" -> "Setting" on the navigation tree to open the system setting interface.

Step 2: Click the <License Setting> button to open the **License Setting** window, enter a valid virtualization license, and click the <Activate> button to complete the configuration.

5.1.2 Managing Adapter

CAUTION

The FC ports on the virtualization device are used in pairs. In other words, the FC ports at the same position of each controller must be in the same work mode. Make sure to select the FC ports at the same position on each controller simultaneously when adding or removing adapters.

5.1.2.1. Adapter Naming Rules

Adapter naming rules: FC-Adapter-a:b:c, where a, b, and c are decimal numbers. The specific rules are as follows:

- a indicates the SP slot number.
- b indicates the slot number of the IO card.
- c indicates the port number on the IO card.

5.1.2.2. Adding FC Adapter

This section explains how to add FC adapter.

Steps

Step 1: Select "Physical" -> "Virtualization" on the navigation tree to open the virtualization interface.

Step 2: Click the <Add> button in the **Adapters** tab of the information display area to open the **Add FC Adapter** window, as shown in [Figure 5-1](#). Select desired adapter and click the <OK> button to complete the configuration.

Add FC Adapter

The selected FC port will work in Initiator mode.

<input type="checkbox"/>	SP Name	FC Port Name	Connection Status
<input type="checkbox"/>	SP1	FC-1:1:3	Disconnect
<input type="checkbox"/>	SP1	FC-1:1:4	Disconnect
<input type="checkbox"/>	SP2	FC-2:1:3	Disconnect
<input type="checkbox"/>	SP2	FC-2:1:4	Disconnect

Total 4 , Selected 0

OK

Cancel

Figure 5-1 Add FC adapter interface

5.1.2.3. Viewing Adapter Session

This section explains how to view FC adapter's session.

Steps

Step 1: Select "Physical" -> "Virtualization" on the navigation tree to open the virtualization interface.

Step 2: Select the desired adapter in the **Adapters** tab of the information display area and click the <View Session> button to open the **Sessions** window. You can view the adapter's session.

5.1.2.4. Removing FC Adapter

This section explains how to remove FC adapter.

Steps

Step 1: Select "Physical" -> "Virtualization" on the navigation tree to open the virtualization interface.

Step 2: Click the <Remove> button in the **Adapters** tab of the information display area to open the **Remove FC Adapter** window, as shown in [Figure 5-2](#). Select desired adapter and click the <OK> button to complete the configuration.

Remove FC Adapter

The selected FC port will work in Target mode.

<input type="checkbox"/>	SP Name	FC Port Name
<input type="checkbox"/>	SP1	FC-1:1:2
<input type="checkbox"/>	SP2	FC-2:1:2

Total 2 , Selected 0

OK

Cancel

Figure 5-2 Remove FC adapter interface

5.2 Allocating Resources for Virtualization Device

5.2.1 Checking Virtualized Device

Log in to the virtualized device and check the usage of the LUN that needs to be allocated to the virtualization device. If it has been allocated to the front-end application server:

- Please log in to the corresponding front-end application server, stop related business on the LUN, and ensure that the cache on the front-end application server has been refreshed and then disconnect its I_T connection with the virtualized device.
- Deallocate the LUN on the virtualized device.

5.2.2 Building Back-End Network

- Connect each controller of the virtualization device to the back-end network to ensure that each controller can access all controllers of the virtualized device.

- Log in to the virtualized device and ensure that all controllers can discover the Initiator corresponding to the adapter of the virtualization device.

5.2.3 Allocating Resources for Virtualization Device

Log in to the virtualized device and allocate a LUN to the virtualization device. Note that:

- It must be ensured that each controller of the virtualization device can access the virtualized LUN to avoid HA takeover of the virtualization device and failure of related paths on the virtualized device, causing business interruption.
- The access authority of LUN must be read and write.

5.2.4 Discovering Resources on Virtualization Device

This section explains how to automatically discover LUNs allocated to virtualization device.

NOTE

If the volume is not displayed or the volume information is incorrect, please click the <Scan> button to rescan.

Steps

Step 1: Select "Physical" -> "Virtualization" on the navigation tree to open the virtualization interface.

Step 2: Select the desired adapter in the **Adapters** tab of the information display area, click the <More> button, click the <Scan> button the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

5.3 Managing External Device

NOTE

The external device corresponding to the virtualized device will be added automatically when its LUN is discovered by virtualization device. If the operation fails, in other words, if there is no corresponding device in the **External Devices** tab, you can also try to add it manually.

5.3.1 Adding External Device

This section explains how to add external device manually.

Steps

Step 1: Select "Physical" -> "Virtualization" on the navigation tree to open the virtualization interface.

Step 2: Click the <Add> button in the **External Devices** tab of the information display area to open the **Add External Device** window, as shown in [Figure 5-3](#). Enter external device information (see [Table 5-1](#) for details) and click the <OK> button to complete the configuration.

Add External Device [X]

Name: *

Vendor: *

Serial Number:

Description:

Target WWN +

No Data Record

Figure 5-3 Add external device interface

Table 5-1 Description of the parameters for Adding external device interface

Parameter	Description
Name	It refers to the name of external device. <ul style="list-style-type: none"> Length: 1-63 characters. Valid character range: [a-zA-Z0-9.-_:].
Vendor	It refers to the manufacturer name of external device.
Serial Number	It refers to the serial number of external device.
Description	It refers to the description of external device.
Target WWN	It refers to the Target WWN of external device.

5.3.2 Viewing External Device Properties

This section explains how to view external device's basic properties.

Steps

Step 1: Select "Physical" -> "Virtualization" on the navigation tree to open the virtualization interface.

Step 2: Select the desired external device in the **External Devices** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. You can view the basic properties of the external device.

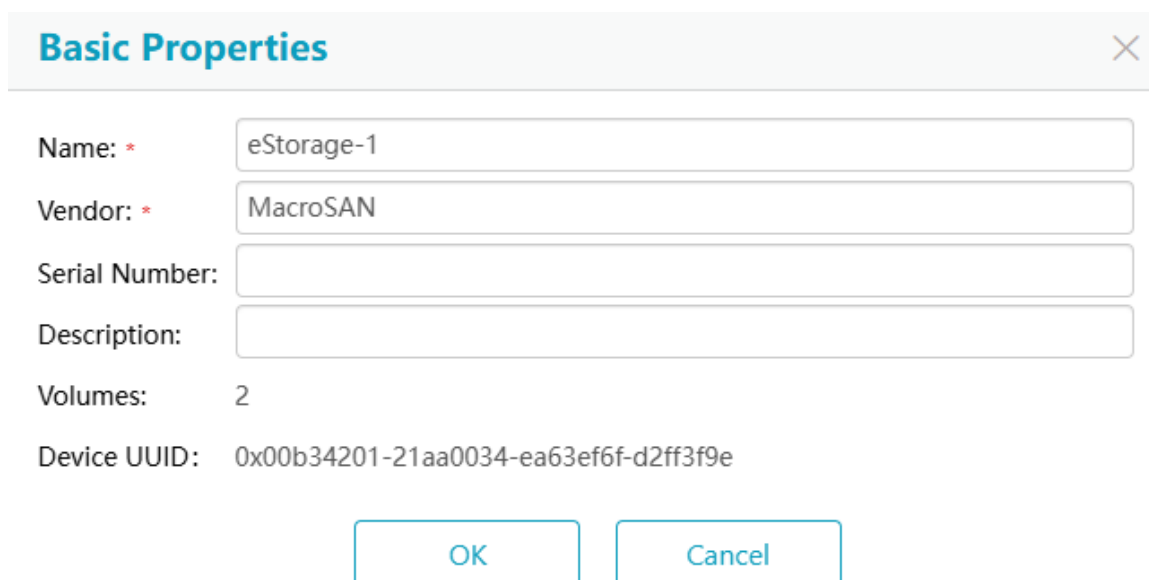
5.3.3 Modifying External Device Properties

This section explains how to modify external device's name, vendor, serial number and description.

Steps

Step 1: Select "Physical" -> "Virtualization" on the navigation tree to open the virtualization interface.

Step 2: Select the desired external device in the **External Devices** tab of the information display area and click the <Properties> button to open the **Basic Properties** window, as shown in [Figure 5-4](#). Modify the properties of external device (see [Table 5-1](#) for details) and click the <OK> button to complete the configuration.



The image shows a 'Basic Properties' dialog box with a title bar containing the text 'Basic Properties' and a close button (X). The dialog contains several input fields and labels: 'Name: *' with a text box containing 'eStorage-1'; 'Vendor: *' with a text box containing 'MacroSAN'; 'Serial Number:' with an empty text box; 'Description:' with an empty text box; 'Volumes:' with the value '2'; and 'Device UUID:' with the value '0x00b34201-21aa0034-ea63ef6f-d2ff3f9e'. At the bottom of the dialog are two buttons: 'OK' and 'Cancel'.

Figure 5-4 External device basic properties interface

5.3.4 Deleting External Device

This section explains how to delete external device.

Prerequisites

There is no volume in the external device.

Steps

Step 1: Select "Physical" -> "Virtualization" on the navigation tree to open the virtualization interface.

Step 2: Select the desired external device in the **External Devices** tab of the information display area, click the <Delete> button, and click the <OK> button in the pop-up confirmation box to complete the configuration.

5.4 Managing Volume

5.4.1 Viewing Volume Properties

This section explains how to view volume's general information and paths.

Steps

Step 1: Select "Physical" -> "Virtualization" on the navigation tree to open the virtualization interface.

Step 2: Select the desired external device in the **External Devices** tab of the information display area, select the desired volume in the extended area, and click the <Properties> button to open the **Basic Properties** window. You can view basic properties of the volume.

5.4.2 Renaming Volume

This section explains how to modify volume's name.

Steps

Step 1: Select "Physical" -> "Virtualization" on the navigation tree to open the virtualization interface.

Step 2: Select the desired external device in the **External Devices** tab of the information display area, select the desired volume in the extended area, and click the <Properties> button to open the **Basic Properties** window. The **General** tab is shown in [Figure 5-5](#). Modify the volume name and click the <Apply> button to complete the configuration.

Basic Properties

General

Paths

Volume Name:*	<input type="text" value="Volume-1"/>
Capacity:	100 GB
WWN:	600B342AD3CD38E68BE38C350D000031
Vendor:	Storage
Device UUID:	N/A
Model:	LU
Online Status:	Online(All)
Attach Status:	Attached
IO Error Flag:	No
Thin Provisioning:	Disable
Owning Pool:	N/A
Owning LUN:	N/A
Owning External Device:	eStorage (undefined)

OK

Apply

Cancel

Figure 5-5 Volume basic properties interface

5.4.3 Detaching Volume

This section explains how to detach volume. If you need to stop the data writing of the virtualization device during the maintenance of virtualized device, you can manually detach the corresponding volume on the virtualization device.

⚠CAUTION

After detaching the volume, data flow on the volume will be unreachable. Please do not detach volume unless necessary.

Prerequisites

Before detaching the volume, if an RDV-LUN has been created on the volume, manually disable the write cache of the corresponding RDV-LUN to avoid data loss in the write cache.

Steps

Step 1: Select "Physical" -> "Virtualization" on the navigation tree to open the virtualization interface.

Step 2: Select the desired external device in the **External Devices** tab of the information display area, select the desired volume in the extended area, click the <Detach> button, and click the <OK> button in the pop-up confirmation box to complete the configuration.

5.4.4 Attaching Volume

This section explains how to attach volume.

Steps

Step 1: Select "Physical" -> "Virtualization" on the navigation tree to open the virtualization interface.

Step 2: Select the desired external device in the **External Devices** tab of the information display area, select the desired volume in the extended area, click the <Attach> button, and click the <OK> button in the pop-up confirmation box to complete the configuration.

5.4.5 Expanding Volume

If you need to expand the volume, please expand the corresponding LUN on the virtualized device firstly. After expanding successfully, scan on the virtualization device to update the volume information.

NOTE

If an RDV-LUN has been created for the volume, you need to manually expand its capacity. After expansion, the capacity of the RDV-LUN is only updated to the new capacity of the corresponding volume. If the RDV-LUN has been allocated to the front-end application server, you need to manually scan on the front-end application server and complete the post-expansion processing.

5.5 Managing RDV-LUN

5.5.1 Creating RDV-LUN

This section explains how to create RDV-LUN based on the attached volume.

Steps

Step 1: Select "Physical" -> "Virtualization" on the navigation tree to open the virtualization interface.

Step 2: Select the desired external device in the **External Devices** tab of the information display area and click the <Create RDV-LUN> button in the extended area to open the **Create RDV-LUN** window, as shown in [Figure 5-6](#). Enter relevant parameters (see [Table 5-2](#) for details), select the

desired volume, click the <OK> button, and click the <OK> button in the pop up confirmation box to complete the configuration.

Create RDV-LUN

Pool: Pool-1

Virtualization Mode: Offline Virtualization

Volume ID: Not reserved

Please select a volume:

<input type="checkbox"/>	Volume Name	Capacity	Online Status
<input type="checkbox"/>	Volume-1	100 GB	Online(All)
<input type="checkbox"/>	Volume-2	100 GB	Online(All)

Total 2 , Selected 0

< 1 >

Name: RDV-LUN-0001

Show Advanced Parameters

OK

Cancel

Figure 5-6 Create RDV-LUN interface

Table 5-2 Description of the parameters for creating RDV-LUN interface

Parameter	Description
Pool	It refers to the owning pool of the RDV-LUN.
Virtualization Mode	<p>It refers to the virtualization of the RDV-LUN, including online virtualization and offline virtualization. The default value is offline virtualization.</p> <ul style="list-style-type: none"> Online Virtualization: It means adding a new path without disconnecting the original path before virtualization. If the new path is available, the original path will be disconnected, after the virtualization, you need to manually enable the read cache and write cache of the RDV-LUN. Offline Virtualization: It means disconnecting the original path before virtualization and services can be provided on a new path. It is

	<p>recommended to select "Not reserved" for Volume ID. It is suggested to use this mode.</p> <hr/> <p>⚠CAUTION</p> <p>If you need online virtualization, please contact to manufacturer technical supporters for confirmation in advance.</p> <hr/>
Volume ID	<p>It refers to whether to reserve the original WWN, model, and vendor of the volume, including the following three strategies:</p> <ul style="list-style-type: none"> • Not reserved: The device allocates a new WWN, vendor and model to the RDV-LUN. • Semi reserved (Only reserve volume WWN only): Keep the WWN information of the original volume. • All reserved (Reserve volume WWN, Vender, Model, etc.): Keep all information of the original volume. <hr/> <p>⚠CAUTION</p> <p>If an all reserved or semi reserved RDV-LUN has a bypass path, ensure that the read cache and write cache of the RDV-LUN are disabled. Otherwise, services may be affected.</p> <hr/>
Name	<p>It refers to the name of RDV-LUN.</p> <ul style="list-style-type: none"> • Length: 1-63 characters. • Valid character range: [a-zA-Z0-9.-_:].
Access Type	It refers to the access type of RDV-LUN.
Owing SP	It refers to the controller of RDV-LUN, including auto, SP1 and SP2.
Read Cache	It refers to enabling or disabling the read cache of RDV-LUN.
Write Cache	It refers to enabling or disabling the write cache of RDV-LUN

5.5.2 Expanding RDV-LUN

This section explains how to expanding RDV-LUN.

NOTE

- The capacity of the RDV-LUN cannot be expanded when it has reached the maximum capacity of the volume.
- The capacity of the RDV-LUN is only updated to the new capacity of the corresponding volume during expansion.

Steps

Step 1: Select "Storage" -> "LUN" on the navigation tree to open the LUN interface.

Step 2: Select the desired RDV-LUN in the **LUNs** tab of the information display area, click the <Expand> button, and click the <OK> button in the pop-up confirmation box to complete the configuration.

5.5.3 Batch Modifying RDV-LUN Write Cache

This section explains how to batch modify RDV-LUN's write cache.

⚠CAUTION

If an all reserved or semi reserved RDV-LUN has a bypass path, ensure that the read cache and write cache of the RDV-LUN are disabled. Otherwise, services may be affected.

Steps

Step 1: Select "Storage" -> "LUN" on the navigation tree to open the LUN interface.

Step 2: Select the <More> button in the **LUNs** tab of the information display area, click the <Batch Modify LUN Write Cache> button in the drop-down menu to open the **Batch Modify LUN Write Cache** window, as shown in [Figure 5-7](#). Enable/Disable write cache, select pool and RDV-LUN, and click the <Confirm> button to complete the configuration.

Batch Modify LUN Write Cache

Pool:

Pool-1

Write Cache:

☐ Enable
 ☒ Disable

Please select the LUN to be operated:

☐

LUN Name

Write Cache

Write Cache Status

<input type="checkbox"/>	RDV-LUN-0001	Enabled	Disabled
<input type="checkbox"/>	RDV-LUN-0002	Enabled	Disabled

Total 2 , Selected 0

<

1

>

☒ Display RDV-LUN Only

Confirm

Cancel

Figure 5-7 Batch modify LUN write cache interface

5.5.4 Deleting RDV-LUN

This section explains how to delete RDV-LUN.

Steps

Step 1: Select "Storage" -> "LUN" on the navigation tree to open the LUN interface.

Step 2: Select the desired RDV-LUN in the **LUNs** tab of the information display area, click the <Delete> button, enter "yes" in the pop-up warning box, and click the <OK> button to complete the configuration.

NOTE

The option of "Automatically disable the write cache of the RDV-LUN, and delete the RDV-LUN after disabling succeeded" is selected by default when you deleting RDV-LUNs.

6 Virtualization and Other Features

6.1 Virtualization and Thin Provisioning

A thin provisioning LUN is created on the virtualized device and allocated to the virtualization device. And an RDV-LUN will be created on the virtualization device based on the corresponding volume. After being allocated to the front-end application server, the RDV-LUN will be used as a Thick-LUN on the front-end application server.

6.2 Virtualization and Snapshot

The operations of configuring snapshots on the RDV-LUN are the same as those of Thick-LUNs. For details, see *MacroSAN MS Series Storage Devices Snapshot Feature GUI User Manual*.

CAUTION

If snapshot is planned to be enabled on the RDV-LUN, the snapshot resource must be created based on a local RAID, and RDV-LUN cannot be used as a snapshot resource.

6.3 Virtualization and Replication

The operations of configuring replication on the RDV-LUN are the same as those of Thick-LUNs. For details, see *MacroSAN MS Series Storage Devices Replication Feature GUI User Manual*.

CAUTION

If replication is planned to be enabled on the RDV-LUN:

- Snapshot resources must be created based on local RAID, and RDV-LUN cannot be used as snapshot resources.
 - If the primary LUN is an RDV-LUN and its capacity is not an integer multiple of GB, the replica LUN will be created by rounding up with the GB unit and a small amount of space will be wasted.
-

6.4 Others

The operations of configuring other features on the RDV-LUN are the same as those of Thick-LUNs. For details, see corresponding user manual.

Appendix A. Device Default Configurations

The default configurations of the device are shown in [Table 6-1](#).

Table 6-1 Device default configuration

Item	Default
Device name	Storage-1
IP address of the SP1 management network port	192.168.0.210
IP address of the SP2 management network port	192.168.0.220
IP address of the SP3 management network port	192.168.0.230
IP address of the SP4 management network port	192.168.0.240
Administrator	admin
Password	admin

Appendix B. Device External Ports Summary

Device external ports list is shown in [Table 6-2](#).

Table 6-2 Device external ports summary

Port name	Port number	Protocol	Switch	Description
FTP listen port	21	TCP	On by default	Files cannot be uploaded/downloaded through GUI when it is off.
SSH listen port	22	TCP	On by default	SSH cannot be logged in when it is off.
DNS port	53	TCP/UDP	On by default	DNS cannot be used when it is off.
SNMP listen port	161	UDP	On by default	SNMP function on Get and Set cannot be used when it is off.
iSCSI listen port	3260	TCP	On by default	iSCSI cannot be used when it is off.
Universal VM Console port	8081	TCP	On by default	VM cannot be used when it is off.
【VVOL】 HTTPS listen port	8443	TCP	On by default	GUI cannot be used when it is off.
【VVOL】 HTTPS service listen port	8448	TCP	On by default	VVOL cannot be used when it is off.
Smart enclosure Internet configuration port	8888	TCP	On by default	Smart enclosure Internet auto configuration cannot be used when it is off.
Webservice listen port	9090	TCP	On by default	Cannot off.
	10100	TCP	On by default	Cannot off.
replication listen port	15500	TCP	On by default	Replication cannot be used when it is off.
	15510	TCP	On by default	Replication cannot be used when it is off.
mirror listen port	15550	TCP	On by default	Dual-active or mirror cannot be used when it is off.
mirror link detection port	16666	UDP	On by default	Dual-active or mirror cannot be used when it is off.
XAN Internet listen port	15775	TCP	On by default	Functions related to XAN cannot be used when it is off.

Appendix C. Glossaries

A

Active-Backup	It is a port aggregation mode. The traffic model between member ports is active/standby mode.
----------------------	---

B

Balance-RR	It is a port aggregation mode. The traffic model between member ports is load balance mode.
-------------------	---

C

Cache	Cache is one of the important performance optimizations for storage devices. It improves storage read/write performance by storing frequently accessed data in high-speed physical memory. At the same time, it identifies hotspots in advance and pre-reads corresponding data into high-speed physical memory, further improving storage read performance.
--------------	--

Cache--Dirty Data	It refers to the reserved data in the write cache yet has not been flushed to disks.
--------------------------	--

Cache--Dynamic Allocation	It means that the system dynamically adjusts the cache space occupied by each LUN in accordance with the corresponding traffic in the current statistical cycle to optimize overall utilization of the system cache.
----------------------------------	--

Cache--Frozen Cache	It means that the dirty data in the cache cannot be successfully down-flushed to the disk and is temporarily stored in the cache because of RAID failure or other reasons.
----------------------------	--

Cache--Fixed Allocation	It means that the system allocates cache space for LUNs based on the set percentage.
--------------------------------	--

Cache--Read-ahead	In the read cache field, the read-ahead function can be used to identify hotspots in advance and pre-read the corresponding data from the disk to the read cache, further improving the read performance of the storage. It is suitable for situations where the traffic model is sequential reads.
--------------------------	---

CLI	One of the management interfaces of the storage device, which manages the device through the command line interface.
------------	--

Console ETH Port	The network ports designed for management.
-------------------------	--

D

Data Reduction	It refers to the technology of reducing data storage space. In this manual, data reduction mainly means data deduplication and data compression.
-----------------------	--

Data Reduction--Compression	Data compression is a data reduction technology that re-encodes data by a specific algorithm to reduce storage space.
------------------------------------	---

Data Reduction--DDSR	A data copy shared resource that used to store all data of reduction LUN and deduplication metadata.
-----------------------------	--

Data Reduction--Deduplication	Data deduplication is a data reduction technology that reduces the physical storage capacity occupied by data through deleting redundant data blocks in the storage system.
Data Reduction--Reduction Ratio	It refers to the ratio of the amount of data written by the user to the amount of data actually written to the disk.
DSU	Disk Shelf Unit (DSU), commonly refers to a disk enclosure, which consists of Expander Processors (EP), fan modules, battery modules, power supply modules and disk modules, so as to achieve storage device expansion. DSU can be divided into SAS disk enclosure and NVMe disk enclosure according to the protocol types they supported.
Dual-Active LUN	It consists of two LUNs, which are primary LUN and mirror LUN.
Dual-Active--Mirror Role	It refers to the role of the LUN in dual-active LUNs, which includes primary LUN and mirror LUN.
Dual-Active--Primary LUN and Mirror LUN	It refers to the two LUNs in dual-active LUN. The primary LUN is always synchronized to mirror LUN when the data in the two LUNs are different.
Dual-Active--Reverse	It refers to reversing the mirror role of two LUNs in the dual-active LUNs.
Dual-Active--Synchronize	It refers to the process of synchronizing the data in primary LUN to mirror LUN when the data in the two LUNs are different.
E	
EP	Expander Processor (EP) commonly refers to a disk enclosure controller, which can be installed in a Disk Shelf Unit (DSU) to achieve back-end data processing and distribution of storage devices.
F	
Fabric	A network topology structure in which nodes transmit data to each other through interconnection switches, such as InfiniBand, Ethernet (RoCE, iWARP), FC, etc. Fabrics in this manual are based on RDMA standards.
FC Adapter	It refers to the FC port that is set to Initiator mode.
FC Port Working Mode	It refers to the usage of the FC port, including Initiator mode, Target mode and NVMe mode, and the default mode is Target.
FP	Fabric Processor (FP) commonly refers to smart switch enclosure controller, which can be installed in an FSU (Fabric Switch Unit) to achieve back-end data processing and distribution of storage devices.
Front-End Application Server	It refers to the servers that use the storage space provided by the storage device.
FSU	FSU (Fabric Switch Unit) commonly refers to smart switch enclosure and consists of FPs (Fabric Processors), fan modules, battery modules, power supply modules and disk modules, so as to achieve business processing, disk swap, storage device capacity expansion and other functions.

G

Gateway	A gateway refers to a network that serves as an entry node to another network.
GUI	Graphical User Interface (GUI) is one of the management interfaces of storage devices, which is used to manage the devices through words and figures.
H	
HA	The storage device includes dual-controller or quad-controller, and each controller is set to Active mode by default, providing external business. If one controller fails, the others will automatically take over its business to ensure business continuity. Once the faulty controller is fixed, it will resume its original tasks and all controllers will be back in Active mode.
HA--Recovery	It refers to the process of reloading the original business of the faulty controller after it recovers.
HA--Takeover	It refers to the process in which when one controller in a storage device fails, another controller automatically takes over its business.
HotCache	It is an important performance optimization for storage devices. SSDs are used as the second-level cache of storage devices based on their high-speed access feature, improving the overall read performance of storage devices.
HotCache--LUN	It refers to the LUN created based on HotCache-RAID and dedicated by HotCache function.
HotCache--Pool	It refers to the pool to which HotCache-RAID and HotCache-LUN belong.
HotCache--RAID	It refers to the RAID created through SSD and dedicated by HotCache function.
Hot Spare Disk	It refers to disks that can be used for rebuilding after redundant RAID degradation.
Hot Spare Disk--Blank Hot Spare Disk	When RAID needs to be rebuilt in the case of blank disk hot spare is enabled, if there is no dedicated hot spare or available global hot spare, a blank disk that meets the requirements in the storage device will be used for rebuilding, and there is no need to manually set the disk as a hot spare, greatly simplifying the operations of the storage administrator.
Hot Spare Disk--Dedicated Hot Spare Disk	Dedicated hot spare disk can only be used by corresponding RAID.
Hot Spare Disk--Global Hot Spare Disk	A global hot spare can be used by all RAIDs in the system, provided that the type and capacity of the global hot spare meet the requirements of the RAID that needs to be rebuilt.
I	
Initiator	It usually means the application server, which is the Initiator of commands and requests in SCSI protocol.
iSCSI	It is a standard network protocol for high-speed data transmission based on Ethernet.

iSCSI--Bi-directional CHAP Authentication

It means Initiator and Target can authenticate each other. Bi-directional CHAP authentication is enabled on the base of uni-directional CHAP authentication. Set specified authentication username and password for the Initiator on the application server; Enable bi-directional CHAP authentication for iSCSI Target on the storage device, and enter this user name and password; When the application server initiates an iSCSI connection request, it will determine whether the CHAP authentication information returned by the storage device is consistent with the authentication information preset by the Initiator, if yes, the connection can be established; if not, the establishment fails.

iSCSI--CHAP Authentication

It is a password-based query response authentication protocol.

iSCSI--Uni-directional CHAP Authentication

It means authentication of Target on Initiator. Enable CHAP authentication for Initiator on the storage device, and set username and password; When using the Initiator on the application server to connect to the storage device, enter the corresponding username and password; When the storage device receives the iSCSI connection request, it checks whether the authentication information carried in the iSCSI connection request is consistent with the preset authentication information in the storage device. If yes, the connection can be established. If not, the connection establishment fails.

L

LUN

It refers to logical storage space accessible to client servers.

LUN--Owing SP

The default ownership of a LUN is set by the user, which means that the created LUN is assigned to a certain controller. When HA switches, it will be automatically switched to the peer controller for management, and the current ownership will change; When the HA status returns to normal, it will be automatically switched back to the local controller for management.

M

Management PC

It refers to the laptop, PC or server that is used to run ODSP Scope.

Multi-Tenant

Multi-tenant is a new resource management technology, the core of which is to provide shared storage resources for multiple branches or departments based on the same physical storage system.

N

NDM

Non-interrupt Data Migration.

NVMe

Non-Volatile Memory express, which is an interface specification for logical device. It is used to access to non-volatile storage media through PCIe bus, greatly improving the storage performance.

NVMf

NVMe over fabrics, which is a technology that access to NVMe through the fabric such as RDMA or optical fiber channel architecture on the base of NVMe protocol.

O

ODSP	Open Data Storage Platform (ODSP) is a special storage software platform developed by MacroSAN Technologies Co., Ltd independently. It is applicable to all series of MacroSAN storage devices, providing advanced data security, business continuity, flexible scalability, open customization and rich storage features for storage devices.
ODSP Scope	Open Data Storage Platform Scope (ODSP Scope) is a GUI management tool for storage devices based on MacroSAN ODSP software platform. It adopts CS architectures and provides a Java-based management interface.
ODSP Scope+	Open Data Storage Platform Scope+ (ODSP Scope+) is an upgraded version of ODSP Scope featured by BS architectures with web-based management interface, providing easier management of the entire system for administrators.
P	
Pool	A pool is a resource zone, which contains a group of disks, RAIDs and LUNs. The data can flow within the pool by Cell to implement dynamic allocation and management of storage resources.
Port Aggregation	It refers to binding two or more physical network ports into one aggregated port, where any member port disconnection does not affect business continuity.
Power Off Disk Safely	The sudden power failure of the disk may cause the magnetic head to scratch the disk surface, resulting in disk media errors. Therefore, software is used to stop and power off the disk normally, and then prompt the user to manually remove the disk to protect the disk.
R	
R3DC	It refers to create XANs between three data centers, and then enabling dual-active/synchronous + asynchronous replication to achieve a multi data center disaster recovery. The coexistence of three data centers ensures the continuity of business in the event of a disaster in any two data centers, greatly improving the availability of disaster recovery solutions.
RAID	RAID is a protection mechanism that combines multiple independent physical disks in different ways to form a disk group, providing higher storage performance than a single disk and supporting data redundancy.
RAID Level	It refers to different data organization ways, commonly including RAID0, RAID1, RAID5, RAID6, RAID10, RAIDx-3, etc.
RAID--Non-redundant	Non-redundancy means that there is no redundancy protection for data in a RAID array. If a member disk of the RAID array fails or is removed, some or all data in the RAID array becomes inaccessible.
RAID Rebuild	It refers to the process of using a hot spare to rebuild and restore RAID redundancy after a redundant RAID is downgraded.
RAID--Redundant	Redundancy means that data in a RAID array is redundant. If a member disk fails or is removed from the RAID array, data availability in the RAID array is not affected.

RDV Initialization	The volumes on the back-end storage device are directly provided to the front-end application server and the original data is reserved.
RDV-LUN	It refers to the LUNs that are created based on volumes initialized in RDV mode and can be directly accessed by front-end application servers.
Reduction LUN	It refers to the LUN with enabled deduplication and/or compression, including deduplication LUN, compression LUN and deduplication and compression LUN.
Replication	Replication is one of the commonly used data protection methods, which refers to the process of replicating data from the primary resource to the replica resource according replication mode initiated by source device after the replication relationship is configured.
Replication--Activate/Suspend Replication Policy	Replication policies can be manually suspended or activated for replication pairs. After suspending the replication policy, replication will not be performed when the policy is met next time. The policy will not take effect until it is activated again. Suspending operation does not affect the current replication in progress.
Replication—Activate/Suspend Replication Mode Switching Policy	Replication pair's replication mode switching policy can be suspended or activated manually. After suspending a replication mode switching policy, replication mode will not be switched automatically until the policy is reactivated in the case of its replication mode switching policy is met.
Replication-in and Replication-out	It means the replication direction. The primary resource is replication-out and the replica resource is replication-in in one replication pair.
Replication--Initial Replication	It refers to the first replication process between primary resource and replica resource.
Replication--Local Replication and Remote Replication	Local replication refers to the replication in one device, which means both the primary resource and the replica resource are in the same device. Remote replication refers to the replication in different devices, which means the primary resource and the replica resource are in different devices. The link of remote replication is usually on wide-area network.
Replication Mode Switching Policy	Replication is switched automatically according to the set replication mode switching policy.
Replication Pair	It refers to the primary resource and replica resource of replication.
Replication Policy	It refers to the time policy configured by the user, and when the time policy is met, replication function will be triggered automatically by the replication source device.
Replication--Primary Resource and Replica Resource	The primary resource refers to the production data volume in the production center, while the replica resource refers to the data replica in the disaster recovery center. When replication is triggered, the data in primary resource is always replicated to the replica resource.
Replication--Scan	For replication pairs, the scanning operation allows you to obtain the differential data of the primary and replica resources, so that only the differential data is replicated in the next replication, thus reducing the amount of replicated data.
Replication--Scan Difference Before Initial Replication	This parameter specifies whether to scan before the initial replication. If yes, the scan is automatically started to obtain the differential data between the primary resource and the replica resource. Only the differential data is

	replicated during the initial replication to reduce the amount of replicated data. If you select No, all data in the primary resource is replicated during the initial replication.
Replication--Source Device and Target Device	The source device refers to the storage device to which the primary resource belongs, and the target device refers to the storage device to which the replica resource belongs. The source and target devices are relative to a certain replication pair. There can be multiple replication pairs between the two devices at the same time, and the replication direction can be the same or different.
Replication—Synchronous Replication and Asynchronous Replication	Synchronous replication refers to synchronizing data in real-time, which means data of the primary LUN is synchronously written to the replica LUN, strictly ensuring real-time consistency. Asynchronous replication refers to synchronizing data periodically, which means the changing data in the primary LUN is replicated to the replica LUN periodically based on the preset replication policy.
Replication--Update	It means that the replication relationship is disabled and the replica resource is promoted to a Thick-LUN.
S	
SDAS	Symmetrical Dual Active Storage system, also known as SDAS system. In order to address business interruption caused by natural disasters or software and hardware failures, a read-write replica is created for a specific LUN in the storage device. When one of the LUNs experiences a disaster, the business can be quickly switched to the replica LUN, achieving the dual purpose of "data protection" and ensuring "business continuity".
Snapshot	Snapshot is one of the commonly used methods of data protection. After configuring snapshots, multiple time points can be created to provide "soft disaster" protection for production data volumes.
Snapshot Policy	It refers to the time policy configured by the user. When the time policy is met, the device will automatically create a snapshot time point.
Snapshot Resource	Snapshot resource relies on LUN. It is used to save data at a snapshot time point on a LUN.
Snapshot Resource Auto-expansion	Snapshot resource auto-expansion is triggered automatically when the resource usage reaches the threshold to avoid invalid snapshot resource caused by full capacity.
Snapshot Resource Data Validity	It is a logical state, which indicates whether the data in the snapshot resource is available, including valid and invalid.
Snapshot Rollback	It is usually called rollback. If the data is damaged because of "soft disaster", the data of the front-end business corresponding to the LUN or view can be rolled back to attempt to recover the business. Snapshot rollback supports rollbacks on time point, view and LUN.
Snapshot Time Point	It is usually called time point. Data on the historical time plane of a LUN is saved by using snapshot. One time point is corresponding to a time plane.
Snapshot View	By creating a snapshot view, the data of the time plane corresponding to the time point associated with the view can be read. At the same time, the view also supports enabling snapshot, creating time points and views.

SNSD	Combining SNSD with the iNoF of the switch can achieve plug-and-play and fast fault detection in NVMF environments, achieving second level switching in case of path failures, improving the reliability of the storage system.
SP	Storage Processor (SP) commonly refers to storage controller, which can be installed in a Storage Processor Unit (SPU) to achieve data sending and receiving, processing and protection of storage devices.
SPU	Storage Processor Unit (SPU) commonly refers to main control cabinet which consists of Storage Processors (SP), fan modules, battery modules, power supply modules, etc. It can be connected to the application server through the front-end network and also to the Storage Switch Unit (SSU), Fabric Switch Unit (FSU) and Disk Shelf Unit (DSU) through the back-end network, which enables the functions of data reading, writing and protection.
SSU	Storage Switch Unit (SSU) is a special disk enclosure and commonly refers to switch enclosure, which consists of Exchange Processors (XP), fan modules, battery modules, power supply modules, disk modules and other modules to achieve disk swapping, storage device capacity expansion and other functions.
T	
Target	Target usually refers to the storage device, which is the receiver of commands and requests in the SCSI protocol.
Thick-LUN	It refers to the LUN without thin provisioning.
Thin-LUN	It refers to the LUN with thin provisioning.
Thin-LUN Data Area	It is used to store Thin-LUN user data.
Thin-LUN Extent	It is the smallest unit of Thin-LUN space management. The smaller the extent, the higher the space utilization.
Thin-LUN Logical Capacity	It refers to the size of Thin LUN shown on the client server.
Thin-LUN Physical Capacity	It refers to the physical space allocated to Thin-LUN.
Thin-LUN Private Area	It is used to store Thin-LUN management data.
Thin Provisioning	Thin Provisioning is a new storage management feature, with the core principle of "deceiving" the operating system into recognizing that there is a large amount of storage space when the actual physical storage space is small; As applications write more and more data, the storage system will automatically expand physical storage space in the background, achieving on-demand allocation and resulting in higher utilization of physical storage space and saving users' investment.
V	
Virtualization Device	It refers to a storage device that provides virtualization function and centrally manages the storage space provided by the virtualized devices.
Virtualized Device	It is external device, also called back-end storage device, whose resources

	are allocated to virtualization devices for unified management of storage devices.
Volume	It refers to the LUN created on a back-end storage device is recognized as a volume after it is assigned to the virtualization device.
Volume Attach Status	The attach status of the volume is determined by user operations.
Volume Online Status	It means whether the virtualization device can access the volume and is determined by the path state.
Volume--Owing SP	It refers to the controller of the virtualization device that can access the volume and is determined by the path state.
X	
XP	Exchange Processor (XP) is a special disk enclosure controller, commonly refers to switch enclosure controller, which can be installed in Storage Switch Units (SSU) to achieve back-end data processing and distribution of the storage device.

Appendix D.Acronyms

A

ATA	Advanced Technology Attachment
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C

CHAP	Challenge Handshake Authentication Protocol
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CLI	Command-Line Port
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COW	Copy on Write
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CRAID	RAID based Cell
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D

DDSR	Data Duplicate Shared Resource
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DSU	Disk Shelf Unit
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E

EP	Expander Processor
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F

FC	Fiber Channel
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G

GE	Gigabit Ethernet
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GUI	Graphical User Port
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H

HA	High Availability
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I

IE	Internet Explorer
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iNoF	Intelligent Lossless NVMe over Fabrics
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IP	Internet Protocol
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iSCSI	Internet Small Computer Systems Port
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J

JRE Java Runtime Environment

L

LUN Logical Unit Number

N

NDM Non-interrupt Data Migration

NGUID Namespace Globally Unique Identifier

NVMe Non-Volatile Memory Express

NVMf NVMe over Fabrics

Q

QoS Quality of Service

R

RAID Redundant Array of Independent Disks

RDV Reserved Data Virtualize

ROW Redirect on Write

S

SAN Storage Area Network

SAS Serial Attached SCSI

SATA Serial ATA

SCSI Small Computer System Port

SDAS Symmetrical Dual Active Storage

SMI-S Storage Management Initiative Specification

SMTP Simple Mail Transfer Protocol

SNMP Simple Network Management Protocol

SNSD Storage Network Smart Discovery

SP Storage Processor

SPU Storage Processor Unit

SSD Solid State Drive

SSU Storage Switch Unit

W

WWN

World Wide Name/World Wide Name

X

XAN

eXchange Area Network

XP

Exchange Processor