MacroSAN MS Series Storage Devices Dual-Active Feature

GUI User Manual

Document version: V2.11.00

MacroSAN Technologies Co., Ltd.

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400-650-5527

Statement

This manual is only for operational reference. Due to upgrades of software version or other reasons, this manual may lag behind the latest software version or device configuration. MacroSAN Technologies Co., Ltd. reserves the right of modify the manual without inform or notice.

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Contents

Figures List

Tables List

Manual Structure

Chapter		Description	Main content
Overview	Preface	This chapter introduces related information about the manual for your reading.	• 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.	• 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.	• Introduction to ODSP Scope+ • Running ODSP Scope+ • Composition of ODSP Scope+ system view interface • Composition of ODSP Scope+ tenant view interface
Dual-active feature	Introduction to dual-active feature	This chapter introduces related knowledge of dual-active.	• Introduction to dual-active • Introduction to arbiter • Introduction to consistency group • Introduction to XAN
	Configuring consistency group (optional)	This chapter introduces how to configure consistency group.	• Creating consistency group • Viewing consistency group • Modifying consistency group properties • Deleting consistency group • Adding members for consistency group • Removing members from consistency group
	Preparations before configuring dual-active	This chapter introduces preparations before configuring dual-active.	• Activating dual-active license • Configuring dual-active auto reversal option • Configuring XAN • Configuring arbiter
	Configuring dual-active	This chapter introduces how to configure dual-active.	• Managing LUN dual-active • Managing consistency group dual-active
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	Device external ports summary

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

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

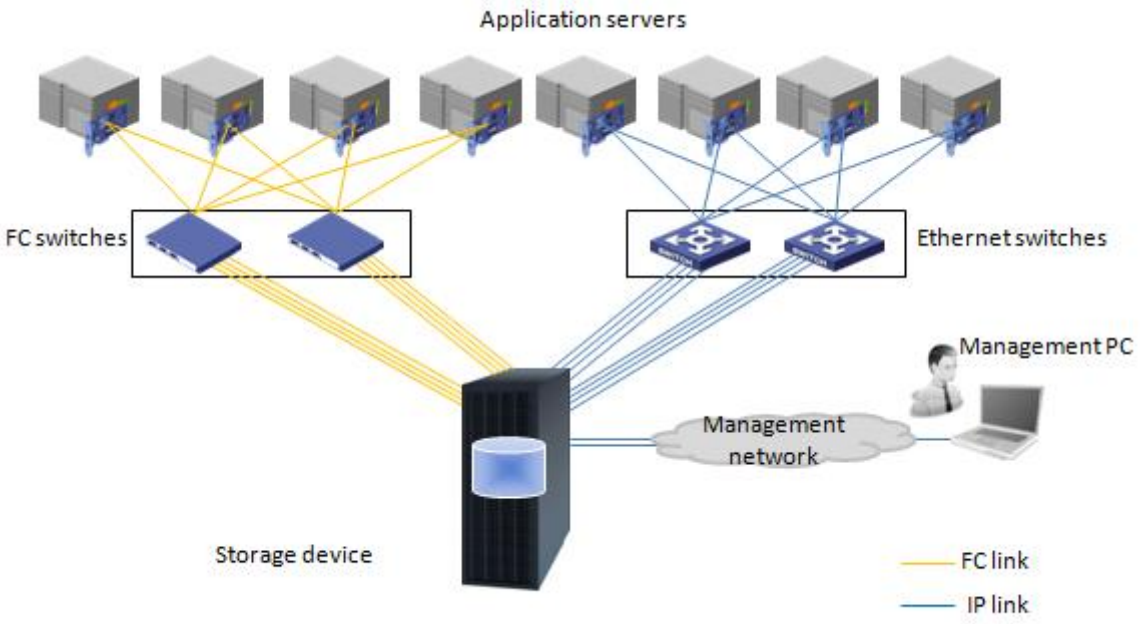

Figure 2-1 Typical networking of MS series storage devices

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.

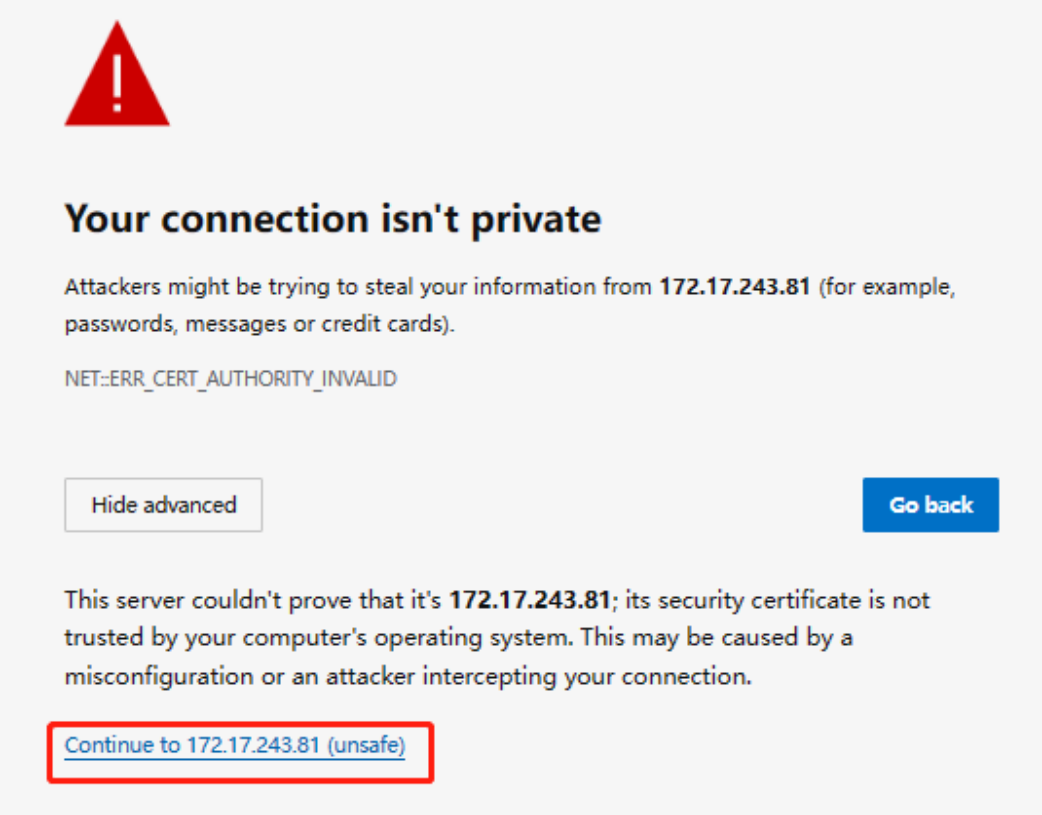

Figure 3-1 Example for prompt of certificate exception

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.

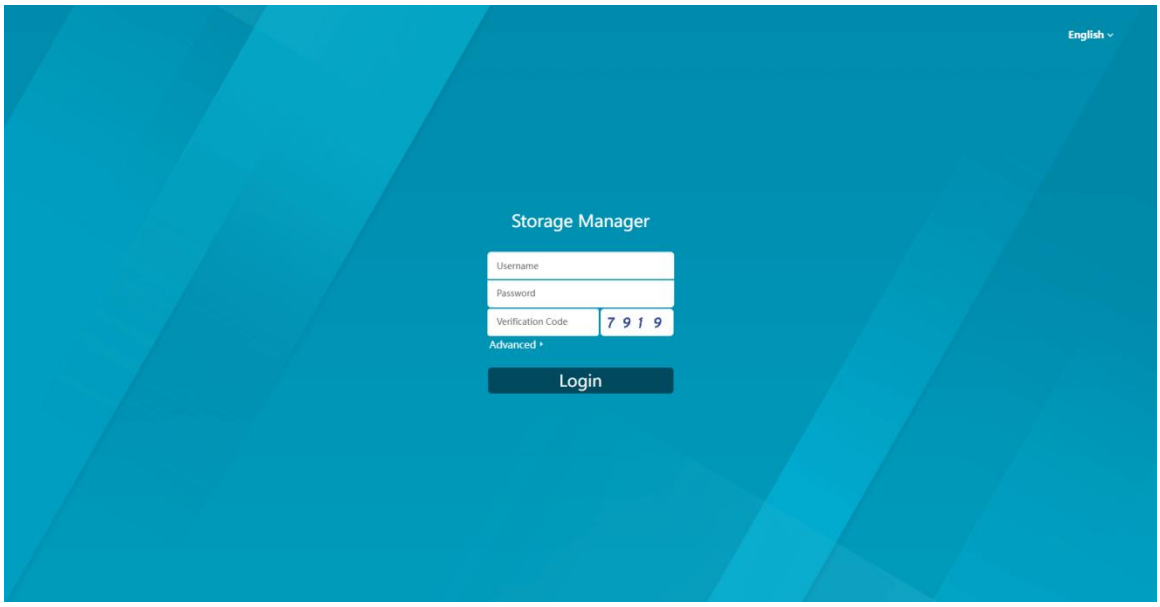

Figure 3-2 ODSP Scope+ login interface

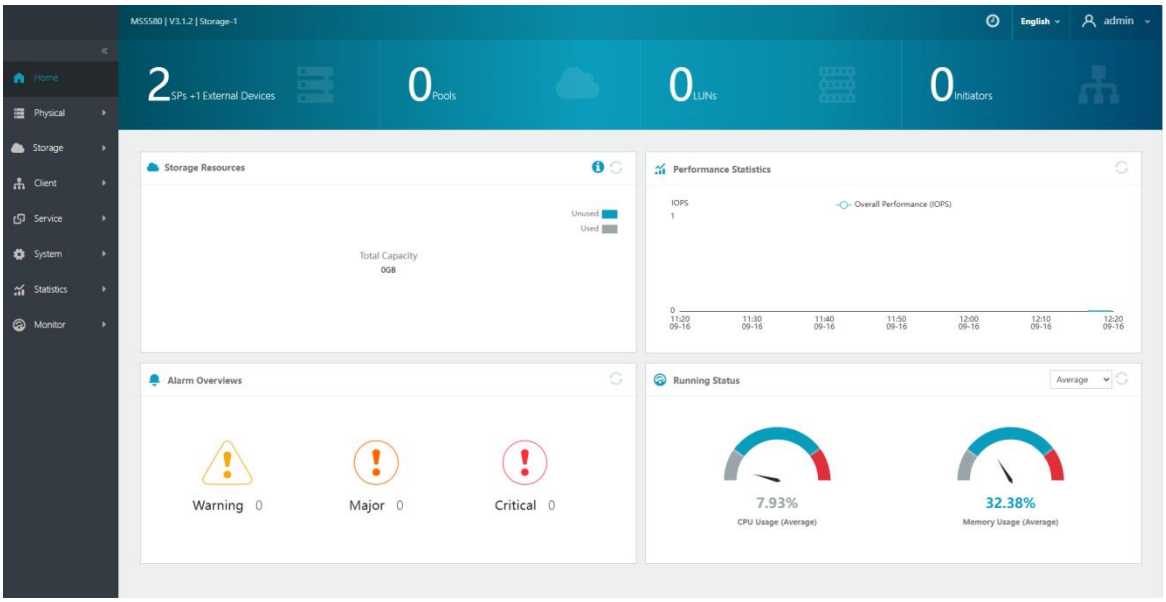

Figure 3-3 Home of ODSP Scope+ system view

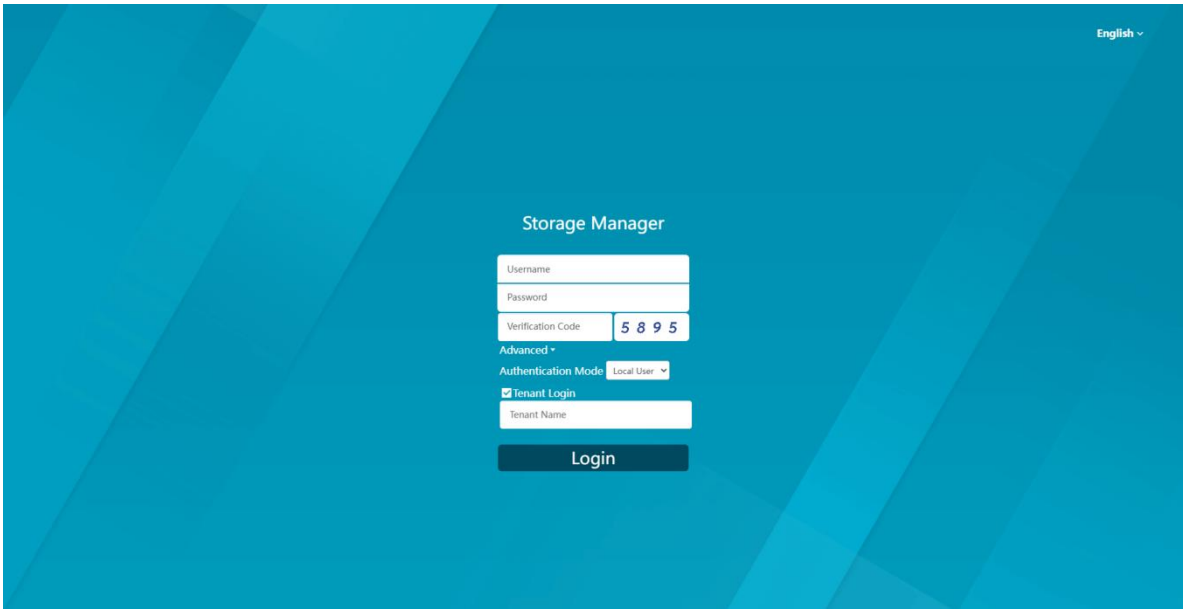

Figure 3-4 ODSP Scope+ tenant login interface

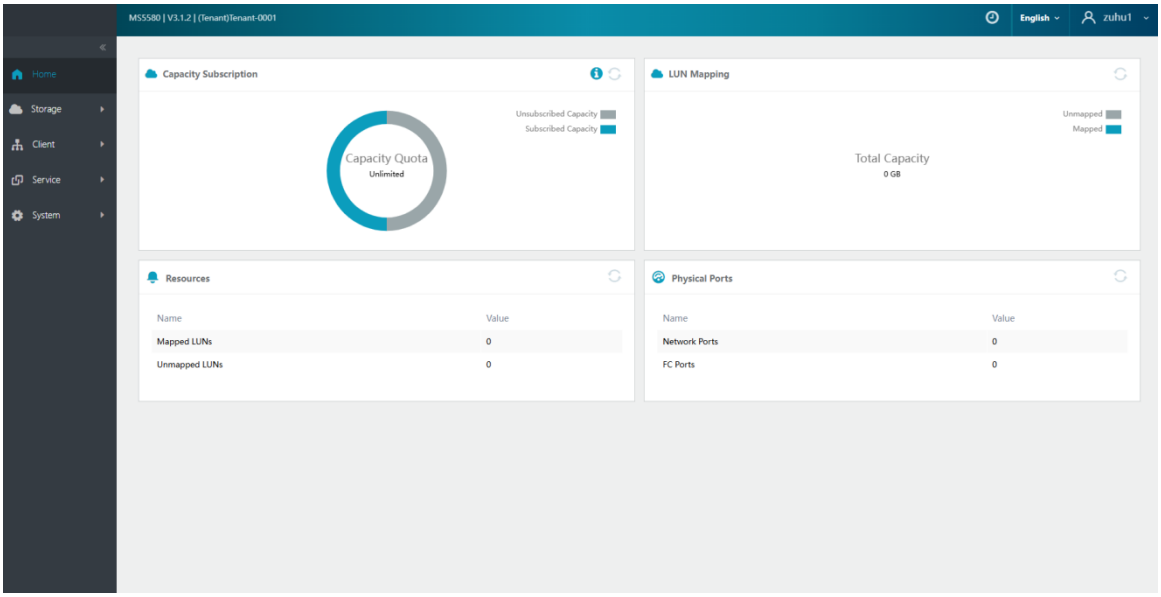

Figure 3-5 Home of ODSP Scope+ tenant view

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.

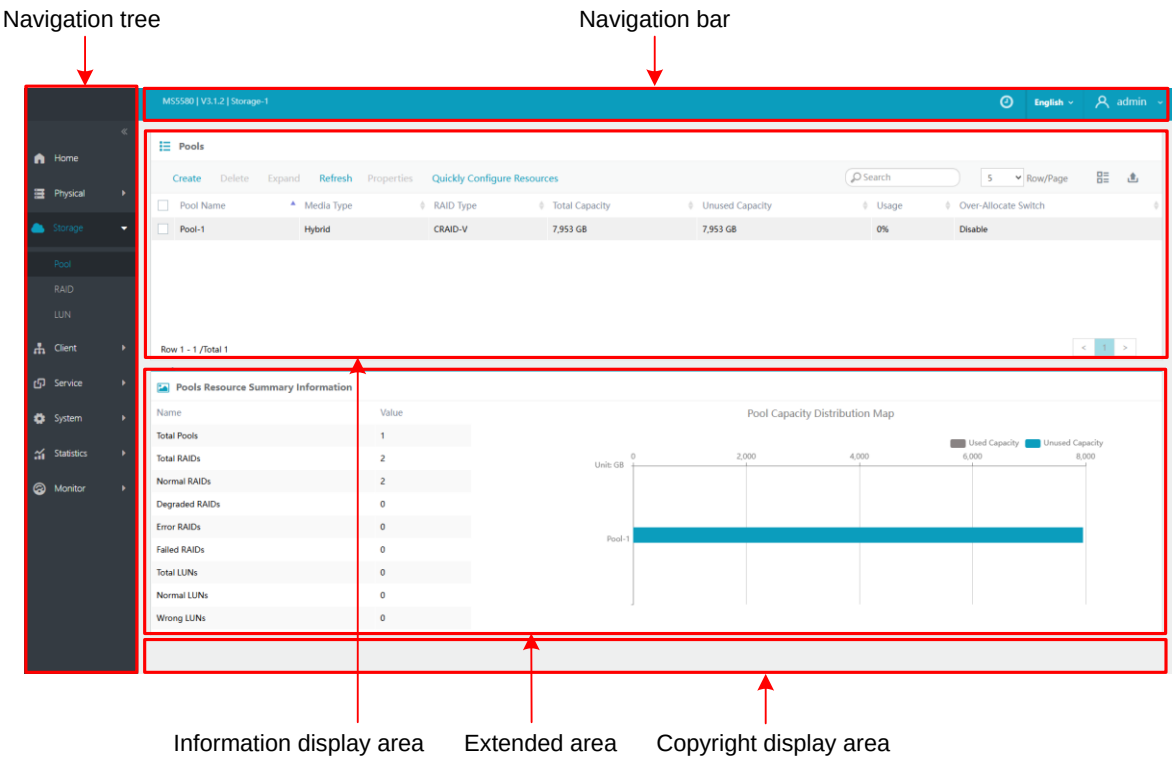

Figure 3-6 Example of ODSP Scope+ typical interface

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.

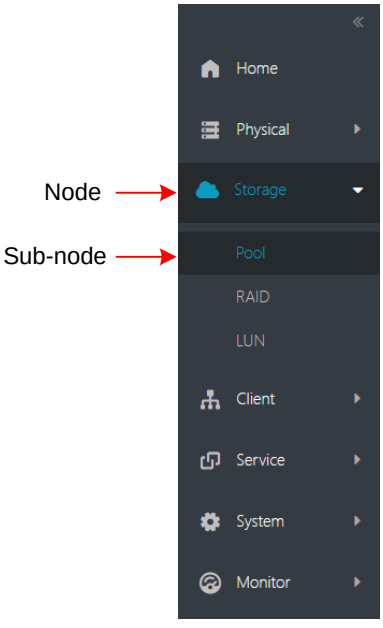

Figure 3-7 Example of ODSP Scope+ navigation tree

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.

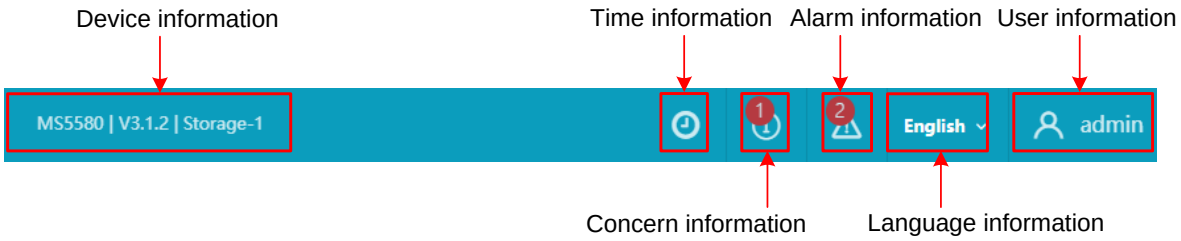

Figure 3-8 Example of ODSP Scope+ navigation bar

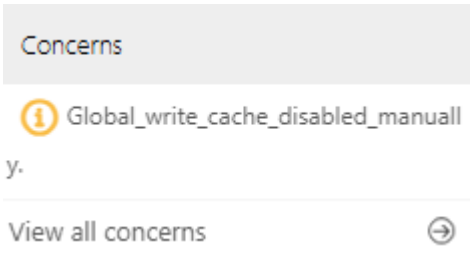

Figure 3-9 Example of ODSP Scope+ concerns

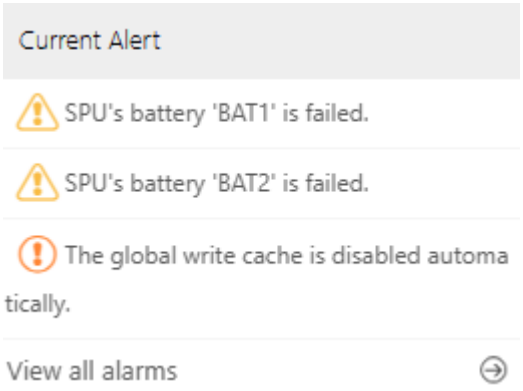

Figure 3-10 Example of ODSP Scope+ alarms

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.

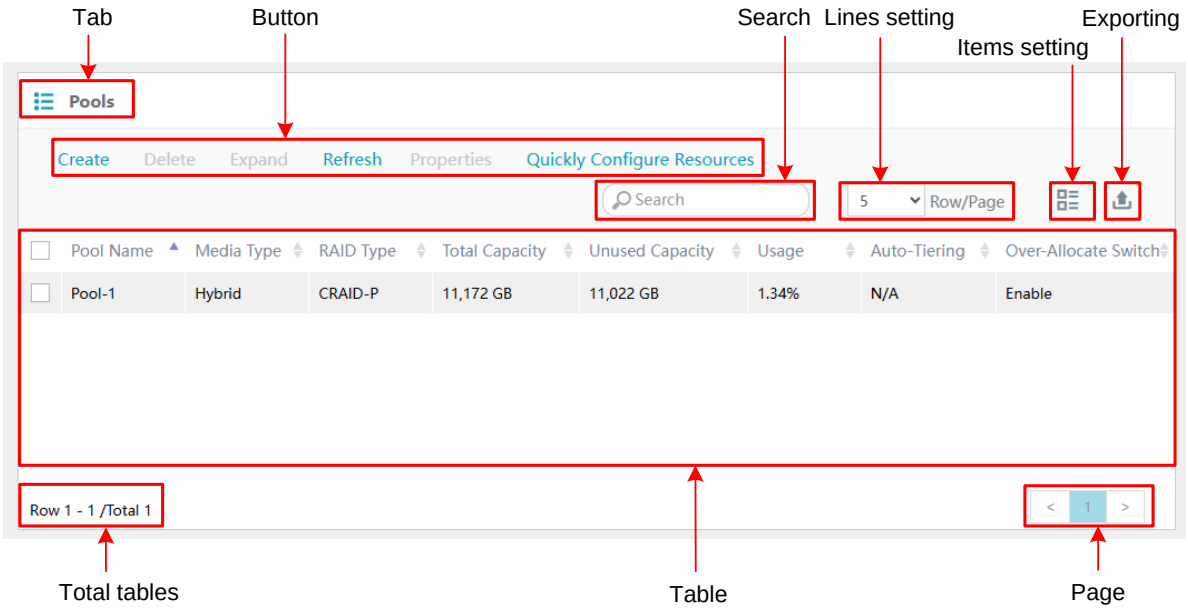

Figure 3-11 Example of ODSP Scope+ information display area

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.

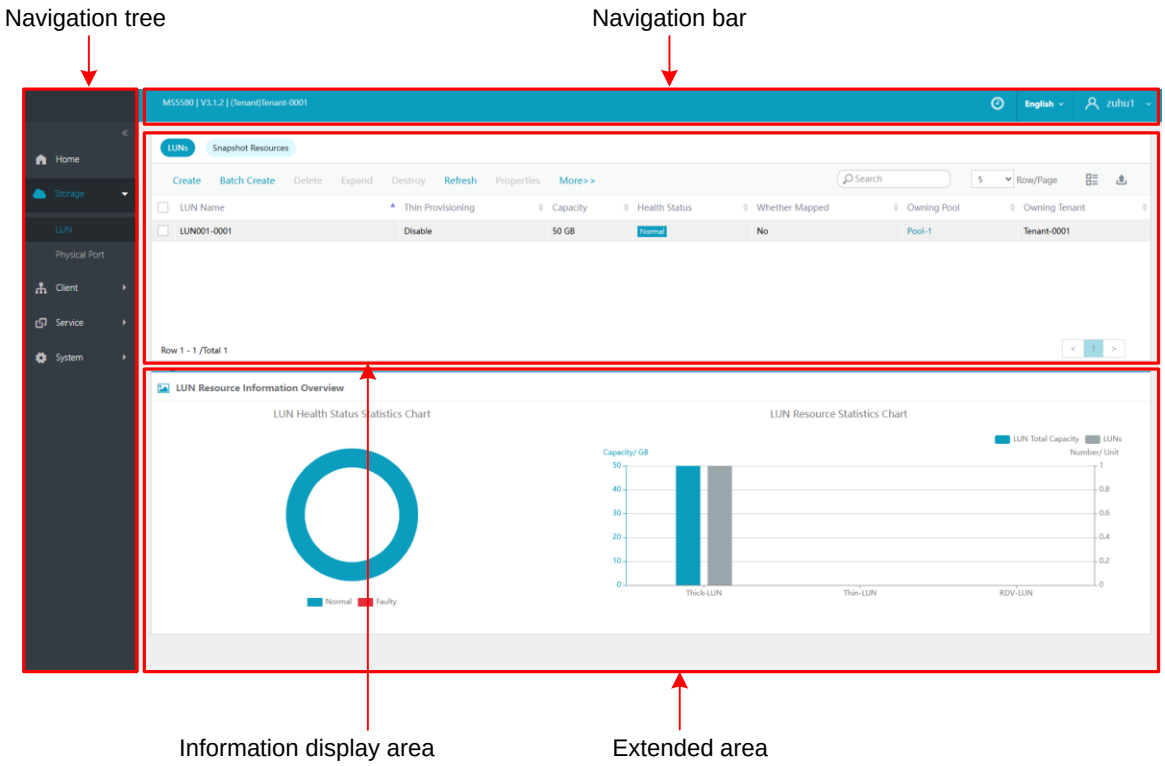

Figure 3-12 Example of ODSP Scope+ typical interface

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.

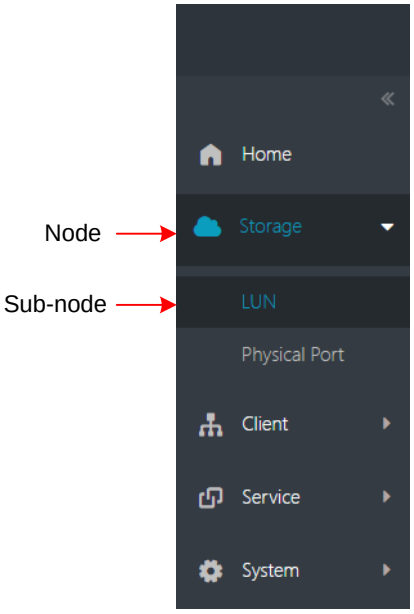

Figure 3-13 Example of ODSP Scope+ navigation tree

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.

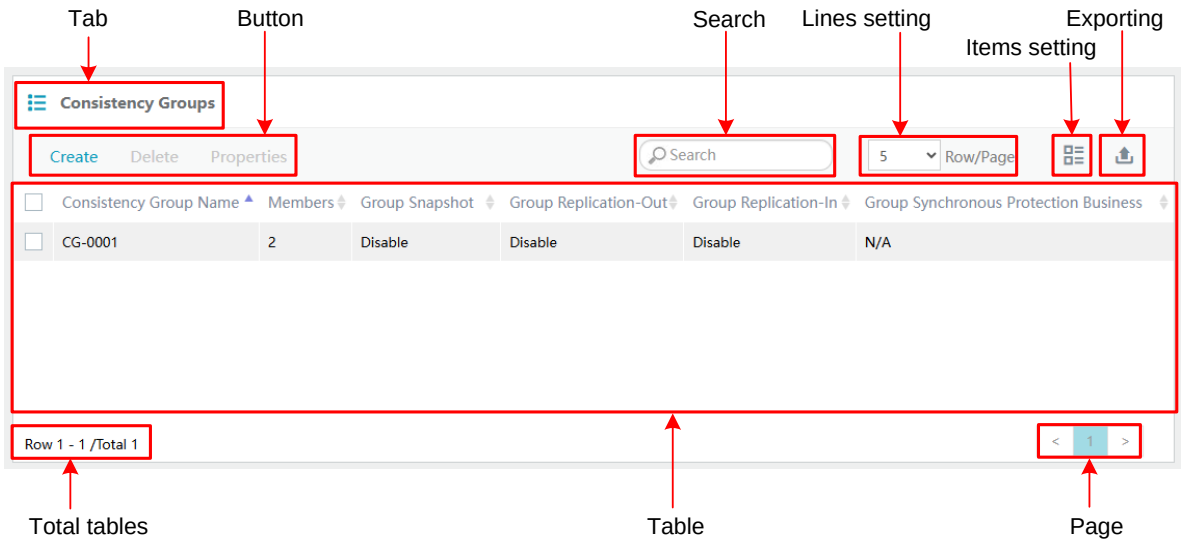

Figure 3-15 Example of ODSP Scope+ information display area

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: Dual-Active Feature

4 Introduction to Dual-Active Feature

4.1 Introduction to Dual-Active

With the cornerstone of data, information system has become a major support for social production capacity and normal operation of enterprises in today's society. In the face of various potential threats, such as natural disasters (fires, earthquakes, typhoons, tsunamis, etc.), man-made disasters (misuses, hacker attacks, etc.), failures on software, hardware and power supply, etc., disaster backup of production data has become a top priority.

In terms of the requirements on disaster backup, asynchronous replication is adopted for asynchronous data protection and remote mirror, also called synchronous replication is adopted for synchronous data protection. Either replication or remote mirror can be positioned as a "data protection", which supports the front-end business supported by production volume. In addition, both the two technologies require manual intervention to promote and allocate the replica volume to the standby server in the case of disasters so as to restore business operation. In other words, the business on the server cannot be interrupted.

In response to the requirements of data protection and business continuity, dual-active data protection technology has been emerged, which is characterized by the followings:

- The two LUNs with dual-active protection feature are located in the first data center and the second data center respectively.
- Two LUNs can be accessed by the server at the same time.
- The data of the two LUNs are identical and mutually protected.

MacroSAN Dual-Active storage system, referred to as SDAS (Symmetrical Dual-Active Storage), also called dual-active for short, whose positioning is "data protection + business continuity". On the basis of cross-device mirror pairs, it also supports two LUNs of the mirror pair to provide business for the front-end at the same time; if a disaster occurs in any data center, the business will continue to run in another data center without manual intervention. There are following requirements on dual-active feature:

- Each controller is installed with a high-speed Ethernet card (including 10GE, 25GE, 100GE, etc.) or FC card (including 16G FC, 32G FC, etc.) to form XAN through ports (see 4.4 Introduction to XAN for details).
- It is required that the two devices have the same model and configuration.

4.2 Introduction to Arbiter

The typical feature of dual-active is that the two LUNs of the mirror pair can provide business for the front end at the same time. If there is a split-brain between the two devices, in other words, there is no link communication link between the devices, the two LUNs of the mirror pair will not be

able to negotiate mirror role by themselves. As a result, "primary" + "primary" appears, causing business interruption.

The arbiter function is added in order to solve the above problems. The arbiter is software deployed on a third-party server. When the two LUNs of the mirror pair in the dual-active storage system are "primary" + "primary", the arbiter can automatically negotiate the role of the mirror to ensure business continuity.

⚠CAUTION

Arbiter is required to be deployed in order to solve the split-brain problem. For details about the requirements of arbiter, see 6.4.1 Preparations before Configuring Arbiter.

4.3 Introduction to Consistency Group

ⓘNOTE

Among the members of consistency group, only one synchronous protection business (including dual-active, remote mirror, local mirror and local clone) can be enabled.

Some production businesses of application server need to be operated on the base of multiple LUNs, such as database, which are usually subdivided into data LUNs, configuration LUNs, and log LUNs. If the data in a certain time plane needs to be obtained, the consistency of the obtained data must be ensured on a LUN. In other words, the data obtained on multiple LUNs is required to correspond to the same time plane. Otherwise, these data cannot be used to run businesses.

The consistent group function allows you to add multiple LUNs associated with data to a consistent group. These LUNs are also called members of the consistent group. When consistency is required for some operations, the system will suspend the IOs of all members in the consistency group, perform related operations to obtain the data of the current time plane, and resume the IO of all members, which ensures the consistency of the acquired data.

Combining dual-active feature with consistency group function can strictly guarantee data consistency of mirror LUNs of multiple members in the consistency group.

4.4 Introduction to XAN

ⓘNOTE

- Multiple XANs can be created on one device. In the typical networking diagram, only the XAN between two devices is used as an example. The front-end networking is just an example, and the actual networking can be adjusted according to actual situation.
- Arbiter is required to be deployed in order to solve the split-brain problem. The arbiter network is required to be independent of XAN, and please ensure that the network between each SP and the arbiter is reachable.

XAN (eXchange Area Network) refers to a dedicated high-speed network for data transfer between MacroSAN storage devices and supports either MESH direct connection or switch connection.

4.4.1 Dual-Controller XAN Typical Networking

4.4.1.1 MESH Direct Connection

MESH direct connection of dual-controller devices means that two SPs of one storage device and that of another storage device are directly connected in pairs, and each SP occupies two identical high-speed Ethernet ports (including 10GE, 25GE, 100GE, etc.) or FC ports (including 16G FC, 32G FC, etc.). Taking dual-controller + front-end FC connection as an example, Figure 4-1 shows a typical XAN networking of MESH direct connection.

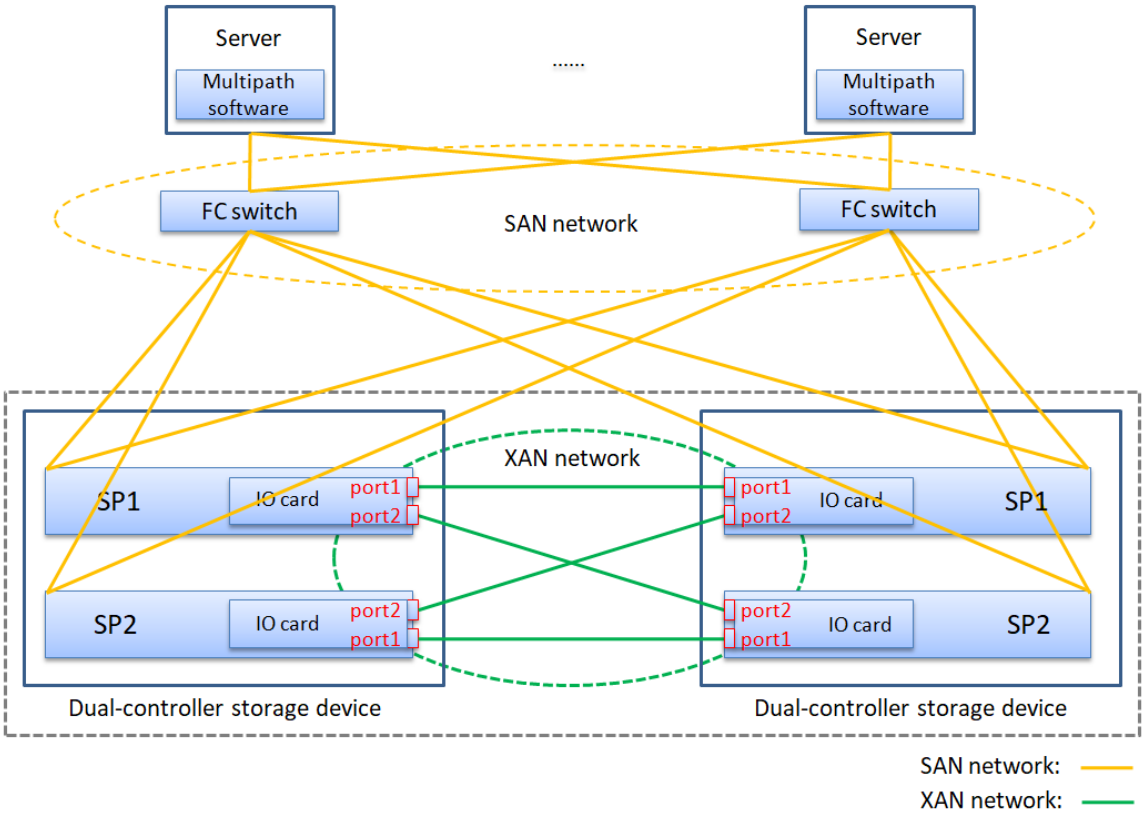

Figure 4-1 XAN typical networking diagram of dual-controller (MESH direct connection)

4.4.1.2 Switch Connection

⚠CAUTION

Switches used for XAN connection cannot be stacked.

Switches connection of dual-controller devices means that the four SPs of two storage devices are connected through two switches to ensure data redundancy. Each SP occupies two identical high-speed Ethernet ports (including 10GE, 25GE, 100GE, etc.) or FC ports (including 16G FC,

32G FC, etc.). Taking dual-controller + front-end FC connection as an example, Figure 4-2 shows a typical XAN networking of switch connection.

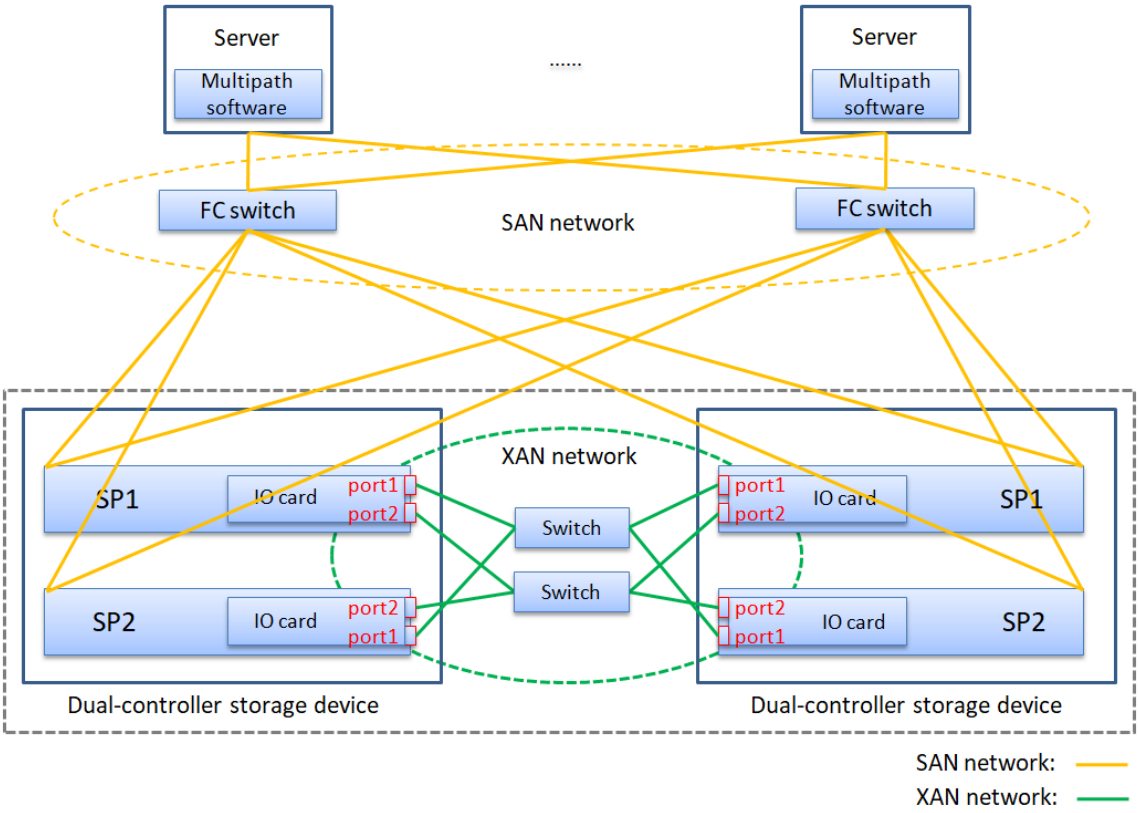

Figure 4-2 XAN typical networking diagram of dual-controller (switch connection)

4.4.2 Four-Controller XAN Typical Networking

4.4.2.1 MESH Direct Connection

MESH direct connection of four-controller devices means that the four SPs of one storage device are cross-connected with the four SPs of another storage device, and each SP occupies four identical high-speed Ethernet ports (including 10GE, 25GE, 100GE, etc.) or FC ports (including 16G FC, 32G FC, etc.). Taking four-controller + front-end FC connection as an example, Figure 4-3 shows a typical XAN networking of MESH direct connection.

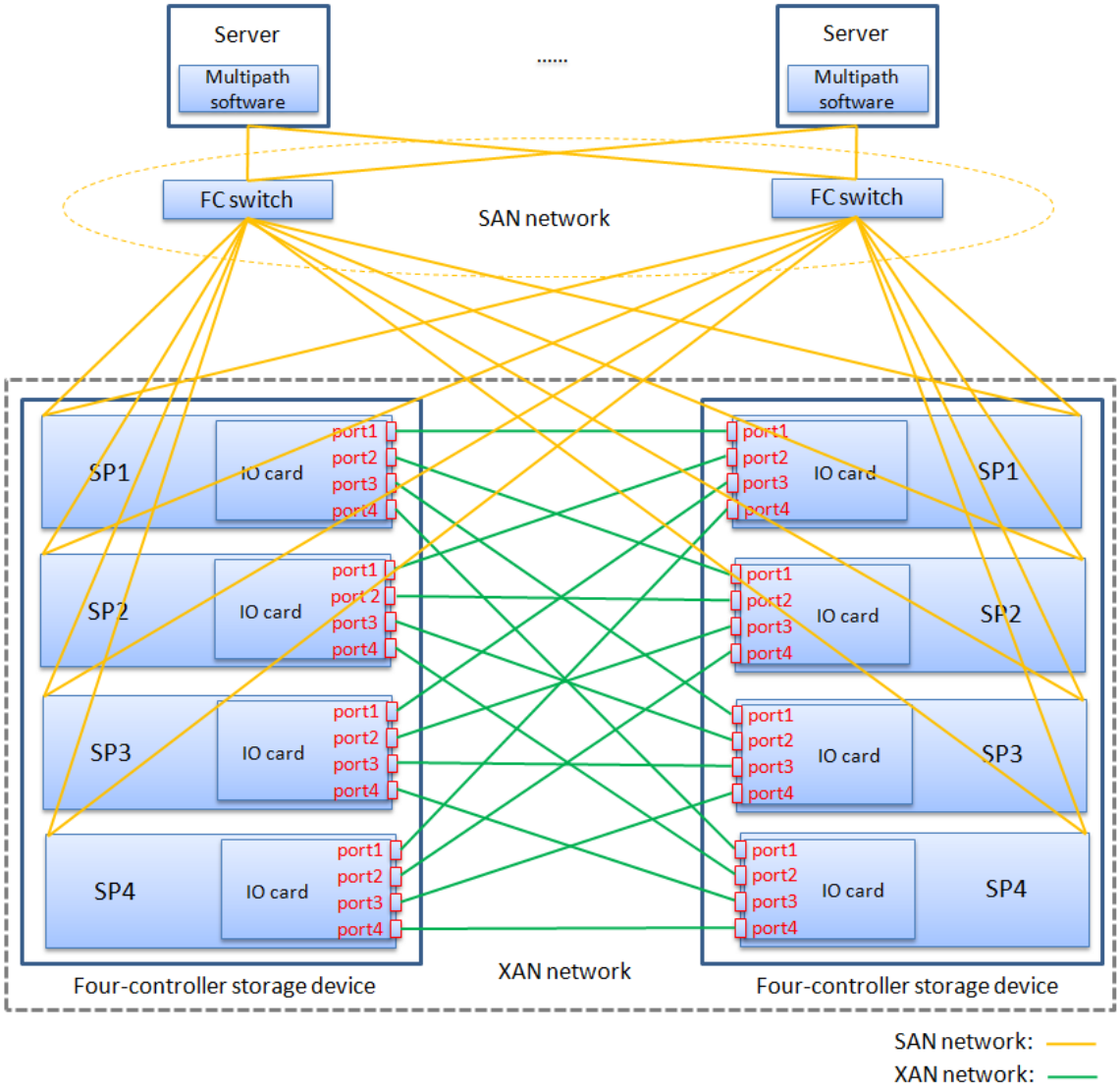

Figure 4-3 XAN typical networking diagram of four-controller (MESH direct connection)

4.4.2.2 Switch Connection

⚠CAUTION

Switches used for XAN connection cannot be stacked.

Switches connection of four-controller devices means that the eight SPs of two storage devices are connected through two switches to ensure data redundancy. Each SP occupies two identical high-speed Ethernet ports (including 10GE, 25GE, 100GE, etc.) or FC ports (including 16G FC, 32G FC, etc.). Taking four-controller + front-end FC connection as an example, Figure 4-4 shows a typical XAN networking of switch connections.

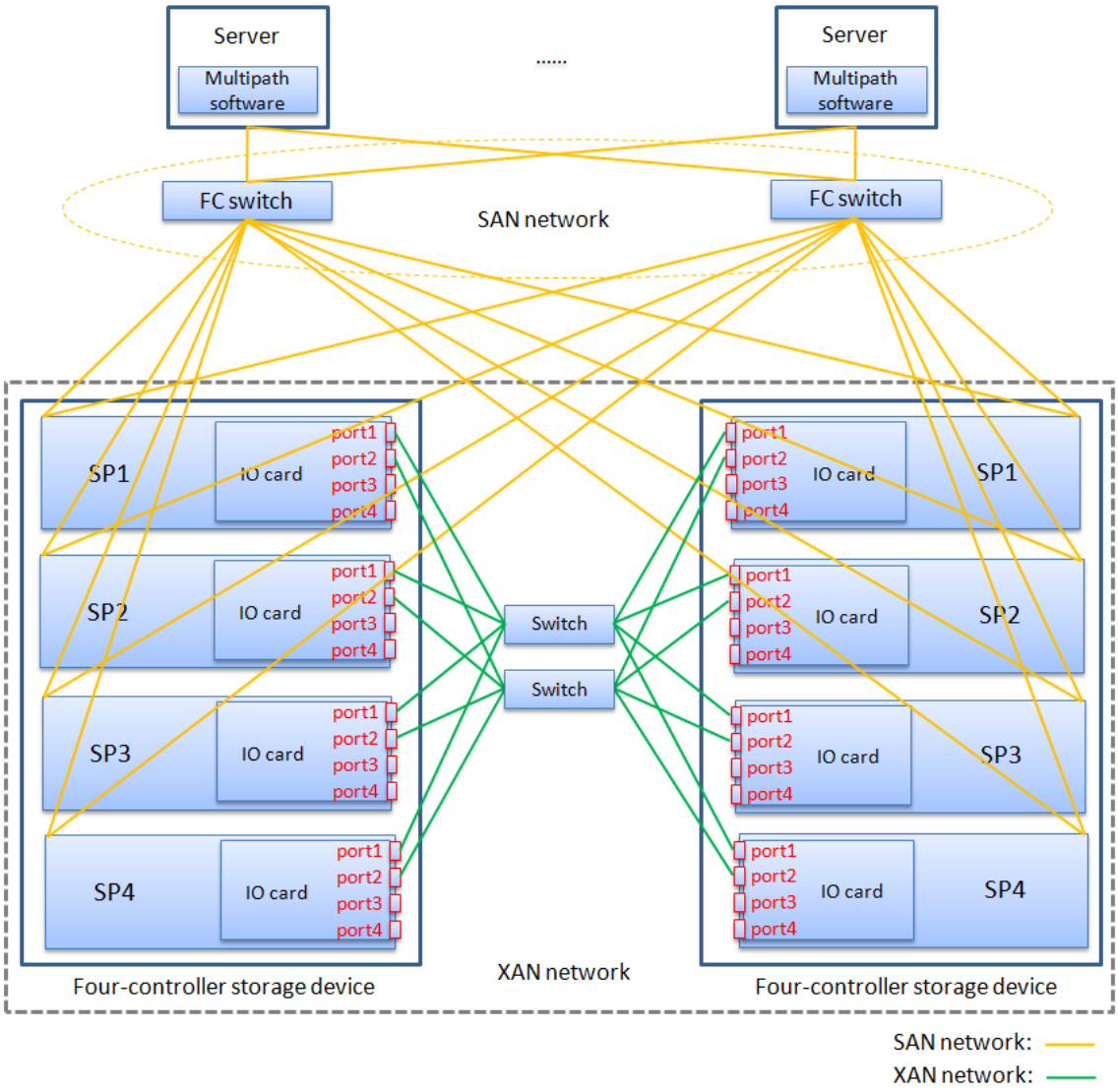

Figure 4-4 XAN typical networking diagram of four-controller (switch connection)

4.4.3 XAN Terms

- XAN device pair: It refers to the two storage devices that form the XAN.
- XAN logical link: For dual-controller devices, there must be at least four logical links between the four SPs of the two devices; for four-controller devices, there must be at least 16 logical links between the eight SPs of the two devices.
- XAN physical link: Multiple ports can be used for XAN in a SP. Therefore, each logical link can also have multiple physical links.

ⓘNOTE

- The logical link naming rule is "link XY", whose X represents the controller ID of the local device, and Y represents the controller ID of the peer device. The controller IDs are marked with letters A-D. In other words, A-D represents SP1-SP4 respectively.

- Example: Link AA indicates the logical link between SP1 on the local device and SP1 on the peer device, and link AB indicates the logical link between SP1 on the local device and SP2 on the peer device.

5 Configuring Consistency Group (Optional)

ⓘNOTE

- The consistency group is an optional function. If some production businesses on the application server need to be operated on the base of multiple LUNs with data consistency requirements, you need to create a consistency group first, and then add multiple LUNs associated with data to this consistency group. Please configure it according to actual needs.
- To improve operation convenience, it is recommended that the member names of the consistency group contain the same prefix for quick research.

5.1 Creating Consistency Group

This section explains how to create consistency group.

Steps

Step 1: Select "Service" -> "Consistency Group" on the navigation tree to open the consistency group interface.

Step 2: Click the <Create> button in the information display area to open the **Create Consistency Group** window, as shown in Figure 5-1. Enter the suffix of the consistency group name, select LUN, and click the <OK> button to complete the configuration.

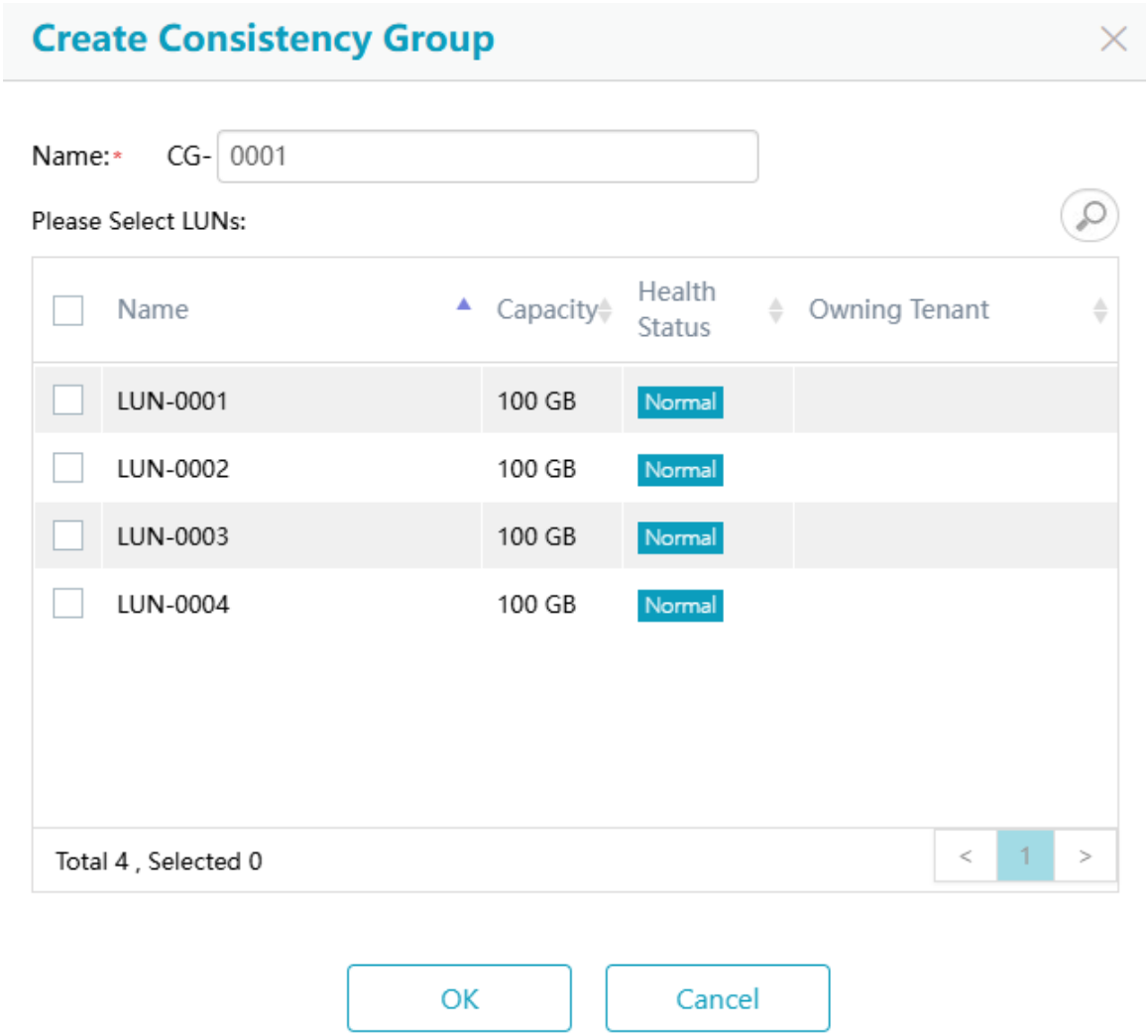

Figure 5-1 Create consistency group interface

5.2 Viewing Consistency Group

5.2.1 Viewing Properties

This section explains how to view consistency group's basic properties.

Steps

Step 1: Select "Service" -> "Consistency Group" on the navigation tree to open the consistency group interface.

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

5.2.2 Viewing Members

This section explains how to view consistency group's members.

Steps

Step 1: Select "Service" -> "Consistency Group" on the navigation tree to open the consistency group interface.

Step 2: Select the desired consistency group in the information display area and you can view the members of the consistency group in the extended area.

5.3 Modifying Consistency Group Properties

This section explains how to modify consistency group's name, group synchronous protection control business and group synchronous protection business flow control.

Steps

Step 1: Select "Service" -> "Consistency Group" on the navigation tree to open the consistency group interface.

Step 2: Select the desired consistency group in the information display area and click the <Properties> button to open the **Basic Properties** window, as shown in Figure 5-2. Modify the properties of consistency group and click the <OK> button to complete the configuration.

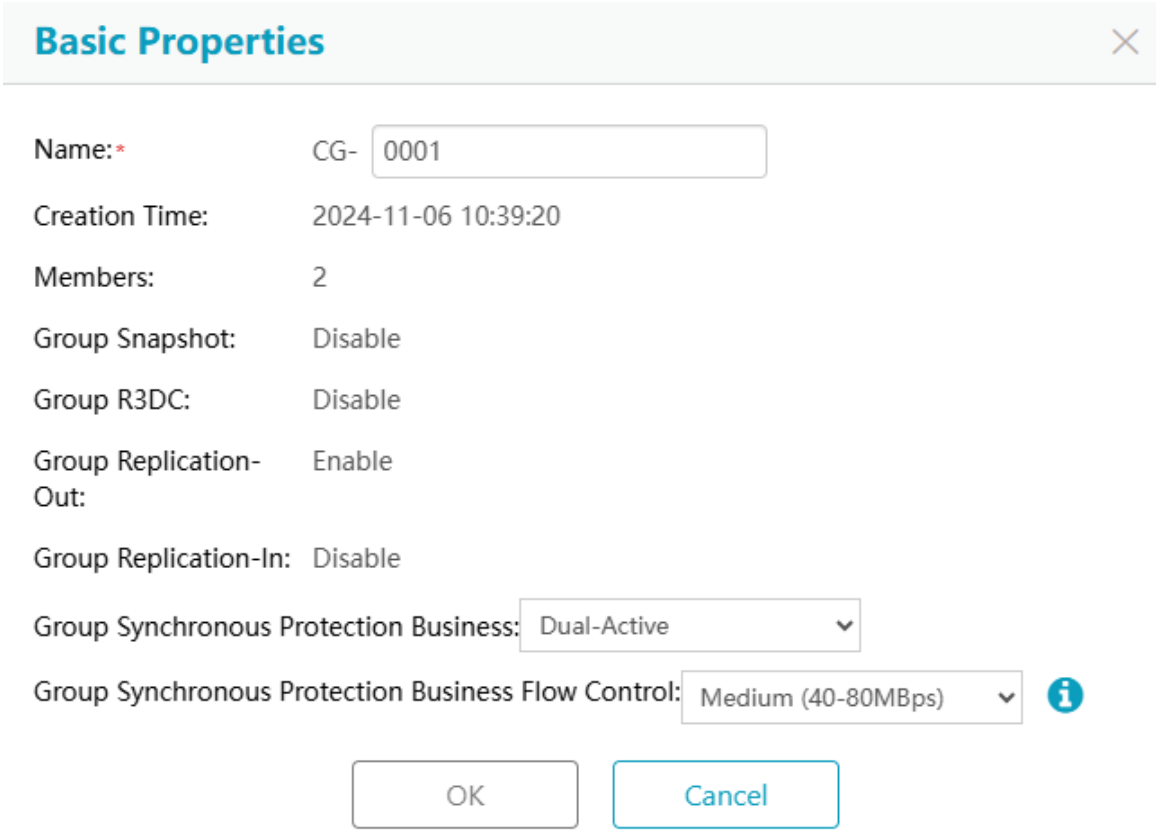

Figure 5-2 Consistency group basic properties interface

Table 5-1 Description of the parameters for consistency group basic properties interface

Parameter	Description
Name	It refers to the name of consistency group. The name prefix is "CG-", and only the suffix need to be entered.
Group Synchronous Protection Business	It refers to synchronous protection business of the consistency group, including N/A, Dual-Active, Remote Mirror, Local Mirror and Local Clone.
Group Synchronous Protection Business Flow Control	It refers to synchronous protection business flow control of the consistency group, For consistency group members, synchronous protection business flow control can be set in units of consistency groups to avoid the effect of synchronous tasks on the front-end business performance. ● Low (0-20MBps) ● Medium (40-80MBps) ● High (100-200MBps) ● Highest (greater than 200MBps) ● Custom: Setting upper limit of rate ratio manually. Valid range: 1-1024MBps.

5.4 Deleting Consistency Group

This section explains how to delete consistency group.

Steps

Step 1: Select "Service" -> "Consistency Group" on the navigation tree to open the consistency group interface.

Step 2: Select the desired consistency group in 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.

5.5 Adding Members for Consistency Group

This section explains how to add members for consistency group.

Steps

Step 1: Select "Service" -> "Consistency Group" on the navigation tree to open the consistency group interface.

Step 2: Select the desired consistency group in the information display area and click the <Add LUN> button in the extended area to open the **Add Consistency Group Member** window, as shown in Figure 5-3. Select the desired LUN and click the <OK> button to complete the configuration.

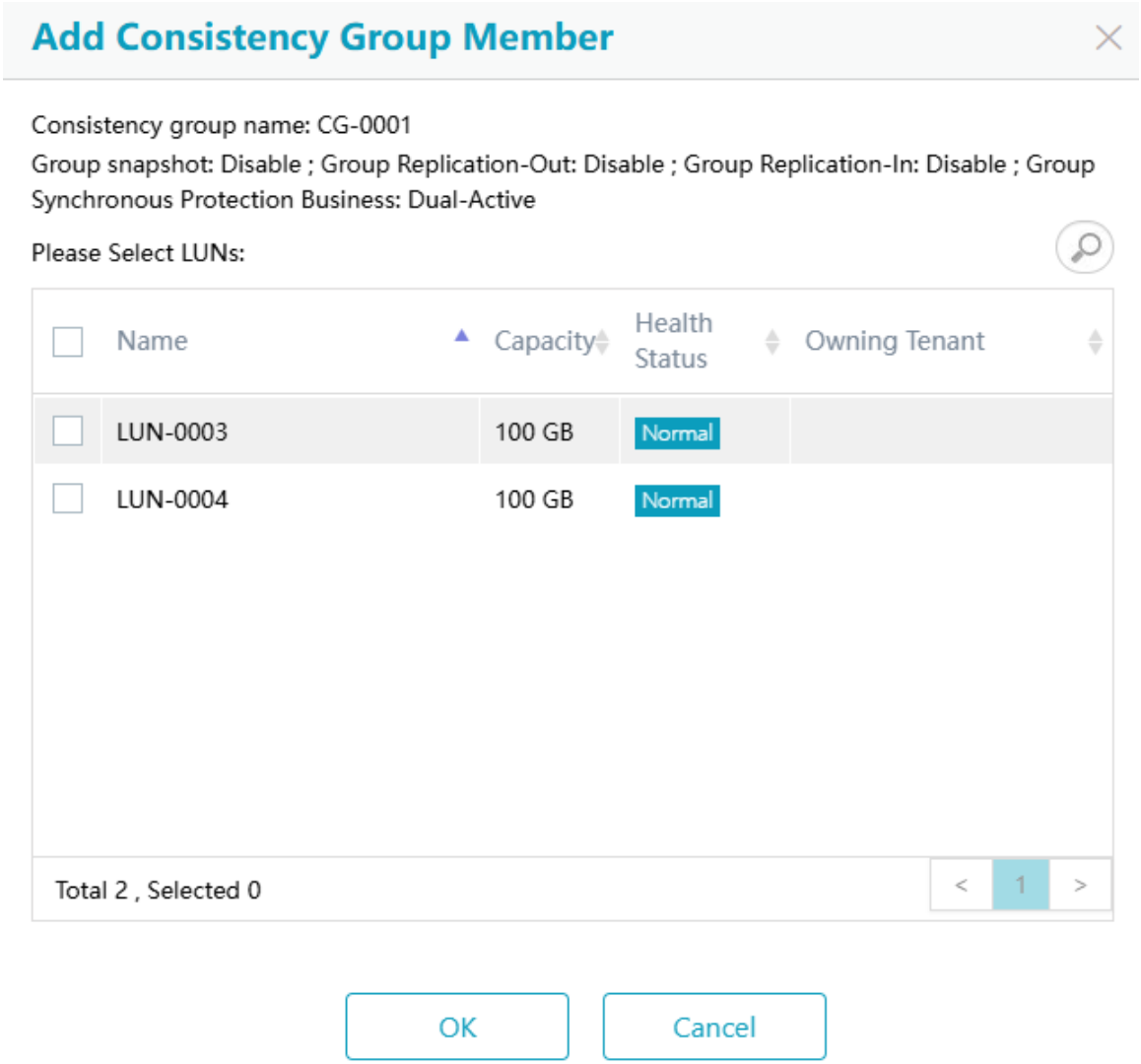

Figure 5-3 Add consistency group member interface

5.6 Removing Members from Consistency Group

This section explains how to remove members from consistency group.

Steps

Step 1: Select "Service" -> "Consistency Group" on the navigation tree to open the consistency group interface.

Step 2: Select the desired consistency group in the information display area, select the desired LUN in the extended area, click the <Remove LUN> button, enter "yes" in the pop-up warning box, and click the <OK> button to complete the configuration.

6 Preparations before Configuring Dual-Active

6.1 Activating Dual-Active License

This section explains how to activate dual-active license.

ⓘNOTE

After activating successfully, the "Dual-Active" sub-node will be displayed under the "Service" 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 dual-active license, and click the <Activate> button to complete the configuration.

6.2 Configuring Dual-Active Auto Reversal Option

This section explains how to configure dual-active auto reversal option.

Steps

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

Step 2: Click the <System Setting> button to open the **System Setting** window and select "Set Dual-Active Global Parameters", as shown in Figure 6-1. Set dual-active auto reversal option and click the <Apply> button to complete the configuration.

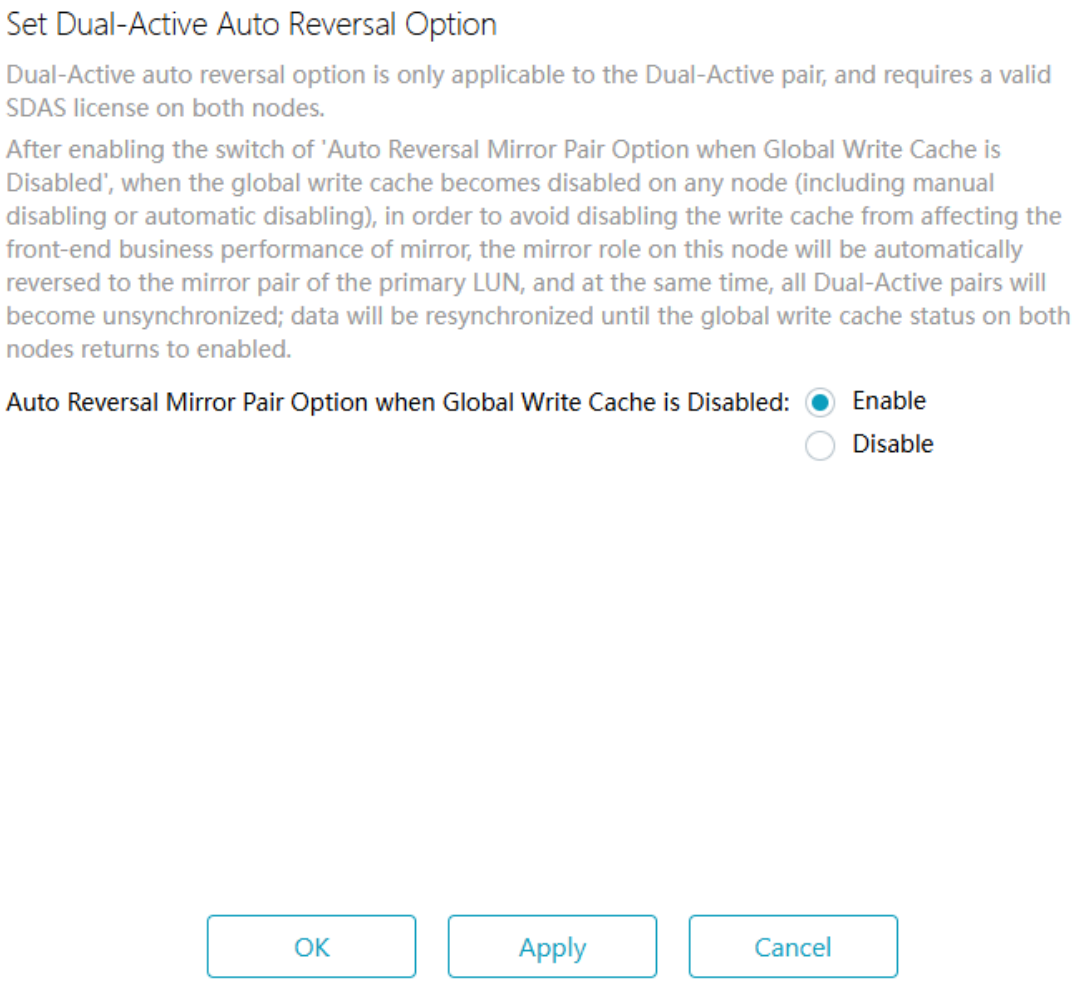

Figure 6-1 Set dual-active auto reversal option interface

6.3 Configuring XAN

ⓘNOTE

Please activate dual-active licenses on the two storage devices respectively before configuring XAN.

6.3.1 Managing Remote Device

6.3.1.1 Adding Remote Device

This section explains how to add remote device.

Steps

Step 1: Select "Service" -> "Remote Device" on the navigation tree to open the remote device interface.

Step 2: Click the <Add> button in the **Remote Devices** tab of the information display area to open the **Add Device** window, as shown in Figure 6-2. Enter the device information (see Table 6-1 for details) and click the <OK> button to complete the configuration.

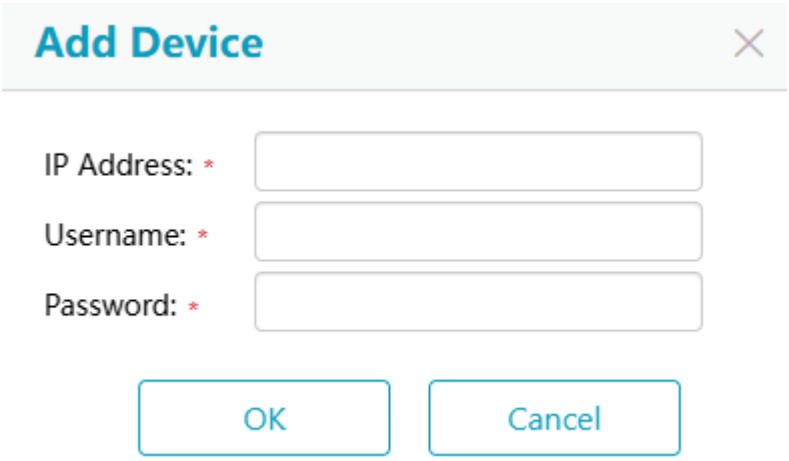

Figure 6-2 Add device interface

Table 6-1 Description of the parameters for adding device interface

Parameter	Description
IP Address	It refers to the IP address of remote device.
Username	It refers to the username of remote dev ice.
Password	It refers to the user's password of remote device.

6.3.1.2 Viewing Remote Device Properties

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

Steps

Step 1: Select "Service" -> "Remote Device" on the navigation tree to open the remote device interface.

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

6.3.1.3 Refreshing Remote Device

This section explains how to refresh remote device.

Steps

Step 1: Select "Service" -> "Remote Device" on the navigation tree to open the remote device interface.

Step 2: Click the <Refresh> button in the **Remote Devices** tab of the information display area to complete the configuration.

6.3.1.4 Deleting Remote Device

This section explains how to delete remote device.

Steps

Step 1: Select "Service" -> "Remote Device" on the navigation tree to open the remote device interface.

Step 2: Select the desired remote device in the **Remote Devices** 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.

6.3.2 Creating XAN

6.3.2.1 Creating XAN Based on IP Management Link + IP Data Link

This section explains how to create XAN based on IP management link + IP data link.

ⓘNOTE

XAN will be automatically created on the two devices on the base of IP management link.

Prerequisites

Before creating an XAN, configure the IP addresses of the XAN link ports on the two devices and ensure that the network is reachable.

Steps

Step 1: Select "Service" -> "Remote Device" on the navigation tree to open the remote device interface.

Step 2: Click the <Create> button in the **XANs** tab of the information display area to open the **Create XAN** wizard.

Step 3: The first step of the **Create XAN** wizard is shown in Figure 6-3. Configure the management link between devices to IP, select the target device, and click the <Next> button to enter the next interface.

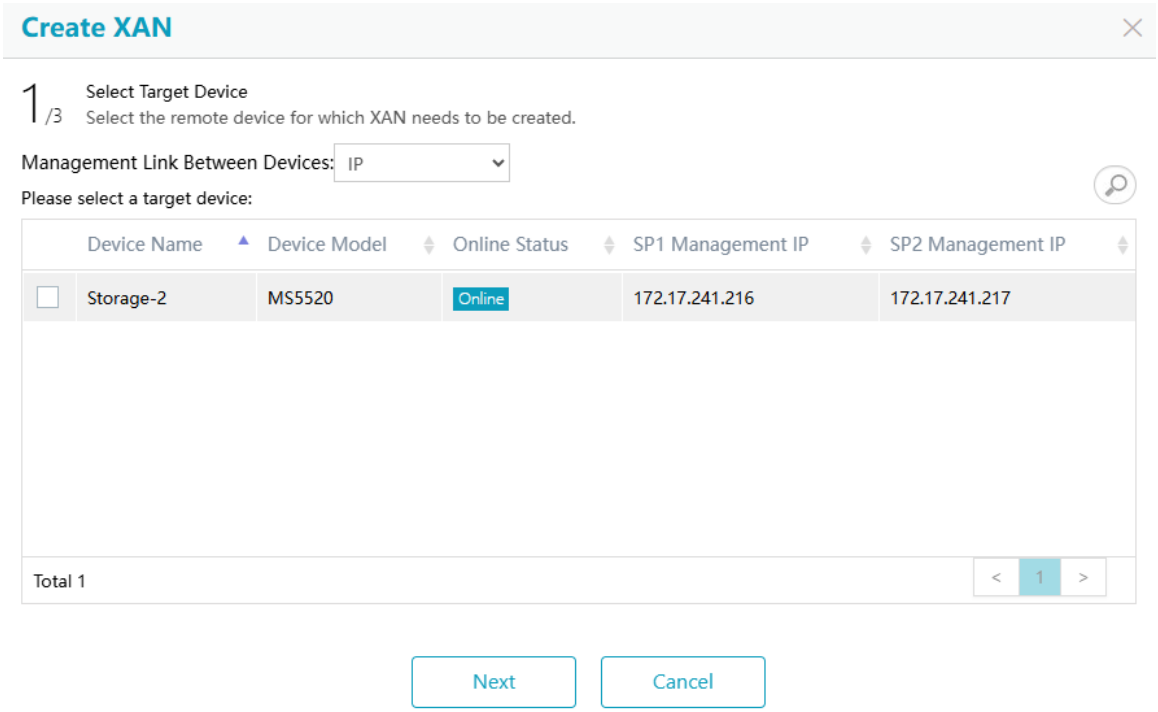

Figure 6-3 Create XAN (IP management link + IP data link) wizard interface (1)

Step 4: The second step of the **Create XAN** wizard is shown in Figure 6-4. Configure the XAN link type to IP, select the local port and peer port, and click the <Test> button to ensure that the network is reachable. Click the <Next> button to enter the next interface.

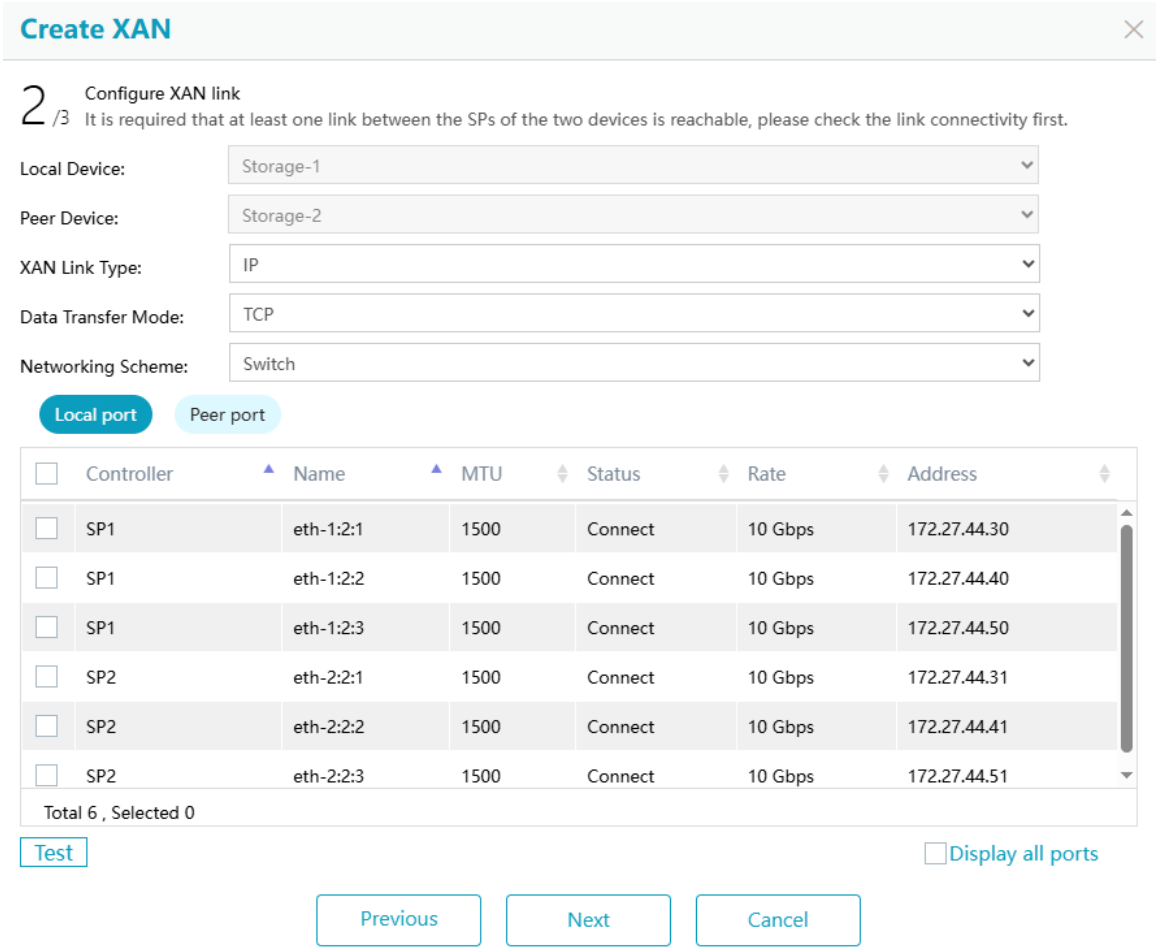

Figure 6-4 Create XAN (IP management link + IP data link) wizard interface (2)

Table 6-2 Description of the parameters for creating XAN (IP management link + IP data link) wizard interface (2)

Parameter	Description
Local Device	It refers to the name of the local device.
Peer Device	It refers to the name of the peer device.
XAN Link Type	It refers to the type of XAN link established between the local device and the peer device. Please select IP.
Data Transfer Mode	It refers to the XAN data transfer mode established between the local device and the peer device. • TCP: It refers to data transfer through the TCP protocol. • RDMA: It refers to data transfer through the RDMA protocol. • ALL: It refers to auto-negotiation transport protocol.
Networking Scheme	It refers to the networking scheme established between local device and peer device, including switch and mesh.

Step 5: In the third step of the **Create XAN** wizard, you can check the configuration information and click the <Finish> button to complete the configuration.

Step 6: After creating the XAN, you can see the XAN link status become "Link" in the **XAN Topology** tab of the extended area, as shown in Figure 6-5.

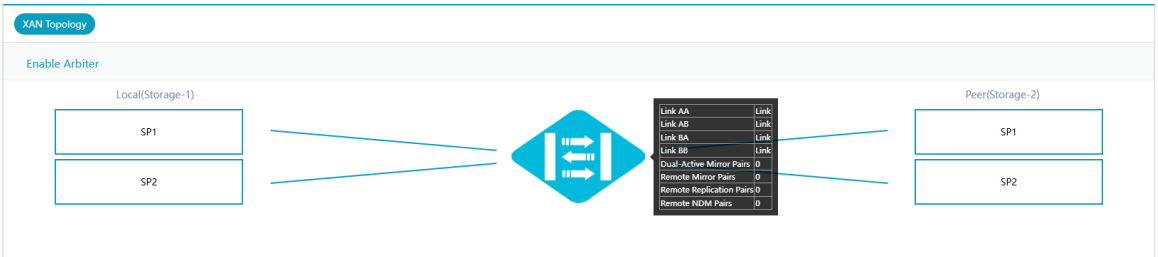

Figure 6-5 XAN topology interface

6.3.2.2 Creating XAN Based on IP Management Link + FC Data Link

This section explains how to create XAN based on IP management link + FC data link.

ⓘNOTE

XAN will be automatically created on the two devices on the base of IP management link.

Steps

Step 1: Select "Service" -> "Remote Device" on the navigation tree to open the remote device interface.

Step 2: Click the <Create> button in the **XANs** tab of the information display area to open the **Create XAN** wizard.

Step 3: The first step of the **Create XAN** wizard is shown in Figure 6-6. Configure the management link between devices to IP, select the target device, and click the <Next> button to enter the next interface.

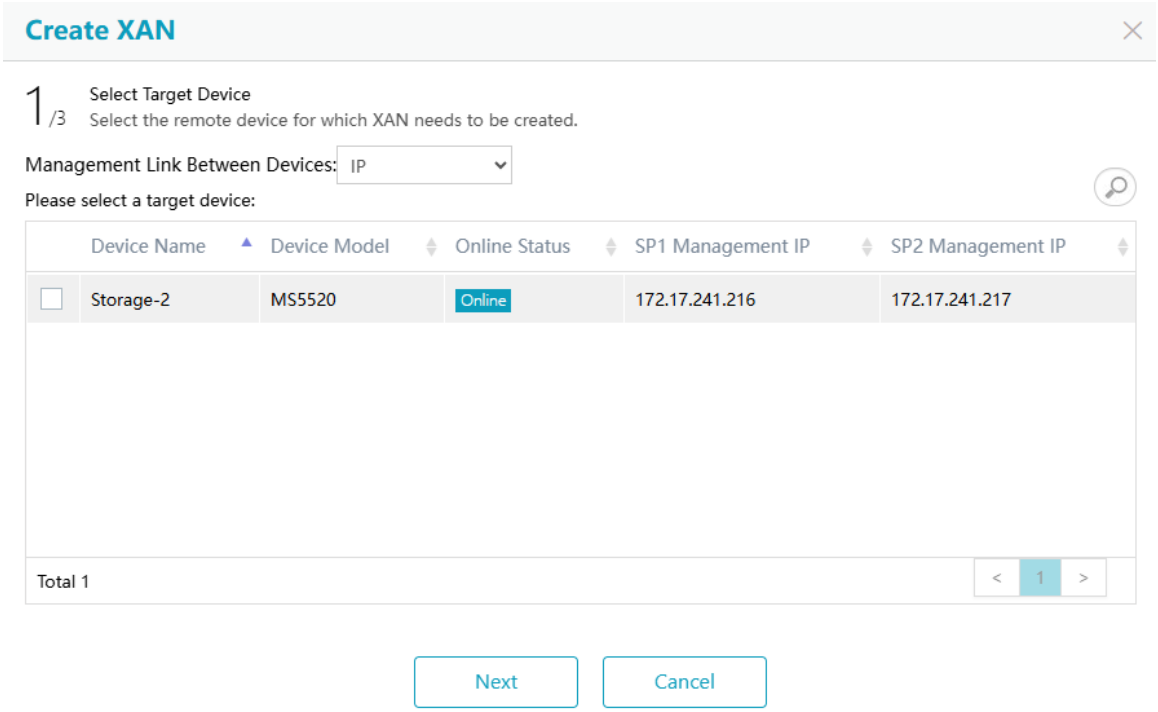

Figure 6-6 Create XAN (IP management link + FC data link) wizard interface (1)

Step 4: The second step of the **Create XAN** wizard is shown in Figure 6-7. Configure the XAN link type to FC, select the local port and peer port, and click the <Next> button to enter the next interface.

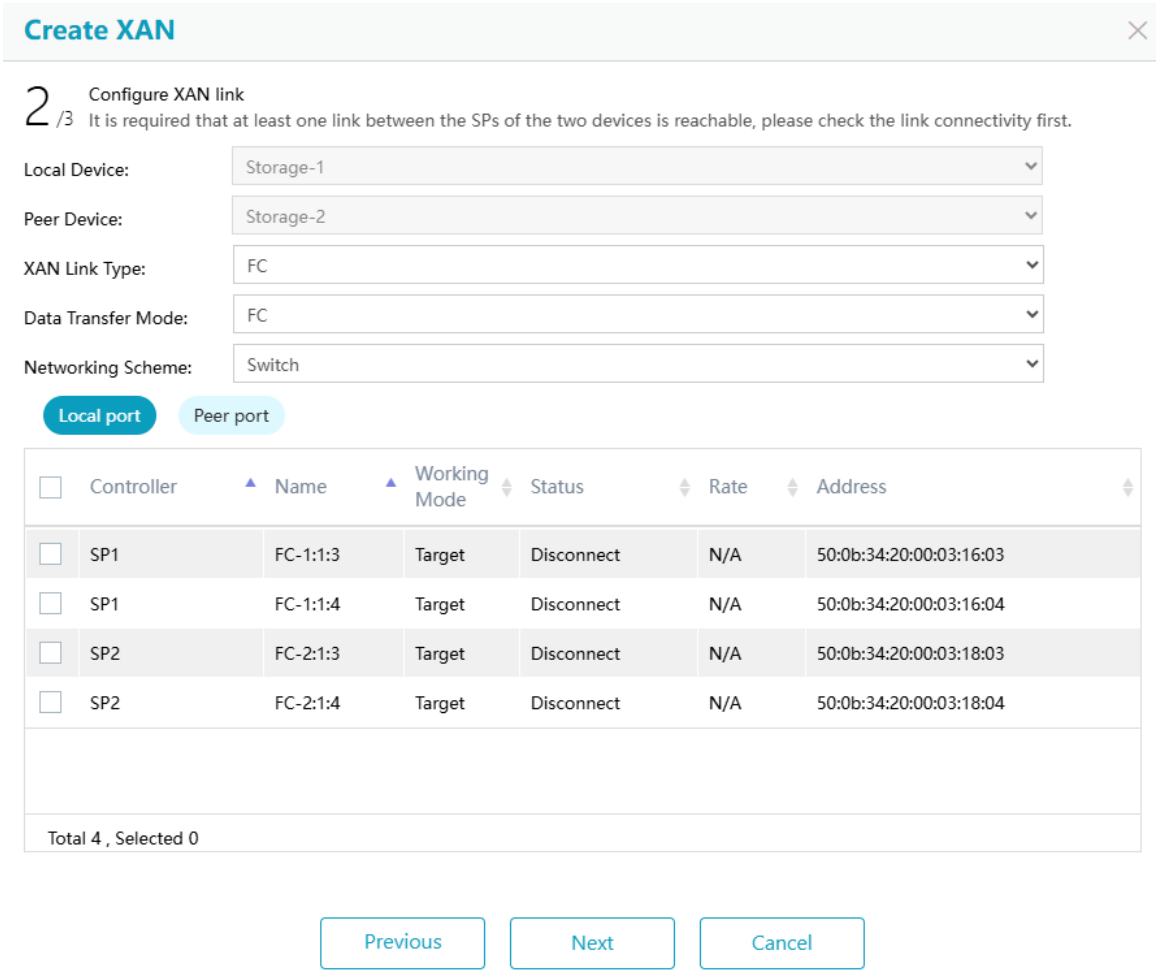

Figure 6-7 Create XAN (IP management link + FC data link) wizard interface (2)

Table 6-3 Description of the parameters for creating XAN (IP management link + FC data link) wizard interface (2)

Parameter	Description
Local Device	It refers to the name of the local device.
Peer Device	It refers to the name of the peer device.
XAN Link Type	It refers to the type of XAN link established between the local device and the peer device. Please select FC.
Data Transfer Mode	It refers to the XAN data transfer mode established between the local device and the peer device. • FC: It refers to data transfer through the FC protocol. • ALL: It refers to auto-negotiation transport protocol.
Networking Scheme	It refers to the networking scheme established between local device and peer device, including switch and mesh.

Step 5: In the third step of the **Create XAN** wizard, you can check the configuration information and click the <Finish> button to complete the configuration.

Step 6: After creating the XAN, you can see the XAN link status become "Link" in the **XAN Topology** tab of the extended area, as shown in Figure 6-5.

6.3.2.3 Creating XAN Based on FC Management Link + FC Data Link

This section explains how to create XAN based on FC management link + FC data link.

⚠CAUTION

If there is no IP management link between two devices, XAN will be created only on the local device on the base of FC management link, and you need to log in to the target device to create XAN under this circumstance.

Steps

Step 1: Select "Service" -> "Remote Device" on the navigation tree to open the remote device interface.

Step 2: Click the <Create> button in the **XANs** tab of the information display area to open the **Create XAN** wizard.

Step 3: The first step of the **Create XAN** wizard is shown in Figure 6-8. Configure the management link between devices to FC and click the <Next> button to enter the next interface.

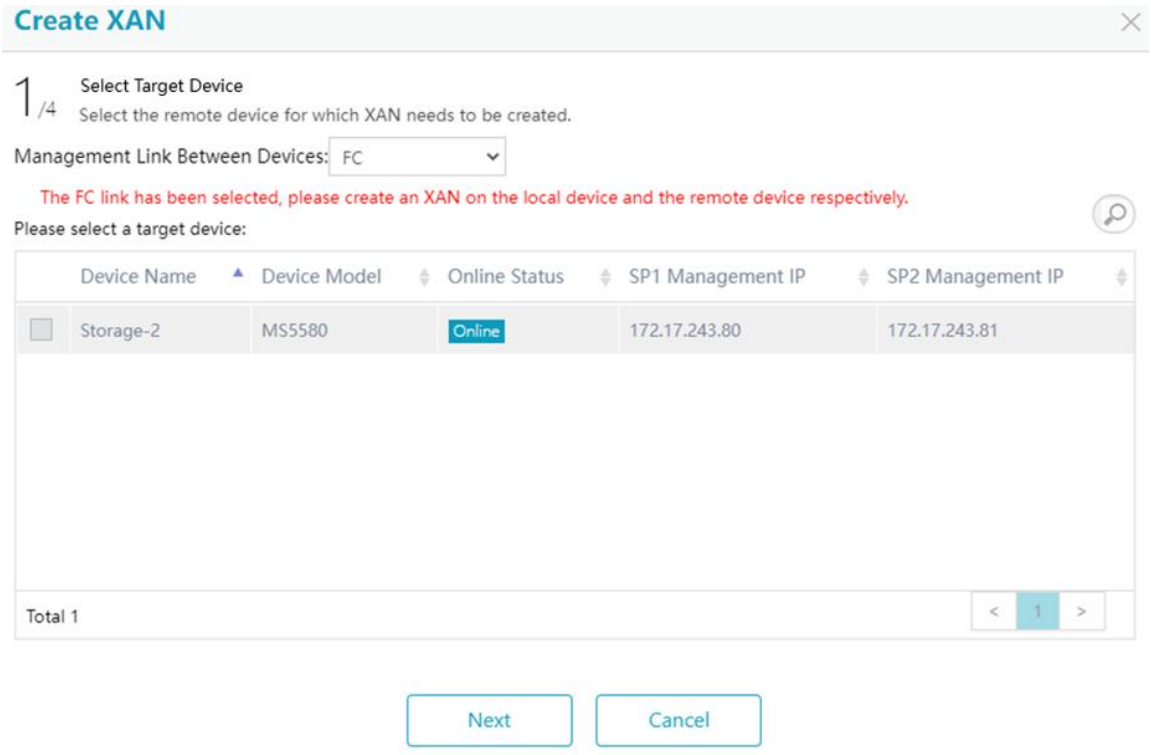

Figure 6-8 Create XAN wizard interface (FC management link + FC data link) (1)

Step 4: The second step of the **Create XAN** wizard is shown in Figure 6-9. Select the local FC port and click the <Next> button to enter the next interface.

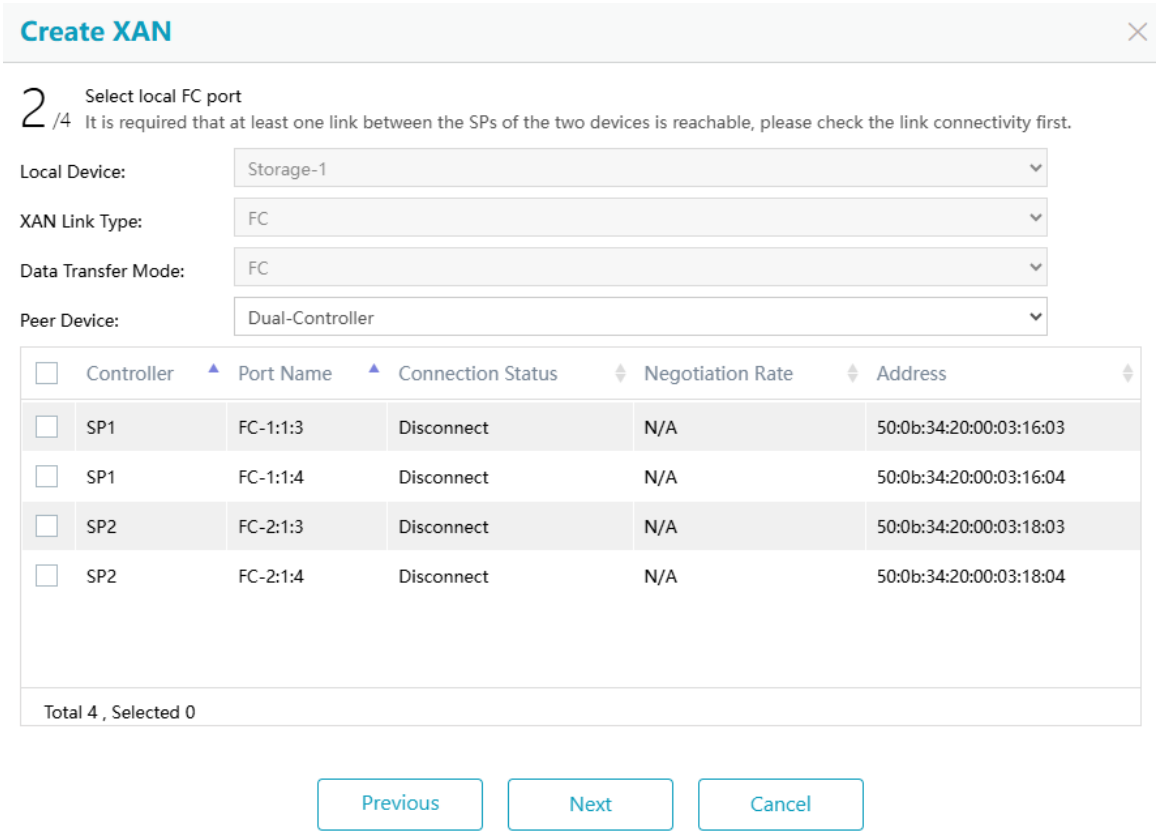

Figure 6-9 Create XAN wizard interface (FC management link + FC data link) (2)

Table 6-4 Description of the parameters for configuring XAN link (3)

Parameter	Description
Local Device	It refers to the name of the local device.
XAN Link Type	It refers to the type of XAN link established between the local device and the peer device. The type is fixed at FC in this scenario.
Data Transfer Mode	It refers to the XAN data transfer mode established between the local device and the peer device. The mode is fixed at FC in this scenario.
Peer Device	It refers to the type of the peer device, including dual-control and four-control.

Step 5: The third step of the **Create XAN** wizard is shown in Figure 6-10. Select the peer FC port and click the <Next> button to enter the next interface.

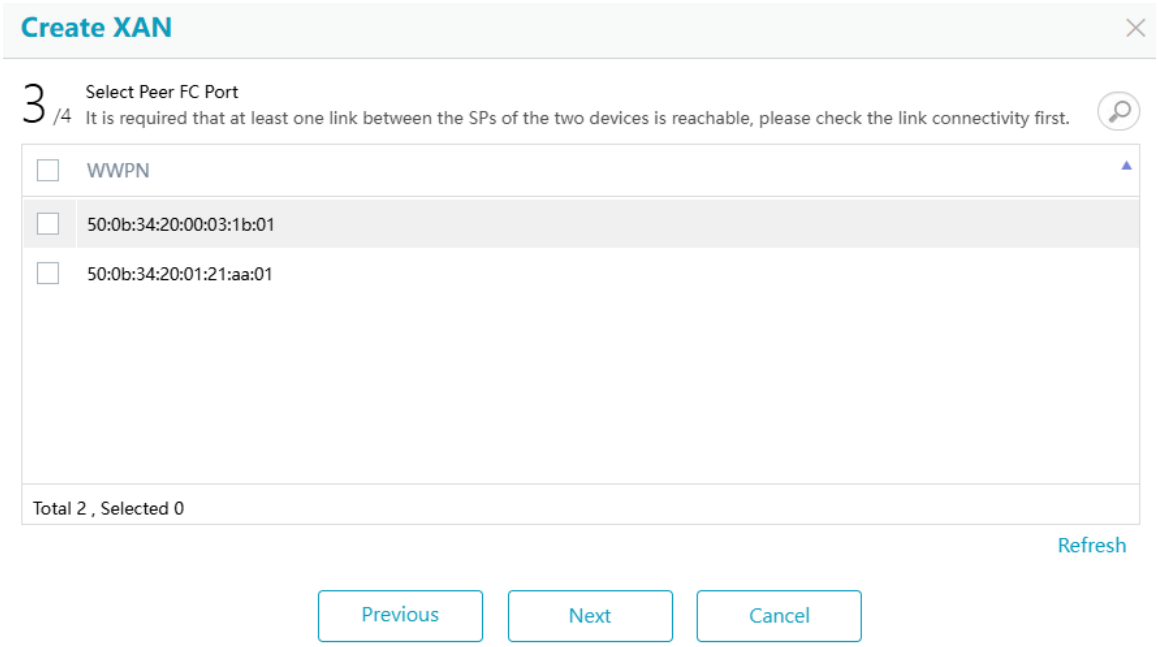

Figure 6-10 Create XAN wizard interface (FC management link + FC data link) (3)

Step 6: In the forth step of the **Create XAN** wizard, you can check the configuration information and click the <Finish> button to complete the configuration.

Step 7: Refer to Step 1 to Step 5 to create an XAN based on the FC management link on the target device.

Step 8: After creating the XAN, the XAN link status will become "Link" in the **XAN Topology** tab of the extended area, as shown in Figure 6-5.

6.3.3 Viewing XAN Properties

This section explains how to view XAN's general information and XAN link.

Steps

Step 1: Select "Service" -> "Remote Device" on the navigation tree to open the remote device interface.

Step 2: Select the desired XAN in the **XANs** 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 XAN.

6.3.4 Modifying XAN Properties

6.3.4.1 Adding XAN Port

This section explains how to add XAN port.

Steps

Step 1: Select "Service" -> "Remote Device" on the navigation tree to open the remote device interface.

Step 2: Select the desired XAN in the **XANs** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **XAN Link** tab is shown in Figure 6-11.

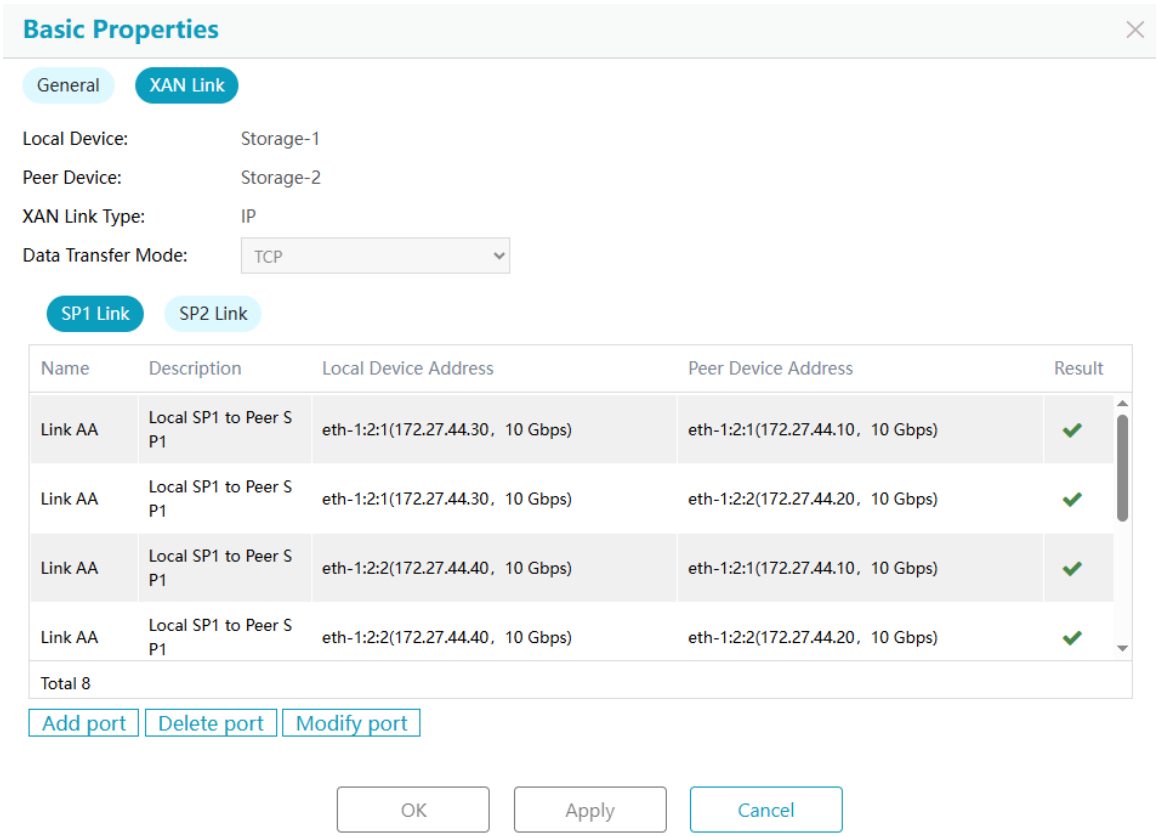

Figure 6-11 XAN basic properties interface

Step 3: Click the <Add port> button to open the **Add XAN Port** window, as shown in Figure 6-12. Select the desired port and click the <OK> button to complete the configuration.

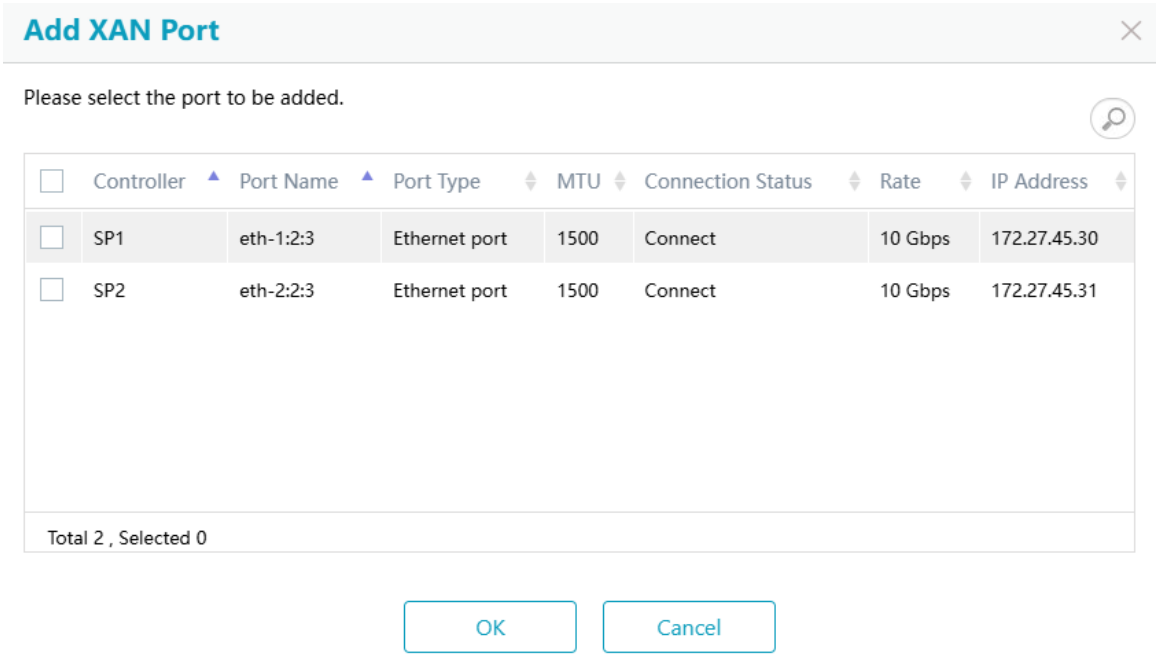

Figure 6-12 Add XAN port interface

6.3.4.2 Modifying XAN Port

This section explains how to modify XAN port's IP address and subnet mask.

Prerequisites

XAN ports modification is supported only for the XAN with IP management link + IP data link.

Steps

Step 1: Select "Service" -> "Remote Device" on the navigation tree to open the remote device interface.

Step 2: Select the desired XAN in the **XANs** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **XAN Link** tab is shown in Figure 6-11.

Step 3: Click the <Modify port> button to open the **Modify XAN Port** window, as shown in Figure 6-13. Select the desired port, modify its IP address and subnet mask, and click the <OK> button to complete the configuration.

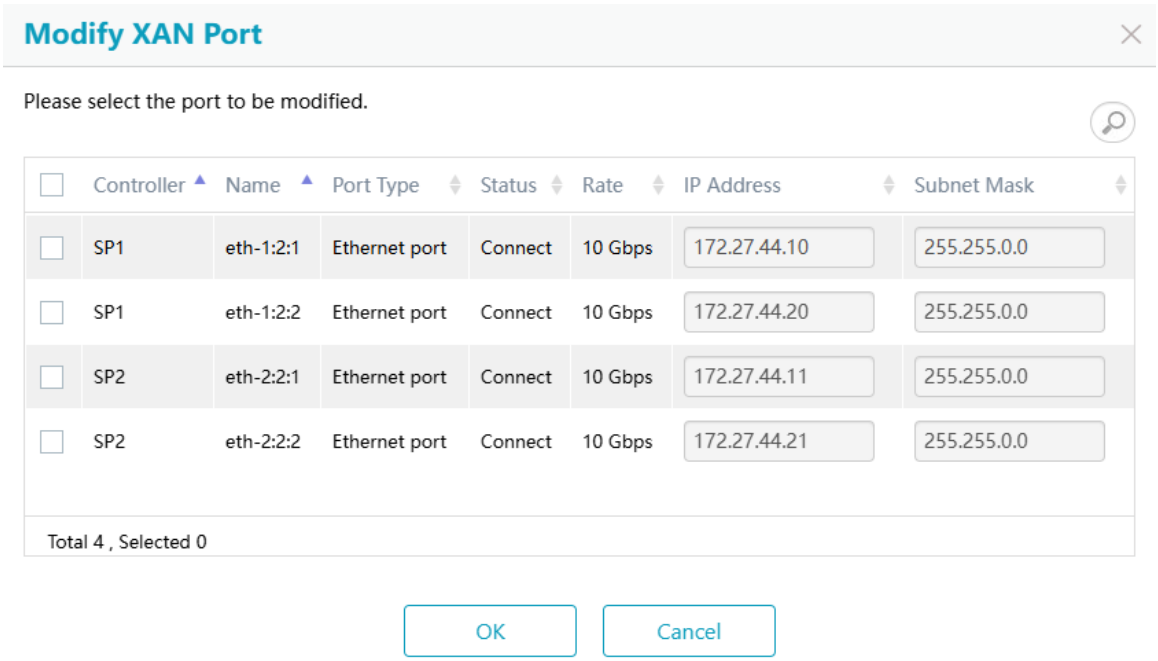

Figure 6-13 Modify XAN port interface

6.3.4.3 Deleting XAN Port

This section explains how to delete XAN port.

Steps

Step 1: Select "Service" -> "Remote Device" on the navigation tree to open the remote device interface.

Step 2: Select the desired XAN in the **XANs** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **XAN Link** tab is shown in Figure 6-11.

Step 3: Click the <Delete port> button to open the **Delete XAN Port** window, as shown in Figure 6-14. Select the desired port and click the <OK> button to complete the configuration.

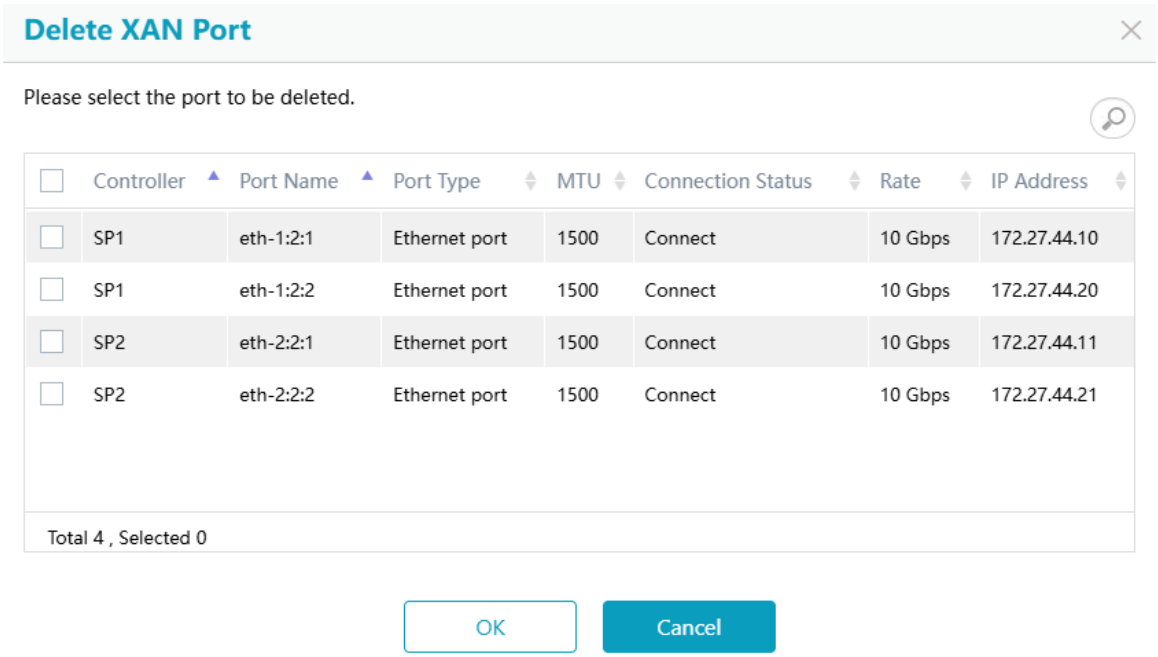

Figure 6-14 Delete XAN port interface

6.3.5 Deleting XAN

This section explains how to delete XAN.

⚠CAUTION

- If the XAN link is reachable, it will be deleted at both ends simultaneously.
- If the XAN link is unreachable, it will be forcibly deleted at the local end, and its configuration information will be remained at the peer end. Do not forcibly delete XAN at one end unless necessary or the legality of the operation has been confirmed.

Prerequisites

There is no business that depends on XAN, such as remote migration pair, remote replication pair, remote mirror pair, dual-active pair, etc.

Steps

Step 1: Select "Service" -> "Remote Device" on the navigation tree to open the remote device interface.

Step 2: Select the desired XAN in the **XANs** 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.

6.4 Configuring Arbiter

⚠CAUTION

Arbiter is required to be deployed in order to solve the split-brain problem.

6.4.1 Preparations before Configuring Arbiter

6.4.1.1 Deploying Arbiter

Please refer to the *Arbiter Installation Guide* to deploy an arbiter on a third-party server, and configure the IP address of the network port on the arbiter to provide communication with the two devices in the XAN device pair.

⚠CAUTION

The third-party server can be either a physical server or a virtual machine, and it is recommended to use a physical server. In order to reduce the fault domain, there are following requirements on the physical server where the arbiter is deployed or the virtual machine or the physical server to which the virtual machine belongs (hereinafter referred to as arbiter server):

- It is required that the LUN provided by the storage device is not used. It is recommended to use local disk to keep the arbitration data.
- It is required there is no business to automatically restart the arbiter server. It is recommended that the server is set for the arbiter exclusively.
- The arbiter business is required to be running with auto startup function once being powered on.
- The arbiter network is required to be independent from XAN, and the network between each SP and the arbiter server is guaranteed to be reachable.

6.4.1.2 Configuring IP Address

Configure the IP addresses of the network ports on the two devices of XAN device pair to communicate with arbiter. Please ensure that the arbiter network is independent of XAN and the network between each SP and the arbiter is reachable during configuration.

ⓘNOTE

For details on how to configure IP address, refer to the chapter of "Managing Ethernet Ports" in *MacroSAN MS Series Storage Devices Basic Configuration GUI User Manual*. Please check the network connectivity between each SP and the arbiter through the ping command after configuration.

6.4.2 Enabling Arbiter

This section explains how to enable arbiter.

ⓘNOTE

- If the arbiter link is a two-layer network, the egress IP address does not need to be configured.
- If the arbiter link is a three-layer network, the egress IP address must be configured.

Steps

Step 1: Select "Service" -> "Remote Device" on the navigation tree to open the remote device interface.

Step 2: Select the desired XAN in the **XANs** tab of the information display area and click the <Enable Arbiter> button in the extended area to open the **Enable Arbiter** window, as shown in Figure 6-15. Enter relevant parameters (see Table 6-5 for details) and click the <OK> button to complete the configuration.

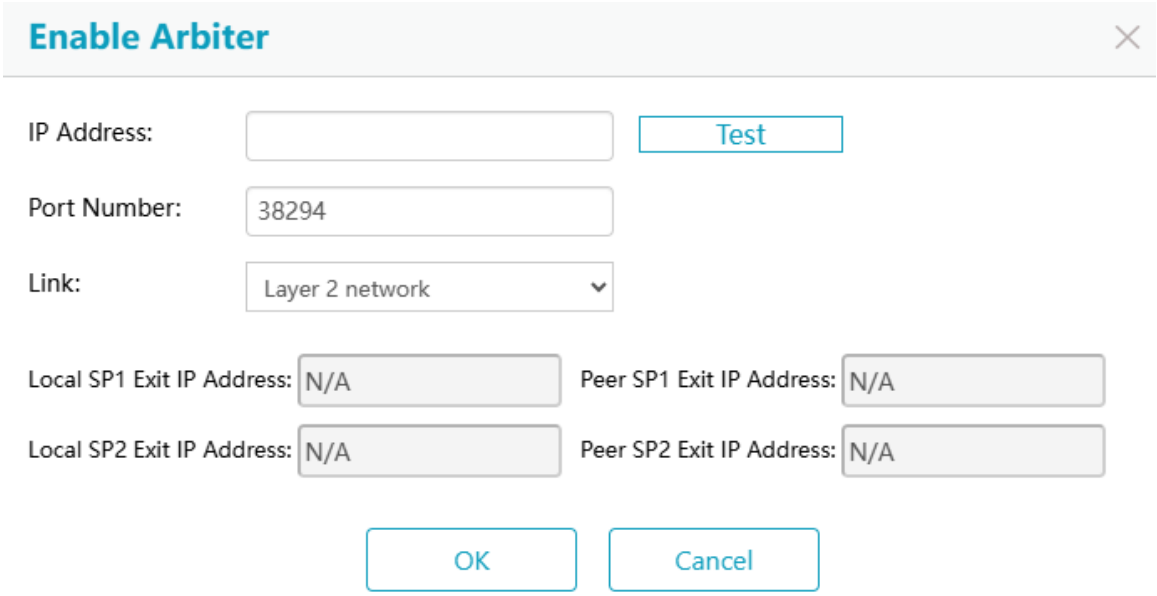

Figure 6-15 Enable arbiter interface

Table 6-5 Description of the parameters for enabling arbiter interface

Parameter	Description
IP Address	It refers to the IP address of the arbiter server. **ⓘNOTE** After configuring the IP address, click the <Test> button to test whether the network between each controller and the arbiter is reachable.
Port Number	It refers to the port used by the arbiter server for monitoring, the port number is 38294.
Egress IP addresses of all SPs	Egress IP address must be configured if the arbiter link is a three-layer network, and the communication between controllers and the arbiter is implemented through egress IP address.

6.4.3 Disabling Arbiter

This section explains how to disable arbiter.

⚠CAUTION

- If XAN link is unreachable, arbiter will be forcibly disabled only at the local end, and arbiter configuration information will be remained at the peer end. Do not forcibly disable the arbiter at one end unless necessary or the legality of the operation has been confirmed.
- If the networks between the SPs of the two devices in the XAN device pair and the arbiter are both unreachable, the arbiter is forcibly disabled only on the XAN and configuration information will be remained on the arbiter. Do not forcibly disable the arbiter unless necessary or the legality of the operation has been confirmed.

Steps

Step 1: Select "Service" -> "Remote Device" on the navigation tree to open the remote device interface.

Step 2: Select the desired XAN in the **XANs** tab of the information display area and click the <Disable Arbiter> button in the extended area，enter "yes" in the pop-up warning box, and click the <OK> button to complete the configuration.

7 Configuring Dual-Active

7.1 Managing LUN Dual-Active

7.1.1 Enabling Dual-Active Mirror

This section explains how to enable dual-active mirror pair.

Prerequisites

- The XAN is well configured and reachable.
- The capacities of primary LUN and mirror LUN must be the same.
- The health status of primary LUN and mirror LUN must be normal.
- The access types of primary LUN and mirror LUN must be the same.
- If snapshot resources have been created for primary LUN and mirror LUN, they must have normal health status and valid data; if no snapshot resources have been created for primary LUN and mirror LUN, they will be created in the system automatically.
- If both primary LUN and mirror LUN are Thin-LUNs, they must have the same extent size.
- Mirror LUN cannot be assigned to client servers.

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Click the <Enable> button in the **LUN Dual-Active** tab of the information display area to open the **Enable Dual-Active** wizard.

Step 3: The first step of the **Enable Dual-Active** wizard is shown in Figure 7-1. Select local LUN, set the mirror role of local LUN, and click the <Next> button to enter the next interface.

ⓘNOTE

Only local LUN is used as the primary LUN for an example in this chapter.

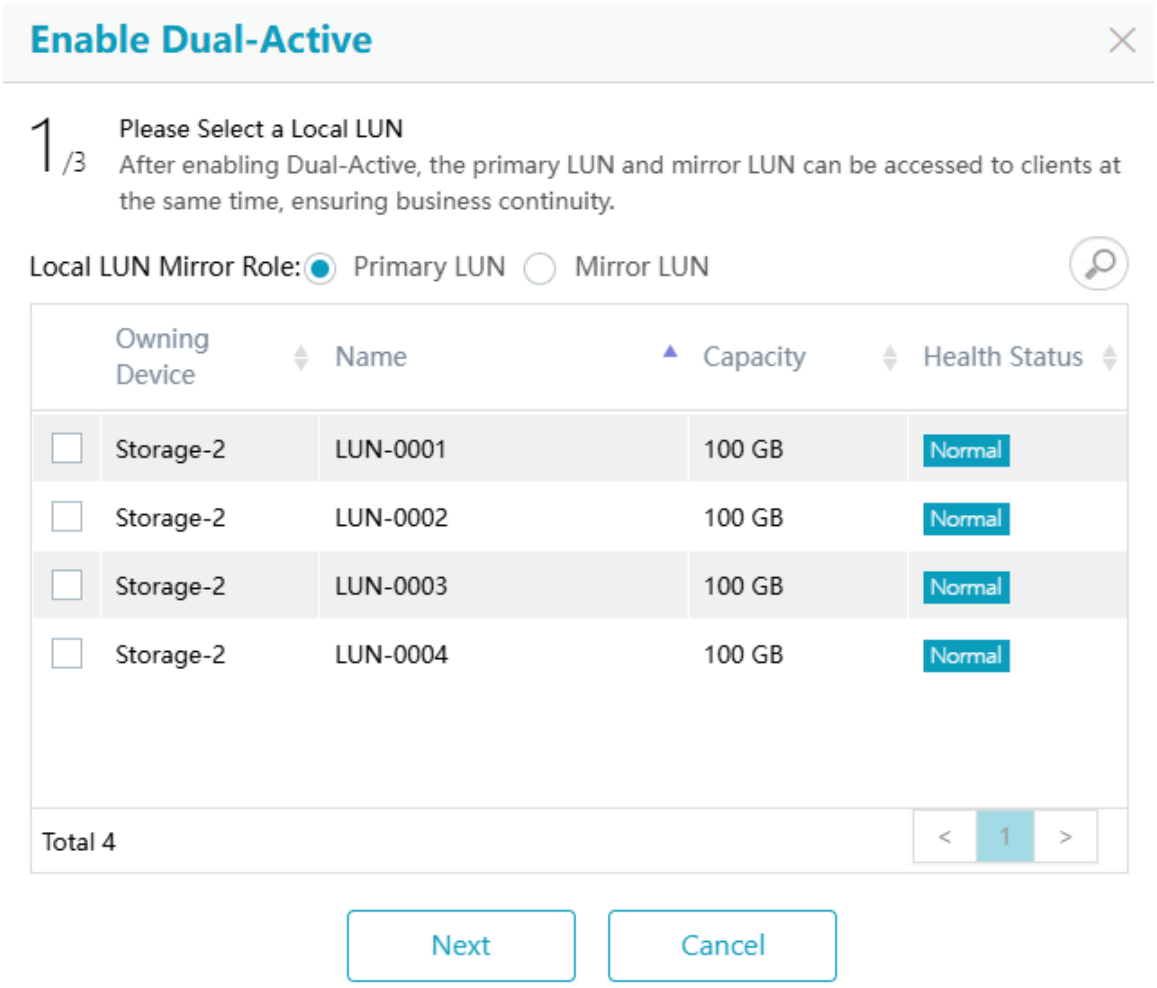

Figure 7-1 Enable Dual-Active wizard interface (1)

Step 4: The second step of the **Enable Dual-Active** wizard is shown in Figure 7-2. Select remote device and peer LUN and click the <Next> button to enter the next interface.

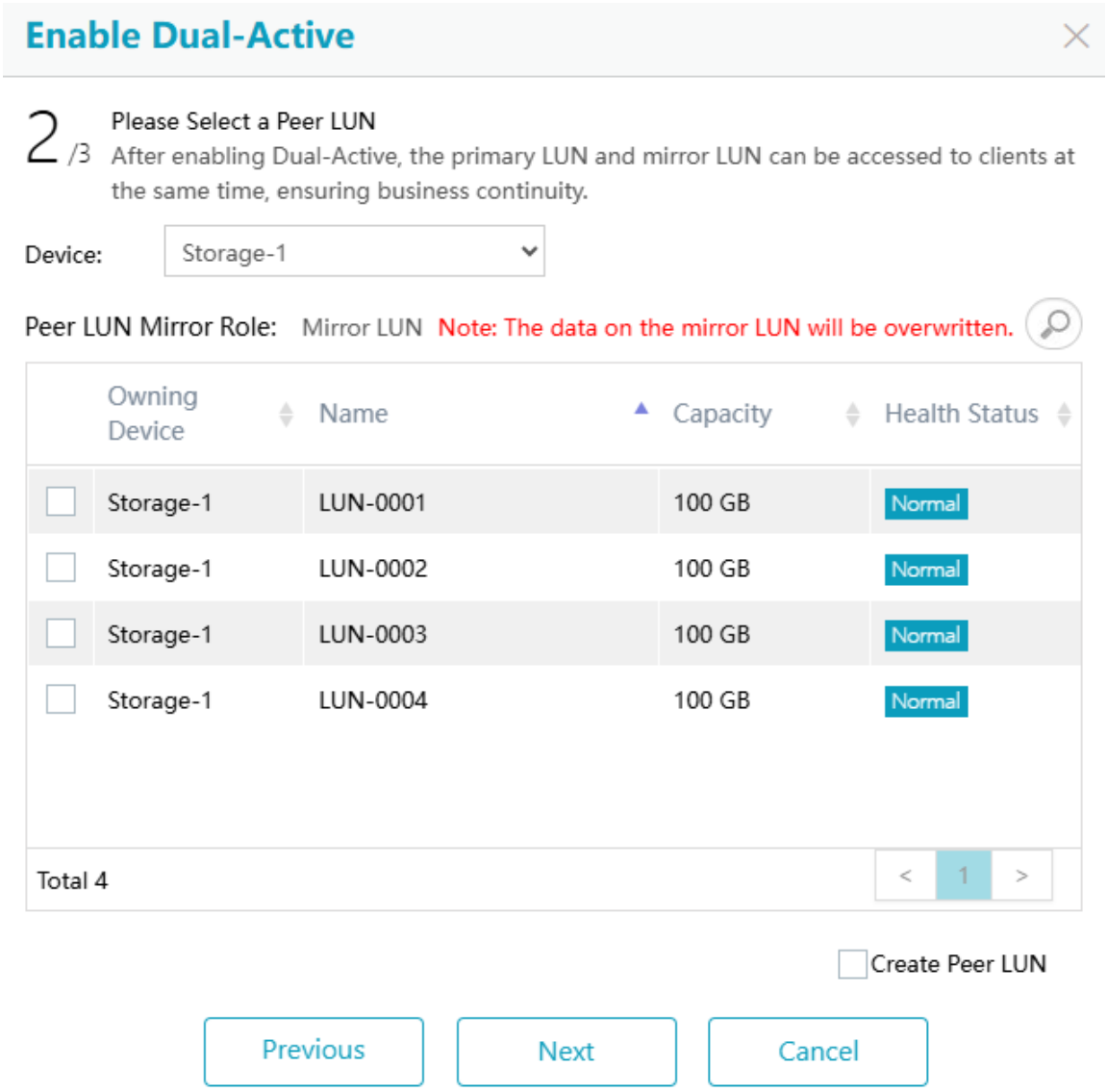

Figure 7-2 Enable Dual-Active wizard interface (2)

ⓘNOTE

If a peer LUN has not been created in advance, you can also select the "Create Peer LUN" option in this step to create a new peer LUN on the remote device. In the next steps, you will create a new peer LUN through extended steps, corresponding to steps 2a/3, 2b/3, etc. This chapter only describes content related to dual-active mirror. For the steps and parameter descriptions of creating a LUN, please refer to the relevant user manual:

- For details on creating a Thick-LUN, see *MacroSAN MS Series Storage Devices Basic Configuration GUI User Manual*.
- For details on creating a Thin-LUN, see *MacroSAN MS Series Storage Devices Thin Provisioning Feature GUI User Manual*.
- For details on creating an RDV-LUN, see *MacroSAN MS Series Storage Devices Virtualization Feature GUI User Manual*.

Step 5: In the third step of the **Enable Dual-Active** wizard, you can check the configuration information and click the <Finish> button to complete the configuration.

7.1.2 Viewing Dual-Active Mirror Properties

This section explains how to view dual-active mirror pair's mirror pair information and mirror pair status.

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select the desired mirror pair in the **LUN Dual-Active** 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 mirror pair.

7.1.3 Modifying Dual-Active Mirror Pair Properties

7.1.3.1 Modifying Synchronous Protection Business Flow Control

This section explains how to modify mirror pair's synchronous protection business flow control.

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select the desired mirror pair in the **LUN Dual-Active** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Mirror Pair Status** tab is shown in Figure 7-3 or Figure 7-4. Modify synchronous protection business flow control and click the <Apply> button to complete the configuration.

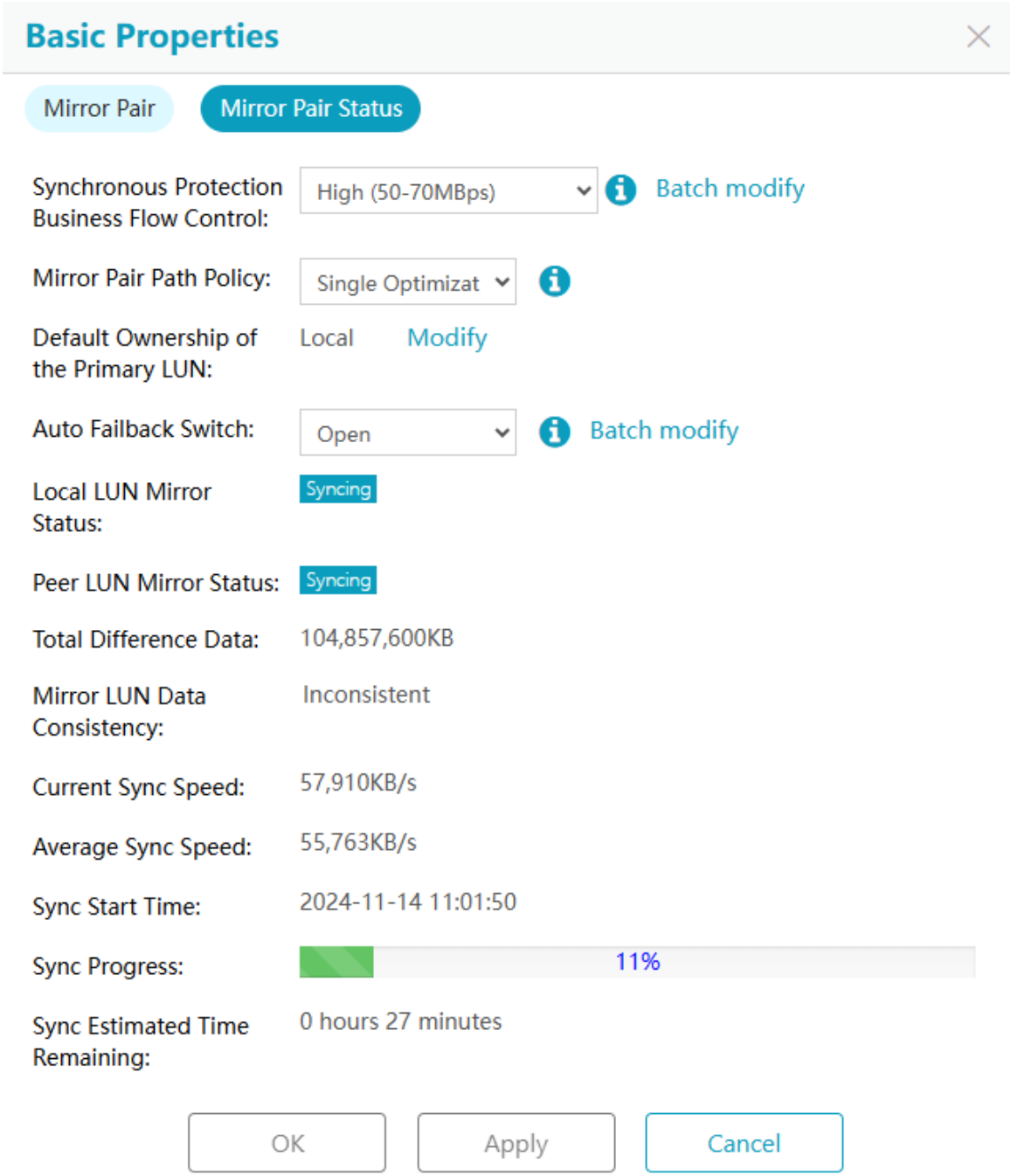

Figure 7-3 Dual-Active mirror pair basic properties interface (ALUA LUN)

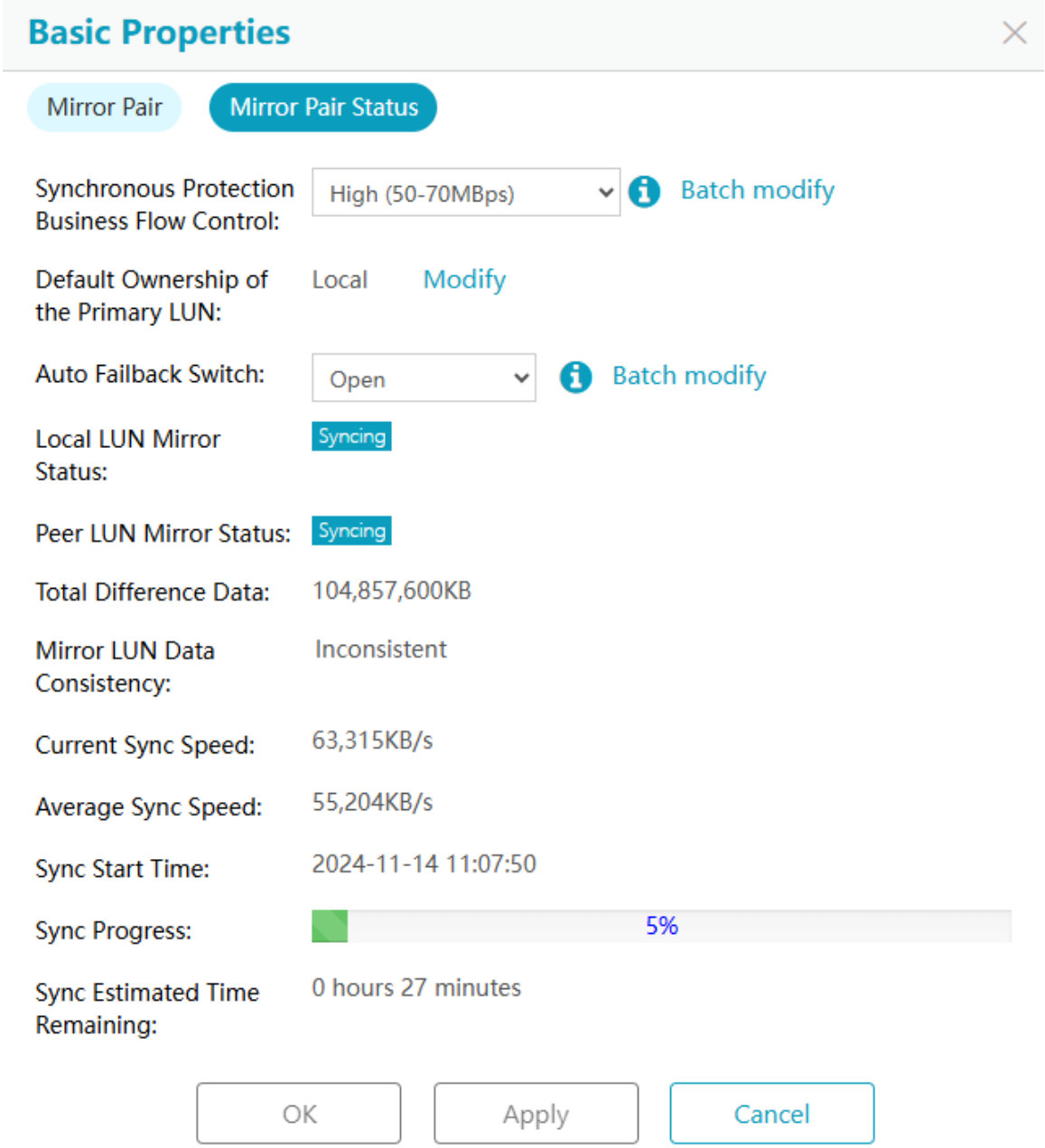

Figure 7-4 Dual-Active mirror pair basic properties interface (SLUA LUN)

7.1.3.2 Batch Modifying Synchronous Protection Business Flow Control

This section explains how to batch modify mirror pairs' synchronous protection business flow control.

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select any desired mirror pair in the **LUN Dual-Active** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Mirror Pair Status** tab is shown in Figure 7-3 or Figure 7-4.

Step 3: Click the <Batch modify> button of the synchronous protection business flow control item to open the **Batch Modify Synchronous Protection Business Flow Control** window, as shown in Figure 7-5. Modify synchronous protection business flow control, select peer device and dual-active pair, and click the <OK> button to complete the configuration.

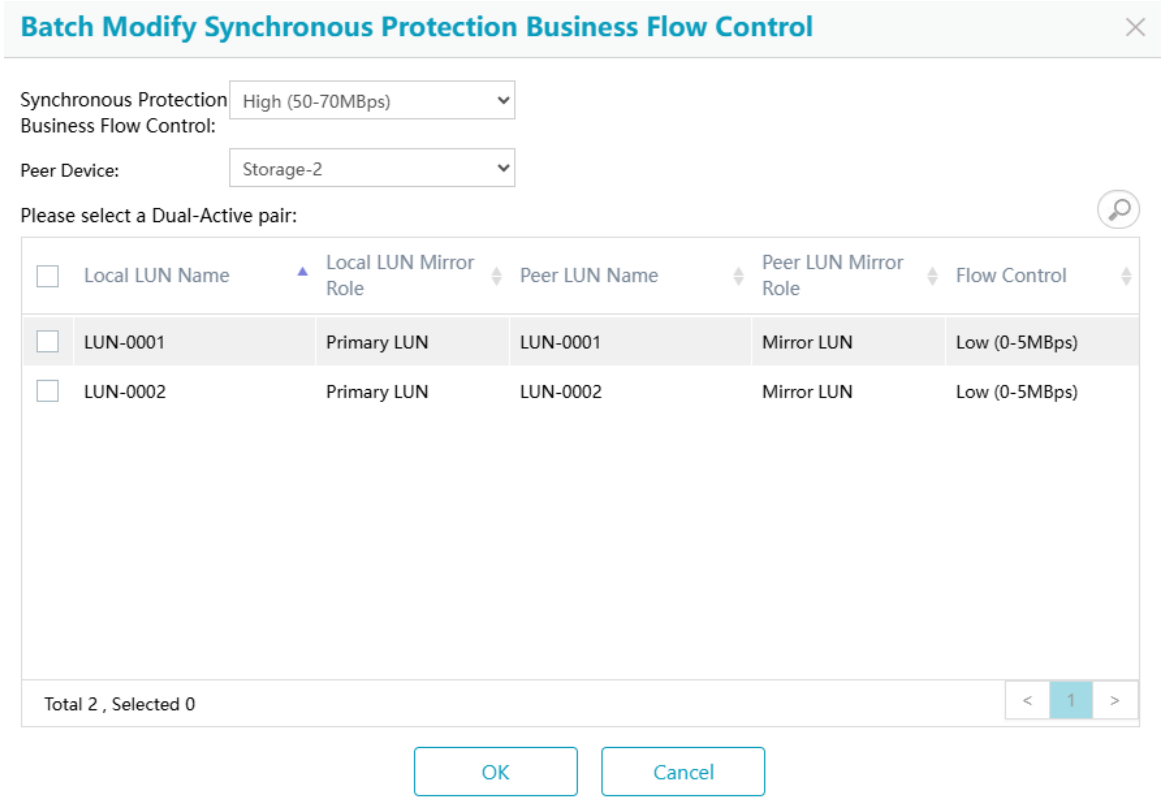

Figure 7-5 Batch modify synchronous protection business flow control interface

7.1.3.3 Modifying Mirror Pair Path Policy

This section explains how to modify mirror pair path policy.

Prerequisites

The access types of both primary LUN and mirror LUN are ALUA.

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select the desired mirror pair in the **LUN Dual-Active** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Mirror Pair Status** tab is shown in Figure 7-3. Modify mirror pair path policy and click the <Apply> button to complete the configuration.

7.1.3.4 Modifying Default Ownership of Primary LUN

This section explains how to modify default ownership of primary LUN.

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select the desired mirror pair in the **LUN Dual-Active** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Mirror Pair Status** tab is shown in Figure 7-3 or Figure 7-4. Modify default ownership of the primary LUN and click the <Apply> button to complete the configuration.

7.1.3.5 Modifying Auto Failback Switch

This section explains how to modify auto failback switch.

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select the desired mirror pair in the **LUN Dual-Active** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Mirror Pair Status** tab is shown in Figure 7-3 or Figure 7-4. Modify auto failback switch and click the <Apply> button to complete the configuration.

7.1.3.6 Batch Modifying Auto Failback Switch

This section explains how to batch modify auto failback switch.

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select any desired mirror pair in the **LUN Dual-Active** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Mirror Pair Status** tab is shown in Figure 7-3 or Figure 7-4.

Step 3: Click the <Batch modify> button of the auto failback switch item to open the **Batch Modify Auto Failback Switch** window, as shown in Figure 7-6. Modify auto failback switch and click the <OK> button to complete the configuration.

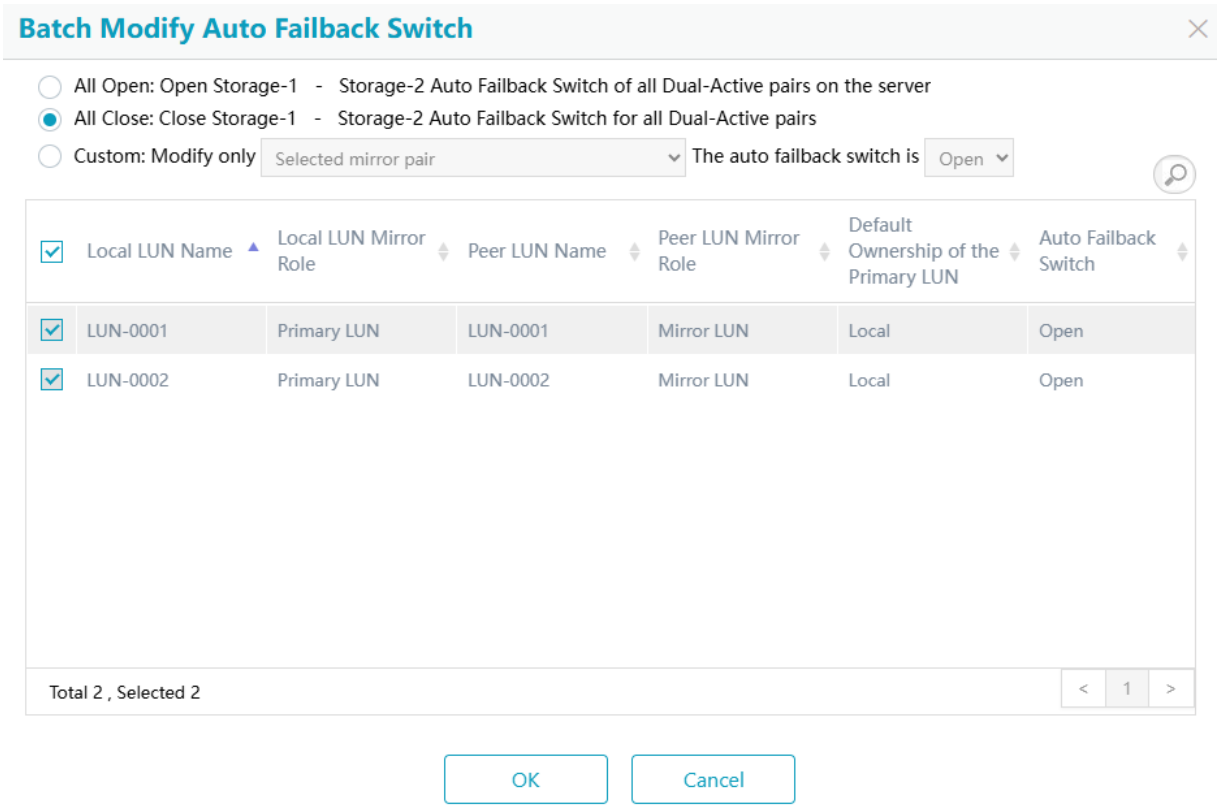

Figure 7-6 Batch modify auto failback switch interface

7.1.4 Suspending Dual-Active Mirror

This section explains how to suspend dual-active mirror pair.

⚠CAUTION

- After suspending mirror, an error will be returned to the IO on mirror LUN. Please do not suspend mirror unless necessary or the legality of the operation has been confirmed.
- If the XAN link is reachable, mirror will be suspended at both ends simultaneously.
- If the XAN link is unreachable, mirror will be suspended at the local end forcibly during suspending. Do not forcibly suspend mirror at one end unless necessary or the legality of the operation has been confirmed.

Prerequisites

The mirror status of dual-active mirror pair is "Unsynchronized", "Syncing," or "Synced".

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select the desired mirror pair in the **LUN Dual-Active** tab of the information display area, click the <More> button, click the <Suspend> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.1.5 Resuming Dual-Active Mirror

This section explains how to resume dual-active mirror pair.

⚠CAUTION

- If the XAN link is reachable, mirror will be resumed at both ends simultaneously.
- If the XAN link is unreachable, mirror will be resumed at the local end forcibly during resuming. Do not forcibly resume mirror at one end unless necessary or the legality of the operation has been confirmed.

Prerequisites

The mirror status of dual-active mirror pair is "Suspended".

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select the desired mirror pair in the **LUN Dual-Active** tab of the information display area, click the <More> button, click the <Resume> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.1.6 Reversing Dual-Active Mirror

ⓘNOTE

Dual-active mirror pair supports main default function and can be flexibly configured according to actual needs. If dual-active mirror pair changes to synchronized from unsynchronized:

- The mirror pair will check whether primary LUN belongs to the default device currently in the case of its auto rollback switch is open. If not, the mirror will be automatically reversed, so that current device of the primary LUN is consistent with the default device.
- Auto reversal will not be triggered in the case of auto rollback switch of the mirror pair is closed.

7.1.6.1 Manually Reversing Mirror

This section explains how to reverse dual-active mirror role manually.

⚠CAUTION

- If the XAN link is reachable, mirror will be reversed at both ends simultaneously.
- If the XAN link is unreachable, you can forcibly reverse the mirror on the mirror LUN. Please make sure that the current primary LUN is not online during the process to avoid "primary + primary" caused by a single-end force mirror reversion, resulting in unrecoverable data loose. Please do not forcibly reverse the mirror at one end unless necessary or the legality of the operation has been confirmed.

Prerequisites

The mirror status of dual-active mirror pair is "Synced".

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select the desired mirror pair in the **LUN Dual-Active** tab of the information display area, click the <More> button, click the <Reverse> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.1.6.2 Auto Reversing Mirror

Dual-active feature supports allocating primary LUN and mirror LUN in the mirror pair to the client server at the same time. The primary LUN and the mirror LUN will be used as the same LUN based on multipath software of client server. Data of the two LUNs in the mirror pair on the side of storage device is synchronized in real time to protect each other.

Auto reversal of mirror pair will be triggered to ensure business continuity in the case of an event affects business continuity. Relevant events include but are not limited to:

- Two SPs in either of the two devices are shut down or restarted at the same time.
- Abnormal power failure occurs in either of the two devices and the battery is available.
- An IO error occurs on the primary LUN and the health status changes to "Error".

7.1.7 Switching Active/Standby Mode

This section explains how to switch dual-active mirror pair's active/standby mode.

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select the desired mirror pair in the **LUN Dual-Active** tab of the information display area, click the <More> button, click the <Switch the Active/Standby Mode> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.1.8 Disabling Dual-Active Mirror

This section explains how to disable dual-active mirror pair.

⚠CAUTION

- If the XAN link is reachable, mirror will be reversed at both ends simultaneously.
- If the XAN link is unreachable, mirror will be forcibly disabled at the local end during disabling. Please do not forcibly disable mirror at one end unless necessary or the legality of the operation has been confirmed.

Prerequisites

The mirror status of dual-active mirror pair is "Synced" or "Suspended".

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

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

7.1.9 Forcing LUN Online

This section explains how to force LUN online.

Prerequisites

The mirror status of dual-active mirror pair is "Negotiate".

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select the desired mirror pair in the **LUN Dual-Active** tab of the information display area, click the <More> button, click the <Force Online> button in the drop-down menu, select LUN and enter "yes" in the pop-up warning box, and click the <OK> button to complete the configuration.

7.2 Managing Consistency Group Dual-Active

7.2.1 Enabling Group Dual-Active Mirror

This section explains how to enable group dual-active mirror pair.

Prerequisites

- The XAN is well configured and reachable.
- The LUN dual-active in the consistency group must meet the following requirements:
  - The capacities of primary LUN and mirror LUN must be the same.
  - The health status of primary LUN and mirror LUN must be normal.
  - The access types of primary LUN and mirror LUN must be the same.
  - If snapshot resources have been created for primary LUN and mirror LUN, they must have normal health status and valid data; if no snapshot resources have been created for primary LUN and mirror LUN, they will be created in the system automatically.
  - If both primary LUN and mirror LUN are Thin-LUNs, they must have the same extent size.
  - Mirror LUN cannot be assigned to client servers.

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Click the <Enable> button in the **Group Dual-Active** tab of the information display area to open the **Enable Group Dual-Active** wizard.

Step 3: The first step of the **Enable Group Dual-Active** wizard is shown in Figure 7-7. Select local group, set the mirror role of local group members, and lick the <Next> button to enter the next interface.

ⓘNOTE

Only local group member is used as the primary LUN for an example in this chapter.

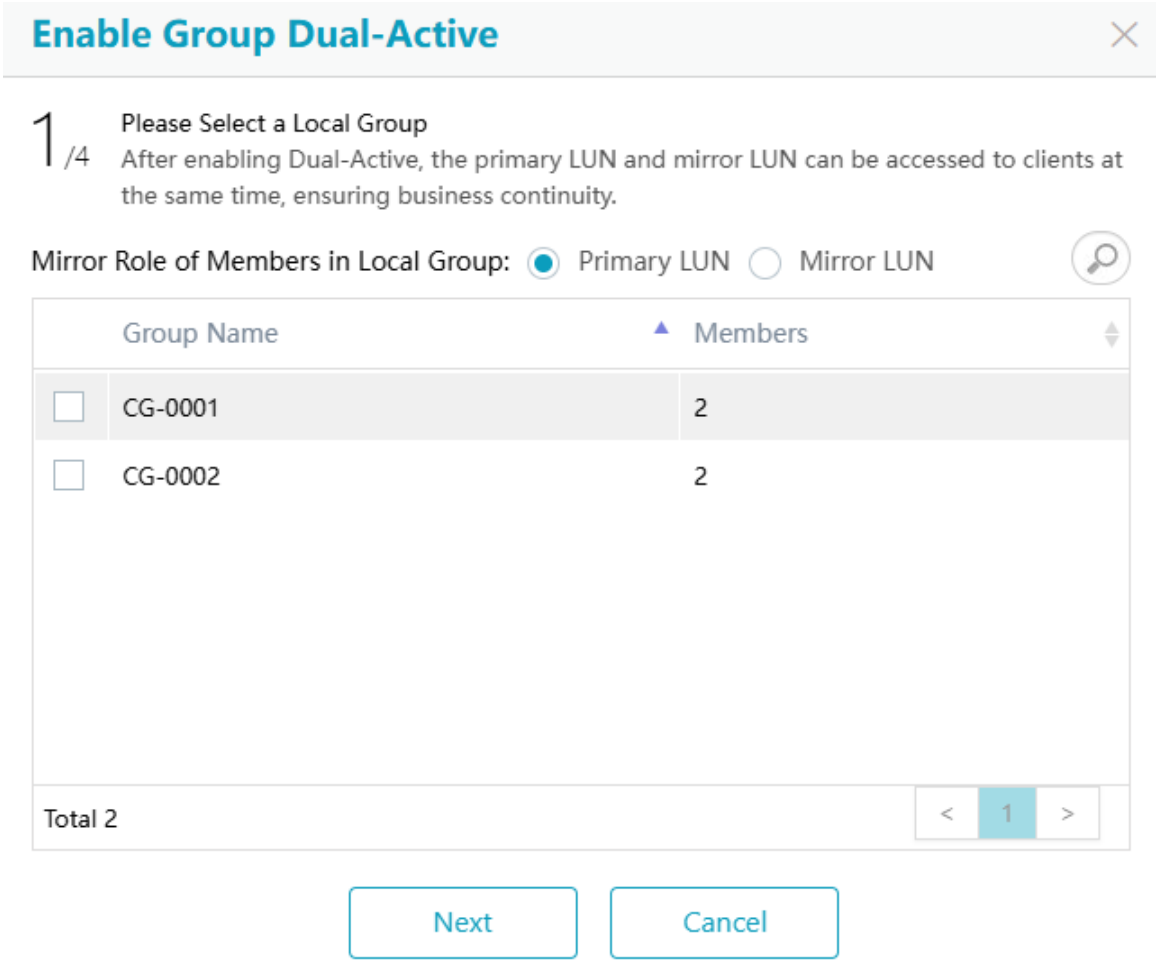

Figure 7-7 Enable group dual-active wizard interface (1)

Step 4: The second step of the **Enable Group Dual-Active** wizard is shown in Figure 7-8. Select remote device and peer group and click the <Next> button to enter the next interface.

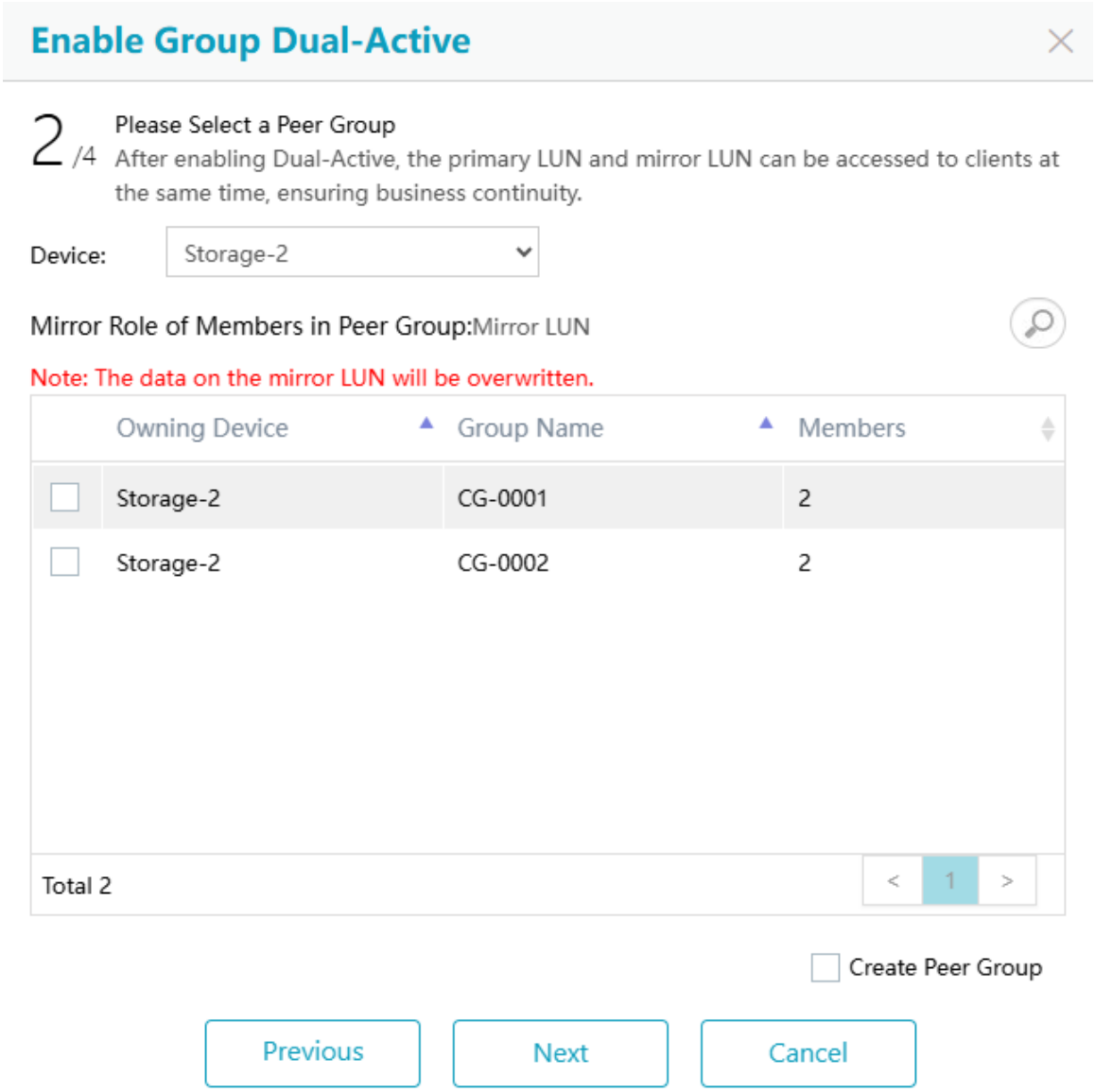

Figure 7-8 Enable group dual-active wizard interface (2)

ⓘNOTE

If a peer group has not been created in advance, you can also select the "Create Peer Group" option in this step to create a new peer group on the remote device. In the next steps, you will create a new peer group through extended step, corresponding to step 2a/4, see 5.1 Creating Consistency Group for details.

Step 5: The third step of the **Enable Group Dual-Active** wizard is shown in Figure 7-9. Configure mirror pair for members and click the <Next> button to enter the next interface.

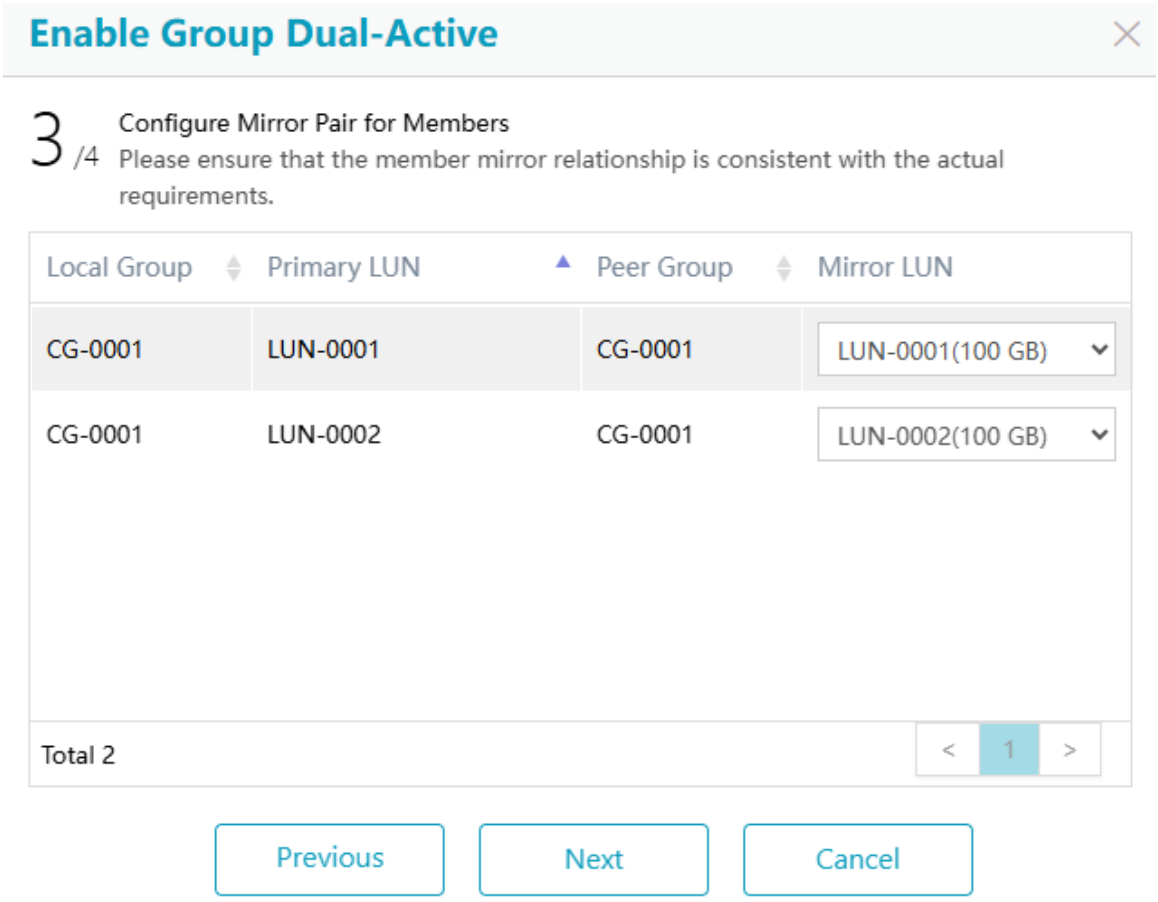

Figure 7-9 Enable group dual-active wizard interface (3)

ⓘNOTE

The system will automatically match mirror pair. In other words, it will automatically select the mirror LUN that meets the requirements for the primary LUN. Please check the member mirror pair relationship to ensure that it is consistent with actual requirements. If the primary LUN is not matched with a mirror LUN that meets the requirements, you can also choose to create a new mirror LUN. In the next step, you will create a new mirror LUN on the remote device through extended steps, corresponding to steps 3a/4, 3b/4, etc. This chapter only describes the content related to group dual-active mirror. For the steps and parameter descriptions of creating a LUN, please refer to the relevant user manual:

- For details on creating a Thick-LUN, see *MacroSAN MS Series Storage Devices Basic Configuration GUI User Manual*.
- For details on creating a Thin-LUN, see *MacroSAN MS Series Storage Devices Thin Provisioning Feature GUI User Manual*.
- For details on creating an RDV-LUN, see *MacroSAN MS Series Storage Devices Virtualization Feature GUI User Manual*.

Step 6: In the fourth step of the **Enable Group Dual-Active** wizard, you can check the configuration information and click the <Finish> button to complete the configuration.

7.2.2 Viewing Group Dual-Active Mirror Properties

This section explains how to view group dual-active mirror pair's basic properties.

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select the desired group mirror pair in the **Group Dual-Active** 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 group mirror pair.

7.2.3 Modifying Group Synchronous Protection Business Flow Control

This section explains how to modify all group dual-active mirror pair members' synchronous protection business flow control.

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select the desired group mirror pair in the **Group Dual-Active** tab of the information display area and click the <Properties> button to open the **Basic Properties** window, as shown in Figure 7-10. Modify group synchronous protection business flow control and click the <OK> button to complete the configuration.

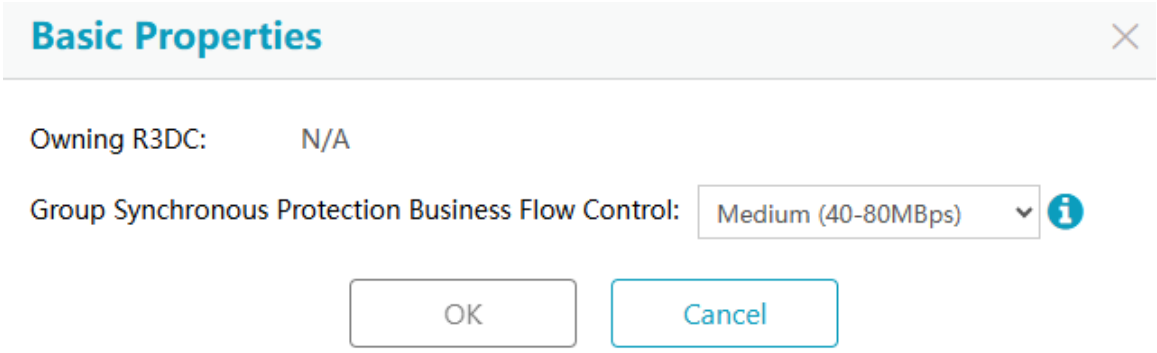

Figure 7-10 Dual-Active mirror pairs group basic properties interface

7.2.4 Suspending Group Dual-Active Mirror

This section explains how to suspend all members in group dual-active mirror pair.

⚠CAUTION

- After suspending group mirror, an error will be returned to the IO on group mirror members. Please do not suspend group mirror unless necessary or the legality of the operation has been confirmed.
- If the XAN link is reachable, group mirror will be suspended at both ends simultaneously.

- If the XAN link is unreachable, group mirror will be suspended at the local end forcibly during suspending. Do not forcibly suspend group mirror at one end unless necessary or the legality of the operation has been confirmed.

Prerequisites

The mirror status of all members is "Synced".

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select the desired group mirror pair in the **Group Dual-Active** tab of the information display area, click the <More> button, click the <Suspend> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.2.5 Resuming Group Dual-Active Mirror

This section explains how to resume all members in group dual-active mirror pair.

⚠CAUTION

- If the XAN link is reachable, group mirror will be resumed at both ends simultaneously.
- If the XAN link is unreachable, group mirror will be resumed at the local end forcibly during resuming. Do not forcibly resume group mirror at one end unless necessary or the legality of the operation has been confirmed.

Prerequisites

There exists a member in the group dual-active mirror pair whose mirror status is "Suspended".

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select the desired group mirror pair in the **Group Dual-Active** tab of the information display area, click the <More> button, click the <Resume> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.2.6 Reversing Group Dual-Active Mirror

ⓘNOTE

Dual-active mirror pair supports main default function and can be flexibly configured according to actual needs. If dual-active mirror pair changes to synchronized from unsynchronized:

- The mirror pair will check whether primary LUN belongs to the default device currently in the case of its auto rollback switch is open. If not, the mirror will be automatically reversed, so that current device of the primary LUN is consistent with the default device.
- Auto reverse will not be triggered in the case of auto rollback switch of the mirror pair is closed.

7.2.6.1 Manually Reversing Group Mirror

This section explains how to reverse mirror role of all members in group dual-active mirror pair manually.

⚠CAUTION

- If the XAN link is reachable, group mirror members will be reversed at both ends simultaneously.
- If the XAN link unreachable, you can forcibly reverse the mirror on the group mirror. Please make sure that the member LUNs of the current primary group are not online during the process to avoid "primary + primary" caused by a single-end force mirror reversion, resulting in unrecoverable data loose. Please do not forcibly reverse the group mirror at one end unless necessary or the legality of the operation has been confirmed.

Prerequisites

The mirror status of all members in the group dual-active mirror pair is "Synced".

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select the desired group mirror pair in the **Group Dual-Active** tab of the information display area, click the <More> button, click the <Reverse> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.2.6.2 Auto Reversing Group Mirror

Dual-active feature supports allocating the primary group and the mirror group to the client server at the same time. The primary LUN and the mirror LUN will be used as the same group based on multipath software on the client server. Data of both primary group and the mirror group on the side of storage device is synchronized in real time to protect each other.

Auto reversal of group mirror will be triggered to ensure business continuity in the case of an event affects business continuity. Relevant events include but are not limited to:

- Two SPs in either of the two devices are shut down or restarted at the same time.
- Abnormal power failure occurs in either of the two devices and the battery is available.
- An IO error occurs on the primary LUN and the health status changes to Error.

7.2.7 Switching Active/Standby Mode

This section explains how to switch group dual-active mirror pair's active/standby mode.

ⓘNOTE

If both active and standby dual-active exist in a group, the dual-active group will switch to standby.

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select the desired group mirror pair in the **Group Dual-Active** tab of the information display area, click the <More> button, click the <Switch the Active/Standby Mode> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.2.8 Disabling Group Dual-Active Mirror

This section explains how to disable all members in group dual-active mirror pair.

⚠CAUTION

- If the XAN link is reachable, group mirror will be reversed at both ends simultaneously.
- If the XAN link is unreachable, group mirror will be forcibly disabled at the local end during disabling. Do not forcibly disable group mirror at one end unless necessary or the legality of the operation has been confirmed.

Prerequisites

The mirror status of all members in the group dual-active mirror pair is "Synced" or "Suspended".

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select the desired group mirror pair in the **Group Dual-Active** tab of the information display area, click the <Disable> button, enter "yes" in the pop-up warning box, and click the <OK> button to complete the configuration.

7.2.9 Forcing Group Mirror Member Online

This section explains how to force group mirror member online.

Prerequisites

There exists a member in the group dual-active mirror pair whose mirror status is "Negotiate".

Steps

Step 1: Select "Service" -> "Dual-Active" on the navigation tree to open the dual-active interface.

Step 2: Select the desired group mirror pair in the **Group Dual-Active** tab of the information display area, click the <More> button, click the <Force Online> button in the drop-down menu, select LUN and enter "yes" in the pop-up warning box, and click the <OK> button to complete the configuration.

Appendix A. Device Default Configurations

The default configurations of the device are shown in Table 7-1.

Table 7-1 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 7-2.

Table 7-2 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 NVMf 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
C	
CHAP	Challenge Handshake Authentication Protocol
CLI	Command-Line Port
COW	Copy on Write
CRAID	RAID based Cell
D	
DDSR	Data Duplicate Shared Resource
DSU	Disk Shelf Unit
E	
EP	Expander Processor
F	
FC	Fiber Channel
G	
GE	Gigabit Ethernet
GUI	Graphical User Port
H	
HA	High Availability
I	
IE	Internet Explorer
iNoF	Intelligent Lossless NVMe over Fabrics
IP	Internet Protocol
iSCSI	Internet Small Computer Systems Port

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