MacroSAN MS Series Storage Devices Replication Feature

GUI User Manual

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Statement

Brand Information

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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.

2.2 Introduction to Typical Networking of MS Series Storage Devices

Figure 2-1 shows the typical networking of MacroSAN MS series storage devices.
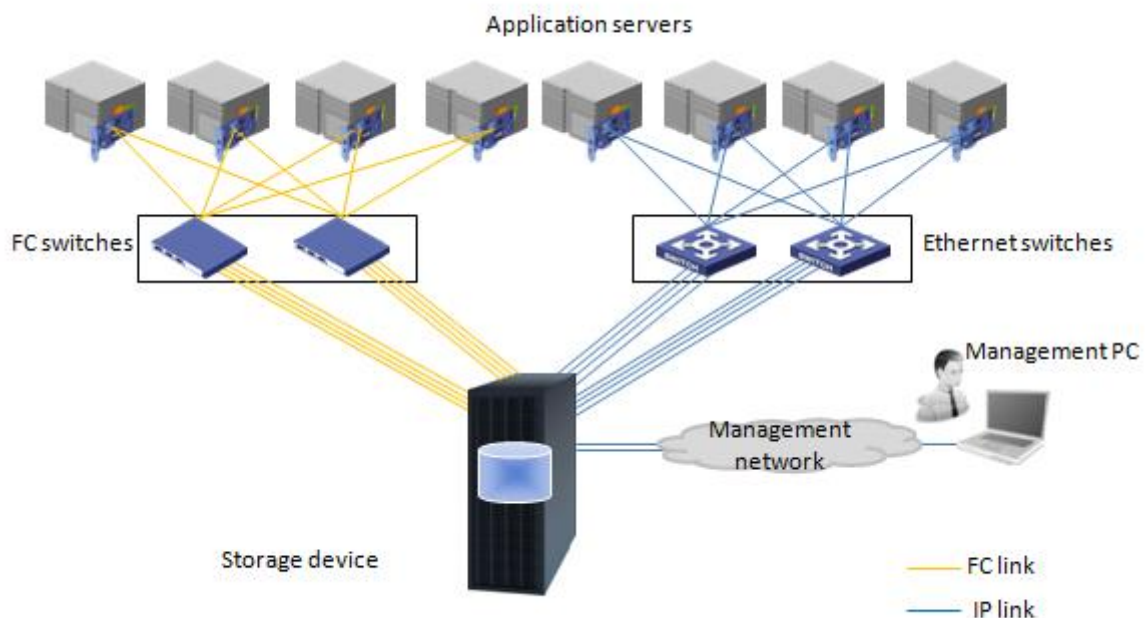
Figure 2-1 Typical networking of MS series storage devices

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.

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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+.

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.
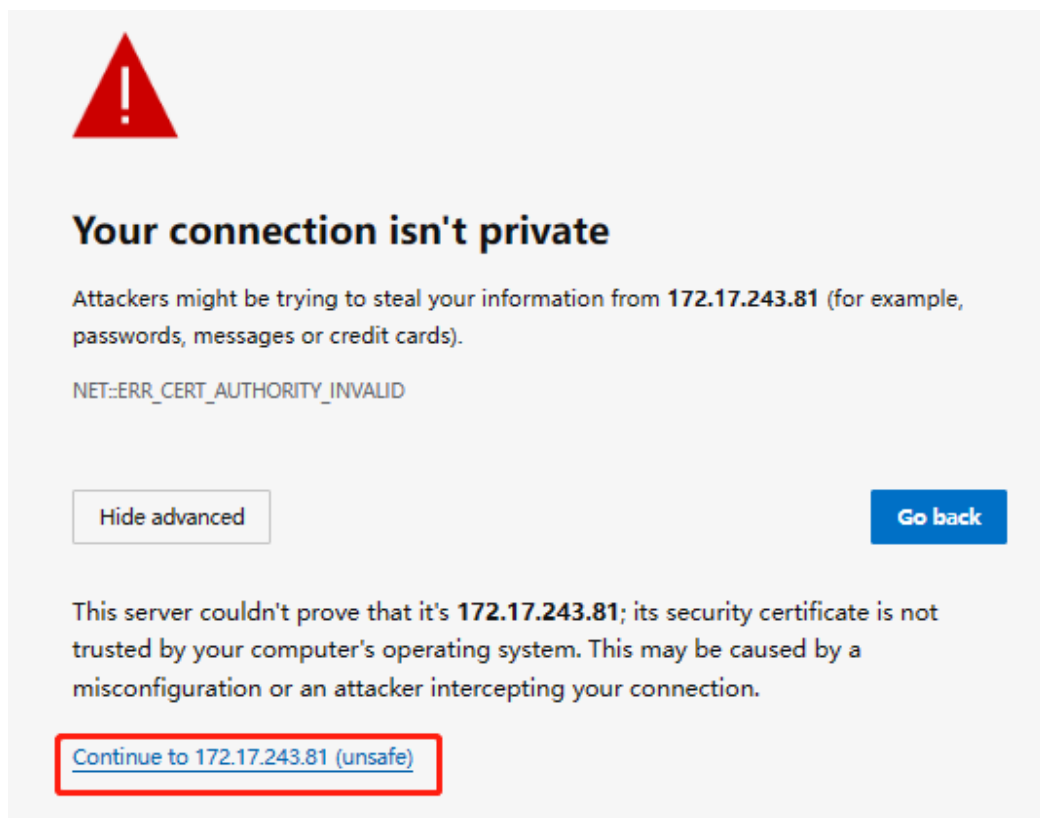
Figure 3-1 Example for prompt of certificate exception

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.
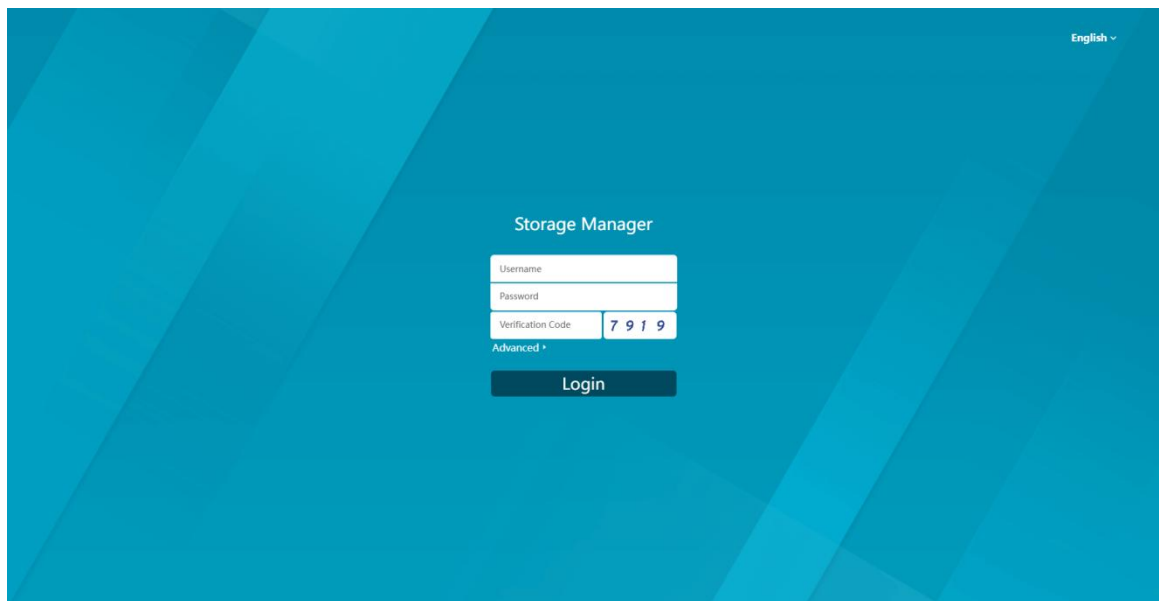
Figure 3-2 ODSP Scope+ login interface
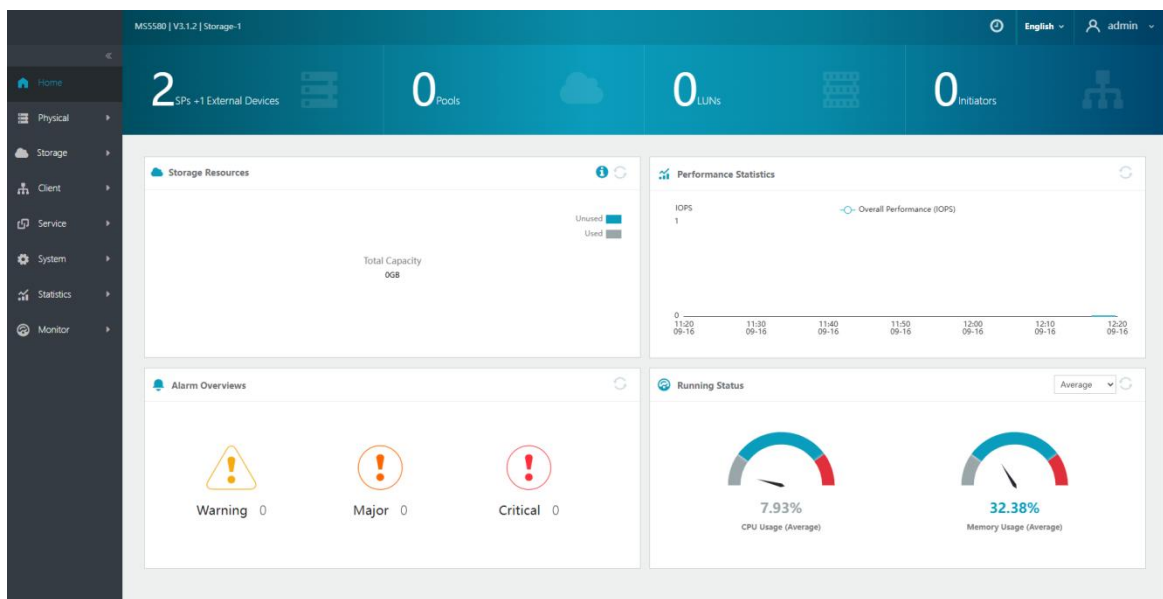
Figure 3-3 Home of ODSP Scope+ system view
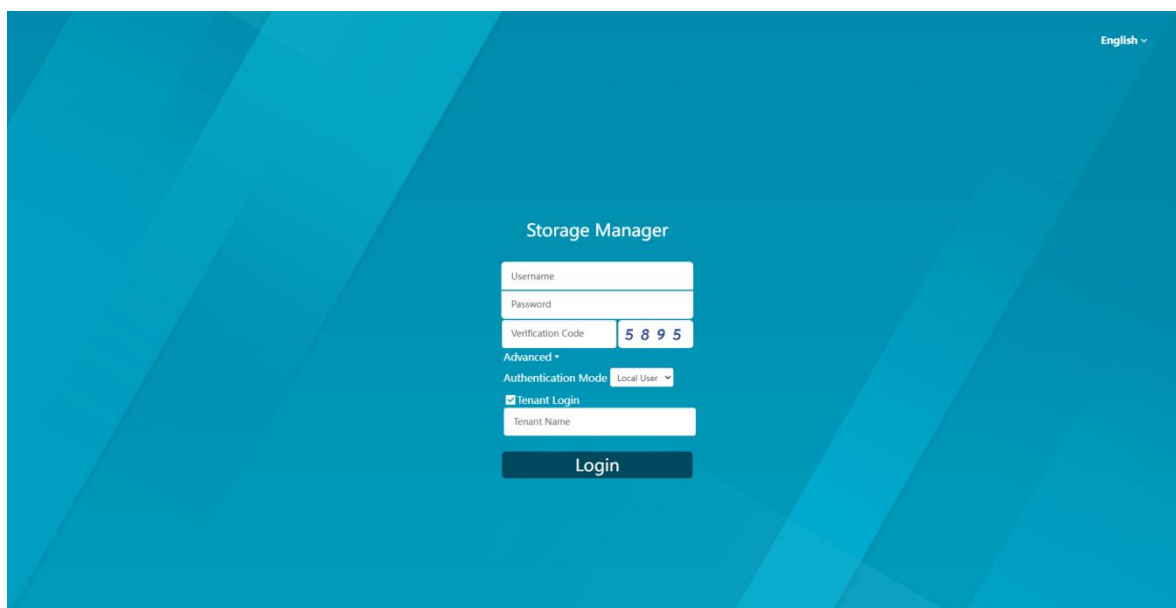
Figure 3-4 ODSP Scope+ tenant login interface
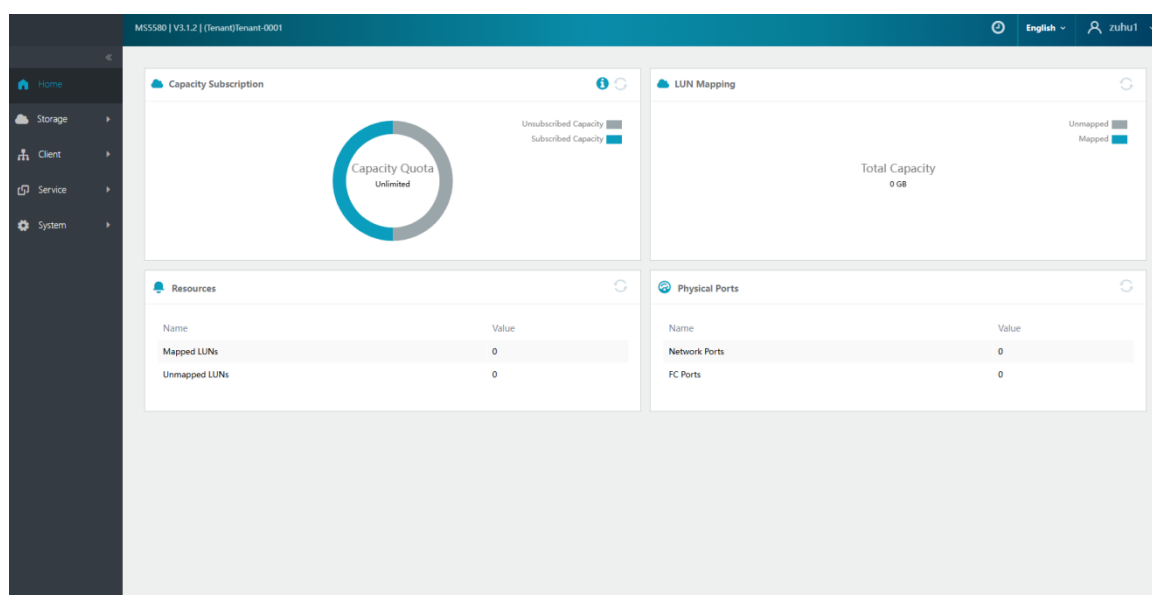
Figure 3-5 Home of ODSP Scope+ tenant view

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.

Navigation tree   Navigation bar

Information display area   Extended area   Copyright display area
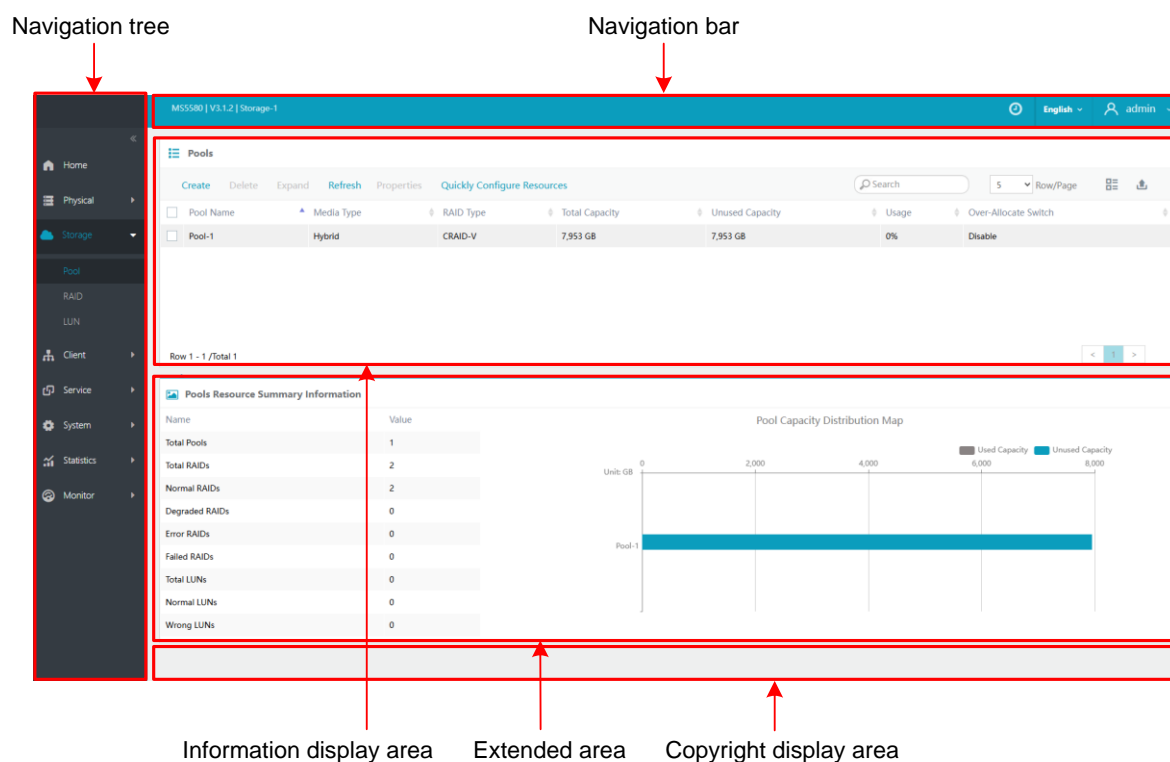
Figure 3-6 Example of ODSP Scope+ typical interface

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.
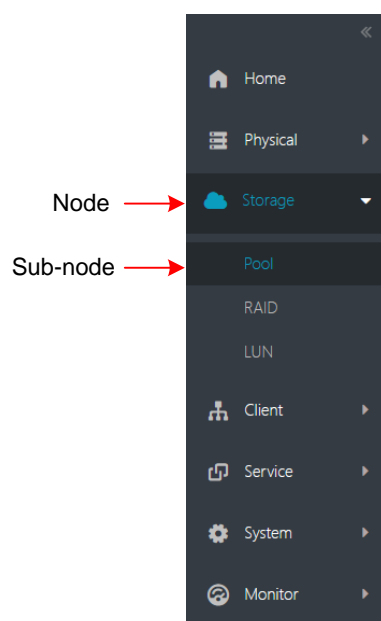
Figure 3-7 Example of ODSP Scope+ navigation tree

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.
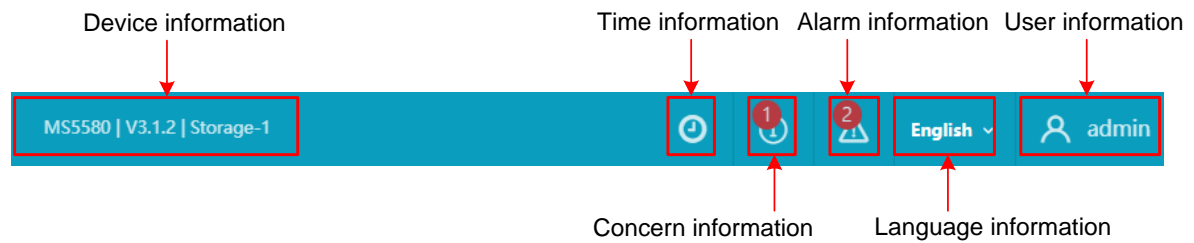
Figure 3-8 Example of ODSP Scope+ navigation bar
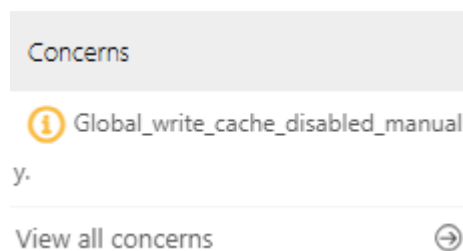
Figure 3-9 Example of ODSP Scope+ concerns
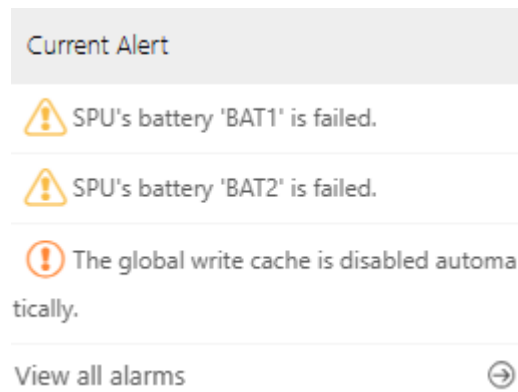
Figure 3-10 Example of ODSP Scope+ alarms

3.3.4 Information Display Area

The information display area is shown in , which visually displays the detailed information of the current selected navigation tree node through the table.
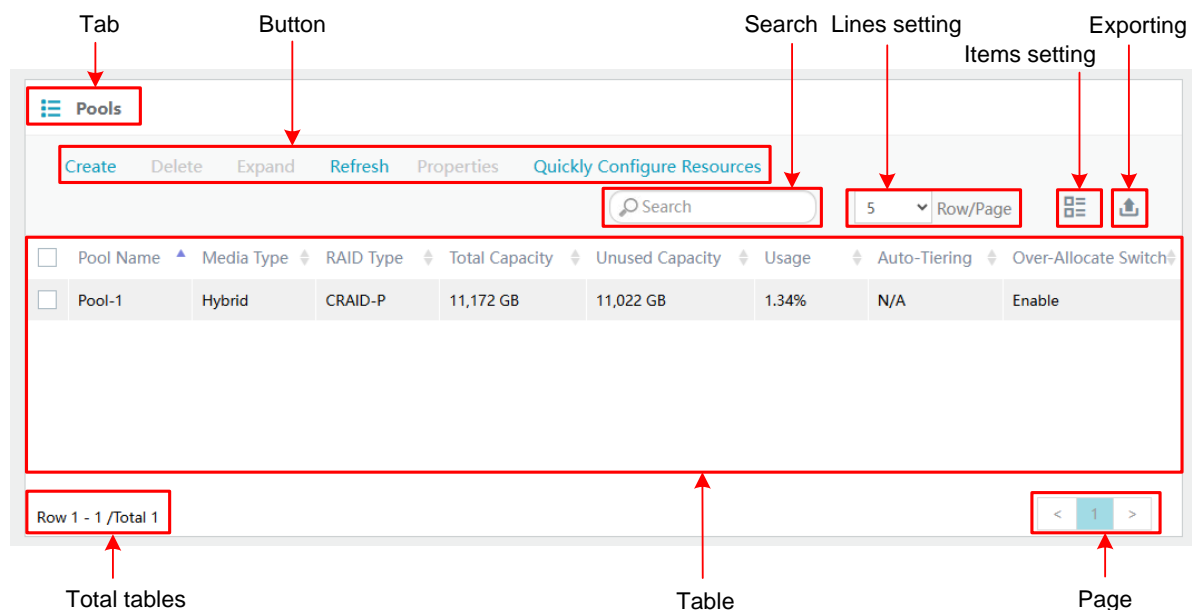
Figure 3-11 Example of ODSP Scope+ information display area

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.

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- 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.
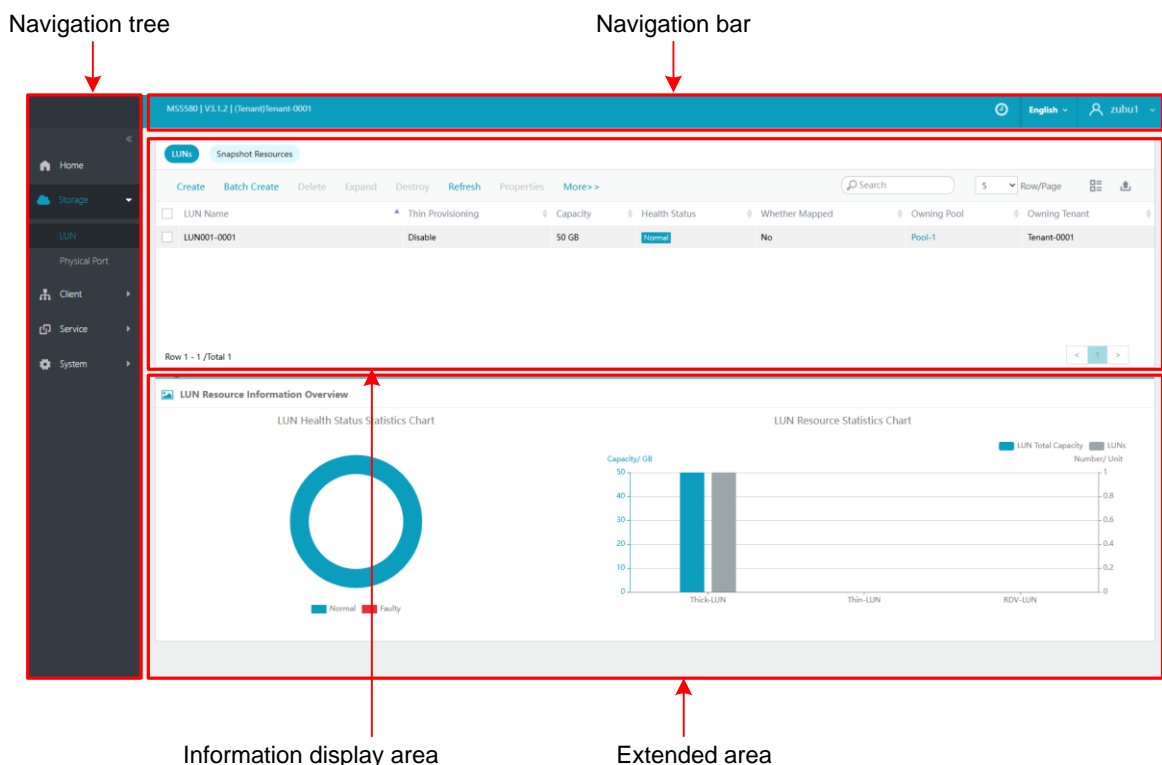
Figure 3-12 Example of ODSP Scope+ typical interface

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.
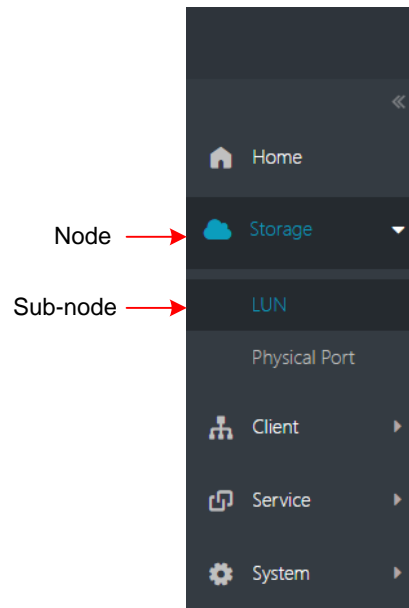
Figure 3-13 Example of ODSP Scope+ navigation tree

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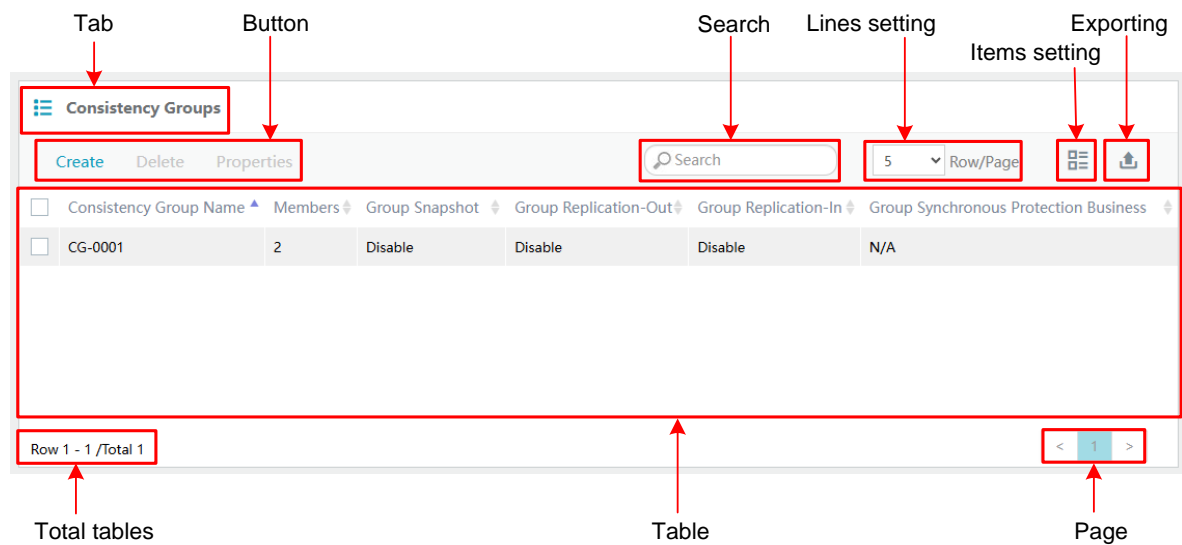
Figure 3-15 Example of ODSP Scope+ information display area

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: Replication Feature

4 Introduction to Replication Feature

4.1 Introduction to Replication

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 and hardware, etc., disaster backup of production data has become a top priority. The replication technology is one of the most common disaster recovery methods.

Based on the replication feature of MacroSAN, a replica volume (replica LUN for short) can be created for the production volume (primary LUN for short) to store data replica. The primary and replica LUNs form a replication pair, and the storage device automatically replicates the data from the primary LUN to the replica LUN. Since the replica and primary LUNs are physically independent, in the event of a disaster, the replica LUN can be used to provide business or recover data.

Both synchronous replication and asynchronous replication are supported in the feature of replication, which can meet the requirements of replication functions in various business scenarios and disaster recovery needs.

- Synchronous replication: Synchronizing data in real-time. The data of the primary LUN in the production center is synchronously written to the replica LUN in the disaster recovery center, strictly ensuring real-time consistency. The advantage of synchronous replication is that each IO is required to be written to both the primary and replica LUNs synchronously, so there is no data loss in the event of a disaster in the production center.

- Asynchronous replication: Synchronizing data periodically. Based on the preset replication policy, data replication is triggered when conditions are met, and differential data is replicated from the primary LUN to the replica LUN according to the policy. Asynchronous replication has little impact on the performance of primary LUN because IO data is synchronized only in the background without writing data to primary LUN.

Synchronous replication and asynchronous replication can be switched online and the two replication modes can be flexibly adjusted online according to changes in usage requirements and business conditions. When the network bandwidth is unstable or the primary LUN business pressure increases, the replication mode can be adjusted to asynchronous replication to prioritize the protection of the primary LUN's business performance; when the network bandwidth is sufficient and the primary LUN business pressure tends to be stable, the replication mode can be adjusted to synchronous replication to improve the level of data protection and ensure that there is no data loss.

Synchronous replication and asynchronous replication also can be switched automatically. After an automatic switchover policy is configured, the device automatically switches the replication mode when the preset policy is met.

4.1.1 Introduction to Local Replication

Local replication is a special application of the replication feature. It means that the primary LUN and replica LUN of the replication are located on the same storage device, which is applicable to local backup and local data migration. Figure 4-1 shows a typical local replication network, where "P" represents the primary LUN, and "R" represents the replica LUN. The storage device will replicate the data in the primary LUN to the replica LUN based on preset replication mode and policy.
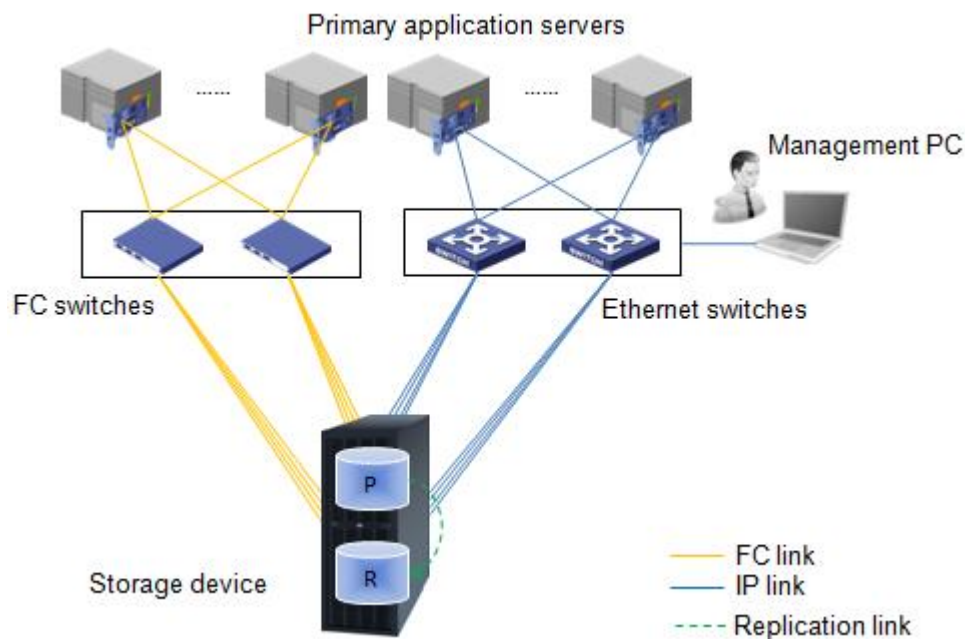
Figure 4-1 Typical networking diagram for local replication

4.1.2 Introduction to Remote Replication

Remote replication is a typical application of the replication feature. It means that the primary LUN and replica LUN of the replication are respectively located on two storage devices and are interconnected through XAN (see 4.4 Introduction to XAN for details about the XAN and the typical networking diagram), which is applicable to remote backup, remote data migration and other occasions. Figure 4-2 shows a typical remote replication network, where "P" represents the primary LUN, and "R" represents the replica LUN. The storage device will replicate the data in the primary LUN to the replica LUN based on different replication modes.
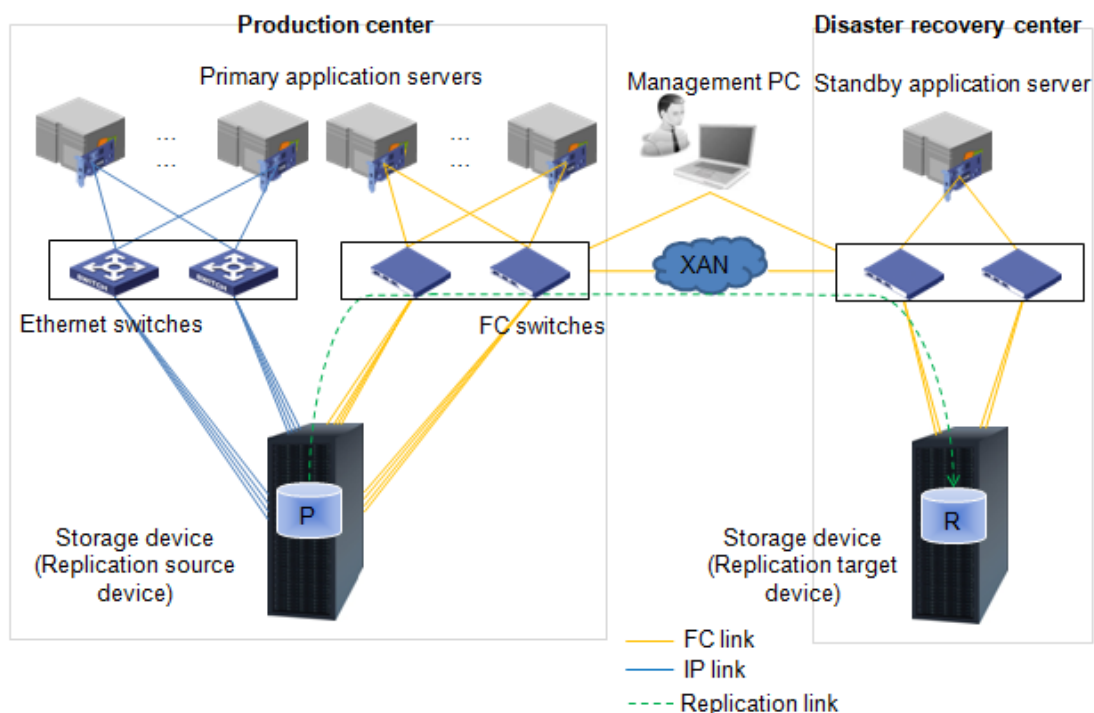
Figure 4-2 Typical networking diagram for remote replication

4.2 Introduction to Snapshot Resource

4.2.1 Snapshot Resource Description

Replication feature relies on snapshot resource. Snapshot resources are used to store the data of time points and views. If the capacity of snapshot resources is too small, snapshot resource may overflow because of heavy business traffic, resulting in invalid snapshot resources and data loss in snapshot resources. Therefore, it is recommended to set a reasonable capacity for snapshot resources. There are two types of snapshot resources:

- COW snapshot resource: In terms of implementation, it is an independent LUN, which supports manual expansion and automatic expansion. When the automatic expansion function is enabled, it will be triggered when the snapshot resource utilization reaches its threshold and the current capacity is less than the maximum capacity of the snapshot resource. The system calculates the capacity to be expanded according to the set automatic expansion ratio and the maximum capacity of the snapshot resource, and then, automatically expands snapshot resources and allocates more physical space for snapshot resources.

- ROW snapshot resource: In terms of implementation, it is a virtual resource that shares physical space with the Thin-LUN to which it belongs. The Thin-LUN to which it belongs monitors the physical space usage and automatically triggers physical space expansion and recovery as needed. ROW snapshot resources also support manual expansion and automatic expansion. During expanding, only the snapshot data size supported by the Thin-LUN to which it belongs can be modified, and no specific physical space allocation is involved.

4.2.2 Definitions of COW Snapshot Resource Status

4.2.2.1. Snapshot Resource Health Status

Health status of snapshot resource is a physical status, indicating whether the physical space to which the snapshot resource belongs is accessible, including normal and error, which is the same as the definition of LUN health status.

4.2.2.2. Snapshot Resource Data Validity Status

Data validity status of snapshot resource is a logical state, indicating whether the data in the snapshot resource is available, including the followings:

- Valid: It indicates that the data in the snapshot resource is available.
- Invalid: It indicates that the data in the snapshot resource is unavailable and only be restored by initializing the snapshot resource under this circumstance, and the data in the snapshot resource will be lost.

4.2.3 Definitions of ROW Snapshot Resource Status

Data validity status of snapshot resource is a logical state, indicating whether the data in the snapshot resource is available, including the followings:

- Valid: It indicates that the data in the snapshot resource is available.
- Invalid: It indicates that the data in the snapshot resource is unavailable and can only be restored by initializing the snapshot resource under this circumstance, and the data in the snapshot resource will be lost.

4.3 Introduction to Consistency Group

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 replication feature with consistency group function can strictly guarantee the data consistency of the replica LUNs of multiple members in the consistency group.

4.4 Introduction to XAN

 NOTE

- Only remote replication depends on XAN. If you configure local replication, please ignore this section.
- 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.

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 4-3 shows a typical XAN networking of MESH direct connection.
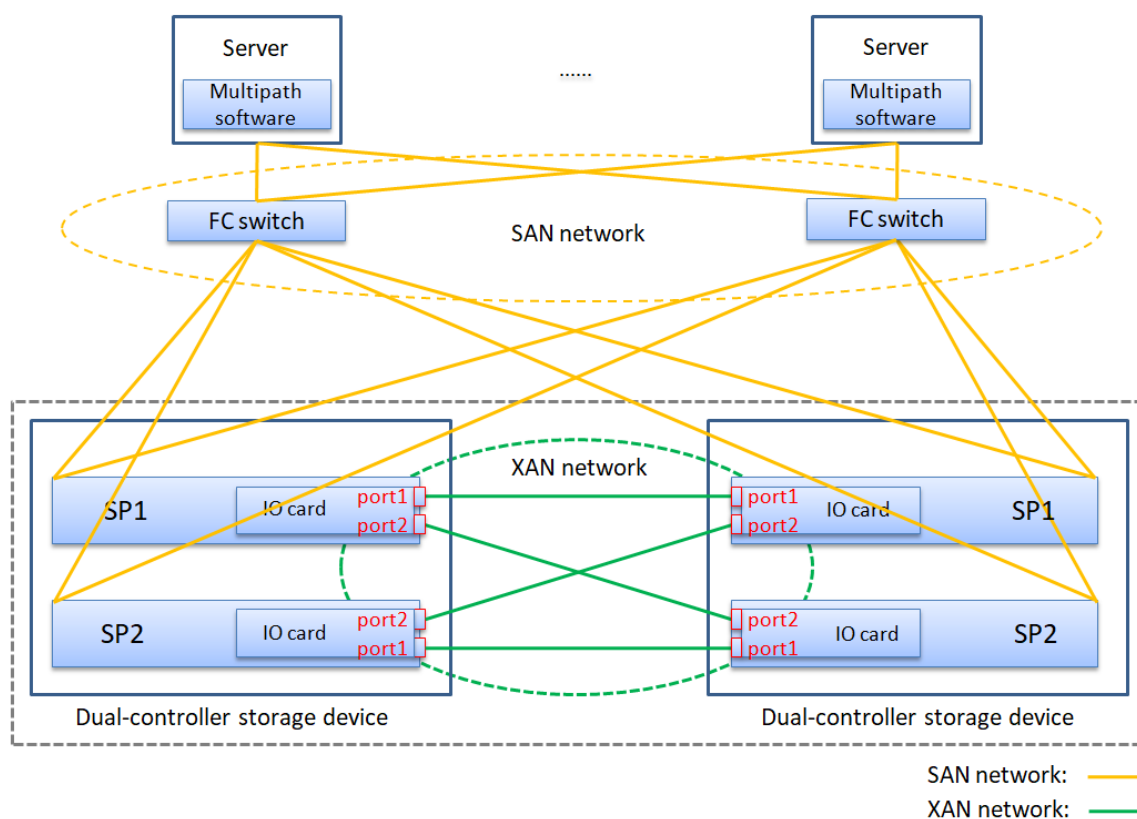
Figure 4-3 XAN typical networking diagram of dual-controller (MESH direct connection)

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 4-4 shows a typical XAN networking of switch connection.
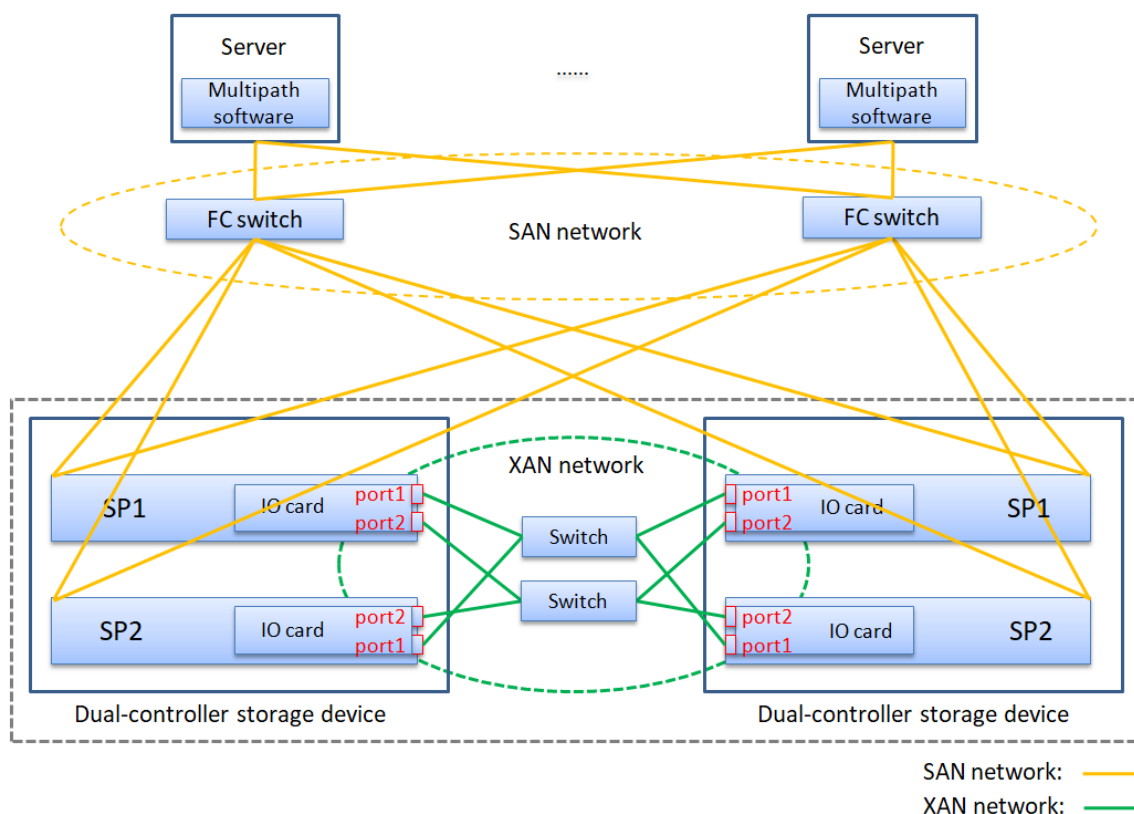
Figure 4-4 XAN typical networking diagram of dual-controller (switch connection)

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 4-5 shows a typical XAN networking of MESH direct connection.
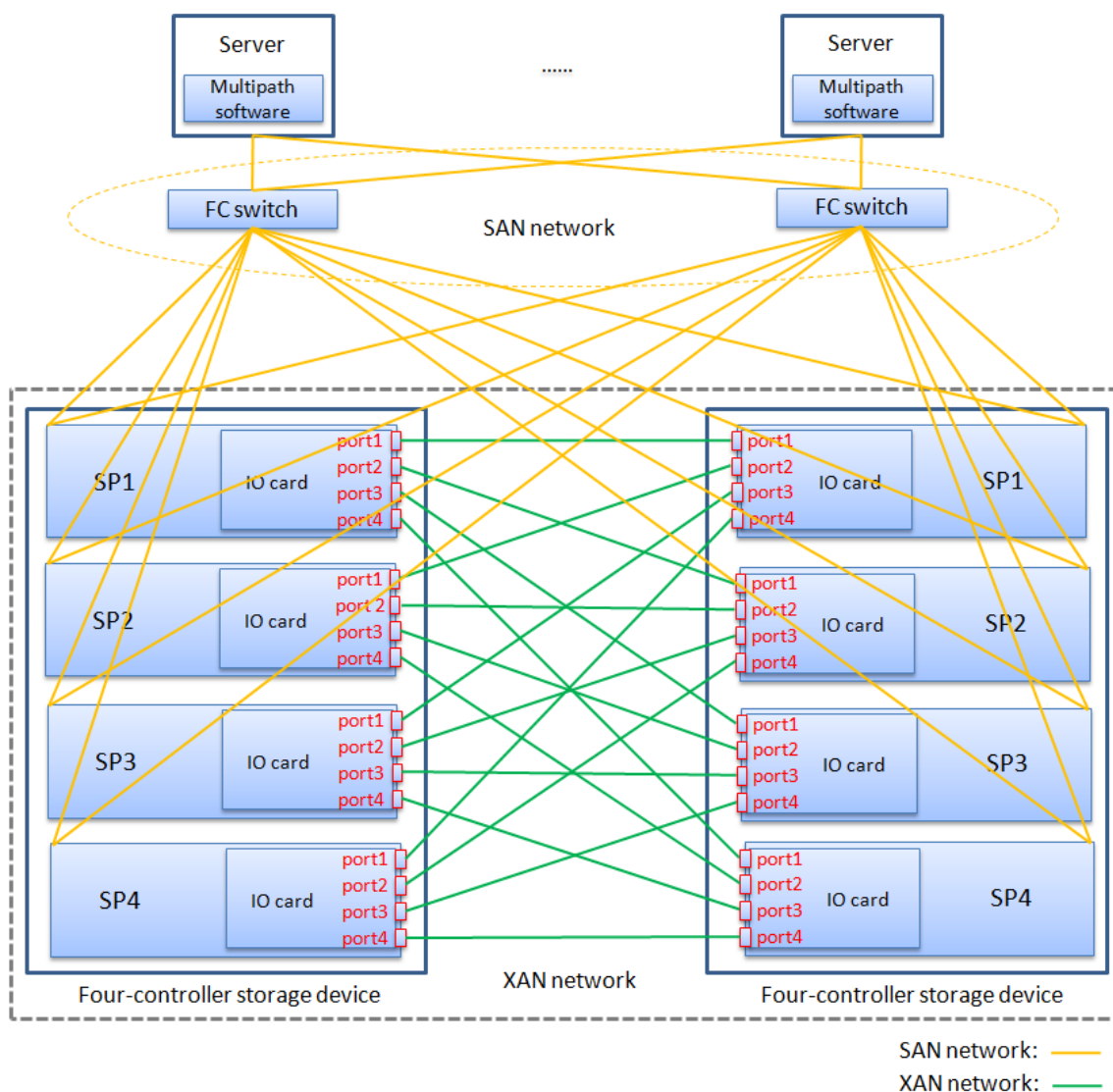
Figure 4-5 XAN typical networking diagram of four-controller (MESH direct connection)

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 4-6 shows a typical XAN networking of switch connections.
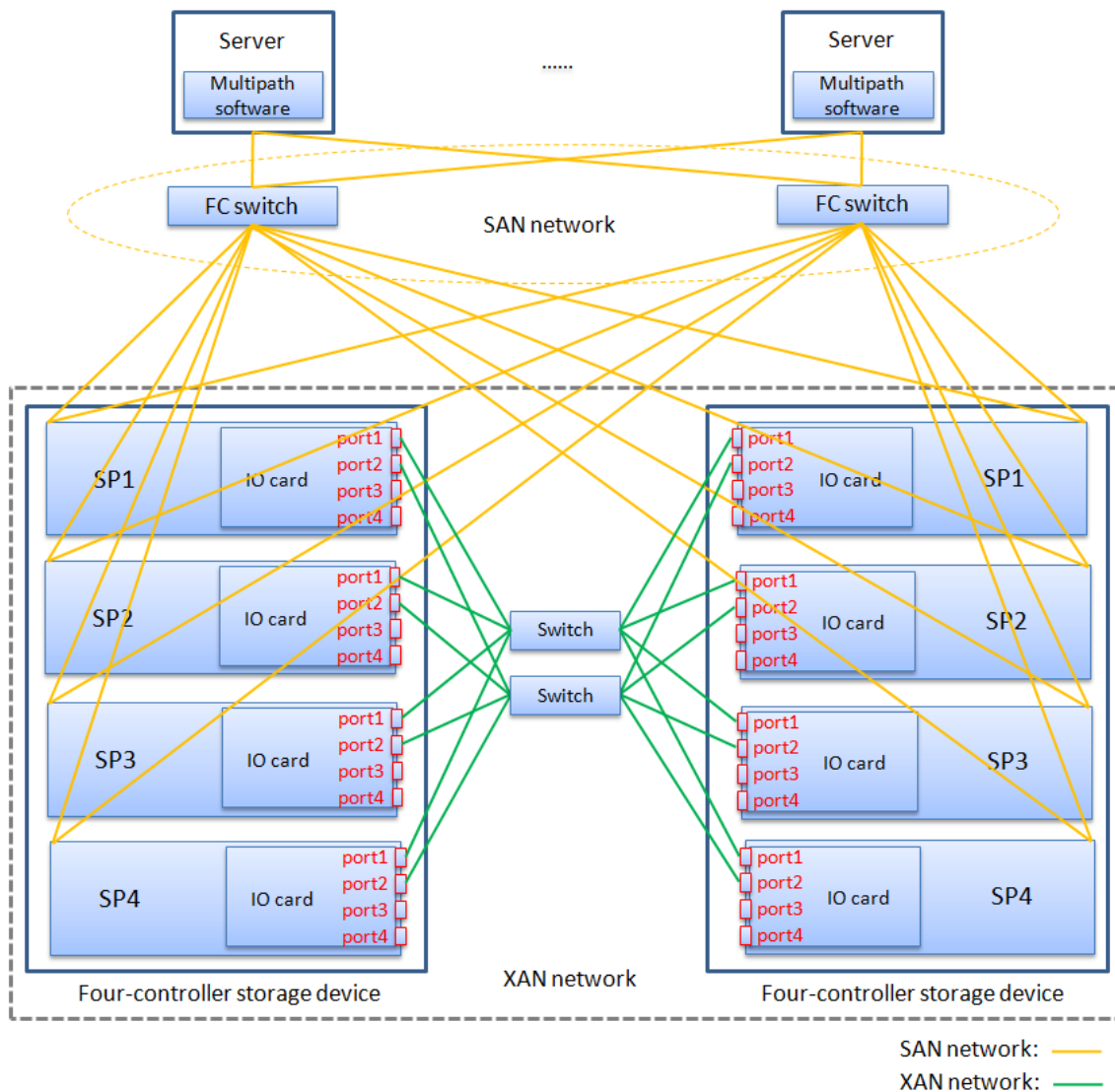
Figure 4-6 XAN typical networking diagram of four-controller (switch connection)

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 sixteen 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.

4.5 Description of Replication Function

4.5.1 Key Terms

- Replication pair primary LUN/replica LUN: The one-to-one relationship between a production data volume and a data replica is called a replication pair. In a replication pair, the production data volume is usually called the primary resource or primary LUN, and the data replica is usually called the replica resource or replica LUN.
- Replication pair primary group/replica group: For the scenario where the data in multiple LUNs has consistency requirements, if you need to use the replication function, multiple primary LUNs and multiple replica LUNs are required to be located in two groups respectively. The group to which the primary LUN belongs is usually called the primary group and the group to which the replica LUN belongs is usually called replica group.
- Replication source device/target device: The source device refers to the storage device to which the primary LUN belongs, and the target device refers to the storage device to which the replica LUN belongs. The source device and the target device 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. Therefore, the role of the device may be different in each replication pair.
- Replication-in/Replication-out: Replication-in and Replication-out are replication direction, which are also relative to a replication pair. The replication direction of primary LUN and replica LUN of one replication pair is called replication-out and replication-in respectively.
- Initial replication: Initial replication refers to the first replication process between the primary LUN and the replica LUN. After the initial replication is completed, the replication will be switched to incremental replication.
- Incremental replication: It is one of the replication modes of asynchronous replication. In the mode of incremental replication, the primary LUN automatically records data changes, and only differential data is replicated when replication is triggered, minimizing the amount of data to be replicated and improving replication efficiency.

4.5.2 Replication Policy

ⓘNOTE

The replication policy only takes effect for asynchronous replication.

Multiple replication policies are supported, and replication will be started automatically when the policy is met:

- Policy S0: Replication is started automatically at a fixed time every month.

- Policy S1: Replication is started automatically at some time of every day/week.
- Policy S2: Replication is started automatically at a certain time with a specified interval.
- Policies A0-A3: Replication is started automatically at a specific interval within the specified time period every day/week.

4.5.3 Replication Mode Switching Policy

Two kinds of replication mode switching policies are supported, and replication mode will be switched automatically when the policy is met:

- Policy W0: Replication mode is switched automatically at some time of every day/week.
- Policy W1: Bandwidth, IOPS, or latency can be used as switching conditions between synchronous and asynchronous replication.
    - Asynchronous replication will be switched automatically when any value of bandwidth, IOPS or latency collected in consecutive cycles is greater than corresponding specified value.
    - Synchronous replication will be switched automatically when any value of bandwidth, IOPS or latency collected in consecutive cycles is lower than corresponding specified value.

4.5.4 Scanning

Scanning is an optimized process for replication. For the following two cases, you can compare the data of the primary LUN and the replica LUN through scanning to obtain the differential data. In this way, only differential data needs to be replicated in the next replication instead of the full amount of data, greatly reducing the amount of replicated data.

- Case 1: For initial replication, if there are small differences between primary LUN and replica LUN, for example, the replication has been done before, you can enable the option of scan difference before initial replication.
- Case 2: For incremental replication, if the differential data between primary LUN and replica LUN is lost because of abnormal situations, you can manually start scanning to retrieve the differential data.

4.5.5 Replication Compression and Encryption

ⓘNOTE

- For synchronous replication, compression and encryption take effect only in initial replication.
- Compression and encryption will take effect at the time of next replication after being enabled or disabled.

The changed data in the primary LUN of the production center is replicated periodically to the replica LUN of the disaster recovery center through replication feature, and the replication compression and encryption functions can be configured according to actual needs:

- Replication compression function can be enabled in the case of low bandwidth of the replication link and large amount of changed data in each replication period. After enabling replication compression function, source device will compress the data to be replicated before sending it. After receiving the data, target device will decompress the data and write it to replica LUN. The amount of data that needs to be transmitted on the replication link can be greatly reduced, and the utilization rate of the replication link can be improved due to the replication compression function.

- Replication encryption function can be enabled in the case of either high data security is needed for the primary LUN or the data is confidential. After enabling replication encryption function, the data to be replicated in source device will be encrypted before being sent, and target device will decrypt the data after receiving it and then write it to replica LUN. Thanks to replication encryption function, the data transmitted on the replication link will be converted into ciphertext, which strictly guarantees data security.

- Replication encryption and compression functions can be enabled individually or simultaneously, which can be flexibly configured according to actual needs.

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.

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 . Select the desired LUN and click the <OK> button to complete the configuration.

Add Consistency Group Member

Consistency group name: CG-0001

Group snapshot: Disable ; Group Replication-Out: Disable ; Group Replication-In: Disable ; Group Synchronous Protection Business: Dual-Active

Please Select LUNs:

	Name	▲ Capacity	Health Status	Owning Tenant
☐	LUN-0003	100 GB	Normal	
☐	LUN-0004	100 GB	Normal	

Total 2 , Selected 0

< 1 >

OK   Cancel

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 Replication

6.1 Activating Replication License

This section explains how to activate replication license.

> **NOTE**
>
> After activating successfully, the "Replication" 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 replication license, and click the <Activate> button to complete the configuration.

6.2 Configuring XAN (Optional)

> **NOTE**
>
> - Only remote replication depends on XAN. If you configure local replication, please ignore this section.
> - Please activate the replication licenses on the two storage devices respectively before configuring XAN.

6.2.1 Managing Remote Device
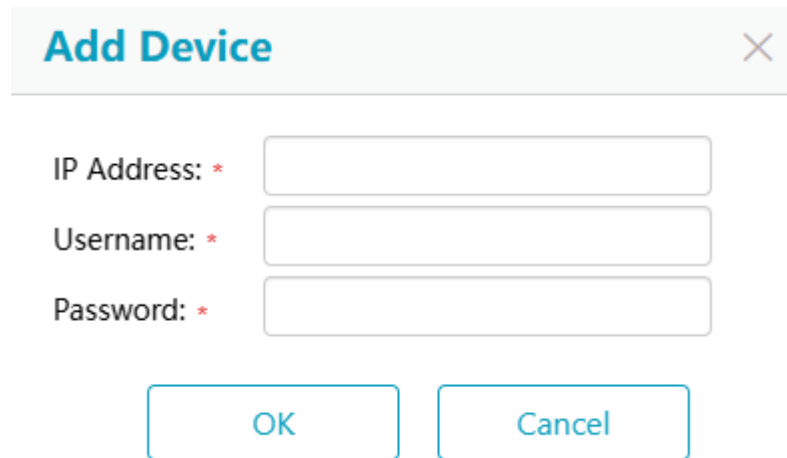
6.2.1.1. Adding Remote Device

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 6-1. Enter the device information (see Table 6-1 for details) and click the <OK> button to complete the configuration.

Add Device

IP Address: * [   ]

Username: * [   ]

Password: * [   ]

[OK]   [Cancel]

Figure 6-1 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 device.
Password	It refers to the user's password of remote device.

6.2.1.2. 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 properties of the remote device.

6.2.1.3. 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.

6.2.1.4. 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.

6.2.2 Creating XAN

6.2.2.1. 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 6-2. Configure the management link between devices to IP, select the target device, and click the <Next> button to enter the next interface.

Figure 6-2 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 6-3. 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 6-3 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 6-4.

Figure 6-4 XAN topology interface

6.2.2.2. 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 6-5. Configure the management link between devices to IP, select the target device, and click the <Next> button to enter the next interface.

Figure 6-5 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 6-6. 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 6-6 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 6-4.

6.2.2.3. 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 6-7. Configure the management link between devices to FC and click the <Next> button to enter the next interface.

Create XAN ✕

1/4   Select Target Device
     Select the remote device for which XAN needs to be created.

Management Link Between Devices: FC

The FC link has been selected, please create an XAN on the local device and the remote device respectively.
Please select a target device:

	Device Name	▲ Device Model	Online Status	SP1 Management IP	SP2 Management IP
☐	MS5520G2INT-SMP	MS5520G2	Exception	172.27.4.10	172.27.4.11

Total 1   < 1 >

Next   Cancel

Figure 6-7 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 6-8. Select the local FC port and click the <Next> button to enter the next interface.

Figure 6-8 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 6-9. Select the peer 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) (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 .

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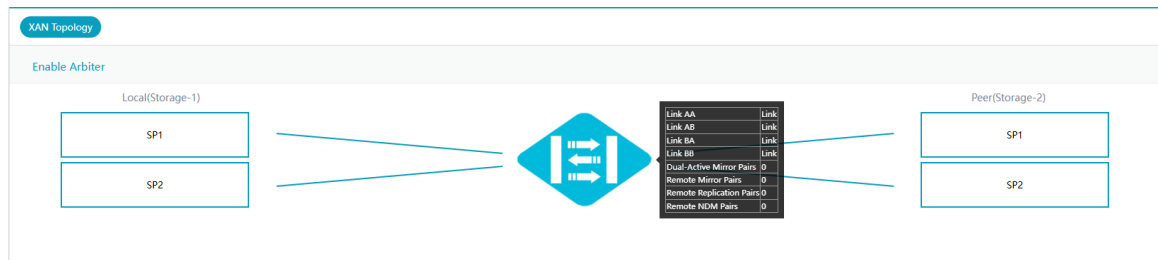
This section explains how to view XAN's general information and XAN link.

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.

6.2.4 Modifying XAN Properties

6.2.4.1. 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 6-10 XAN basic properties interface

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

Add XAN Port ✕

Please select the port to be added. 🔍

	Controller ▲	Port Name ▲	Port Type ⇕	MTU ⇕	Connection Status ⇕	Rate ⇕	IP Address ⇕
☐	SP1	eth-1:2:3	Ethernet port	1500	Connect	10 Gbps	172.27.45.30
☐	SP2	eth-2:2:3	Ethernet port	1500	Connect	10 Gbps	172.27.45.31

Total 2 , Selected 0

OK   Cancel

Figure 6-11 Add XAN port interface

6.2.4.2. 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 6-10.

Step 3: Click the <Modify port> button to open the **Modify XAN Port** window, as shown in Figure 6-12. Select the desired port, modify its IP address and subnet mask, and click the <OK> button to complete the configuration.

Figure 6-12 Modify XAN port interface

6.2.4.3. 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 6-10.

Step 3: Click the <Delete port> button to open the **Delete XAN Port** window, as shown in Figure 6-13. Select the desired port and click the <OK> button to complete the configuration.

Figure 6-13 Delete XAN port interface

6.2.5 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.

7 Configuring Replication

7.1 Managing LUN Replication

7.1.1 Enabling Replication

7.1.1.1. Enabling Local Replication

This section explains how to enable local replication.

Prerequisites

- It is recommended to configure related business on the client server before enabling replication to improve replication efficiency.
- If replication is configured for data migration, the capacity of replica LUN must be greater than or equal to that of primary LUN.
- If replication is configured for data backup, the capacity of replica LUN must be equal to that of primary LUN. Otherwise, the extra space will be wasted and reverse replication from replica LUN to primary LUN cannot be configured.
- The health status of primary LUN and replica LUN must be normal.
- The default SP of primary LUN and replica LUN must be the same.
- If snapshot resources have been created for primary LUN and replica LUN, they must have normal health status and valid data; if no snapshot resources have been created for primary LUN and replica LUN, they will be created in the system automatically.
- If both primary LUN and replica LUN are Thin-LUNs, it is recommended that the thin-provisioning parameters of replica LUN be consistent with those of primary LUN.
- Replica LUN can only be assigned to client servers in read-only mode.
- If snapshots are enabled on replica LUN, all time points must be deleted. Otherwise, a large amount of data will be written to replica LUN in the initial replication process, causing great expansion on snapshot resource space of replica LUN.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

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

Step 3: The first step of the **Enable Replication** wizard is shown in Figure 7-1. Select replication mode (see Table 7-1 for details) and primary LUN and click the <Next> button to enter the next interface.

Figure 7-1 Enable local replication wizard interface (1)

Table 7-1 Description of the parameters for enabling local replication wizard interface (1)

Parameter	Description
Mode	There are two kinds of replication modes as follows: ● Synchronous replication: Synchronizing data in real-time. The data of the primary LUN is synchronously written to the replica LUN, strictly ensuring real-time consistency. ● Asynchronous replication: Synchronizing data periodically. Based on the preset replication policy, the changing data in the primary LUN is replicated to the replica LUN periodically.

Step 4: The second step of the **Enable Replication** wizard is shown in . Select replica LUN and click the <Next> button to enter the next interface.

Figure 7-2 Enable local replication wizard interface (2)

ⓘ**NOTE**

If a replica LUN has not been created in advance, you can also select the option of "Create Replica LUN" in this step to create a new replica LUN on the target device. In the next steps, you will create a new replica LUN through extended steps, corresponding to steps 2a/7, 2b/7 etc. This chapter only describes the content related to local replication. 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: The third step of the **Enable Replication** wizard is shown in Figure 7-3. Set replication policy (see Table 7-2 for details) and click the <Next> button to enter the next interface.

- The replication policy only takes effect for asynchronous replication.

- No replication policy configuration means that the replication can only be started manually instead of automatically.

- If a replication task has already existed when the replication policy is triggered, the new replication task will be automatically cancelled. Therefore, please try to stagger the policy trigger time when configuring multiple policies at the same time.

- It is recommended to stagger the triggering time of the policies on multiple replication pairs.

Figure 7-3 Enable local replication wizard interface (3)

Table 7-2 Description of the parameters for enabling local replication wizard interface (3)

Parameter	Description
Cycle Replication Policy	Replication is started automatically according to the set cycle replication policy. The following cycle replication policies are supported: ● Policy S0: Replication is started automatically at a fixed time every month.

- Policy S1: Replication is started automatically at some time of every day/week.
- Policy S2: Replication is started automatically at a certain time with a specified interval.

ⓘNOTE

Click the <Show Advanced Policy> button and you can also set advanced policy A0~A3 according to actual needs, and automatically start replication at specific time interval within a specified period of time per day/week.

Step 6: The fourth step of the **Enable Replication** wizard is shown in . Set replication mode switching policy (see for details) and click the <Next> button to enter the next interface.

Figure 7-4 Enable local replication wizard interface (4)

Table 7-3 Description of the parameters for enabling local replication wizard interface (4)

Parameter	Description
Replication Mode Switching Policy	Replication is switched automatically according to the set replication mode switching policy. The following switching policies are supported: ● Policy W0: Replication mode is switched automatically at some time of every day/week. For example, in the case of asynchronous replication, if policy W0 is set with synchronous replication during 06:00:00-22:00:00 every day, the mode will be switched to synchronous replication at 06:00:00 and to asynchronous replication at 22:00:00 every day. ● Policy W1: Bandwidth, IOPS, or delay can be used as switching conditions between synchronous and asynchronous replication. ➢ Asynchronous replication will be switched automatically when any value of bandwidth, IOPS or delay collected in consecutive cycles is greater than corresponding specified value. ➢ Synchronous replication will be switched automatically when any value of bandwidth, IOPS or delay collected in consecutive cycles is lower than corresponding specified value.

Step 7: The fifth step of the **Enable Replication** wizard is shown in <u>Figure 7-5</u>. Set replication split resume policy (see <u>Table 7-4</u> for details) and click the <Next> button to enter the next interface.

Figure 7-5 Enable local replication wizard interface (5)

Table 7-4 Description of the parameters for enabling local replication wizard interface (5)

Parameter	Description
Replication Split Resume Policy	Replication is split/resumed automatically at some time of every day/week. The synchronous direction can be set after resumption. For example, if policy R0 is set with replication recovery during 06:00:00-22:00:00 every day, the replication will be resumed at 06:00:00 and be split at 22:00:00 automatically every day.

Step 8: The sixth step of the **Enable Replication** wizard is shown in <u>Figure 7-6</u>. Set replication options parameters (see <u>Table 7-5</u> for details) and click the <Next> button to enter the next interface.

Figure 7-6 Enable local replication wizard interface (6)

Table 7-5 Description of the parameters for enabling local replication wizard interface (6)

Parameter	Description
Scan Difference Before Initial Replication	It refers to enabling or disabling scanning difference before initial replication. The default value is disabling. ⓘ**NOTE** If there are small differences between primary LUN and replica LUN, for example, the replication has been done before, please enable the option. After enabling, the differential data between primary LUN and replica LUN will be scanned first when the initial replication is triggered. Only the differential data will be replicated during initial replication, greatly reducing the amount of replicated data.

Replication Compression	It refers to enabling or disabling replication compression. The default value is disabling.
Replication Encryption	It refers to enabling or disabling replication encryption. The default value is disabling.
Replication Flow Control	It is used to control the replication rate so that the synchronous bandwidth consumption of the back-end replication does not affect the front-end traffic on the primary LUN. ● Low (0-5MBps) ● Medium (10-20MBps) ● High (50-70MBps) ● Highest (greater than 100MBps) ● Custom: It refers to manually setting the upper limit of the rate. Valid range: 1-1024MBps.
Primary LUN Snapshot Resource Capacity	It refers to the snapshot resource capacity of primary LUN, which can be configured automatically or manually.
Replica LUN Snapshot Resource Capacity	It refers to the snapshot resource capacity of replica LUN, which can be configured automatically or manually.

Step 9: In the seventh step of the **Enable Replication** wizard, you can check the configuration information and click the <Finish> button to complete the configuration.

7.1.1.2. Enabling Remote Replication

This section explains how to enable remote replication.

Prerequisites
● The XAN is well configured and reachable.
● It is recommended to configure related business on the client server before enabling replication to improve replication efficiency.
● If replication is configured for data migration, the capacity of replica LUN must be greater than or equal to that of primary LUN.
● If replication is configured for data backup, the capacity of replica LUN must be equal to that of primary LUN. Otherwise, the extra space will be wasted and reverse replication from replica LUN to primary LUN cannot be configured.
● The health status of primary LUN and replica LUN must be normal.
● The default SP of primary LUN and replica LUN must be the same.
● If snapshot resources have been created for primary LUN and replica LUN, they must have normal health status and valid data; if no snapshot resources have been created for primary LUN and replica LUN, they will be created in the system automatically.
● If both primary LUN and replica LUN are Thin-LUNs, it is recommended that the thin-provisioning parameters of replica LUN be consistent with those of primary LUN.
● Replica LUN can only be assigned to client servers in read-only mode.

- If snapshots are enabled on replica LUN, all time points must be deleted. Otherwise, a large amount of data will be written to replica LUN in the initial replication process, causing great expansion on snapshot resource space of replica LUN.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

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

Step 3: The first step of the **Enable Replication** wizard is shown in Figure 7-7. Select replication mode (see Table 7-1 for details) and primary LUN and click the <Next> button to enter the next interface.

Figure 7-7 Enable remote replication wizard interface (1)

Step 4: The second step of the **Enable Replication** wizard is shown in Figure 7-8. Select target device and replica LUN and click the <Next> button to enter the next interface.

Figure 7-8 Enable remote replication wizard interface (2)

ⓘ**NOTE**

If a replica LUN has not been created in advance, you can also select the option of "Create Replica LUN" in this step to create a new replica LUN on the target device. In the next steps, you will create a new replica LUN through the extended steps, corresponding to steps 2a/7, 2b/7 etc. This chapter only describes the content related to remote replication. 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: The third step of the **Enable Replication** wizard is shown in Figure 7-9. Set replication policy (see Table 7-2 for details) and click the <Next> button to enter the next interface.

Figure 7-9 Enable remote replication wizard interface (3)

Step 6: The fourth step of the **Enable Replication** wizard is shown in Figure 7-10. Set replication mode switching policy (see Table 7-3 for details) and click the <Next> button to enter the next interface.

Enable Replication   ✕

4 /7 Set Replication Mode Switching Policy
According to the set mode switching policy, the device will automatically switch the replication mode.

Replication Mode
Switching Policy:

☐ Policy W0

Day: ☑ Mon. ☑ Tues. ☑ Wed. ☑ Thurs. ☑ Fri. ☑ Sat. ☑ Sun.

Time Period: `06:00:00 - 22:00:00` ⓘ

Replication Mode: Synchronous Replication ⌄

☐ Policy W1 ⓘ

Bandwidth: `1000` MBps(valid range: 0-4096000)

IOPS: `0` (valid range: 0-10000000)

Delay: `0` Microsecond(valid range: 0-10000000)

Period: `10` (valid range: 3-60)

[Previous] [Next] [Cancel]

Figure 7-10 Enable remote replication wizard interface (4)

Step 7: The fifth step of the **Enable Replication** wizard is shown in Figure 7-11. Set replication split resume policy (see Table 7-4 for details) and click the <Next> button to enter the next interface.

Enable Replication ✕

5/7 Set Replication Split Resume Policy
According to the set split resume policy, the device will automatically split or resume the replication.

Replication Split
Resume Policy:

☐ Policy R0

Day: ☑ Mon. ☑ Tues. ☑ Wed. ☑ Thurs. ☑ Fri. ☑ Sat. ☑ Sun.

Time Period: 06:00:00 - 22:00:00 ⓘ

Sync Type: Forward ⌄ ⓘ

Split/Resumed: Resume ⌄

| Previous | Next | Cancel |

Figure 7-11 Enable remote replication wizard interface (5)

Step 8: The sixth step of the **Enable Replication** wizard is shown in Figure 7-12. Set replication option parameters (see Table 7-5 for details) and click the <Next> button to enter the next interface.

Figure 7-12 Enable remote replication wizard interface (6)

Step 9: In the seventh step of the **Enable Replication** wizard, you can check the configuration information and click the <Finish> button to complete the configuration.

7.1.2 Viewing Replication Properties

This section explains how to view replication pair's general information, replication policy, replication mode switching policy, replication split resume policy, replication-out and replication-in.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired replication pair in the **LUN Replications** 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 replication pair.

7.1.3 Modifying Replication

7.1.3.1. Modifying Replication Policy

This section explains how to modify replication pair's replication policy.

ⓘNOTE
- The replication policy only takes effect for asynchronous replication.
- Activating/suspending a replication policy does not affect ongoing scan or replication.

- After suspending a replication policy, replication will not be started automatically until the replication policy is reactivated in the case of its replication policy is met.
- No replication policy configuration means that the replication can only be started manually instead of automatically.
- If a replication task has already existed when the replication policy is triggered, the new replication task will be automatically cancelled. Therefore, please try to stagger the policy trigger time when configuring multiple policies at the same time.
- It is recommended to stagger the triggering time of the policies on multiple replication pairs.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired replication pair in the **LUN Replications** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Replication Policy** tab is shown in Figure 7-13. Modify replication policy (see Table 7-2 for details) and click the <Apply> button to complete the configuration.

Figure 7-13 Replication policy interface

7.1.3.2. Modifying Replication Mode Switching Policy

This section explains how to modify replication pair's replication mode switching policy.

ⓘ **NOTE**

● 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.

● No replication mode switching policy configuration means that the replication mode can only be switched manually instead of automatically.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired replication pair in the **LUN Replications** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Replication Mode Switching Policy** tab is shown in Figure 7-14. Modify replication mode switching policy (see Table 7-3 for details) and click the <Apply> button to complete the configuration.

Figure 7-14 Replication mode switching policy interface

7.1.3.3. Modifying Replication Split Resume Policy

This section explains how to modify replication pair's replication split resume policy.

ⓘ**NOTE**

● After suspending a replication split resume policy, replication will not be split or resumed automatically until the policy is reactivated in the case of its replication split resume policy is met.

- No replication split resume policy configuration means that the replication can only be split or resumed manually instead of automatically.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired replication pair in the **LUN Replications** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Replication Split Resume Policy** tab is shown in Figure 7-15. Modify replication split resume policy (see Table 7-4 for details) and click the <Apply> button to complete the configuration.

Figure 7-15 Replication split resume policy interface

7.1.3.4. Modifying Replication-Out

This section explains how to enable or disable scan difference before initial replication, replication compression, replication encryption and how to modify replication flow control, etc.

ⓘNOTE

- For synchronous replication, compression and encryption take effect only in initial replication.
- Compression and encryption will take effect at the time of next replication after being enabled or disabled.

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired replication pair in the **LUN Replications** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Replication-Out** tab is shown in . Modify replication-out (see for details) and click the <Apply> button to complete the configuration.

Figure 7-16 Replication-out interface

7.1.3.5. Batch Modifying Replication Flow Control

This section explains how to batch modify replication pair's replication flow control.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired replication pair in the **LUN Replications** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Replication-Out** tab is shown in Figure 7-16.

Step 3: Click the <Batch modify> button to open the **Batch Modify Replication Flow Control** window, as show in Figure 7-17. Modify replication flow control, select peer device and replication pair, and click the <OK> button to complete the configuration.

Figure 7-17 Batch modify replication flow control interface

7.1.3.6. Switching Replication Mode

This section explains how to switch replication pair's replication mode manually.

ⓘ**NOTE**

If replication mode switching policy has been set before, the replication mode will be switched automatically according to the policy.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired replication pair in the **LUN Replications** tab of the information display area, click the <Switch Replication Mode> button, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.1.3.7. Switching Active/Standby Replication

This section explains how to switch active/standby replication.

> **ⓘNOTE**
>
> Replication and scanning cannot be operated in the case of standby.

Prerequisites

If the replication status is scanning or replicating, please manually stop scanning or pause replication before switching active/standby mode.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired replication pair in the **LUN Replications** 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.

7.1.4 Starting Scanning

This section explains how to start scanning difference manually.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired replication pair in the **LUN Replications** tab of the information display area, click the <Scan> button, click the <Start Scanning> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.1.5 Stopping Scanning

This section explains how to stop scanning replication.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired replication pair in the **LUN Replications** tab of the information display area, click the <Scan> button, click the <Stop Scanning> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.1.6 Starting Replication

This section explains how to start replication manually.

If replication policy has been set before, the replication will be automatically started according to the policy.

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired replication pair in the **LUN Replications** tab of the information display area, click the <Replication> button, click the <Start Replicating> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.1.7 Pausing Replication

This section explains how to pause replication.

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired replication pair in the **LUN Replications** tab of the information display area, click the <Replication> button, click the <Pause Replicating> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.1.8 Reversing Replication

This section explains how to reverse replication.

After reversing replication, the current primary LUN will become a new replica LUN, and the current replica LUN will become a new primary LUN. Please reconfigure the replication policy on the new primary LUN.

- The replication status must be idle.
- The capacity of the primary LUN is the same as that of replica LUN currently.
- The primary LUN is not assigned to the client server currently.
- Differential data does not exist on the primary LUN currently.
- The replication policy has been deleted from the primary LUN currently.
- If snapshots are enabled on the primary LUN and a snapshot policy is set currently, manually delete the snapshot policy.

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

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

7.1.9 Splitting Replication

This section explains how to split replication.

NOTE

If replication split resume policy has been set before, the replication will be automatically split according to the policy.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

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

7.1.10 Resuming Replication

This section explains how to resume split replication.

NOTE

If replication split resume policy has been set before, the replication will be automatically resumed according to the policy.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

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

7.1.11 Updating Replication

This section explains how to update all replication information of the device.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Click the <More> button in the **LUN Replications** tab of the information display area, click the <Update> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.1.12 Disabling Replication

This section explains how to disable replication.

Prerequisites

Replication cannot be disabled when the replication status is scanning or replicating. Please manually stop scanning or pause replicating first in this occasion.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired replication pair in the **LUN Replications** tab of the information display area and click the <Disable> button to open the **Disable Replication** window, as shown in Figure 7-18. Select the method of disabling and click the <OK> button, confirm the object in the pop-up warning box, and click the <OK> button to complete the configuration.

ⓘNOTE

- If you select "Promote Replica LUN", the replica LUN will be used as a Thick-LUN after replication is disabled. If the replica LUN data is incomplete, you can choose whether to roll back the data in the replica LUN to the latest time point. It is recommended to select the Rollback check box and try to ensure data integrity of original replica LUN after replication is disabled.

- If you select "Delete Replica LUN", the replica LUN will be deleted automatically after replication is disabled.

Figure 7-18 Disable replication interface

7.2 Managing Consistency Group Replication

7.2.1 Enabling Group Replication

7.2.1.1. Enabling Group Local Replication

This section explains how to enable consistency group local replication.

Prerequisites

- It is recommended to configure related business on the client server before enabling replication to improve replication efficiency.
- The LUN replication in the consistency group must meet the following requirements:
  - ➢ If replication is configured for data migration, the capacity of replica LUN must be greater than or equal to that of primary LUN.
  - ➢ If replication is configured for data backup, the capacity of replica LUN must be equal to that of primary LUN. Otherwise, the extra space will be wasted and reverse replication from replica LUN to primary LUN cannot be configured.
  - ➢ The health status of primary LUN and replica LUN must be normal.
  - ➢ The default SP of primary LUN and replica LUN must be the same.
  - ➢ If snapshot resources have been created for primary LUN and replica LUN, they must have normal health status and valid data; if no snapshot resources have been created for primary LUN and replica LUN, they will be created in the system automatically.
  - ➢ If both primary LUN and replica LUN are Thin-LUNs, it is recommended that the thin-provisioning parameters of replica LUN be consistent with those of primary LUN.
  - ➢ Replica LUN can only be assigned to client servers in read-only mode.

➢ If snapshots are enabled on replica LUN, all time points must be deleted. Otherwise, a large amount of data will be written to replica LUN in the initial replication process, causing great expansion on snapshot resource space of replica LUN.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

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

Step 3: The first step of the **Enable Group Replication** wizard is shown in Figure 7-19. Select replication mode (see Table 7-6 for details) and primary group and click the <Next> button to enter the next interface.

Figure 7-19 Enable group local replication wizard interface (1)

Table 7-6 Description of the parameters for enabling group local replication wizard interface (1)

Parameter	Description
Mode	There are two kinds of replication modes as follows: ● Synchronous replication: Synchronizing data in real-time. The data of the LUN in primary group is synchronously written to the LUN in replica

| | group, strictly ensuring real-time consistency. |
| | ● Asynchronous replication: Synchronizing data periodically. Based on the preset replication policy, the changing data in the LUN in primary group is replicated to the LUN in replica group periodically. |

Step 4: The second step of the **Enable Group Replication** wizard is shown in Figure 7-20. Select replica group and click the <Next> button to enter the next interface.

Figure 7-20 Enable group local replication wizard interface (2)

ⓘNOTE

If a replica group has not been created in advance, you can also select the option of "Create Replica Group" in this step to create a new replica group on the target device. In the next steps, you will create a new replica group through extended step, corresponding to step 2a/8. See 5.1 Creating Consistency Group for details.

Step 5: The third step of the **Enable Group Replication** wizard is shown in Figure 7-21. Configure replication pair for members and click the <Next> button to enter the next interface.

Figure 7-21 Enable group local replication wizard interface (3)

ⓘ**NOTE**

The system will automatically match the replication pair. In other words, it will automatically select the replica LUN that meets the requirements for the primary LUN. Please check the member's replication pair relationship to ensure that it is consistent with the actual requirements. If a primary LUN is not matched with a replica LUN that meets the requirements, you can also choose to create a new replica LUN. In the next step, you will create a new replica LUN on the target device through extended steps, corresponding to steps 3a/8, 3b/8, etc. This chapter only describes the content related to group local replication. 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: The fourth step of the **Enable Group Replication** wizard is shown in Figure 7-22. Set group replication policy (see Table 7-7 for details) and click the <Next> button to enter the next interface.

- The group replication policy only takes effect for asynchronous replication.
- No group replication policy configuration means that the replication can only be started manually instead of automatically.
- If a replication task has already existed when the group replication policy is triggered, the new replication task will be automatically cancelled. Therefore, please try to stagger the policy trigger time when configuring multiple policies at the same time.
- It is recommended to stagger the triggering time of the policies on multiple group replication pairs.

Figure 7-22 Enable group local replication wizard interface (4)

Table 7-7 Description of the parameters for enabling group local replication wizard interface (4)

Parameter	Description
Cycle Replication Policy	Replication is started automatically according to the set cycle replication policy. The following cycle replication policies are supported:

- Policy S0: Replication is started automatically at a fixed time every month.
- Policy S1: Replication is started automatically at some time of every day/week.
- Policy S2: Replication is started automatically at a certain time with a specified interval.

ⓘ**NOTE**

Click the <Show Advanced Policy> button and you can also set advanced policy A0~A3 according to actual needs, and automatically start replication at specific time intervals within a specified period of time per day/week.

Step 7: The fifth step of the **Enable Group Replication** wizard is shown in Figure 7-23. Set group replication mode switching policy (see Table 7-8 for details) and click the <Next> button to enter the next interface.

Enable Group Replication   ✕

5/8   Set Replication Mode Switching Policy
According to the set mode switching policy, the device will automatically switch the replication mode.

Replication Mode
Switching Policy:

☐ Policy W0

Day: ☑ Mon. ☑ Tues. ☑ Wed. ☑ Thurs. ☑ Fri. ☑ Sat. ☑ Sun.

Time Period: `06:00:00 - 22:00:00` ℹ

Replication Mode: Synchronous Replication ⌄

☐ Policy W1 ℹ

Bandwidth: `1000`   MBps(valid range: 0-4096000)

IOPS: `0`   (valid range: 0-10000000)

Delay: `0`   Microsecond(valid range: 0-10000000)

Period: `10`   (valid range: 3-60)

[Previous]   [Next]   [Cancel]

Figure 7-23 Enable group local replication wizard interface (5)

Table 7-8 Description of the parameters for enabling group local replication wizard interface (5)

Parameter	Description
Replication Mode Switching Policy	Replication is switched automatically according to the set replication mode switching policy. The following switching policies are supported: ● Policy W0: Replication mode is switched automatically at some time of every day/week. For example, in the case of asynchronous replication, if policy W0 is set with synchronous replication during 06:00:00-22:00:00 every day, the mode will be switched to synchronous replication at 06:00:00 and to asynchronous replication at 22:00:00 every day. ● Policy W1: Bandwidth, IOPS, or delay can be used as switching conditions between synchronous and asynchronous replication. ➢ Asynchronous replication will be switched automatically when any value of bandwidth, IOPS or delay collected in consecutive cycles

| | is greater than corresponding specified value. |
| | ➢ Synchronous replication will be switched automatically when any value of bandwidth, IOPS or delay collected in consecutive cycles is lower than corresponding specified value. |

Step 8: The sixth step of the **Enable Group Replication** wizard is shown in Figure 7-24. Set group replication split resume policy (see Table 7-9 for details) and click the <Next> button to enter the next interface.

Figure 7-24 Enable local replication wizard interface (6)

Table 7-9 Description of the parameters for enabling group local replication wizard interface (6)

Parameter	Description
Replication Split Resume Policy	Replication is split/resumed automatically at some time of every day/week. The synchronous direction can be set after resumption. For example, if policy R0 is set with replication recovery during 06:00:00-22:00:00 every day, the replication will be resumed at 06:00:00 and be split at 22:00:00 automatically every day.

Step 9: The seventh step of the **Enable Group Replication** wizard is shown in Figure 7-25. Set group replication option parameters (see Table 7-10 for details) and click the <Next> button to enter the next interface.

Figure 7-25 Enable group local replication wizard interface (7)

Table 7-10 Description of the parameters for enabling group local replication wizard interface (7)

Parameter	Description
Scan Difference Before Initial Replication	It refers to enabling or disabling scanning difference before initial replication. The default value is disabling. ⓘ**NOTE** If there are small differences between primary LUN and replica LUN, for example, the replication has been done before, please enable the option. After enabling, the differential data between primary LUN and replica LUN will be scanned first when the initial replication is triggered. Only the differential data will be replicated during initial replication, greatly reducing the amount of replicated data.
Replication Compression	It refers to enabling or disabling replication compression. The default value is disabling.
Replication Encryption	It refers to enabling or disabling replication encryption. The default value is disabling.
Replication Flow Control	It is used to control the replication rate so that the synchronous bandwidth consumption of the back-end replication does not affect the front-end traffic on the primary LUN. ● Low (0-20MBps) ● Medium (40-80MBps) ● High (100-200MBps) ● Highest (greater than 200MBps)

	● Custom: It refers to manually setting the upper limit of the rate. Valid range: 1-1024MBps.
Primary Group Member Snapshot Resource Capacity	It refers to the snapshot resource capacity of LUN in primary group, which can be configured automatically or manually.
Replica Group Member Snapshot Resource Capacity	It refers to the snapshot resource capacity of LUN in replica group, which can be configured automatically or manually.

Step 10: In the eighth step of the **Enable Group Replication** wizard, you can check the configuration information and click the <Finish> button to complete the configuration.

7.2.1.2. Enabling Group Remote Replication

This section explains how to enable consistency group remote replication.

Prerequisites

● The XAN is well configured and reachable.

● It is recommended to configure related business on the client server before enabling replication to improve replication efficiency.

● The LUN replication in the consistency group must meet the following requirements:

  ➢ If replication is configured for data migration, the capacity of replica LUN must be greater than or equal to that of primary LUN.

  ➢ If replication is configured for data backup, the capacity of replica LUN must be equal to that of primary LUN. Otherwise, the extra space will be wasted and reverse replication from replica LUN to primary LUN cannot be configured.

  ➢ The health status of primary LUN and replica LUN must be normal.

  ➢ The default SP of primary LUN and replica LUN must be the same.

  ➢ If snapshot resources have been created for primary LUN and replica LUN, they must have normal health status and valid data; if no snapshot resources have been created for primary LUN and replica LUN, they will be created in the system automatically.

  ➢ If both primary LUN and replica LUN are Thin-LUNs, it is recommended that the thin-provisioning parameters of replica LUN be consistent with those of primary LUN.

  ➢ Replica LUN can only be assigned to client servers in read-only mode.

  ➢ If snapshots are enabled on replica LUN, all time points must be deleted. Otherwise, a large amount of data will be written to replica LUN in the initial replication process, causing great expansion on snapshot resource space of replica LUN.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

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

Step 3: The first step of the **Enable Group Replication** wizard is shown in Figure 7-26. Select replication mode (see Table 7-6 for details) and primary group and click the <Next> button to enter the next interface.

Figure 7-26 Enable group remote replication wizard interface (1)

Step 4: The second step of the **Enable Group Replication** wizard is shown in Figure 7-27. Select target device and replica group and click the <Next> button to enter the next interface.

Figure 7-27 Enable group remote replication wizard interface (2)

ⓘ**NOTE**

If a replica group has not been created in advance, you can also select the option of "Create Replica Group" in this step to create a new replica group on the target device. In the next steps, you will create a new replica group through extended step, corresponding to step 2a/8. See 5.1 Creating Consistency Group for details on how to create it.

Step 5: The third step of the **Enable Group Replication** wizard is shown in Figure 7-28. Configure replication pairs for members and click the <Next> button to enter the next interface.

Figure 7-28 Enable group remote replication wizard interface (3)

ⓘ**NOTE**

The system will automatically match the replication pair. In other words, it will automatically select the replica LUN that meets the requirements for the primary LUN. Please check the member's replication pair relationship to ensure that it is consistent with the actual requirements. If the primary LUN is not matched with a replica LUN that meets the requirements, you can also choose to create a new replica LUN. In the next step, you will create a new replica LUN on the target device through extended steps, corresponding to steps 3a/8, 3b/8, etc. This chapter only describes the content related to group local replication. 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: The fourth step of the **Enable Group Replication** wizard is shown in Figure 7-29. Set group replication policy (see Table 7-7 for details) and click the <Next> button to enter the next interface.

Figure 7-29 Enable group remote replication wizard interface (4)

Step 7: The fifth step of the **Enable Group Replication** wizard is shown in Figure 7-30. Set group replication mode switching policy (see Table 7-8 for details) and click the <Next> button to enter the next interface.

Enable Group Replication   ✕

5 /8 Set Replication Mode Switching Policy
According to the set mode switching policy, the device will automatically switch the replication mode.

Replication Mode
Switching Policy:

☐ Policy W0

Day: ☑ Mon. ☑ Tues. ☑ Wed. ☑ Thurs. ☑ Fri. ☑ Sat.
            ☑ Sun.

Time Period: `06:00:00 - 22:00:00`   ⓘ

Replication Mode: `Synchronous Replication  ⌄`

☐ Policy W1 ⓘ

Bandwidth: `1000`   MBps(valid range: 0-4096000)

IOPS: `0`   (valid range: 0-10000000)

Delay: `0`   Microsecond(valid range: 0-10000000)

Period: `10`   (valid range: 3-60)

[Previous]   [Next]   [Cancel]

Figure 7-30 Enable group remote replication wizard interface (5)

Step 8: The sixth step of the **Enable Group Replication** wizard is shown in Figure 7-31. Set group replication split resume policy (see Table 7-9 for details) and click the <Next> button to enter the next interface.

Figure 7-31 Enable group remote replication wizard interface (5)

Step 9: The seventh step of the **Enable Group Replication** wizard is shown in Figure 7-32. Set group replication option parameters (see Table 7-10 for details) and click the <Next> button to enter the next interface.

Figure 7-32 Enable group remote replication wizard interface (6)

Step 10: In the eighth step of the **Enable Group Replication** wizard, you can check the configuration information and click the <Finish> button to complete the configuration.

7.2.2 Viewing Group Replication Properties

This section explains how to view group replication pair's general information, replication policy, replication mode switching policy, replication split resume policy, replication-out and replication-in.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired group replication pair in the **Group Replications** 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 replication pair.

7.2.3 Modifying Group Replication

7.2.3.1. Modifying Group Replication Policy

This section explains how to modify group replication pair's replication policy.

ⓘ**NOTE**
- The group replication policy only takes effect for asynchronous replication.
- Activating/suspending a group replication policy does not affect ongoing scans or replications.

- After suspending a group replication policy, replication will not be started automatically until the group replication policy is reactivated in the case of its replication policy is met.
- No group replication policy configuration means that the replication can only be started manually instead of automatically.
- If a replication task has already existed when the group replication policy is triggered, the new replication task will be automatically cancelled. Therefore, please try to stagger the policy trigger time when configuring multiple policies at the same time.
- It is recommended to stagger the triggering time of the policies on multiple group replication pairs.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired group replication pair in the **Group Replications** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Replication Policy** tab is shown in Figure 7-33. Modify replication policy (see Table 7-7 for details) and click the <Apply >button to complete the configuration.

Figure 7-33 Group replication policy interface

7.2.3.2. Modifying Group Replication Mode Switching Policy

This section explains how to modify group replication pair's replication mode switching policy.

ⓘNOTE

- After suspending a group 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.
- No group replication mode switching policy configuration means that the replication mode can only be switched manually instead of automatically.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired group replication pair in the **Group Replications** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Replication Mode Switching Policy** tab is shown in Figure 7-34. Modify group replication mode switching policy (see Table 7-8 for details) and click the <Apply> button to complete the configuration.

Figure 7-34 Group replication mode switching policy interface

7.2.3.1. Modifying Group Replication Split Resume Policy

This section explains how to modify replication pair's replication split resume policy.

ⓘNOTE

● After suspending a group replication split resume policy, replication will not be split or resumed automatically until the policy is reactivated in the case of its replication split resume policy is met.

- No group replication split resume policy configuration means that the replication can only be split or resumed manually instead of automatically.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired group replication pair in the **Group Replications** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Replication Split Resume Policy** tab is shown in . Modify group replication split resume policy (see for details) and click the <Apply> button to complete the configuration.

Figure 7-35 Group replication split resume policy interface

7.2.3.2. Modifying Group Replication-Out

This section explains how to enable or disable scan difference before initial replication, replication compression, replication encryption and how to modify replication flow control, etc.

ⓘ**NOTE**
- For synchronous replication, compression and encryption take effect only in initial replication.

● Compression and encryption will take effect at the time of next replication after being enabled or disabled.

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired group replication pair in the **Group Replications** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Replication-Out** tab is shown in Figure 7-36. Modify group replication-out (see Table 7-10 for details) and click the <Apply> button to complete the configuration.

Figure 7-36 Group replication-out interface

7.2.3.3. Switching Group Replication Mode

This section explains how to switch group replication pair's replication mode.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired group replication pair in the **Group Replications** tab of the information display area, click the <Switch Replication Mode> button, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.2.3.4. Switching Active/Standby Replication

This section explains how to switch active/standby replication.

Prerequisites

If the group member's replication status is scanning or replicating, please manually stop scanning or pause replication before switching active/standby mode.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired group replication pair in the **Group Replications** 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.

7.2.4 Starting Group Scanning

This section explains how to start scanning difference manually.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired group replication pair in the **Group Replications** tab of the information display area, click the <Scan> button, click the <Start Scanning> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.2.5 Stopping Group Scanning

This section explains how to stop scanning group replication.

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired group replication pair in the **Group Replications** tab of the information display area, click the <Scan> button, click the <Stop Scanning> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.2.6 Starting Group Replication

This section explains how to start group replication manually.

NOTE

If group replication policy has been set before, the replication will be automatically started according to the policy.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired group replication pair in the **Group Replications** tab of the information display area, click the <Replication> button, click the <Start Replicating> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.2.7 Pausing Group Replication

This section explains how to pause replication pair with replicating status in the group replication pair.

Prerequisites

There exists a member in the group replication pair whose replication status is "replicating".

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Select the desired group replication pair in the **Group Replications** tab of the information display area, click the <Replicate> button, click the <Pause Replicating> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.2.8 Reversing Group Replication

This section explains how to reverse group replication pair..

After reversing group replication, the current primary group will become a new replica group, and the current replica group will become a new primary group. Please reconfigure the replication policy on the new primary group.

Prerequisites

- The replication status of group member must be idle.
- The capacity of the primary LUN is the same as that of replica LUN currently.
- The primary LUN is not assigned to the client server currently.
- Differential data does not exist on the primary LUN currently.
- The replication policy has been deleted from the primary LUN currently.
- If snapshots are enabled on the primary LUN and a snapshot policy is set currently, manually delete the snapshot policy.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

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

7.2.9 Splitting Group Replication

This section explains how to split group replication pair.

ⓘ**NOTE**

If group replication split resume policy has been set before, the replication will be automatically split according to the policy.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

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

7.2.10 Resuming Group Replication

This section explains how to resume split group replication pair.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

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

7.2.11 Updating Group Replication

This section explains how to update all group replication information of the device.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

Step 2: Click the <More> button in the **Group Replications** tab of the information display area, click the <Update> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7.2.12 Disabling Group Replication

This section explains how to disable group replication.

ⓘ**NOTE**

Only the replication relationship between primary group and replica group can be automatically terminated when the group replication is disabled, and the replication relationships between members will be remained and the group replication policy will not be synchronized to the members. If replication is also needed for members, manually configure their replication policy. Otherwise, please manually disable the replication of members.

Prerequisites

Group replication cannot be disabled when the group member status is scanning or replicating. Please manually stop scanning or pause replicating first in this occasion.

Steps

Step 1: Select "Service" -> "Replication" on the navigation tree to open the replication interface.

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

8 Configuring Snapshot Resource (Optional)

⚠**CAUTION**

- Snapshot resources will be created automatically if they have not been created on LUNs with the demand of business features (such as Snapshot, Replication, Dual-Active, Mirror, Clone, NDM, etc.).
- It is recommended to set default values for the parameters of snapshot resources. If you need to configure snapshot resources in special cases, please refer to this chapter.

8.1 Managing COW Snapshot Resource

8.1.1 Creating Snapshot Resource

8.1.1.1. Automatically Creating Snapshot Resource

Snapshot resources will be created automatically if they have not been created on LUNs with the demand of business features (such as Snapshot, Replication, Dual-Active, Mirror, Clone, NDM, etc.).

ⓘ**NOTE**

- For Thick-LUNs, the system automatically creates COW snapshot resources.
- For Thin-LUNs, the system automatically creates ROW snapshot resources. If you need to use COW snapshot resources, please refer to 8.1.1.2Manually Creating Snapshot Resource.

8.1.1.2. Manually Creating Snapshot Resource

This section explains how to create snapshot resource manually.

Steps

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

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

Step 3: The first step of the **Create Snapshot Resource** wizard is shown in Figure 8-1. Select desired LUN and click the <Next> button to enter the next interface.

Figure 8-1 Create snapshot resource wizard interface (1)

Step 4: The second step of the **Create Snapshot Resource** wizard is shown in Figure 8-2. Set snapshot resource layout (see Table 8-1 for details) and click the <Next> button to enter the next interface.

Figure 8-2 Create snapshot resource wizard interface (2)

Table 8-1 Description of the parameters for creating snapshot resource wizard interface (2)

Parameter	Description
Name	It refers to the name of snapshot resource. ● Length: 1-63 characters. ● The default name of snapshot resource is "SR-LUN name".
Capacity	The system provides two capacity allocation methods: ● Custom Allocation: You can manually select the RAID to create snapshot resources and set the allocated capacity on each RAID. The snapshot resource capacity is equal to the sum of the allocated capacity of the selected RAIDs. ● Auto Allocation: You can set snapshot resource capacity and the system will automatically allocate capacity on the selected RAID according to equal distribution policy.

Step 5: The third step of the **Create Snapshot Resource** wizard is shown in . Set snapshot resource auto expansion policy (see for details) and click the <Next> button to enter the next interface.

Create Snapshot Resource ✕

3/4 Set Snapshot Resource Auto Expansion Policy
When the snapshot resource usage reaches the threshold, the snapshot resource will be automatically expanded.

Auto Expansion Threshold: `70` % (valid range: 50%-90%)

Auto Expansion Ratio: `20` % (valid range: 10%-100%)

Maximum Snapshot Resource Capacity: `0` GB (description: 0 means unlimited) ℹ️

[Previous] [Next] [Cancel]

Figure 8-3 Create snapshot resource wizard interface (3)

Table 8-2 Description of the parameters for creating snapshot resource wizard interface (3)

Parameter	Description
Auto Expansion Parameters	Auto expansion will be triggered when snapshot resource usage reaches auto expansion threshold and the current capacity is less than the maximum snapshot resource capacity. The system calculates capacity to be expanded based on set auto expansion ratio and maximum snapshot resource capacity.

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

8.1.2 Viewing Snapshot Resource Properties

This section explains how to view snapshot resource's general information, cache configuration and auto expansion information.

Steps

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

Step 2: Select the desired snapshot resource in the **Snapshot Resources** 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 snapshot resource.

8.1.3 Modifying Snapshot Resource Properties

8.1.3.1. Renaming Snapshot Resource

This section explains how to modify snapshot resource's name.

Steps

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

Step 2: Select the desired snapshot resource in the **Snapshot Resources** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **General** tab is shown in Figure 8-4. Modify snapshot resource name and click the <Apply> button to complete the configuration.

Figure 8-4 Snapshot resource basic properties interface

ⓘ**NOTE**

If snapshot is enabled on the owning LUN of snapshot resource, you can also rename snapshot resource in the **Snapshot Resources** tab of extended area on the snapshot interface through selecting "Service" -> "Snapshot".

8.1.3.2. Modifying Cache Configuration

This section explains how to modify snapshot resource's cache configuration on reading and writing.

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

Step 2: Select the desired snapshot resource in the **Snapshot Resources** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Cache Configuration** tab is shown in Figure 8-5. Modify cache configuration (see Table 8-3 for details) and click the <Apply> button to complete the configuration.

Figure 8-5 Snapshot resource cache configuration interface

Table 8-3 Description of the parameters for snapshot resource cache configuration interface

Parameter	Description
Read Cache	It refers to enabling or disabling read cache, which is enabled by default and cannot be modified.
Read Cache Status	It refers to the current status of read cache.

Read Cache Allocation Policy	The system supports two read cache allocation policies, and different policies can be set for each snapshot resource: ● Dynamic allocation: The system dynamically adjusts the read cache space occupied by each snapshot resource according to the read I/O on each snapshot resource in the current statistical period, so as to optimize the overall utilization of the system read cache. ● Fixed allocation: The system allocates the read cache space for the snapshot resource according to the set percentage. ⚠**CAUTION** ● Modifying read cache allocation policy of snapshot resource will affect its read performance. Please do not modify it arbitrarily unless you know the I/O model of the business well to avoid affecting business performance.
Read Cache Read-Ahead Policy	The system supports three read cache read-ahead policies and different policies can be set for each snapshot resource: ● Dynamic read-ahead: It refers to the read-ahead carried only for read I/O with consecutive addresses, which is applicable to applications whose traffic model is sequential reading. ● Fixed read-ahead: It refers to the read-ahead for all read IOs, which is applicable to occasions where the traffic model is a pseudo-sequential reading. ● No read-ahead: It refers to disabling the read-ahead function of the read cache of snapshot resources, which is applicable to occasions where the traffic model is random reading. ⚠**CAUTION** ● Modifying read cache read-ahead policy of snapshot resource will affect its read performance. Please do not modify it arbitrarily unless you know the I/O model of the business well to avoid affecting business performance.
Read Cache Read-Ahead Depth	It is used for dynamic read-ahead and fixed read-ahead, and it can be set according to the actual business model.
Write Cache	It refers to enabling or disabling write cache, which is enabled by default and cannot be modified.
Write Cache Status	It refers to the current state of the write cache.
Write Cache Allocation Policy	The system supports two write cache allocation policies, and different policies can be set for each snapshot resource: ● Dynamic allocation: The system dynamically adjusts the write cache space occupied by each snapshot resource according to the write I/O on each snapshot resource in the current statistical period, so as to optimize the overall utilization of the system write cache. ● Fixed allocation: The system allocates write cache space for the snapshot resource according to the set percentage.

> **⚠CAUTION**
>
> Modifying write cache allocation policy of snapshot resource will affect its write performance. Please do not modify it arbitrarily unless you know the I/O model of the business well to avoid affecting business performance.

> **ⓘNOTE**
>
> It snapshot is enabled on the owning LUN of snapshot resource, you can also modify snapshot resource's read cache configuration in the **Snapshot Resources** tab of extended area on the snapshot interface through selecting "Service" -> "Snapshot".

8.1.3.3. Modifying Auto Expansion Policy

This section explains how to modify auto expansion policy.

Steps

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

Step 2: Select the desired snapshot resource in the **Snapshot Resources** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Auto Expansion** tab is shown in Figure 8-6. Modify auto expansion policy (see Table 8-2 for details) and click the <Apply> button to complete the configuration.

Figure 8-6 Snapshot resource auto expansion interface

If snapshot is enabled on the owning LUN of snapshot resource, you can also modify snapshot resource's auto expansion information in the **Snapshot Resources** tab of extended area on the snapshot interface through selecting "Service" -> "Snapshot".

8.1.3.4. Initializing Snapshot Resource

This section explains how to initialize snapshot resource.

ⓘ**NOTE**

The data of invalid snapshot resource is unavailable. At this time, the snapshot resource can only be restored through initialization and the data in it will be lost.

Steps

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

Step 2: Select the desired snapshot resource in the **Snapshot Resources** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **General** tab is shown in Figure 8-7. The value corresponding to the data validity status item is invalid and click the <Reinitialization> button, enter "yes" in the pop-up warning box, and click the <OK> button to complete the configuration.

Figure 8-7 Initialize snapshot resource interface

> **ⓘNOTE**
>
> If snapshot is enabled on the owning LUN of snapshot resource, you can also initialize snapshot resource in the **Snapshot Resources** tab of extended area on the snapshot interface through selecting "Service" -> "Snapshot".

8.1.4 Expanding Snapshot Resource

This section explains how to expand snapshot resource manually.

> **ⓘNOTE**
>
> The system will automatically expand the snapshot resource according to the snapshot resource usage when the snapshot resource auto expansion is enabled.

Steps

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

Step 2: Select the desired snapshot resource in the **Snapshot Resources** tab of the information display area and click <Expand> button to open the **LUN Expansion** window, as shown in Figure

8-8. Enter expansion capacity (see Table 8-4 for details), select RAID, and click the <OK> button to complete the configuration.

Figure 8-8 LUN expansion interface

Table 8-4 Description of the parameters for LUN expansion

Parameter	Description
Expansion	The system provides two ways to allocate LUN expansion capacity: ● Custom Allocation: You can manually select the RAID to expand the LUN, and set the allocated capacity on each RAID. The LUN expansion capacity is equal to the sum of the allocated capacity on the selected RAID. ● Auto Allocation: You can set LUN expansion capacity and the system will automatically allocate capacity on the selected RAID according to the equal distribution policy.

ⓘNOTE

If snapshot is enabled on the owning LUN of snapshot resource, you can also expand snapshot resource in the **Snapshot Resources** tab of extended area on the snapshot interface through selecting "Service" -> "Snapshot".

8.1.5 Cleaning up Snapshot Resource

This section explains how to clean up snapshot resource.

Steps

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

Step 2: Click the <Cleanup> button in the **Snapshot Resources** tab of the information display area, enter "yes" in the pop-up warning box, and click the <OK> button to complete the configuration.

8.1.6 Deleting Snapshot Resource

This section explains how to delete snapshot resource.

Prerequisites

Business features that depend on the snapshot resource (such as Snapshot, Replication, Dual-Active, Mirror, Clone and NDM) are not enabled on the LUN to which snapshot resource belongs.

Steps

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

Step 2: Select the desired snapshot resource in the **Snapshot Resources** 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.

8.2 Managing ROW Snapshot Resource

8.2.1 Creating Snapshot Resource

Snapshot resources will be created automatically if they have not been created on LUNs with the demand of business features (such as Snapshot, Replication, Dual-Active, Mirror, Clone, NDM, etc.).

ⓘNOTE

- For Thick-LUNs, the system automatically creates COW snapshot resources.
- For Thin-LUNs, the system automatically creates ROW snapshot resources. If you need to use COW snapshot resources, refer to 8.1.1.2Manually Creating Snapshot Resource.

- ROW snapshot resources share physical space with corresponding Thin-LUN, which monitors the physical space usage and automatically triggers physical space expansion and reclamation as needed. Creating ROW snapshot resource will only modify the size of the snapshot data supported by the Thin-LUN to which it belongs instead of allocating specific physical space.

8.2.2 Viewing Snapshot Resource Properties

This section explains how to view snapshot resource's general information and auto expansion.

Steps

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

Step 2: Select the desired snapshot resource in the **Snapshot Resources** 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 snapshot resource.

8.2.3 Modifying Snapshot Resource Properties

8.2.3.1. Modifying Auto Expansion Policy

This section explains how to modify auto expansion information.

Steps

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

Step 2: Select the desired snapshot resource in the **Snapshot Resources** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Auto Expansion** tab is shown in Figure 8-9. Modify auto expansion policy (see Table 8-2 for details) and click the <Apply> button to complete the configuration.

Figure 8-9 Snapshot resource auto expansion policy interface

ⓘ**NOTE**

If snapshot is enabled on the owning LUN of snapshot resource, you can also modify snapshot resource's auto expansion information in the **Snapshot Resources** tab of extended area on the snapshot interface through selecting "Service" -> "Snapshot".

8.2.3.2. Initializing Snapshot Resource

This section explains how to initialize snapshot resource.

ⓘ**NOTE**

The data of invalid snapshot resource is unavailable. At this time, the snapshot resource can only be restored through initialization and the data in it will be lost.

Steps

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

Step 2: Select the desired snapshot resource in the **Snapshot Resources** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **General** tab is shown in Figure 8-10. The value corresponding to the data validity status item is invalid and click the <Reinitialization> button, enter "yes" in the pop-up warning box, and click the <OK> button to complete the configuration.

Figure 8-10 Initialize snapshot resource interface

ⓘ**NOTE**

If snapshot is enabled on the owning LUN of snapshot resource, you can also initialize snapshot resource in the **Snapshot Resources** tab of extended area on the snapshot interface through selecting "Service" -> "Snapshot".

8.2.4 Expanding Snapshot Resource

This section explains how to expand snapshot resource manually.
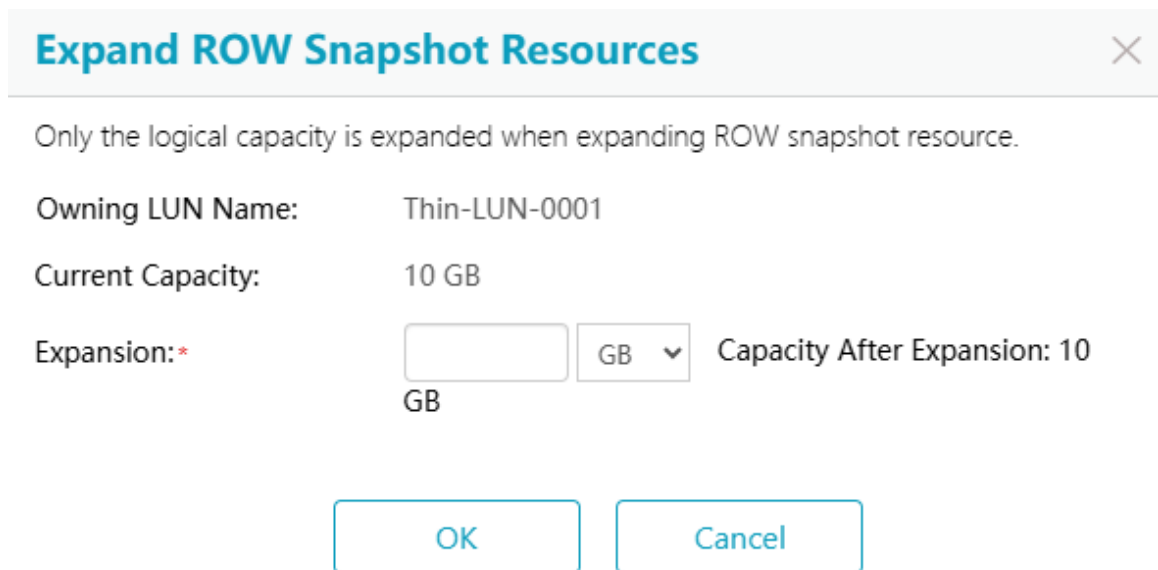
ⓘ**NOTE**

- The system will automatically expand the snapshot resource according to the snapshot resource usage when the snapshot resource auto expansion is enabled.
- Only logical capacity is expanded when expanding ROW snapshot resource. In other words, only the size of the snapshot data supported by the Thin-LUN to which it belongs is modified without specific physical space allocation.

Steps

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

Step 2: Select the desired snapshot resource in the **Snapshot Resources** tab of the information display area and click <Expand> button to open the **Expand ROW Snapshot Resource** window, as shown in . Enter expansion capacity and click the <OK> button to complete the configuration.

Expand ROW Snapshot Resources   ✕

Only the logical capacity is expanded when expanding ROW snapshot resource.

Owning LUN Name: Thin-LUN-0001

Current Capacity: 10 GB

Expansion: *   [   ] [GB ∨]   Capacity After Expansion: 10
                                        GB

              [OK   ]   [Cancel   ]

Figure 8-11 Expand ROW snapshot resource interface

ⓘ**NOTE**

If snapshot is enabled on the owning LUN of snapshot resource, you can also expand snapshot resource in the **Snapshot Resources** tab of extended area on the snapshot interface through selecting "Service" -> "Snapshot".

8.2.5 Cleaning up Snapshot Resource

This section explains how to clean up snapshot resource.

ⓘ**NOTE**

Cleaning up snapshot resources will automatically delete all snapshot resources in LUNs for which Snapshot, Replication, Dual-Active, Mirror, Clone and NDM are not enabled. After the deletion, the snapshot resources cannot be restored.

Steps

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

Step 2: Click the <Cleanup> button in the **Snapshot Resources** tab of the information display area, enter "yes" in the pop-up warning box, and click the <OK> button to complete the configuration.

8.2.6 Deleting Snapshot Resource

This section explains how to delete snapshot resource.

Prerequisites

Business features that depend on the snapshot resource (such as Snapshot, Replication, Dual-Active, Mirror, Clone and NDM) are not enabled on the LUN to which snapshot resource belongs.

Steps

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

Step 2: Select the desired snapshot resource in the **Snapshot Resources** 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.

9 Features of Replication and Snapshot

9.1 Configuring Snapshot on Primary LUN/Group of Replication Pair

> **ⓘNOTE**
>
> The configurations of snapshot on both primary LUN and primary group of replication pair are similar. The snapshot configuration on the primary LUN of replication pair is used as an example to illustrate in this document.

After the snapshot is enabled on the primary LUN of replication pair, you can enable or disable the option of auto save replication time point, as shown in Figure 9-1. After this option is enabled, the device does not actively delete the replication time point for the replication on the primary LUN when the incremental replication is completed. Instead, the time point is reserved as a public time point for users to use. You can manually delete, create views, and roll back.

Figure 9-1 Replication-out interface after enabling snapshot on primary LUN

9.2 Configuring Snapshot on Replica LUN/Group of Replication Pair

ⓘNOTE

The configurations of snapshot on both replica LUN and replica group of replication pair are similar. The snapshot configuration on replica LUN of replication pair is used as an example to illustrate in this document.

When enabling the snapshot on the replica LUN of the replication pair, the second step interface of the **Enable Snapshot** wizard is shown in Figure 9-2. That is, the maximum number of time points can be set for the replica LUN of the replication pair. However, the time point policy is not supported. After the snapshot is enabled on the replica LUN, the device does not actively delete the replication time point on the replica LUN when the incremental replication is completed. Instead, the time point is reserved as a public time point for users. You can manually delete, create views, and roll back.

Enable Snapshot ✕

2 /2 Set Snapshot Policy
Time point will be created automatically on the device according to the set policy.

Snapshot Resource Auto configurati ⌄ 50 GB ⌄ ⓘ
Capacity: *

Max Time Points: * 8 (valid range: 0-2048)

Security Snapshot: ◯ Enable ● Disable

Time Point Policy:

☐ Policy S0: Execute monthly ⓘ

Day: 1 (valid range: 1-31, separated by commas)

Time: 11:25:00

☐ Policy S1: Execute weekly

Day: ☑ Mon. ☑ Tues. ☑ Wed. ☑ Thurs. ☑ Fri. ☑ Sat.
☑ Sun.

Time: 11:25:00

☐ Policy S2: Continue execute

Start Time: 2024-11-11 11:25:00 Interval: 1 Hour (1-168) ⌄

Show Advanced Policy

[Previous] [Finish] [Cancel]

Figure 9-2 Enable snapshot on replica LUN interface

Appendix A. Device Default Configurations

The default configurations of the device are shown in Table 9-1.

Table 9-1 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 9-2.

Table 9-2 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