MacroSAN MS Series Storage Devices Snapshot Feature

GUI User Manual

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MacroSAN Technologies Co., Ltd.

Statement

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Contents

Figures List

Tables List

Manual Structure

Chapter		Description	Main content
Overview	Preface	This chapter introduces related information about the manual for your reading.	- Intended audiences - Manual guidance - Manual conventions - Document acquisition - Feedback
	Overview of MS series storage devices	This chapter introduces the basic functions and typical networking of MS series storage devices, making it easy for you to have a simple understanding of the devices.	- Introduction to MS series storage devices - Introduction to typical networking of MS series storage devices
	ODSP Scope+ console	This chapter introduces the ODSP Scope+ console to help you familiarize with management interface usage.	- Introduction to ODSP Scope+ - Running ODSP Scope+ - Composition of ODSP Scope+ system view interface - Composition of ODSP Scope+ tenant view interface
Snapshot feature	Introduction to snapshot feature	This chapter introduces related knowledge of snapshot.	- Introduction to snapshot - Introduction to cascaded snapshot - Introduction to COW snapshot and ROW snapshot - Introduction to snapshot resource - Introduction to consistency group - Description of snapshot function
	Configuring consistency group (optional)	This chapter introduces how to configure consistency group.	- Creating consistency group - Viewing consistency group - Modifying consistency group properties - Deleting consistency group - Adding members for consistency group - Removing members from consistency group
	Configuring snapshot	This chapter introduces how to configure snapshot.	- Activating snapshot license - Managing LUN snapshot - Managing time point - Managing view - Managing snapshot rollback - Managing consistency group snapshot - Managing consistency group

			time point
	Configuring snapshot resource (optional)	This chapter introduces how to configure COW snapshot resource and ROW snapshot resource.	● Managing COW snapshot resource ● Managing ROW snapshot resource
Appendixes	Device default configurations	This chapter introduces device's default configurations.	Device default configurations
	Device external ports summary	This chapter introduces the summary of device external ports.	Device external ports summary
	Glossaries	This chapter introduces the glossaries in this manual.	Glossaries
	Acronyms	This chapter introduces the acronyms in this manual.	Acronyms

Part 1: Overview

1 Preface

1.1 Intended Audiences

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

1.2 Manual Guidance

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

Table 1-1 List of user manual

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

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

1.3 Manual Conventions

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

1.3.1 Conventions of Description

ⓘ**NOTE**

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

⚠**CAUTION**

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

⚠**WARNING**

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

1.3.2 Other Conventions

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

1.4 Document Acquisition

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

ⓘNOTE

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

1.5 Feedback

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

2 Overview of MS Series Storage Devices

2.1 Introduction to MS Series Storage Devices

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

MacroSAN ODSP storage devices consist of the following modular components:

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

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

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

ⓘ**NOTE**

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

2.2 Introduction to Typical Networking of MS Series Storage Devices

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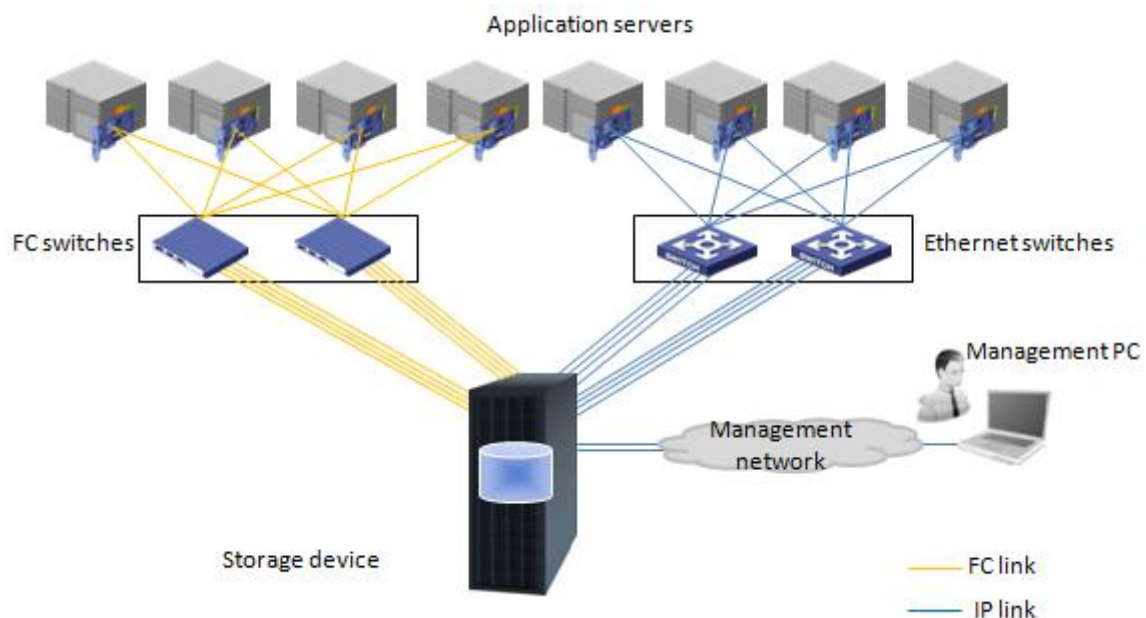
Figure 2-1 Typical networking of MS series storage devices

Networking explanation:

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

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+.
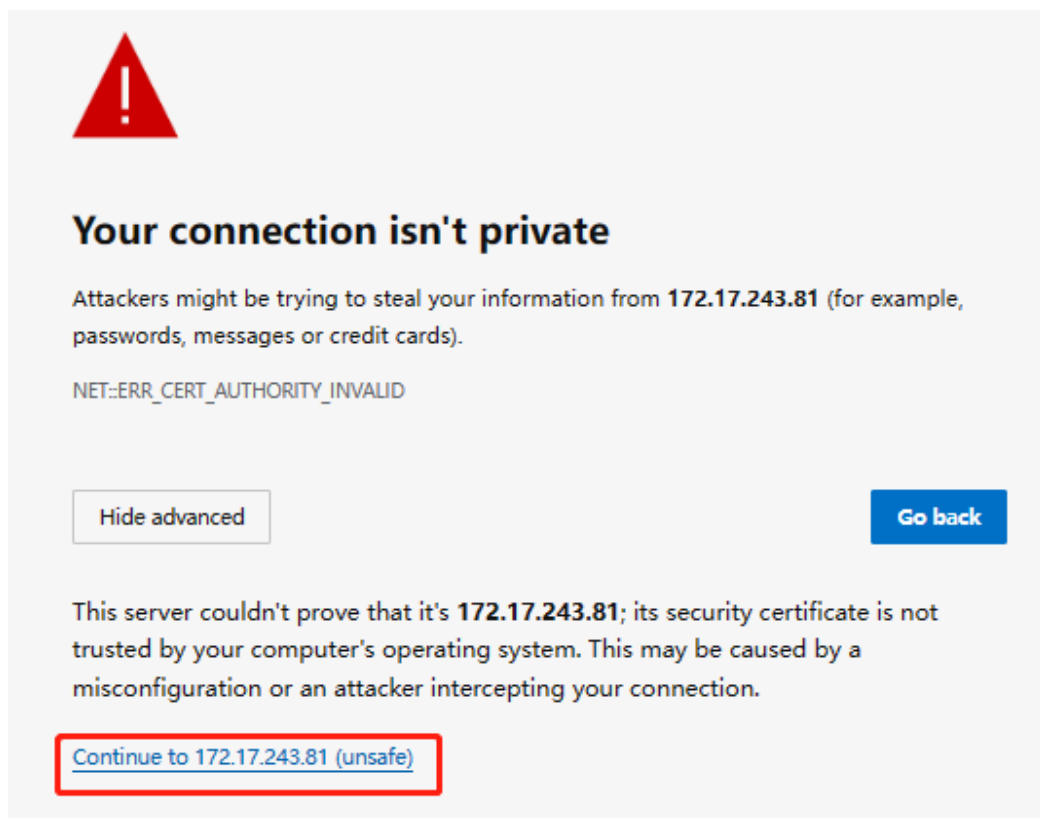
Figure 3-1 Example for prompt of certificate exception

The login interface of ODSP Scope+ is shown in . 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 , 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.
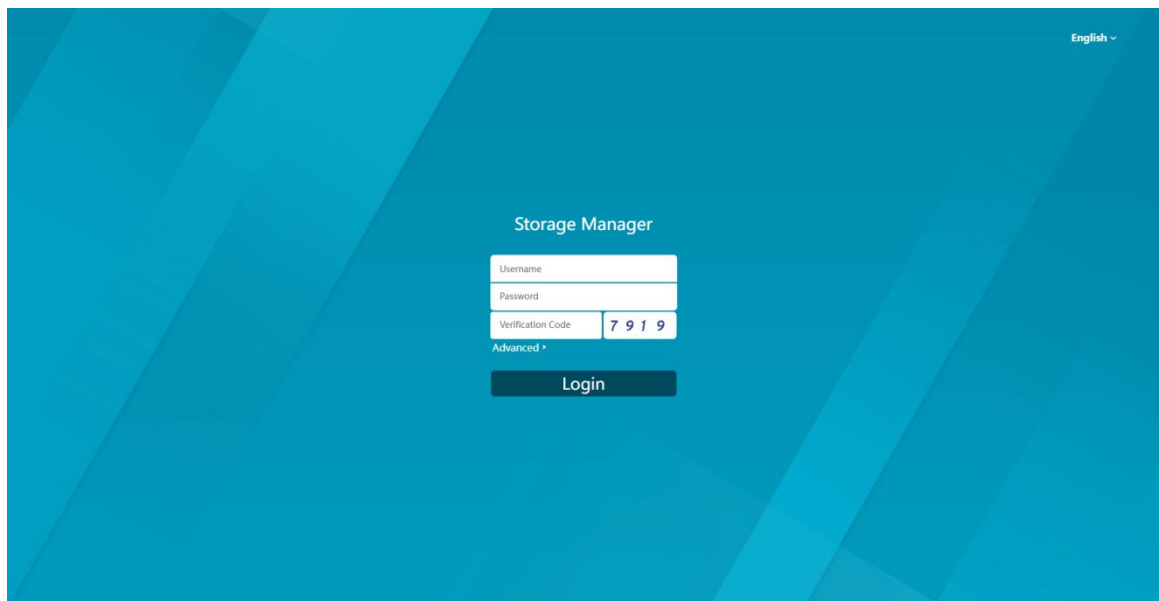
Figure 3-2 ODSP Scope+ login interface
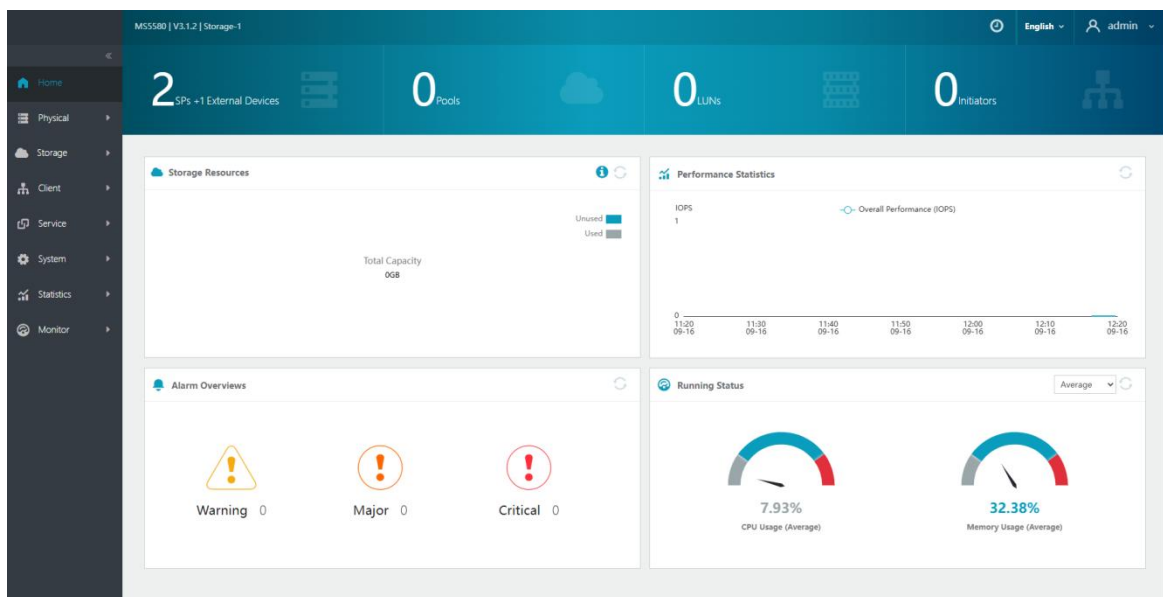
Figure 3-3 Home of ODSP Scope+ system view
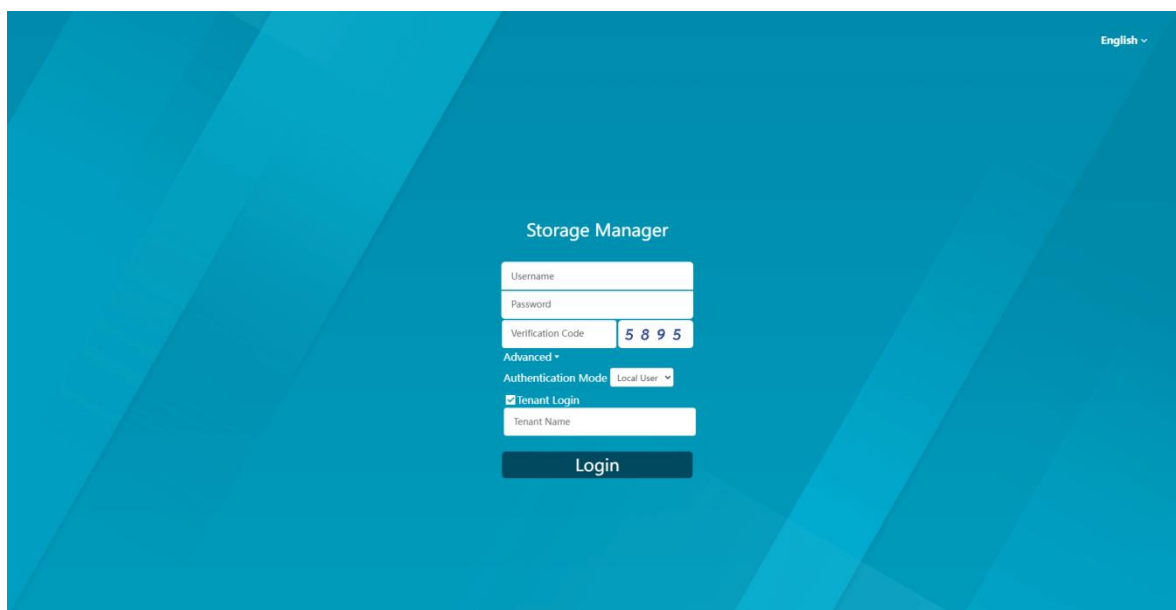
Figure 3-4 ODSP Scope+ tenant login interface
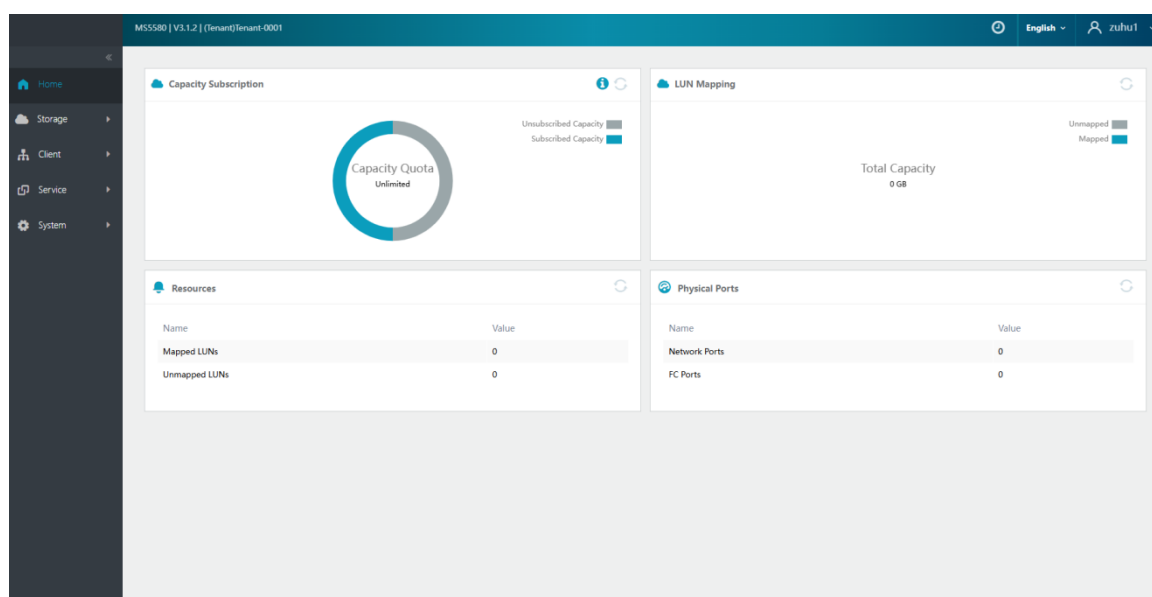
Figure 3-5 Home of ODSP Scope+ tenant view

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
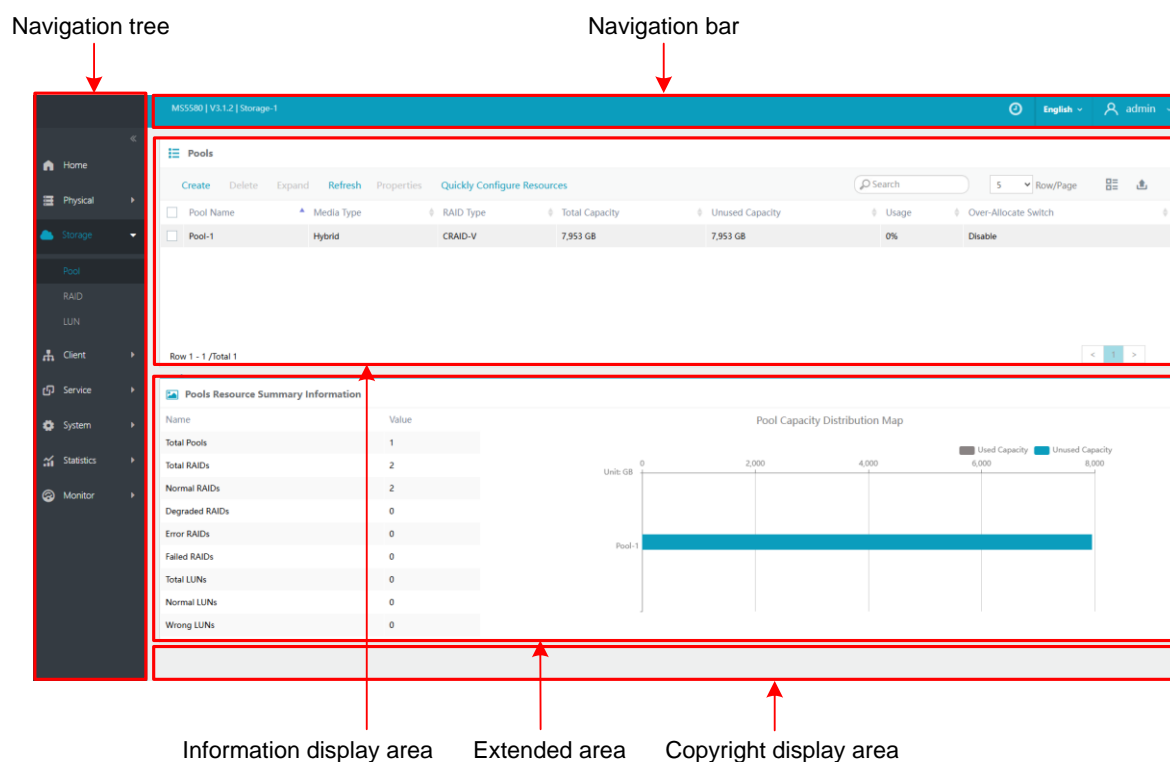
Figure 3-6 Example of ODSP Scope+ typical interface

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.

Node

Sub-node
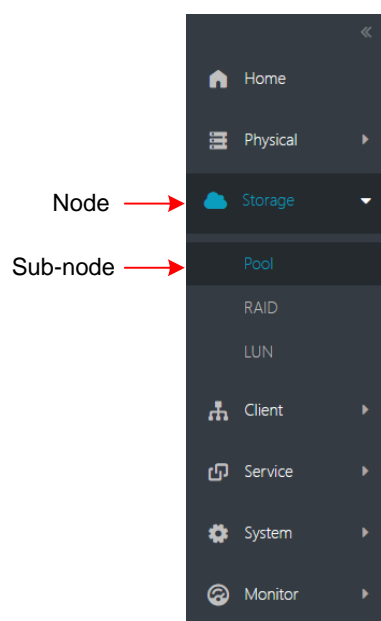
Figure 3-7 Example of ODSP Scope+ navigation tree

3.3.3 Navigation Bar

The navigation bar is shown in Figure 3-8 and it mainly includes the following six parts.

- Device information: It displays the model, version number and name of the device.
- Time information: Click this icon to open the window of modifying device time to modify the device time.
- Concern information: It displays the summary of the concerns. Click this icon to view the concerns in the floating window, as shown in Figure 3-9.
- Alarm information: It displays the summary of the current alarm of the device. Click this icon to expand the floating window to view the specific alarm items, as shown in Figure 3-10.
- Language information: Both simplified Chinese and English are supported currently. Click this icon to switch languages.
- User information: It displays the current login user on the web interface. Click this icon to perform operations such as modifying login timeout, changing password and logging out of the login session.
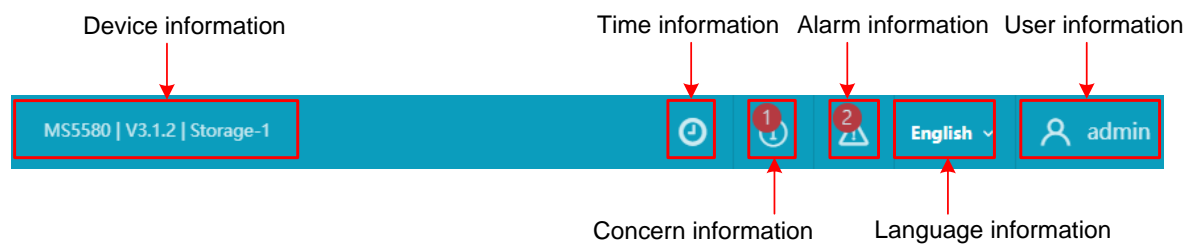
Figure 3-8 Example of ODSP Scope+ navigation bar
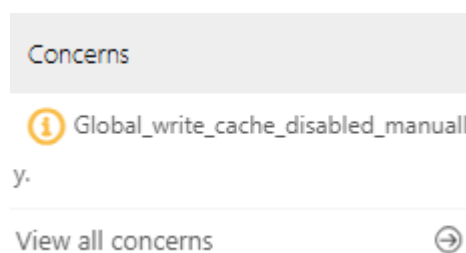
Figure 3-9 Example of ODSP Scope+ concerns
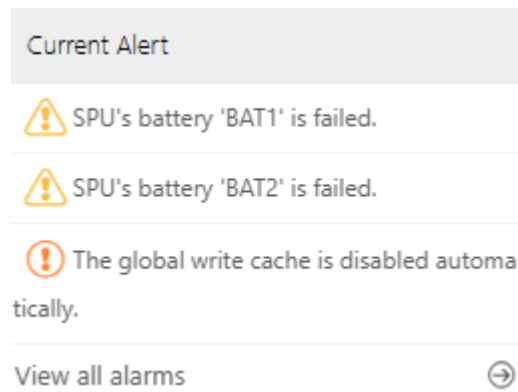
Figure 3-10 Example of ODSP Scope+ alarms

3.3.4 Information Display Area

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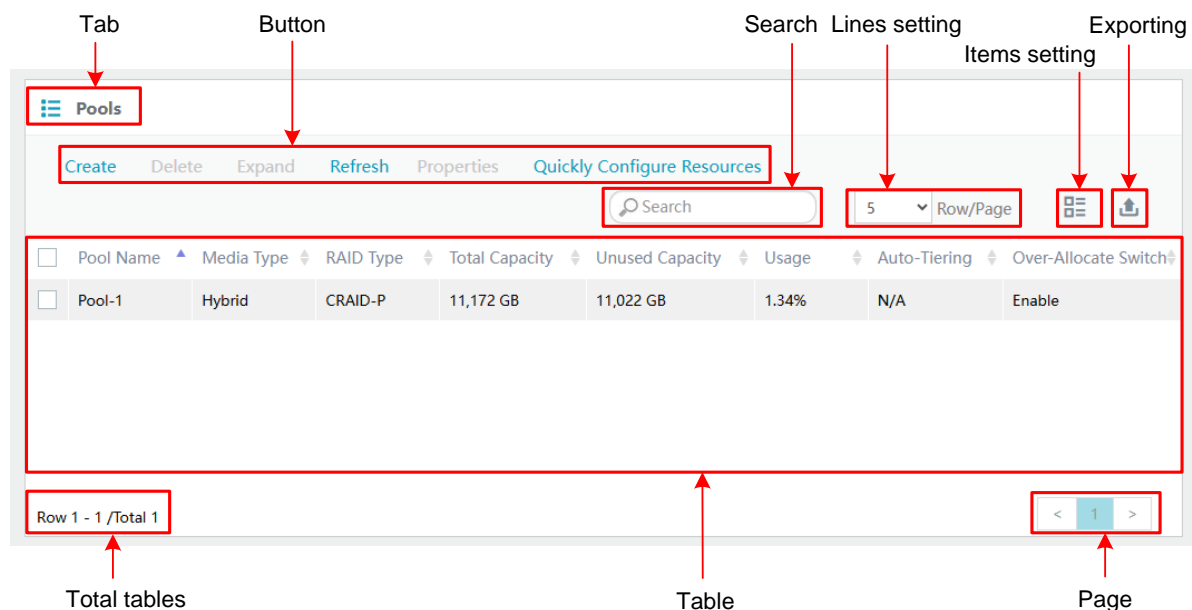
Figure 3-11 Example of ODSP Scope+ information display area

In the ODSP Scope+ information display area:

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

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

3.3.5 Extended Area

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

3.3.6 Copyright Display Area

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

3.4 Composition of ODSP Scope+ Tenant View Interface

3.4.1 Interface Overview

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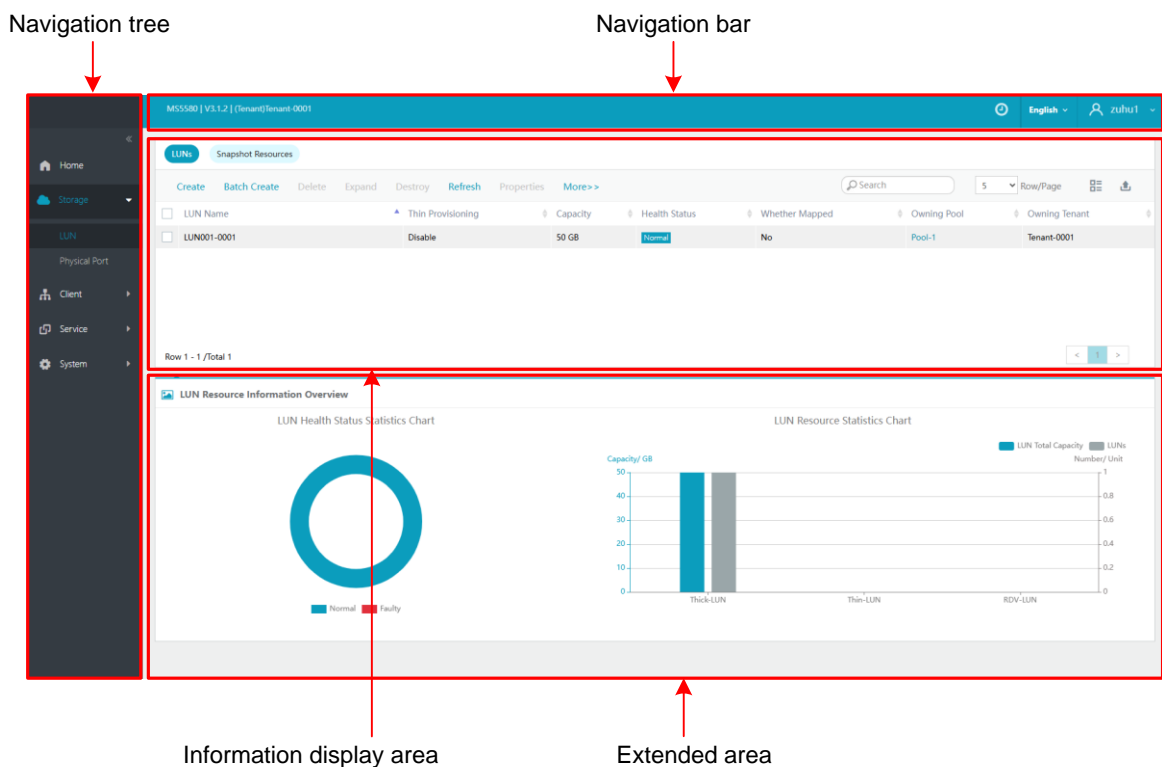
Figure 3-12 Example of ODSP Scope+ typical interface

3.4.2 Navigation Tree

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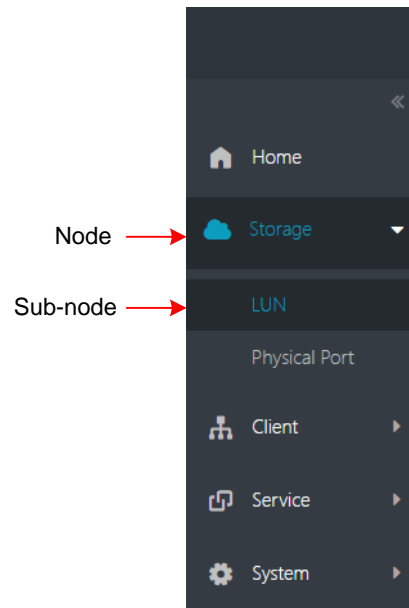
Figure 3-13 Example of ODSP Scope+ navigation tree

3.4.3 Navigation Bar

The navigation bar is shown in Figure 3-14 and it mainly includes the following four parts.

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

Figure 3-14 Example of ODSP Scope+ navigation bar

3.4.4 Information Display Area

The information display area is shown in Figure 3-15, which visually displays the detailed information of the current selected navigation tree node through the table.
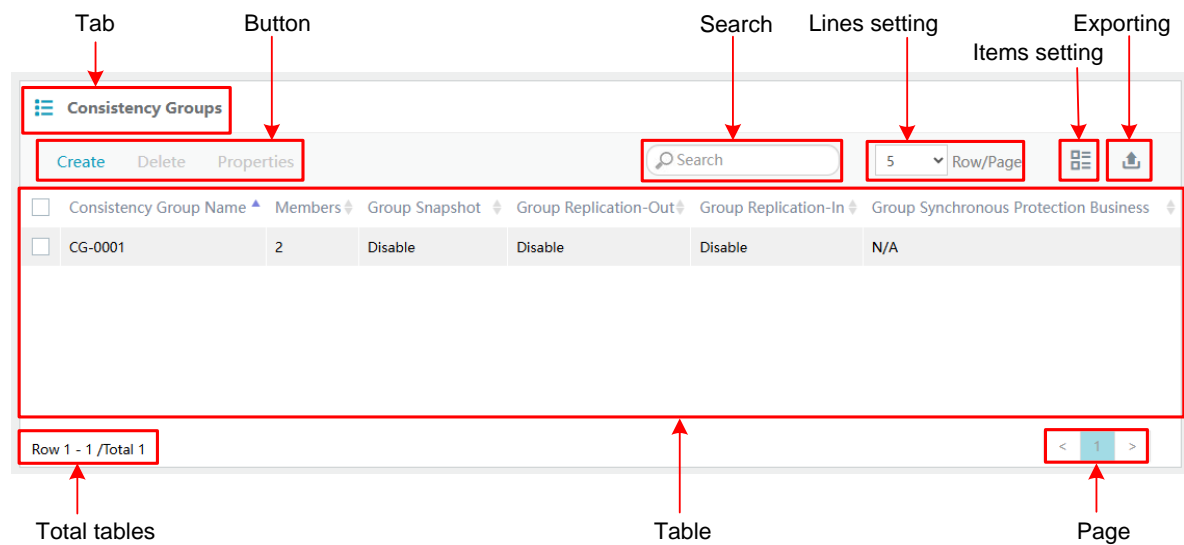
Figure 3-15 Example of ODSP Scope+ information display area

In the ODSP Scope+ information display area:

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

3.4.5 Extended Area

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

Part 2: Snapshot Feature

4 Introduction to Snapshot Feature

4.1 Introduction to Snapshot

With the cornerstone of data, information system has become a major support for social production capacity and the normal operation of enterprises in today's society.

In practical applications, it is inevitable that data will be damaged because of human error or system failure. Facing various potential "soft disaster" threats, it is necessary to furthest restore the original data in the case of data errors. Snapshot technology is one of the most common data protection methods.

The principle of snapshot feature of MacroSAN can be regarded as a camera, whose data at the time point is a film and view is a developed photo. Multiple time points can be created through snapshot. Each time point records data of the LUN at the corresponding time point. Then you can view data of corresponding time point at the specified time point by creating a view at any time, or you can restore data corresponding to the specified time point or view by rollback. Thanks to the characteristics of instant generation, less storage space, periodic creation time point, and no business interruption, snapshot feature can restore the integrity and correctness of data.

4.2 Introduction to Cascaded Snapshot

Cascaded snapshots means that a view created in a LUN still supports snapshots after the LUN is enabled with snapshot, and then a time point and a view are created for the view. A cascaded snapshot is formed after the snapshot is enabled on a view. The LUN is called root LUN. The snapshot enabled on the root LUN is corresponding to snapshot level 0, and the snapshot enabled on the view of the root LUN is corresponding to snapshot level 1, and so on. The maximum level is 8, and the cascaded levels are marked as 0~7 in turn.

Cascaded snapshots can roll back the data of the root LUN or view to that at the corresponding time of any time point or any view. You can flexibly select a time point or view at the current level or across levels according to actual needs.

4.3 Introduction to COW Snapshot and ROW Snapshot

MacroSAN supports two mainstream snapshot technologies, which are COW (Copy on Write) snapshot and ROW (Redirect on Write) snapshot. The comparison of the two snapshot technologies is in Table 4-1. You can configure flexibly according to the actual needs.

Table 4-1 COW snapshot vs. ROW snapshot

Item	COW snapshot	ROW snapshot
Key	The old data is copied as snapshot data firstly when new data is written.	As the snapshot data, the location of old data remains unchanged when new data is

		written, and new data is redirected to the new location.
Applicability	There is no requirement for LUN type, and both Thick-LUN and Thin-LUN are supported.	It can only be enabled in Thin-LUNs.
Snapshot data	Snapshot data is physically located in a dedicated area (see 7.1 Managing COW Snapshot Resource for details about snapshot resources).	Snapshot data is physically located in the physical space of the Thin-LUN to which it belongs. The snapshot resources are virtualized by software (see 7.2 Managing ROW Snapshot Resource for details) in order to facilitate the management of space occupied by the snapshot data and maintain the same usage habits as COW snapshots. The virtual snapshot resource shares physical space with corresponding Thin-LUN.
Advantages and disadvantages	● Advantages: Snapshot data is located in an independent snapshot resource to achieve high management efficiency. ● Disadvantages: The existing old data needs to be copied when new data is written for the first time after creating a snapshot, which has effects on the performance.	● Advantages: There is no need to copy data in the process of IO writing, which has little effects on performance. ● Disadvantages: Snapshot data and production data share the same physical space. Therefore, space needs to be reclaimed in the background when performing operations such as deleting views and disabling snapshots.
Suggestions	● Only COW snapshots can be used in Thick-LUNs. ● It is recommended to use ROW snapshots in Thin-LUNs.	

ⓘ**NOTE**

In order to improve usability, MacroSAN has made some special packaging designs in implementation by adapting the same user interface design on COW snapshot and ROW snapshot as much as possible to maintain the same usage habits. The content of this document applies to the technologies of both COW snapshot and ROW snapshot unless stated otherwise.

4.4 Introduction to Snapshot Resource

4.4.1 Snapshot Resource Description

Snapshot feature relies on snapshot resource. Snapshot resources are used to store the data of the 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 different kinds of snapshot resources (see 4.3 Introduction to COW Snapshot and ROW Snapshot for details) for different snapshot technology:

- 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 is modified, and no specific physical space allocation is involved.

4.4.2 Definitions of COW Snapshot Resource Status

4.4.2.1 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.

4.4.2.1 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.

4.4.3 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.

4.5 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 snapshot feature with consistency group function can strictly guarantee the time point data consistency of multiple members in the consistency group.

4.6 Description of Snapshot Function

4.6.1 Snapshot Time Point Policy

A snapshot time point policy is usually called a time point policy for short, which refers to a time point creation policy configured by the user. When the policy is met, the device will automatically create a time point. Multiple time point policies are supported as follows:

- Policy S0: Time point is created automatically at a fixed time of every month.
- Policy S1: Time point is created automatically at a fixed time of every day/week.
- Policy S2: Time point is created automatically at a certain time with a specified interval.
- Policy A0-A3: Time point is created automatically at a specific interval within the specified time period every day/week.

4.6.2 Snapshot Time Point

A snapshot time point is usually called a time point for short. Data of multiple historical moments of LUN or view can be saved through the snapshot feature. A time point corresponds to a data plane at a time. There are two types of time points as followings:

- Public Time Point: It refers to the time point manually created by user or automatically created according to the time point policy, which can be operated by user.
- Replication Time Point: It refers to the time point generated by replication business, which cannot be operated by user.

4.6.3 Snapshot View

A snapshot view is usually called a view for short. By creating a snapshot view, you can view the data at the moment corresponding to the point in time associated with the view. Besides, the view

also supports functions of enabling snapshots, creating time points and views. There are also two types of views as followings, corresponding to the two types of time point:

- Public View: It refers to the view manually created by the user based on the public time point, which can be operated by the user.
- Replication View: It refers to the view created by the replication business based on the replication time point, which cannot be operated by the user.

⚠**WARNING**

Views are usually used to view the data at the corresponding moment of the time point. The view supports temporary data writing for normal loading of client server business, but please do not write a large amount of data to the view to avoid snapshot resource overflow, resulting in invalid snapshot resource and data loss in the snapshot resource.

4.6.4 Snapshot Rollback

A snapshot rollback is usually called a rollback for short. If the data is damaged because of "soft disaster", you can attempt to restore the business by rolling back the data in the LUNs or views corresponding to the front-end business.

There are three rollback methods as follows:

- Time Point Rollback: Rollback the data of the root LUN or view to the corresponding moment of the specified time point, you can select the time point at this level or across levels.
- View Rollback: Rollback the data of the root LUN or view to the data of the corresponding moment of the specified view, you can select the view at this level, or across levels.
- LUN Rollback: Roll back the data of the view to the root LUN. Update the data of the view with that in the root LUN.

The object corresponding to the data source of the rollback (the object whose data does not change) is called rollback-to-object, which can be a time point, a view or a LUN. The object whose data have changed is called rollback object, which can be a view or a LUN. After the rollback is completed, the data plane of both rollback object and rollback-to-object will become the same.

⚠**WARNING**

The production data in the LUN or view will be updated through snapshot rollback. Before performing the rollback, please ensure that you have obtained relevant permission.

4.6.5 View Copy

Views are usually used to temporarily view the data at the corresponding time point, which supports temporary writing of a small amount of data. If the view needs to be used for a long time, it is recommended to use the view copy function to completely copy the data in a view to a user LUN (it will be used as the target LUN of view copy) and access the user LUN directly.

4.6.6 Consistency Group Snapshot

A consistency group snapshot is also called a group snapshot, which refers to the snapshot function for consistency groups.

- You can set group time point policies when snapshots are enabled for a consistency group.
- The system automatically creates a group time point according to the preset group time point policy. At this time, the IO of all members will be suspended, and then all members will create the time point separately. After the creation is completed, the IO of all members will be restored to strictly ensure data consistency of the time point.
- You can select group time points to perform batch operations, such as creating views, snapshot rollbacks, etc.

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.

Basic Properties   ✕

Name:*	CG- 0001
Creation Time:	2025-09-12 13:57:48
Members:	2
Group Snapshot:	Disable
Group R3DC:	Disable
Group Replication-Out:	Disable
Group Replication-In:	Disable
Group Synchronous Protection Business:	Local Mirror ⌄
Group Synchronous Protection Business Flow Control:	Medium (40-80MBps) ⌄ 🛈

OK   Cancel

Figure 5-2 Consistency group basic properties interface

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

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

5.4 Deleting Consistency Group

This section explains how to delete consistency group.

Steps

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

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

5.5 Adding Members for Consistency Group

This section explains how to add members for consistency group.

Steps

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

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

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 Configuring Snapshot

6.1 Activating Snapshot License

This section explains how to activate snapshot license.

ⓘNOTE

After activating successfully, the "Snapshot" 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 setting interface.

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

6.2 Managing LUN Snapshot

6.2.1 Enabling Snapshot

6.2.1.1 Enabling LUN Snapshot

This section explains how to enable LUN snapshot.

Prerequisites

- It is recommended to configure related business on the client server before enabling snapshot. Otherwise, the changed data during the configuration process will be recorded through snapshot, which occupies a lot of snapshot resource space.
- The health status of the LUN must be normal.
- If snapshot resources have been created for the LUN, they must have normal health status and valid data; if no snapshot resources have been created for the LUN, they will be created in the system automatically.

Steps

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

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

Step 3: The first step of the **Enable Snapshot** wizard is shown in Figure 6-1. Select desired LUN and click the <Next> button to enter the next interface.

Figure 6-1 Enable LUN snapshot wizard interface (1)

Step 4: The second step of the **Enable Snapshot** wizard is shown in Figure 6-2. Set snapshot policy (see Table 6-1 for details) and click the <Finish> button to complete the configuration.

Figure 6-2 Enable LUN snapshot wizard interface (2)

Table 6-1 Description of the parameters for enabling LUN snapshot wizard interface (2)

Parameter	Description
Snapshot Resource Capacity	It refers to the snapshot resource capacity of the LUN, which can be configured manually or automatically.
Max Time Points	It refers to the total number of public time points allowed to be created on the LUN.
Security Snapshot	It refers to enabling or disabling security snapshot of time point. The default value is disabling.

Automatic Delete	It refers to enabling or disabling auto-deletion of time point. It can be set when the security snapshot is enabled.
	ⓘNOTE
	After enabling security snapshot:
	● If the automatic deletion is enabled, the time point will be deleted automatically after protection period.
	● If the automatic deletion is disabled, the time point will not be deleted automatically after protection period and can be deleted manually only.
Protection Period	It refers to the protection period of time point. It can be set when the security snapshot is enabled.
Time Point Policy	The system will automatically create a time point according to the set time point policy. The following snapshot time point policies are supported:
	● Policy S0: Time point is created automatically at a fixed time of every month.
	● Policy S1: Time point is created automatically at a fixed time of every day/week.
	● Policy S2: Time point is created automatically at a certain time with a specified interval.
	● Policy A0-A3: Time point is created automatically at a specific interval within the specified time period every day/week.
	ⓘNOTE
	● No time point policy configuration means that the creation of time point can only be started manually instead of automatically.
	● It is recommended to try to stagger the time point policies. Otherwise, time points will be created frequently.

6.2.1.2   Enabling View Snapshot

This section explains how to enable view snapshot.

Steps

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

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

Step 3: The first step of the **Enable Snapshot** wizard is shown in Figure 6-3. Select desired view and click the <Next> button to enter the next interface.

Figure 6-3 Enable view snapshot wizard interface (1)

Step 4: The second step of the **Enable snapshot** wizard is shown in Figure 6-4. Set snapshot policy (see Table 6-2 for details) and click the <Finish> button to complete the configuration.

Enable Snapshot   ✕

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

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

Security Snapshot: ◉ Enable   ○ Disable

Automatic Delete: ○ Enable   ◉ Disable

Protection Period: [1]   [Days(1-7300) ▼]

Time Point Policy:

☐ Policy S0: Execute monthly   ⓘ

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

Time: [09:43:00]

☐ Policy S1: Execute weekly

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

Time: [09:43:00]

☐ Policy S2: Continue execute

Start Time: [2024-11-13 09:43:00]   Interval: [1]   [Hour (1-168) ▼]

Show Advanced Policy

[Previous]   [Finish]   [Cancel]

Figure 6-4 Enable view snapshot wizard interface (2)

Table 6-2 Description of the parameters for enabling view snapshot wizard interface (2)

Parameter	Description
Max Time Points	It refers to the total number of public time points allowed to be created on the view.
Security Snapshot	It refers to enabling or disabling security snapshot of time point. The default value is disabling.
Automatic Delete	It refers to enabling or disabling auto-deletion of time point. It can be set when the security snapshot is enabled.
	ⓘNOTE
	After enabling security snapshot:

	- If the automatic deletion is enabled, the time point will be deleted automatically after protection period. - If the automatic deletion is disabled, the time point will not be deleted automatically after protection period and can be deleted manually only.
Protection Period	It refers to the protection period of time point. It can be set when the security snapshot is enabled.
Time Point Policy	The system will automatically create a time point according to the set time point policy. The following snapshot time point policies are supported: - Policy S0: Time point is created automatically at a fixed time of every month. - Policy S1: Time point is created automatically at a fixed time of every day/week. - Policy S2: Time point is created automatically at a certain time with a specified interval. - Policy A0-A3: Time point is created automatically at a specific interval within the specified time period every day/week. **ⓘNOTE** - No time point policy configuration means that the creation of time point can only be started manually instead of automatically. - It is recommended to try to stagger the time point policies. Otherwise, time points will be created frequently.

6.2.2 Viewing Snapshot Properties

This section explains how to view snapshot's general information, snapshot policy and owning snapshot group.

ⓘNOTE

You can only view LUN snapshot's owning snapshot group.

Steps

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

Step 2: Select the desired snapshot in the **Snapshots** 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.

6.2.3 Modifying Snapshot Policy

6.2.3.1   Modifying LUN Snapshot Policy

This section explains how to modify LUN snapshot's max time points, security snapshot and time point policy.

ⓘ**NOTE**

LUN snapshot in group snapshot is not supported to modify security snapshot and time point policy separately.

Steps

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

Step 2: Select the desired LUN in the **Snapshots** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **LUN Snapshot Policy** tab is shown in Figure 6-5. Modify LUN snapshot policy (see Table 6-1 for details) and click the <Apply> button to complete the configuration.

Figure 6-5 LUN snapshot policy interface

6.2.3.2   Modifying View Snapshot Policy

This section explains how to modify view snapshot's max time points, security snapshot and time point policy.

Steps

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

Step 2: Select the desired view in the **Snapshots** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **View Snapshot Policy** tab is shown in Figure 6-6. Modify relevant parameters (see Table 6-2 for details) and click the <Apply> button to complete the configuration.

Figure 6-6 View snapshot policy interface

6.2.4 Disabling Snapshot

This section explains how to disable snapshot.

⚠CAUTION

All public time points and views will be deleted automatically when the snapshot is disabled. Please operate with caution.

Prerequisites

- There is no copy in the snapshot.
- There is no rollback in the snapshot, including the status of rolling back and rollback failure.
- There is no view that has already been assigned to client server in the snapshot.
- There is no view that has been already enabled with snapshot.
- There is no security snapshot time point in the snapshot.

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

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

6.3 Managing Time Point

6.3.1 Creating Time Point

This section explains how to creat time point manually.
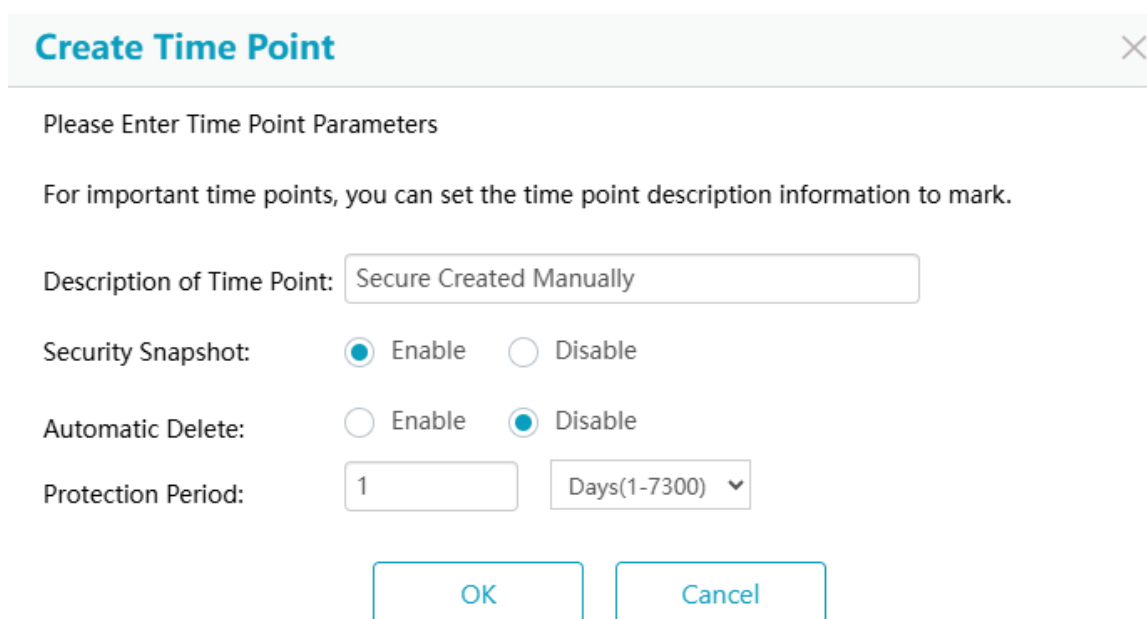
ⓘ**NOTE**

If time point policy has been set before, the system will automatically create the time point according to the set time point policy. If the total number of current time points reaches its maximum number, the earliest unused time point will be automatically deleted when time points are created automatically.

Steps

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

Step 2: Select the desired snapshot in the **Snapshots** tab of the information display area and click the <Create> button in the **Time Points** tab of the extended area to open the **Create Time Point** window, as shown in Figure 6-7. Enter relevant parameters (see Table 6-3 for details) and click the <OK> button to complete the configuration.

Create Time Point   ✕

Please Enter Time Point Parameters

For important time points, you can set the time point description information to mark.

Description of Time Point: | Secure Created Manually |

Security Snapshot: ● Enable   ○ Disable

Automatic Delete: ○ Enable   ● Disable

Protection Period: | 1 | Days(1-7300) ▼

[OK]   [Cancel]

Figure 6-7 Create time point interface

Table 6-3 Description of the parameters for creating time point interface

Parameter	Description
Description of Time Point	It refers to the description of time point. ⓘNOTE ● If security snapshot is disabled, the default description is "Created Manually". ● If security snapshot is enabled, the default description is "Secure Created Manually".
Security Snapshot	It refers to enabling or disabling security snapshot of time point. The default value is disabling.
Automatic Delete	It refers to enabling or disabling auto-deletion of time point. It can be set when the security snapshot is enabled. ⓘNOTE After enabling security snapshot: ● If the automatic deletion is enabled, the time point will be deleted automatically after protection period. ● If the automatic deletion is disabled, the time point will not be deleted automatically after protection period and can be deleted manually only.
Protection Period	It refers to the protection period of time point. It can be set when the security snapshot is enabled.

6.3.2 Viewing Time Point Properties

This section explains how to view time point's basic properties.

Steps

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

Step 2: Select the desired snapshot in the **Snapshots** tab of the information display area, select the desired time point in the **Time Points** tab of the extended area, and click the <Properties> button to open the **Basic Properties** window. You can view the basic properties of the time point.

6.3.3 Modifying Time Point Properties

This section explains how to modify time point's description and security snapshot.

ⓘNOTE

If you want to modify the protection period of a time point that has enabled security snapshot, the period can only be extended and not shortened.

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

Step 2: Select the desired snapshot in the **Snapshots** tab of the information display area, select the desired time point in the **Time Points** tab of the extended area, and click the <Properties> button to open the **Basic Properties** window, as shown in Figure 6-8. Modify the properties of time point (see Table 6-3 for details) and click the <OK> button to complete the configuration.

Basic Properties   ✕

Time ID:	1
Timestamp:	2024-10-10 13:59:18
Type:	Public
Data Variation:	104,857,600 KB
Description:	Created Manually
Whether Created View:	No
Security Snapshot:	Enable
Automatic Delete:	⦿ Enable ◯ Disable
Protection Period:	10 Days(1-7300) ⌄ ℹ
Within Protection:	Yes
Remaining Protection:	1 days 6 hours

OK   Cancel

Figure 6-8 Time point basic properties interface

6.3.4 Deleting Time Point

This section explains how to delete time point.

● There is no view on the time point.

● There is no rollback on the time point, including the status of rolling back and rollback failure.

● There is no security snapshot on the time point, or security snapshot has been enabled but outside protection period.

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

Step 2: Select the desired snapshot in the **Snapshots** tab of the information display area, select the desired time point in the **Time Points** tab of the extended area, click the <Delete> button, enter "yes" in the pop-up warning box, and click the <OK> button to complete the configuration.

6.3.5 Refreshing Time Point

This section explains how to refresh time point list.

Steps

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

Step 2: Select the desired snapshot in the **Snapshots** tab of the information display area, click the <Refresh> button in the **Time Points** tab of the extended area, and click the <OK> button in the pop-up confirmation box to complete the configuration.

6.4 Managing View

6.4.1 Creating View

This section explains how to create view based on time point.

ⓘNOTE

View can be assigned to the client. Users can view the data at the corresponding time point. It is not recommended to write a large amount of data into the view.

Steps

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

Step 2: Select the desired snapshot in the **Snapshots** tab of the information display area and click the <Create> button in the **Views** tab of the extended area to open the **Create View** window, as shown in Figure 6-9. Enter view name prefix, select a time point, and click the <OK> button to complete the configuration.

Figure 6-9 Create view interface

6.4.2 Viewing View

6.4.2.1 Viewing Properties

This section explains how to view view's general information and owning LUN group.

Steps

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

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

6.4.2.2 Viewing Access Paths

This section explains how to view view's access paths.

The view has been mapped with I_T.

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

Step 2: Select the desired snapshot in the **Snapshots** tab of the information display area, select the desired view in the **Views** tab of the extended area, and click the <Access Paths> button to open the **Access Paths** window. You can view the access paths of the view.

6.4.3 Modifying View Properties

This section explains how to modify view's name and delay alarm threshold.

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

Step 2: Select the desired snapshot in the **Snapshots** tab of the information display area, select the desired view in the **Views** tab of the extended area, and click the <Properties> button to open the **Basic Properties** window, as shown in Figure 6-10. Modify the properties of view and click the <OK> button to complete the configuration.

Basic Properties   ✕

General   Owning LUN Group

View Name: *   View-LUN-0001-20241113093110-1

WWN: 600B342D2FF3F9E6734017E7FA00018B ⓘ

NGUID: D2FF3F9E6734017E00B342D7FA00018B ⓘ

View Type: Public

Access Type: ALUA

Mapped Time Point   1
ID:

Mapped Time   2024-11-13 09:31:10
Stamp:

Used Capacity: 0 KB

Whether Mapped: Yes

Delay Alarm   0   ms (range: 0-60000, 0 means global parameters)
Threshold: *

OK   Cancel

Figure 6-10 View basic properties interface

6.4.4 Copying View

This section explains how to copy view.

⚠**CAUTION**

Different owing SPs of both source LUN and target LUN of the view copy will lead to poor copy performance.

Prerequisites

● The source LUN and target LUN of view copy must have the same access type.

● The view cannot be assigned to client servers.

Steps

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

Step 2: Select the desired snapshot in the **Snapshots** tab of the information display area, select the desired view in the **Views** tab of the extended area, and click the <Copy> button to open the

View Copy window, as shown in Figure 6-11. Select target LUN and click the <OK> button to complete the configuration.

Figure 6-11 View copy interface

After the view copy is started, the item of "Whether There Is a Copy Task" in the **Views** tab of the extended area will change to "Yes". Click the "Yes" to view the copy task information of the view, as shown in Figure 6-12.
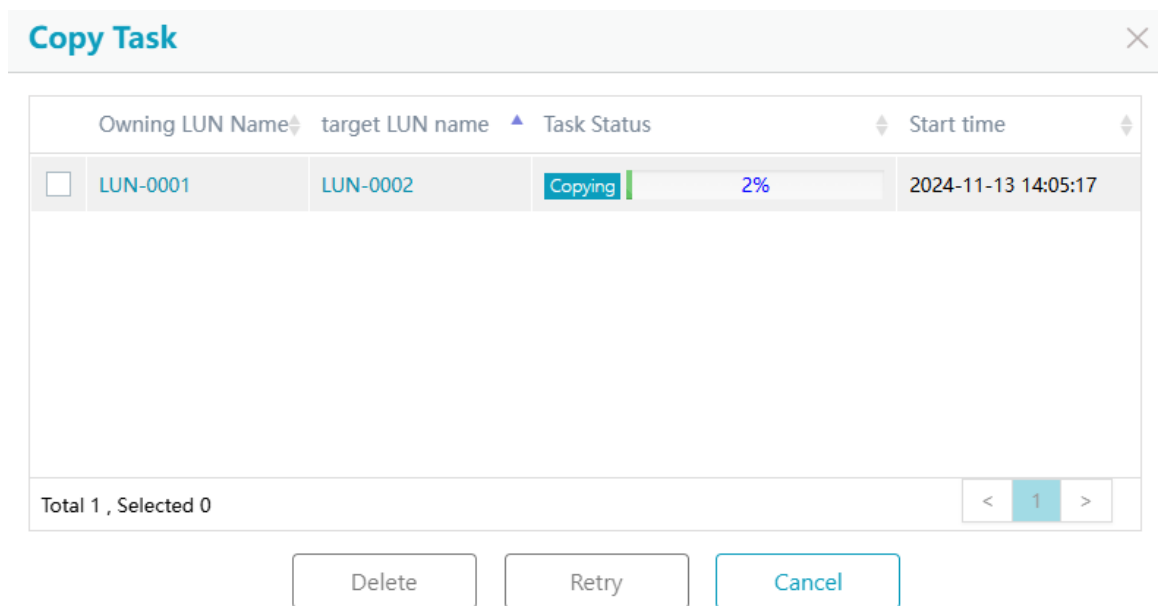
Figure 6-12 View copy task information interface

6.4.5 Deleting View

This section explains how to delete view.

Prerequisites

- The view has no snapshot function.
- The view has no task of copy and rollback.
- The view has not been assigned to client servers.

Steps

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

Step 2: Select the desired snapshot in the **Snapshots** tab of the information display area, select the desired view in the **Views** tab of the extended area, click the <Delete> button, enter "yes" in the pop-up warning box, and click the <OK> button to complete the configuration.

6.5 Managing Snapshot Rollback

⚠**WARNING**

- The production data in the LUN or view will be updated through snapshot rollback. Before performing the rollback, please ensure that you have obtained the relevant permission.
- Since data will be written to the snapshot resource during rollback, please ensure that the snapshot resource space is sufficient. Otherwise, the rollback may fail.

There are following requirements on starting rollback:

- The LUN or view cannot be assigned to client servers.

- The LUN cannot be a replica LUN of replication.

- The LUN cannot be a mirror LUN.

- There is no view copy or rollback on the LUN or view.

6.5.1 Time Point Rollback

This section explains how to roll back the data of LUN or view to the data at the selected time point.

Steps

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

Step 2: Select the desired snapshot in the **Snapshots** tab of the information display area, select the time point of the rollback-to-object in the **Time Points** tab of the extended area, and click the <Rollback> button:

- For ROW snapshots, a confirmation box will be popped up (as shown in Figure 6-13). Click the <OK> button and the **Start Rollback** window will be opened (as shown in Figure 6-14). Select rollback object and click the <OK> button to start rollback.

❓ Confirm

Note: Thin provisioning is enabled for for the selected LUN, more space may need to be allocated during the rollback process. Please ensure that there is free space in the Pool, otherwise the rollback may fail. Are you sure to perform the rollback operation?

OK   Cancel

Figure 6-13 ROW snapshot time point rollback interface (1)

Figure 6-14 ROW snapshot time point rollback interface (2)

- For COW snapshots, the **Start Rollback** window will be opened, as shown in Figure 6-15. Select rollback object and click the <OK> button to start rollback.

Start Rollback

The rollback process may require additional snapshot resources. Please ensure that the snapshot resource space is sufficient, otherwise the rollback may fail.

Rollback to ⓘ : LUN-0001 ,time point 1(Timestamp:2024-11-13 09:34:51)

Please select a rollback object:

Name	Object type	Cascading level
☐ LUN-0001	LUN	0
☐ View-LUN-0001-20241113093451-2	View	1
☐ View-LUN-0001-20241113093510-1	View	1

Total 3   < 1 >

OK   Cancel

Figure 6-15 COW snapshot time point rollback interface

6.5.2 View Rollback

This section explains how to roll back the data of LUN or view to the data at the selected view.

Steps

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

Step 2: Select the desired snapshot in the **Snapshots** tab of the information display area, select the view of the rollback-to-object in the **Views** tab of the extended area, and click the <Rollback> button:

- For ROW snapshots, a confirmation box will be popped up (as shown in Figure 6-16). Click the <OK> button and the **Start Rollback** window will be opened (as shown in Figure 6-17). Select rollback object and click the <OK> button to start rollback.

Figure 6-16 ROW snapshot view rollback interface (1)

Figure 6-17 ROW snapshot view rollback interface (2)

- For COW snapshot, the **Start Rollback** window will be opened, as shown in Figure 6-18. Select rollback object and click the <OK> button to start rollback.

Figure 6-18 COW snapshot view rollback interface

6.5.3 LUN Rollback

This section explains how to roll back the data of view to the data at the root LUN.

Steps

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

Step 2: Select the LUN of the rollback-to-object in the **Snapshots** tab of the information display area and click the <Rollback> button in the **Time Points** or **Views** tab of the extended area:

- For ROW snapshots, a confirmation box will be popped up (as shown in Figure 6-19). Click the <OK> button and the **Start Rollback** window will be opened (as shown in Figure 6-20). Select rollback object and click the <OK> button to start rollback.

Figure 6-19 ROW snapshot LUN rollback interface (1)

Figure 6-20 ROW snapshot LUN rollback interface (2)

- For COW snapshot, the **Start Rollback** window will be opened, as shown in Figure 6-21. Select rollback object and click the <OK> button to start rollback.

Figure 6-21 COW snapshot LUN rollback interface

ⓘ**NOTE**

● If you select the view in the **Snapshots** tab of the information display area in this step, the view rollback function will be started.

● Please do not select any object in the **Time Points** tab or **Views** tab of the extended area in this step.

After the rollback is started, the rollback status of rollback object will change to "Rolling back". Click the "Rolling back" link to view the rollback task information, as shown in Figure 6-22.

Figure 6-22 Snapshot rollback task information interface

6.6 Managing Consistency Group Snapshot

6.6.1 Enabling Group Snapshot

This section explains how to enable consistency group snapshot.

Prerequisites

- It is recommended to configure related business on the client server before enabling snapshot. Otherwise, the changed data during the configuration process will be recoded through snapshot, which occupies a lot of snapshot resource space.

- The LUN in the consistency group must meet the following requirements:

  - The health status of the LUN must be normal.

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

Steps

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

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

Step 3: The first step of the **Enable Group Snapshot** wizard is shown in . Select desired group and click the <Next> button to enter the next interface.

Figure 6-23 Enable group snapshot wizard interface (1)

Step 4: The second step of the **Enable Group Snapshot** wizard is shown in Figure 6-24. Set group snapshot policy (see Table 6-4 for details) and click the <Next> button to enter the next interface.

Figure 6-24 Enable group snapshot wizard interface (2)

Table 6-4 Description of the parameters for enabling group snapshot wizard interface (2)

Parameter	Description
Snapshot Resource Capacity	It refers to the snapshot resource capacity of the LUN in group, which can be configured manually or automatically.
Max Time Points	It refers to the total number of public time points allowed to be created on the LUN in group.
Security Snapshot	It refers to enabling or disabling security snapshot of time point. The default

	value is disabling.
Automatic Delete	It refers to enabling or disabling auto-deletion of time point. It can be set when the security snapshot is enabled.
	ⓘ**NOTE** After enabling security snapshot: ● If the automatic deletion is enabled, the time point will be deleted automatically after protection period. ● If the automatic deletion is disabled, the time point will not be deleted automatically after protection period and can be deleted manually only.
Protection Period	It refers to the protection period of time point. It can be set when the security snapshot is enabled.
Time Point Policy	The system will automatically create a time point according to the set time point policy. The following snapshot time point policies are supported: ● Policy S0: Time point is created automatically at a fixed time of every month. ● Policy S1: Time point is created automatically at a fixed time of every day/week. ● Policy S2: Time point is created automatically at a certain time with a specified interval. ● Policy A0-A3: Time point is created automatically at a specific interval within the specified time period every day/week.
	ⓘ**NOTE** ● No time point policy configuration means that the creation of time point can only be started manually instead of automatically. ● It is recommended to try to stagger the time point policies. Otherwise, time points will be created frequently.

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

6.6.2 Viewing Group Snapshot Properties

This section explains how to view group snapshot's general information and group snapshot policy.

Steps

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

Step 2: Select the desired group in the **Groups Snapshots** 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 snapshot.

6.6.3 Modifying Group Snapshot Policy

This section explains how to modify group snapshot's max time points, security snapshot and time point policy.

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

Step 2: Select the desired group in the **Group Snapshots** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. The **Group Snapshot Policy** tab is shown in Figure 6-25. Modify group snapshot policy (see Table 6-4 for details) and click the <Apply> button to complete the configuration.

Figure 6-25 Group snapshot policy interface

6.6.4 Disabling Group Snapshot

This section explains how to disable group snapshot.

There is no security snapshot time point in the group snapshot.

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

Step 2: Select the desired group in the **Group Snapshots** tab of the information display area, click the <Disable> button, select the "Snapshots of all members in the group are disabled" in the pop-up warning box as needed, enter "yes", and click the <OK> button to complete the configuration.

ⓘ**NOTE**

If you do not select "Snapshots of all members in the group are disabled", only group snapshots will be automatically disabled and member snapshots will be retained and group snapshot policies will not be synchronized to members. You need to manually configure snapshot policies for members.

6.7 Managing Consistency Group Time Point

6.7.1 Creating Group Time Point

This section explains how to create group time point manually.

ⓘ**NOTE**

If group time point policy has been set before, the system will automatically create the group time point according to the set policy. If the total number of current time points reaches its maximum number, the earliest unused time point will be automatically deleted when group time points are created automatically.

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

Step 2: Select the desired group in the **Group Snapshots** tab of the information display area and click the <Create Time Point> button in the **Time Points** tab of the extended area to open the **Create Group Time Point** window, as shown in Figure 6-26. Enter relevant parameters (see Table 6-5 for details) and click the <OK> button to complete the configuration.

Figure 6-26 Create group time point interface

Table 6-5 Description of the parameters for creating group time point interface

Parameter	Description
Description of Time Point	It refers to the description of group time point. ⓘNOTE ● If security snapshot is disabled, the default description is "Created Manually". ● If security snapshot is enabled, the default description is "Secure Created Manually".
Security Snapshot	It refers to enabling or disabling security snapshot of time point. The default value is disabling.
Automatic Delete	It refers to enabling or disabling auto-deletion of time point. It can be set when the security snapshot is enabled. ⓘNOTE After enabling security snapshot: ● If the automatic deletion is enabled, the time point will be deleted automatically after protection period. ● If the automatic deletion is disabled, the time point will not be deleted automatically after protection period and can be deleted manually only.
Protection Period	It refers to the protection period of time point. It can be set when the security snapshot is enabled.

6.7.2 Viewing Group Time Point Properties

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

Steps

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

Step 2: Select the desired group in the **Group Snapshots** tab of the information display area, select the desired group time point in the **Time Points** tab of the extended area, and click the <Properties> button to open the **Basic Properties** window. You can view the basic properties of the group time point.

6.7.3 Modifying Group Time Point Properties

This section explains how to modify group time point's description and security snapshot.

ⓘNOTE

If you want to modify the protection period of a group time point that has enabled security snapshot, the period can only be extended and not shortened.

Steps

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

Step 2: Select the desired group in the **Group Snapshots** tab of the information display area, select the desired group time point in the **Time Points** tab of the extended area, and click the <Properties> button to open the **Basic Properties** window, as shown in Figure 6-27. Modify the properties of group time point (see Table 6-5 for details) and click the <OK> button to complete the configuration.

Figure 6-27 Group time point basic properties interface

6.7.4 Deleting Group Time Point

This section explains how to delete group time point.

- There is no view on the time point of members in group.
- There is no rollback on the time point of members in group, including the status of rolling back and rollback failure.
- There is no security snapshot on the time point, or security snapshot has been enabled but outside protection period.

Steps

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

Step 2: Select the desired group in the **Snapshot Groups** tab of the information display area, select the desired group time point in the **Time Points** tab of the extended area, click the <Delete Time Point> button, enter "yes" in the pop-up warning box, and click the <OK> button to complete the configuration.

6.7.5 Creating View at Group Time Point

This section explains how to create view based on group time point.

ⓘ**NOTE**

Views will be created for all group members based on the time point of group member corresponding to the select group time point. After the views are created successfully, they will be uniformly displayed in the **Views** tab of **Snapshot** tab in extended area.

Steps

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

Step 2: Select the desired group in the **Group Snapshots** tab of the information display area, select the desired group time point in the **Time Points** tab of the extended area, and click the <Create View> button to open the **Create View at Group Time Point** window, as shown in Figure 6-28. Click the <OK> button to complete the configuration.

Create View at Group Time Point   ✕

Set View Parameters
Batch create views for the member time points corresponding to the group time points that have not created views.

Description: The actual created view name is 'View-'+the first 41 characters of the LUN name of the view+'-'+the timestamp of the corresponding time point of the view+'-'+ Numbering.

Group Members ▲	Member Time Point ID ⬍	Timestamp ⬍
LUN-0001	1	2024-11-13 16:34:09
LUN-0002	1	2024-11-13 16:34:09

Total 2

OK   Cancel

Figure 6-28 Create view at group time point interface

6.7.6 Deleting View at Group Time Point

This section explains how to delete the view of the member time point in the group time point.

Steps

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

Step 2: Select the desired group in the **Group Snapshots** tab of the information display area, select the group time point in the **Time Points** tab of the extended area, and click the <Delete View> button to open the **Delete View at Group Time Point** window, as shown in Figure 6-29. Select view and click the <OK> button to complete the configuration.

Figure 6-29 Delete view at group time point interface

6.7.7 Group Snapshot Rollback

This section explains how to batch rollback the data of members in group to the data of corresponding time point.

⚠WARNING

The production data in the LUN or view will be updated through snapshot rollback. Before performing the rollback, please ensure that you have obtained the relevant permission.

Prerequisites

- The group members cannot be assigned to client servers.
- The group members cannot be replica LUNs of replication.
- The group members cannot be mirror LUNs.
- There is no view copy or rollback on the group members.

Steps

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

Step 2: Select the desired group in the **Group Snapshots** tab of the information display area, select the desired group time point in the **Time Points** tab of the extended area, click the <Rollback> button, and click the <OK> button in the pop-up confirmation box to start rollback.

After rollback is started, the rollback status of rollback object will change to "Rolling back". Click the "Rolling back" link to view the rollback task information, as shown in Figure 6-30.

Rollback Status ✕

Rollback Status:	Rolling back
Rollback Progress:	41%
Rollback object:	LUN-0001
Rollback object cascading level:	0
Object of Rollback To:	LUN-0001
Object of Rollback To Cascading Level:	0
Rollback to Time Point ID:	1
Rollback to time stamp:	N/A
Start Time of Rollback:	2023-01-17 15:40:50
Rollback Estimated Time Remaining:	2023-01-17 15:42:31

Close
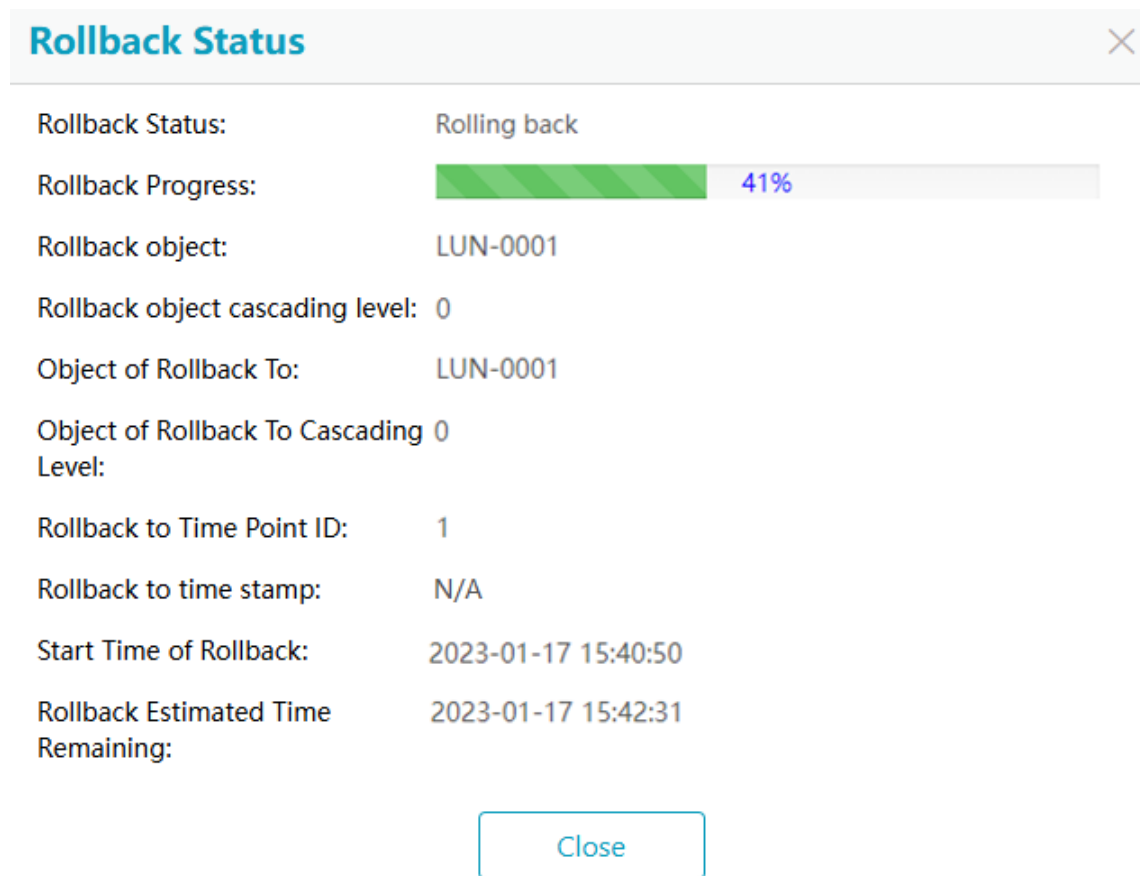
Figure 6-30 Group snapshot rollback task information interface

6.7.8 Refreshing Group Time Point

This section explains how to refresh group time point list.

Steps

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

Step 2: Select the desired group in the **Group Snapshots** tab of the information display area, click the <Refresh> button in the **Time Points** tab of the extended area, and click the <OK> button in the pop-up confirmation box to complete the configuration.

7 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.

7.1 Managing COW Snapshot Resource

7.1.1 Creating Snapshot Resource

7.1.1.1 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 7.1.1.2 Manually Creating Snapshot Resource.

7.1.1.2 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 7-1. Select desired LUN and click the <Next> button to enter the next interface.

Figure 7-1 Create snapshot resource wizard interface (1)

Step 4: The second step of the **Create Snapshot Resource** wizard is shown in Figure 7-2. Set snapshot resource layout (see Table 7-1 for details) and click the <Next> button to enter the next interface.

Figure 7-2 Create snapshot resource wizard interface (2)

Table 7-1 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 Figure 7-3. Set snapshot resource auto expansion policy (see Table 7-2 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 7-3 Create snapshot resource wizard interface (3)

Table 7-2 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.

7.1.2 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.

7.1.3 Modifying Snapshot Resource Properties

7.1.3.1   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 <u>Figure 7-4</u>. Modify snapshot resource name and click the <Apply> button to complete the configuration.

Basic Properties   ✕

| General | Cache Configuration | Auto Expansion |

Owning LUN:	LUN-0001
Snapshot Type:	COW
Snapshot Resource Name:*	SR-LUN-0001
Health Status:	Normal
Creation Time:	2024-11-08 18:25:51
Capacity:	1 GB
Used Capacity:	256 MB
Free Capacity:	768 MB
Resource Usage:	25%
Data Validity Status:	Valid

OK   Apply   Cancel

Figure 7-4 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".

7.1.3.2   Modifying Cache Configuration

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

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 **Cache Configuration** tab is shown in Figure 7-5. Modify cache configuration (see Table 7-3 for details) and click the <Apply> button to complete the configuration.

Basic Properties   ✕

General   Cache Configuration   Auto Expansion

Read Cache: Enable   ⌄

Read Cache Status: Enabled

Read Cache Allocation   Dynamic Allocat ⌄   ⓘ
Policy:

Read Cache Read-   Dynamic Read-A ⌄   ⓘ
Ahead Policy:

Read Cache Read-   16   (valid range: 1-16)
Ahead Depth:*

Write Cache: Enable   ⌄

Write Cache Status: Disabled

Write Cache Allocation   Dynamic Allocat ⌄   ⓘ
Policy:

          OK   Apply   Cancel

Figure 7-5 Snapshot resource cache configuration interface

Table 7-3 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.

	The system supports two read cache allocation policies, and different policies can be set for each snapshot resource:
Read Cache Allocation Policy	• 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".

7.1.3.3   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 7-6. Modify auto expansion policy (see Table 7-2 for details) and click the <Apply> button to complete the configuration.


Figure 7-6 Snapshot resource auto expansion 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".

7.1.3.4 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 <u>Figure 7-7</u>. 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 7-7 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".

7.1.4 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

7-8. Enter expansion capacity (see Table 7-4 for details), select RAID, and click the <OK> button to complete the configuration.

Figure 7-8 LUN expansion interface

Table 7-4 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".

7.1.5 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.

7.1.6 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.

7.2 Managing ROW Snapshot Resource

7.2.1 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 7.1.1.2 Manually 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.

7.2.2 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.

7.2.3 Modifying Snapshot Resource Properties

7.2.3.1   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 7-9. Modify auto expansion policy (see Table 7-2 for details) and click the <Apply> button to complete the configuration.

Figure 7-9 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".

7.2.3.2   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 7-10. 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 7-10 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".

7.2.4 Expanding Snapshot Resource

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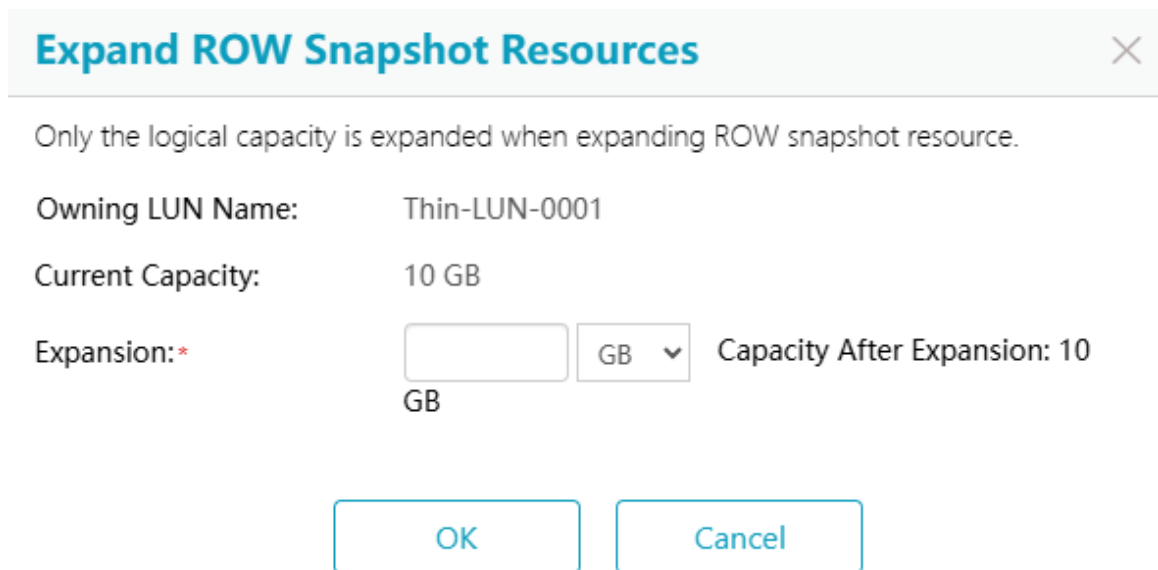
ⓘ **NOTE**

- 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 <u>Figure 7-11</u>. 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 7-11 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".

7.2.5 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.

7.2.6 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.

Appendix A. Device Default Configurations

The default configurations of the device are shown in Table 7-5.

Table 7-5 Device default configuration

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

Appendix B. Device External Ports Summary

Device external ports list is shown in .

Table 7-6 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