MacroSAN MS Series Storage Devices Auto-Tiering Feature

GUI User Manual

Document version: V2.11.00

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400-650-5527

Statement

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

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Auto-tiering feature	Introduction to auto-tiering feature	This chapter introduces related knowledge of auto-tiering.	• Introduction to CRAID-V • Introduction to ICMT • Introduction to auto-tiering • Introduction to LUN migration policy
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Part 1: Overview

1 Preface

1.1 Intended Audiences

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

1.2 Manual Guidance

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

Table 1-1 List of user manual

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

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

1.3 Manual Conventions

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

1.3.1 Conventions of Description

ⓘNOTE

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

⚠CAUTION

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

⚠WARNING

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

1.3.2 Other Conventions

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

1.4 Document Acquisition

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

ⓘNOTE

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

1.5 Feedback

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

2 Overview of MS Series Storage Devices

2.1 Introduction to MS Series Storage Devices

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

MacroSAN ODSP storage devices consist of the following modular components:

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

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

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

ⓘNOTE

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

2.2 Introduction to Typical Networking of MS Series Storage Devices

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

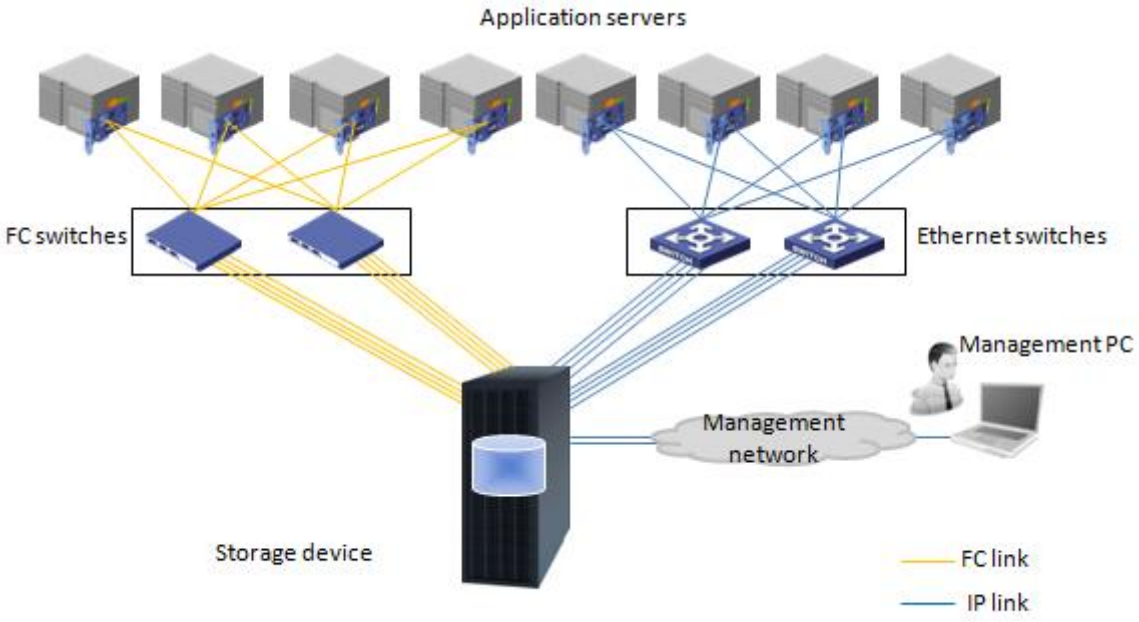

Figure 2-1 Typical networking of MS series storage devices

Networking explanation:

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

⚠CAUTION

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

3 ODSP Scope+ Console

3.1 Introduction to ODSP Scope+

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

The followings are browsers that have passed compatibility testing.

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

ⓘNOTE

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

3.2 Running ODSP Scope+

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

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

ⓘNOTE

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

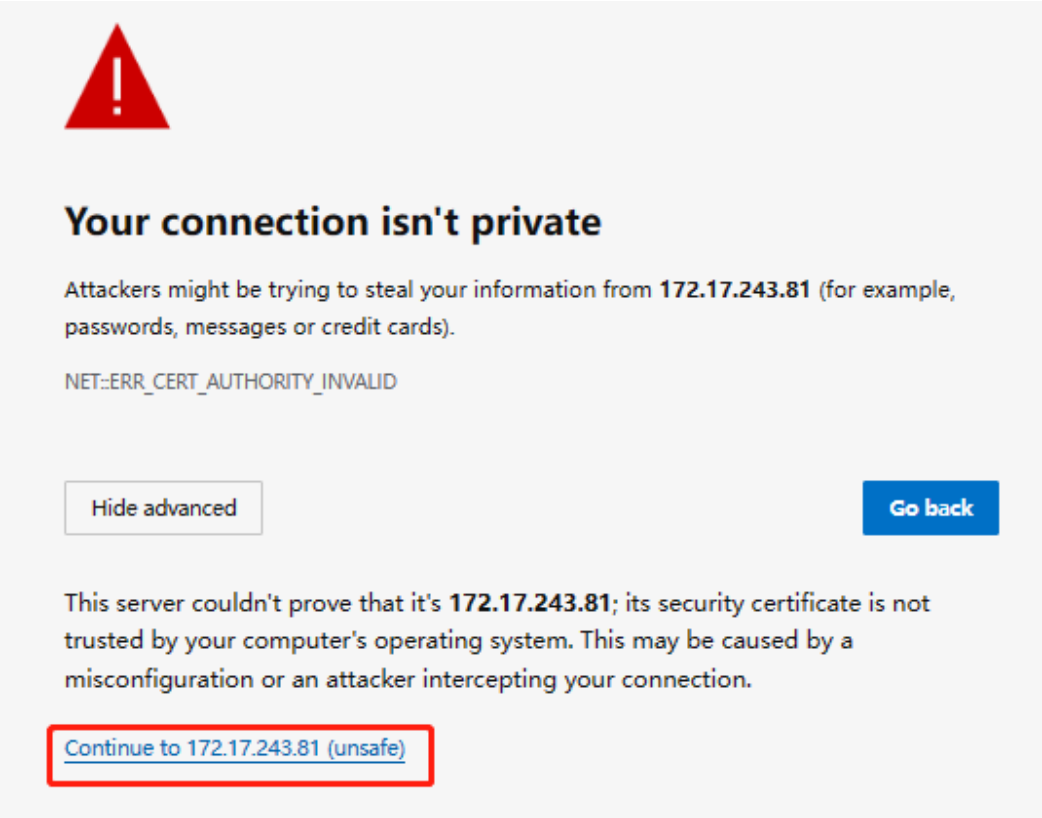

Figure 3-1 Example for prompt of certificate exception

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

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

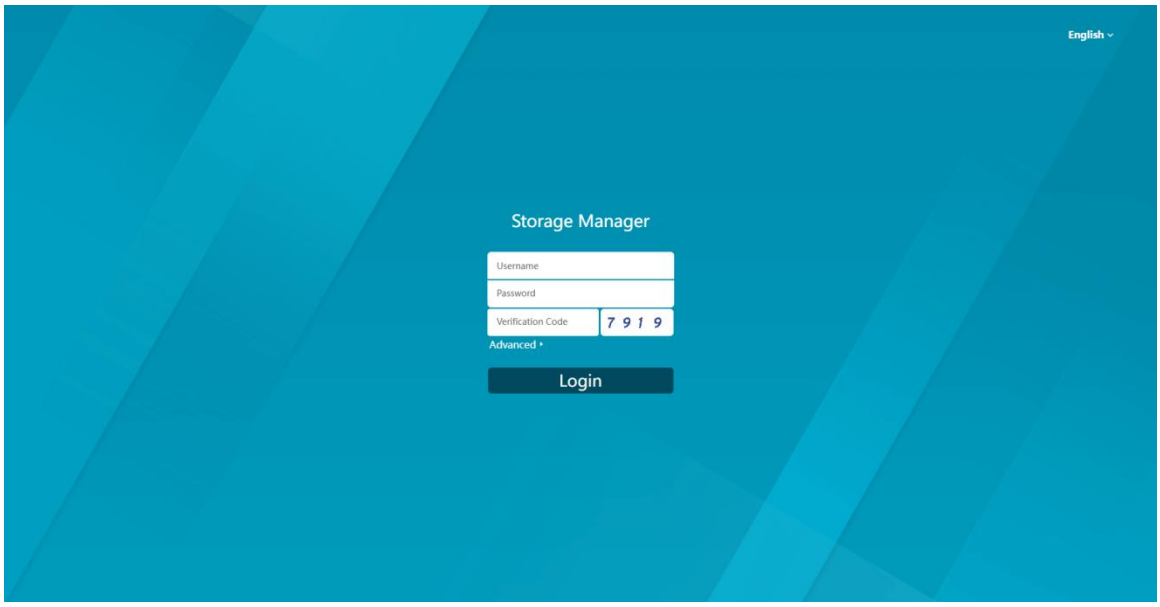

Figure 3-2 ODSP Scope+ login interface

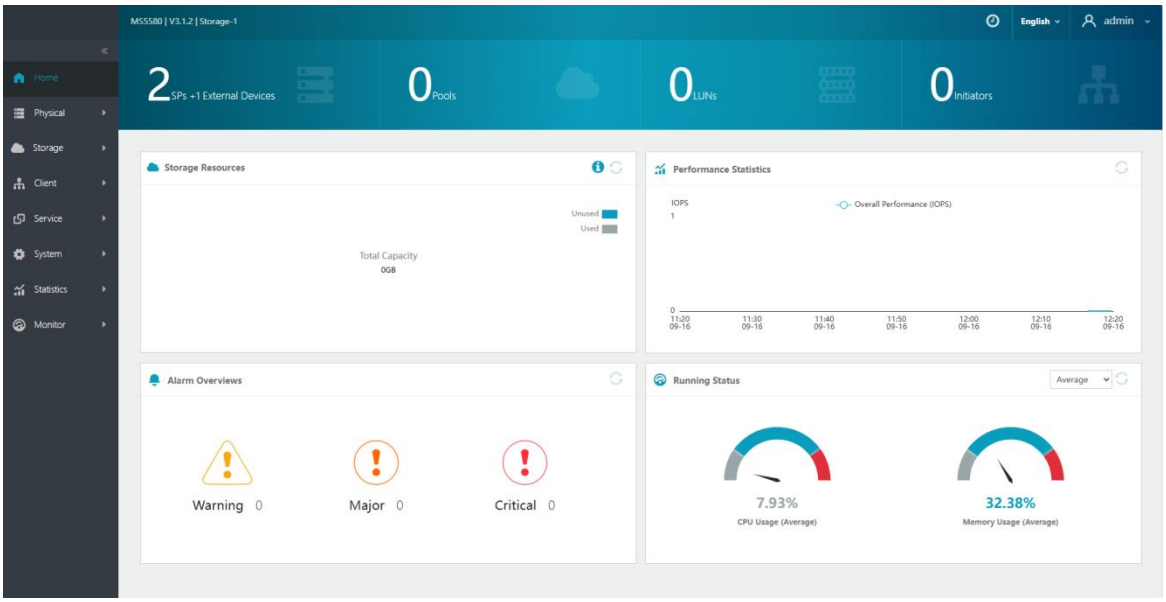

Figure 3-3 Home of ODSP Scope+ system view

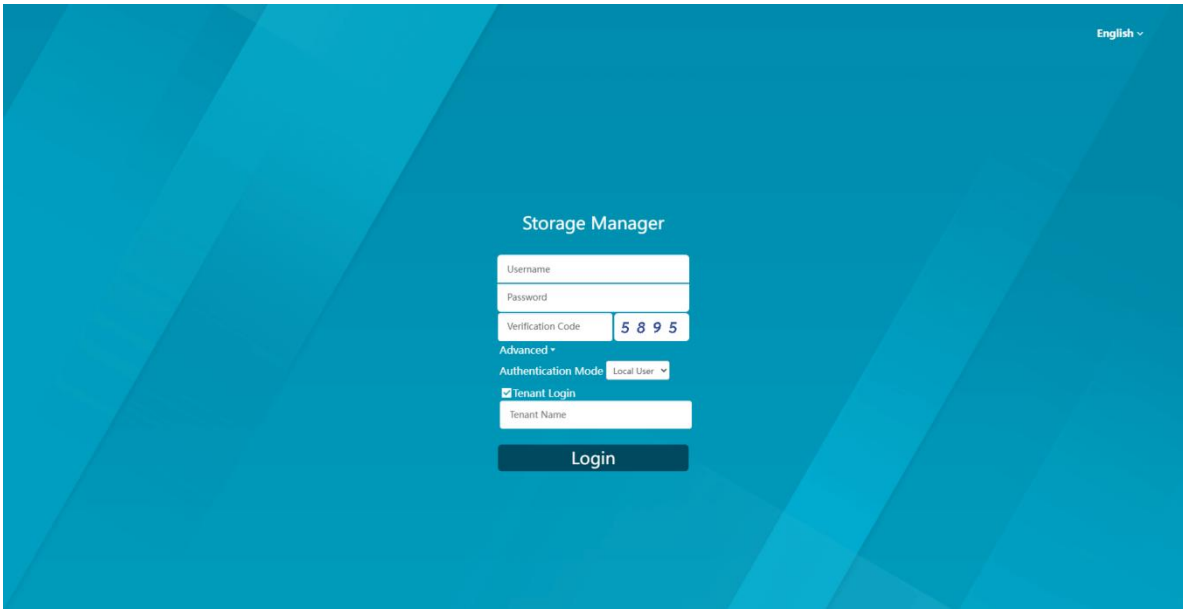

Figure 3-4 ODSP Scope+ tenant login interface

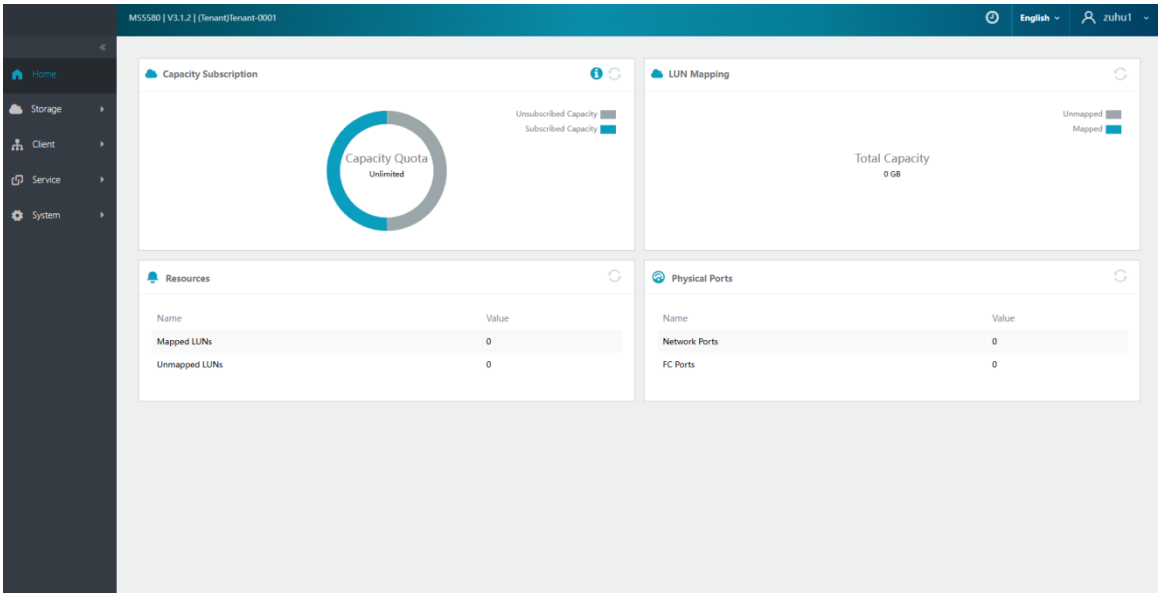

Figure 3-5 Home of ODSP Scope+ tenant view

3.3 Composition of ODSP Scope+ System View Interface

3.3.1 Interface Overview

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

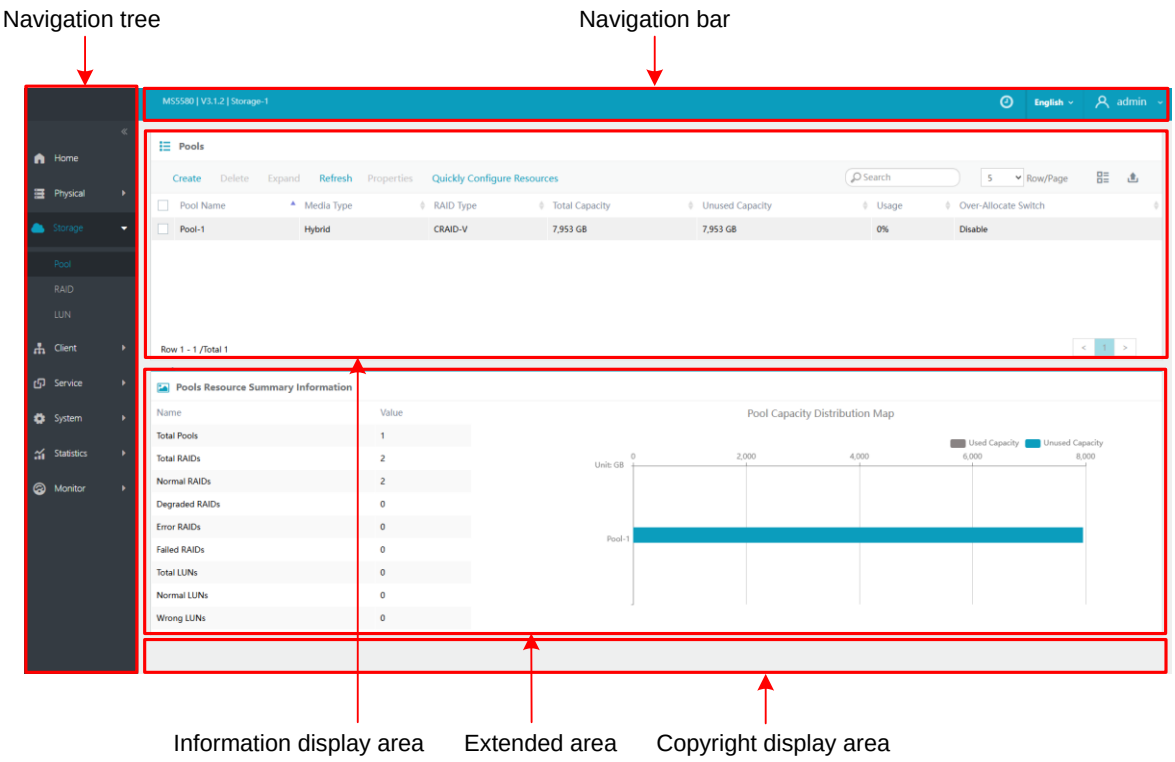

Figure 3-6 Example of ODSP Scope+ typical interface

3.3.2 Navigation Tree

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

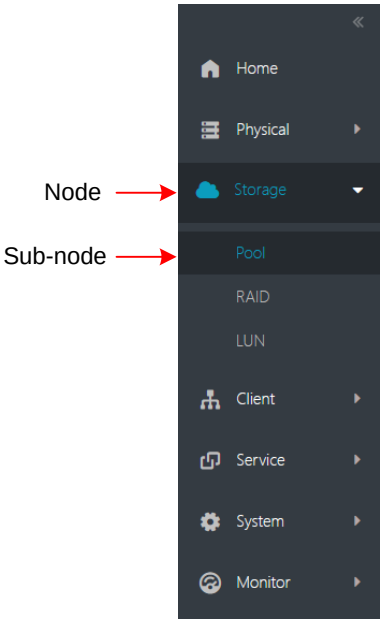

Figure 3-7 Example of ODSP Scope+ navigation tree

3.3.3 Navigation Bar

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

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

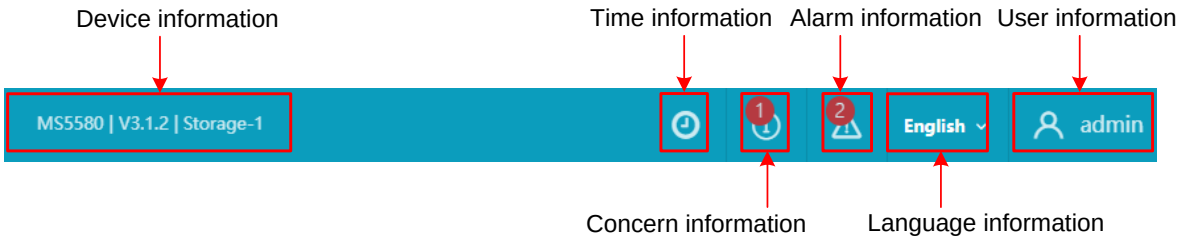

Figure 3-8 Example of ODSP Scope+ navigation bar

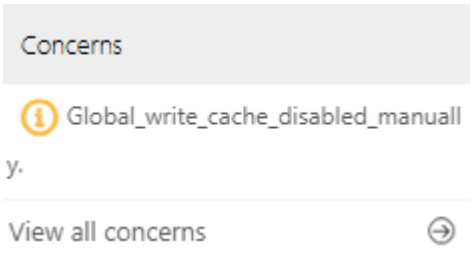

Figure 3-9 Example of ODSP Scope+ concerns

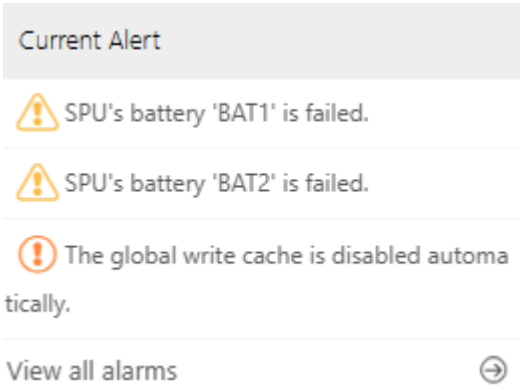

Figure 3-10 Example of ODSP Scope+ alarms

3.3.4 Information Display Area

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

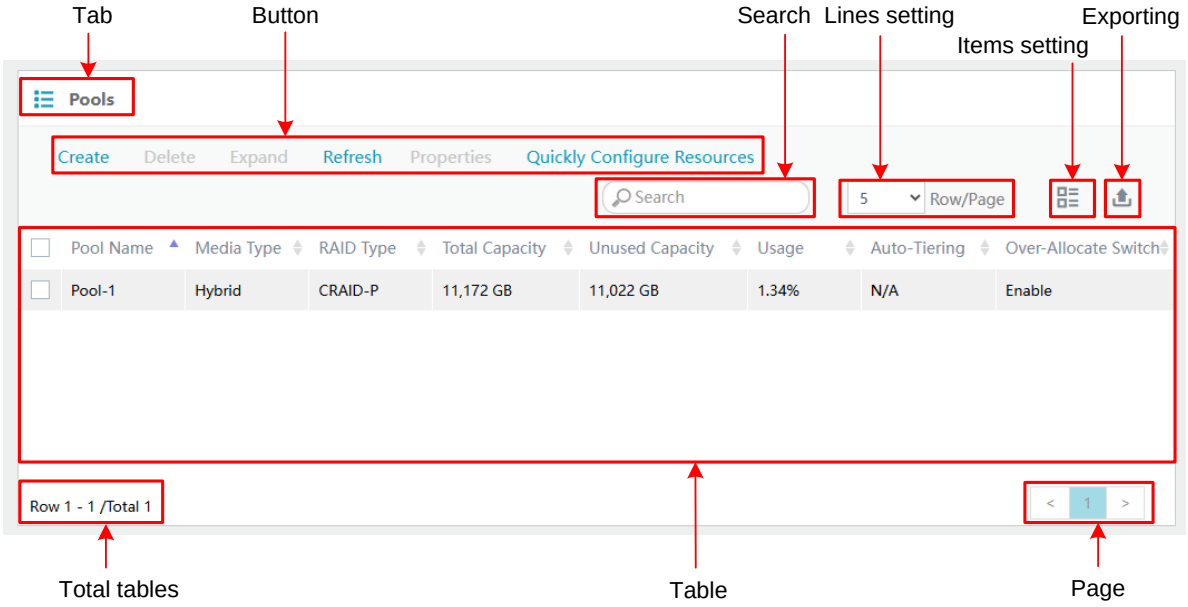

Figure 3-11 Example of ODSP Scope+ information display area

In the ODSP Scope+ information display area:

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

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

3.3.5 Extended Area

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

3.3.6 Copyright Display Area

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

3.4 Composition of ODSP Scope+ Tenant View Interface

3.4.1 Interface Overview

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

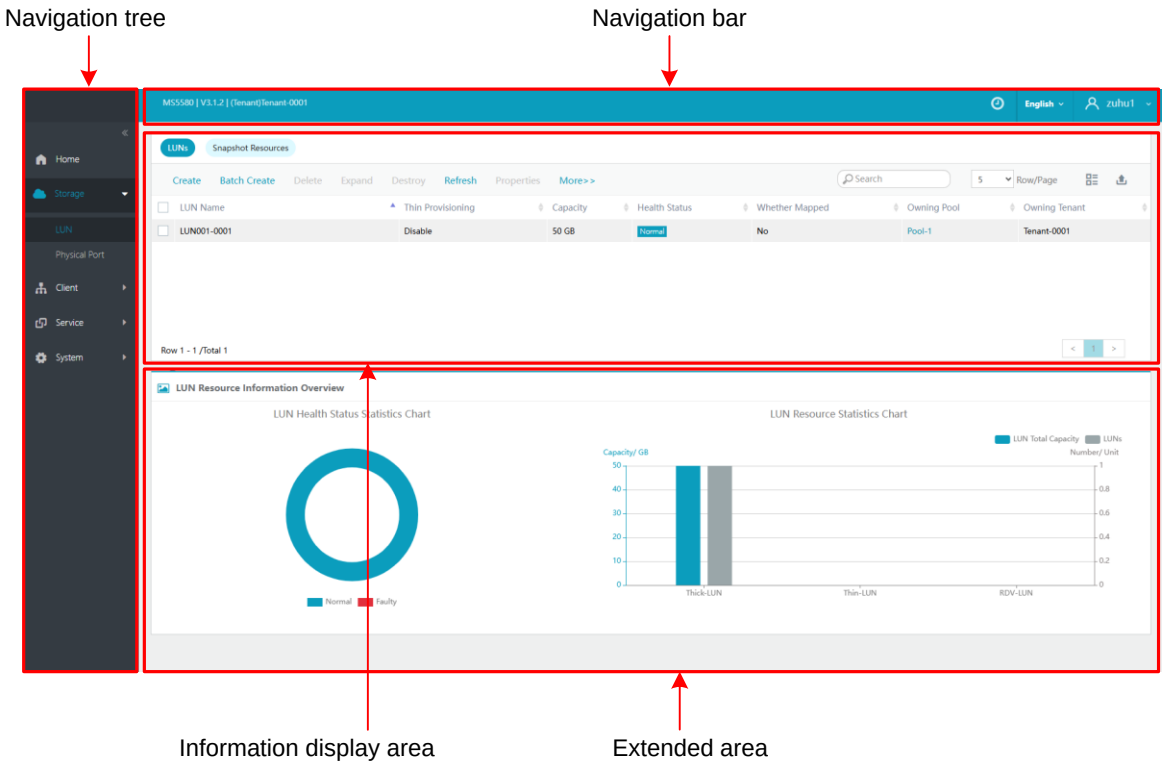

Figure 3-12 Example of ODSP Scope+ typical interface

3.4.2 Navigation Tree

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

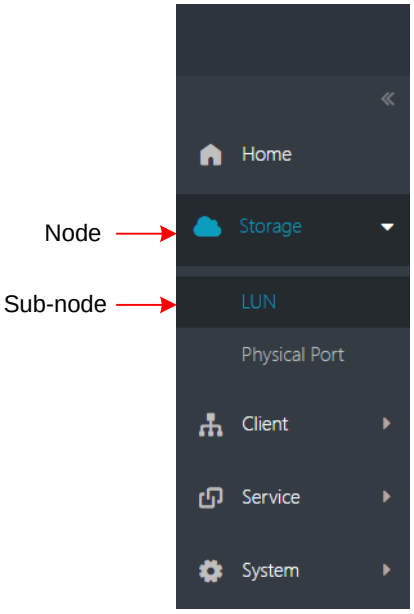

Figure 3-13 Example of ODSP Scope+ navigation tree

3.4.3 Navigation Bar

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

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

Figure 3-14 Example of ODSP Scope+ navigation bar

3.4.4 Information Display Area

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

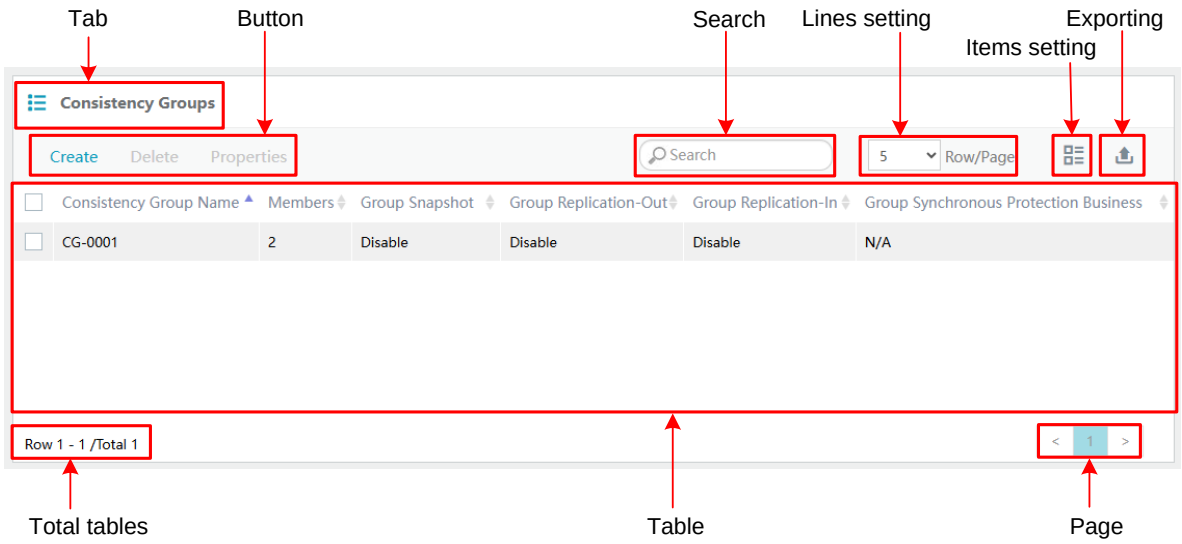

Figure 3-15 Example of ODSP Scope+ information display area

In the ODSP Scope+ information display area:

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

3.4.5 Extended Area

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

Part 2: Auto-Tiering Feature

4 Introduction to Auto-Tiering Feature

4.1 Introduction to CRAID-V

MacroSAN storage devices realize the innovation on CRAID technology and manage RAID health status through finer-grained cells on the base of traditional RAID to minimize the impact of disk media errors on RAID, which greatly improves the availability and robustness of RAID.

CRAID-V is a CRAID created based on virtual disks, and its hot spare space is scattered on all physical disks in CRAID-V. Therefore, all physical disks will be rebuilt if there is a fault in the physical disks, which improves rebuild efficiency, reduces rebuild time and ensures data security.

4.2 Introduction to ICMT

As one of the core technologies of MacroSAN storage devices, ICMT (Intelligent Cell Management Technology) is an innovative cell-based technology for storage resource management.

A cell-based pool tier is added between the traditional LUN tier and RAID tier to organize multiple RAIDs with different storage media and levels into a logical storage resource entity, breaking the limitations of traditional serial storage resource architecture and making it possible to configure storage resources globally. The storage resources in the pool are divided and allocated in units of cell, which can realize a global resource configuration that is more flexible for upper-layer applications and does not need to pay attention to lower-layer details, allowing data to flow freely.

4.3 Introduction to Auto-Tiering

4.3.1 Auto-Tiering Overview

Generally, the data in a storage device can be divided into hot data and cold data, and most storage devices have a large amount of cold data. As the amount of business data continues to grow, customers need to purchase a large number of hard disks to store cold data if they use traditional storage method continuously, resulting in an increase in IT construction costs.

Based on the technology of CRAID-V and ICMT, MacroSAN has developed an auto-tiering technology. Hot data is migrated to the storage media with higher performance (such as SSD hard disk) and cold data is migrated to the lower-cost and larger-capacity storage media (such as 7200RPM mechanical hard disks) through IO monitoring, heat analysis, data migration and other functions, realizing dynamic allocation between data with different degrees of cold and heat and storage media with various characteristics, which can reduce users' IT construction costs and improve storage system performance simultaneously.

MacroSAN auto-tiering technology is realized on the base of intelligent pool. Unlike traditional pool, the RAID in the intelligent pool is composed of different storage media and can be divided into three storage tiers according to the performance level, which are high-performance tier,

performance tier and capacity tier respectively, as shown in Table 4-1. Auto-tiering means the dynamic migration of LUN data between two or three storage tiers of a pool.

Table 4-1 Introduction to storage tier

Storage tier	Disk type
High performance tier	SSD
Performance tier	• SAS (15000RPM) • SAS (10000RPM)
Capacity tier	• SAS (7200RPM) • SATA (7200RPM)

4.3.2 IO Monitoring Policy and Migration Policy of Auto-Tiering

Auto-tiering includes three stages, which are IO monitoring, heat analysis and data migration. Firstly, the storage system uses cell as a unit to count the IO frequency of each cell according to the preset IO monitoring policy, and then identifies hot data and cold data based on heat analysis, and indicates the direction in which the data needs to be migrated to realizes the redistribution of hot and cold data in the storage system through data migration. As a result, hot data is distributed in the high-performance tier and performance tier while cold data is distributed in the capacity tier as much as possible.

Auto-tiering provides various IO monitoring policies and migration policies. See Table 4-2 for details to configure flexibly according to requirements.

Table 4-2 Description of auto-tiering IO monitoring policy and migration policy

Item	Description
IO monitoring policy	• Scheduled monitoring: It refers to IO monitoring only in the monitoring period. • Cycle monitoring: It refers to IO monitoring at specified intervals starting from the specified time.
Migration policy	• Scheduled migration: It refers to data migration only in the migration period. • Manual migration: It refers to manually starting data migration. • Cycle migration: It refers to data migration at specified intervals starting from the specified time.
Relationship between IO monitoring policy and migration policy	• Manual migration policy is supported if IO monitoring is disabled. • If IO monitoring is enabled with scheduled monitoring, both scheduled migration and manual migration are supported. • If IO monitoring is enabled with cycle monitoring, scheduled migration, manual migration and cycle migration are supported.

4.4 Introduction to LUN Migration Policy

You can set LUN migration policies as follows flexibly in the auto-tiering pool:

- No migration: The system does not automatically migrate data on the LUN.

- Auto migration: The system decides whether to migrate the data of the LUN to the upper layer or to the lower layer according to the heat statistics algorithm.
- Automatically migrate with the same capacity ratio: The system decides whether to migrate the data of the LUN to the upper layer or to the lower layer according to the heat statistics algorithm, and at the same time, the percentage of the LUN in each storage tier need to be unchanged.
- Migrate to a high performance storage tier: The data of this LUN can only be migrated to a tier with higher performance.
- Migrate to a low performance storage tier: The data of this LUN can only be migrated to a tier with lower performance.
- Fixed migration: The data on the LUN is always migrated to the tier with lower performance when the new migration is triggered.

5 Configuring Auto-Tiering

5.1 Activating Auto-Tiering License

This section explains how to activate auto-tiering license.

Steps

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

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

5.2 Managing Auto-Tiering

5.2.1 Enabling Auto-Tiering

5.2.1.1. Enabling Auto-Tiering when Creating Pool

This section explains how to enable auto-tiering when creating pool.

ⓘNOTE

When creating a pool whose RAID type is CRAID-V, you can directly enable the auto-tiering function in the **Create Pool** wizard. The IO monitoring policy and migration policy of auto-tiering are the default value. User can reset it according to the requirement after creating the pool successfully.

Steps

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

Step 2: Click the <Create> button in the information display area to open the **Create Pool** wizard.

Step 3: In the first step of the **Create Pool** wizard, select the "Enable Auto-Tiering" option, click the <Show Advanced Parameters> button, as shown in Figure 5-1. Set pool parameters (see Table 5-1 for details) and click the <Next> button to enter the next interface.

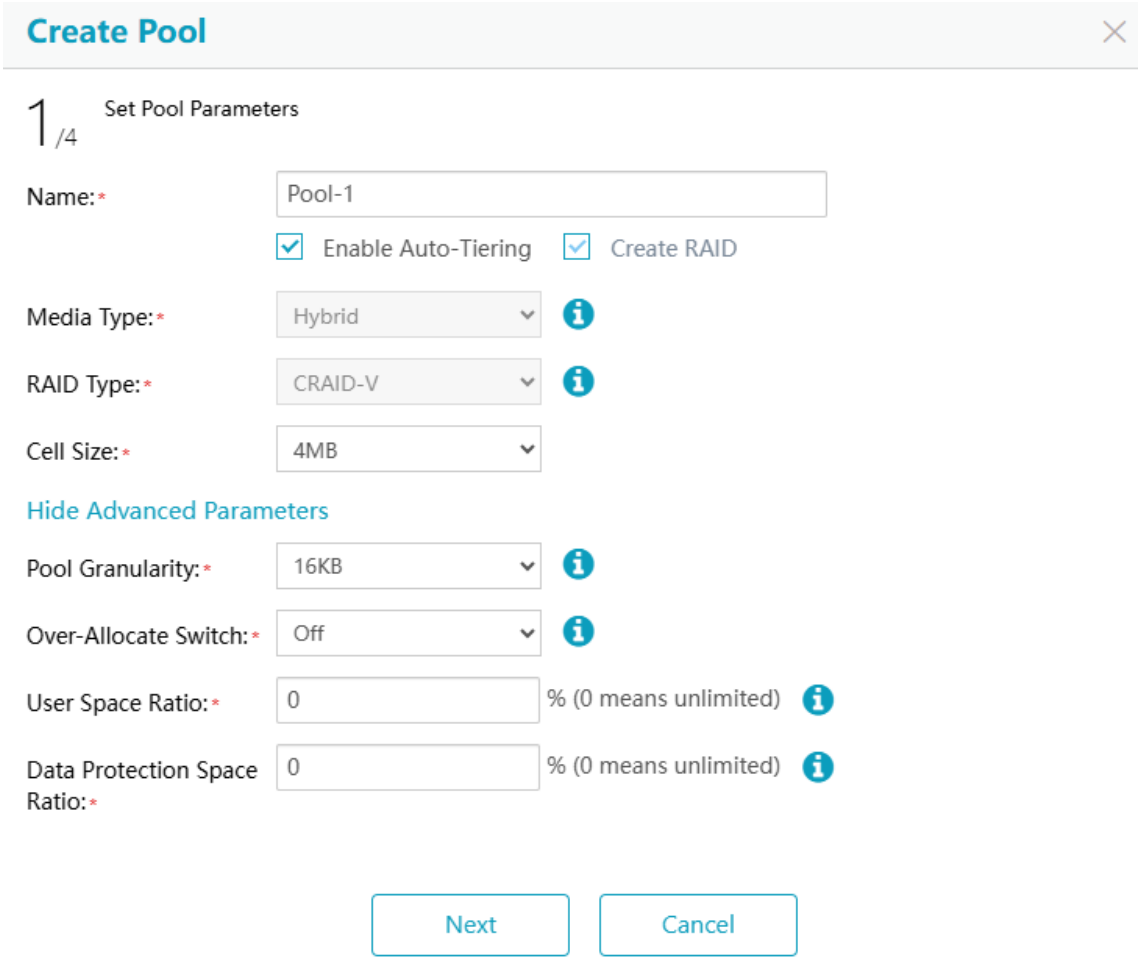

Figure 5-1 Create auto-tiering pool interface (1)

Table 5-1 Description of the parameters for creating auto-tiering pool (1)

Parameter	Description
Name	It refers to the name of pool. • Length: 1-31 characters. • Valid character range: [a-zA-Z0-9.-_:]. • It is recommended that the prefix of pool's name is "Pool".
Media Type	It refers to the media type of the auto-tiering pool. The default value is hybrid and cannot be modified.
RAID Type	It refers to the RAID type of the auto-tiering pool. The default value is CRAID-V and cannot be modified.
Cell Size	It refers to the size of cell. The default value is 4MB.
Pool Granularity	Pool granularity is not only the basic unit of DDSR space management, but also the unit of IO processing on deduplication and compression. It can be set to 8KB or16KB, and the default value is 16KB.

	⚠CAUTION Granularity affects overall performance. It is recommended to use the default value. If you need to adjust the granularity, please contact to manufacturer's technical supporters for confirmation.
Over-Allocate Switch	It refers to enabling or disabling over-allocate. Over-allocate is set mainly for Thin-LUNs in pools, which means whether allowing the subscribed capacity to exceed the total capacity in the pool when creating or expanding Thin-LUNs. You can set a specific over-allocate ratio when over-allocate switch is enabled.
User Space Ratio	It refers to the proportion of space that can be occupied by user LUNs (including data copy LUNs) in the subscription space quota of the pool. The sum of user space ratio and data protection space ratio should be no more than 100%. Valid range: 0-99%.
Data Protection Space Ratio	It refers to the proportion of space that can be occupied by snapshot resources in the subscription space quota of the pool. The sum of user space ratio and data protection space ratio should be no more than 100%. Valid range: 0-90%.

Step 4: The second step of the **Create Pool** wizard is shown in Figure 5-2. Select two or three different storage tiers with one disk type for each tier and click the <Next> button to enter the next interface.

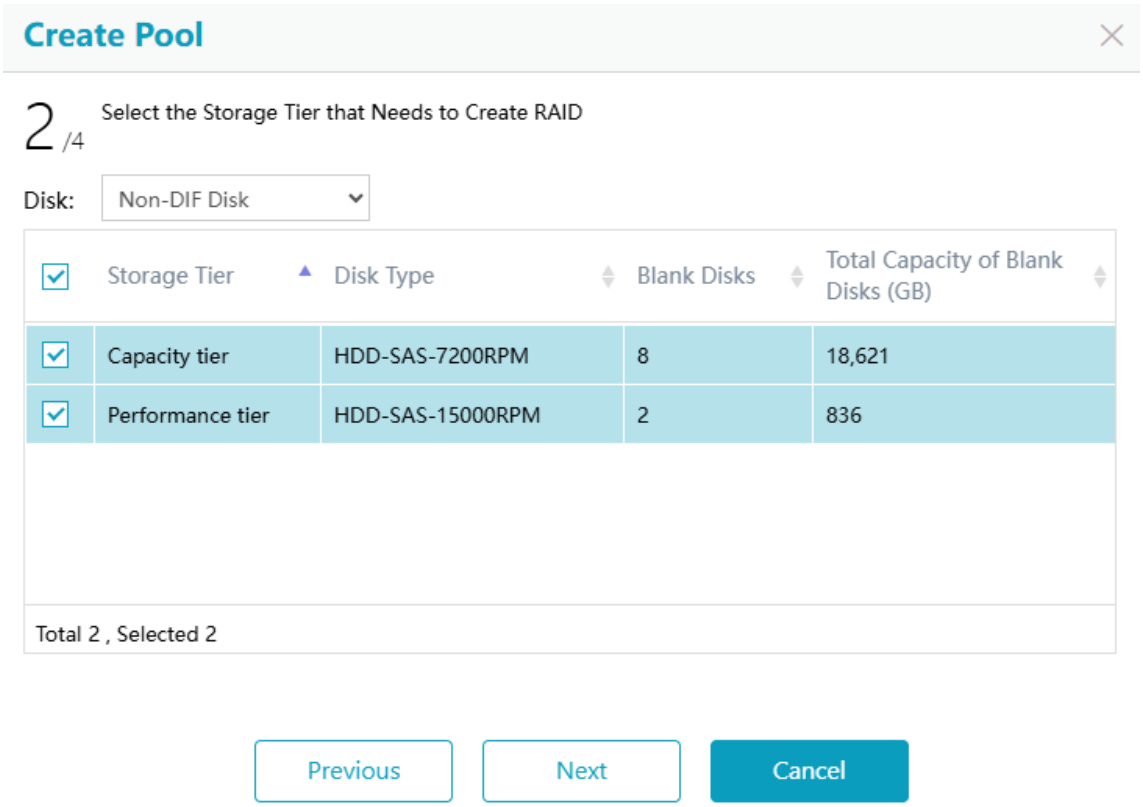

Figure 5-2 Create auto-tiering pool interface (2)

Step 5: The third step of the **Create Pool** wizard is shown in Figure 5-3. Enter relevant RAID parameters (see Table 5-2 for details), select disks as needed, and click the <Next> button to enter the next interface.

ⓘNOTE

Multiple storage tiers are selected in step 4, and the RAID of each storage tier will be created through the extended steps in this step, corresponding to steps 3a/4, 3b/4, etc. The RAID configuration methods for different storage tiers are the same. The capacity tier is used as an example for illustration in this document.

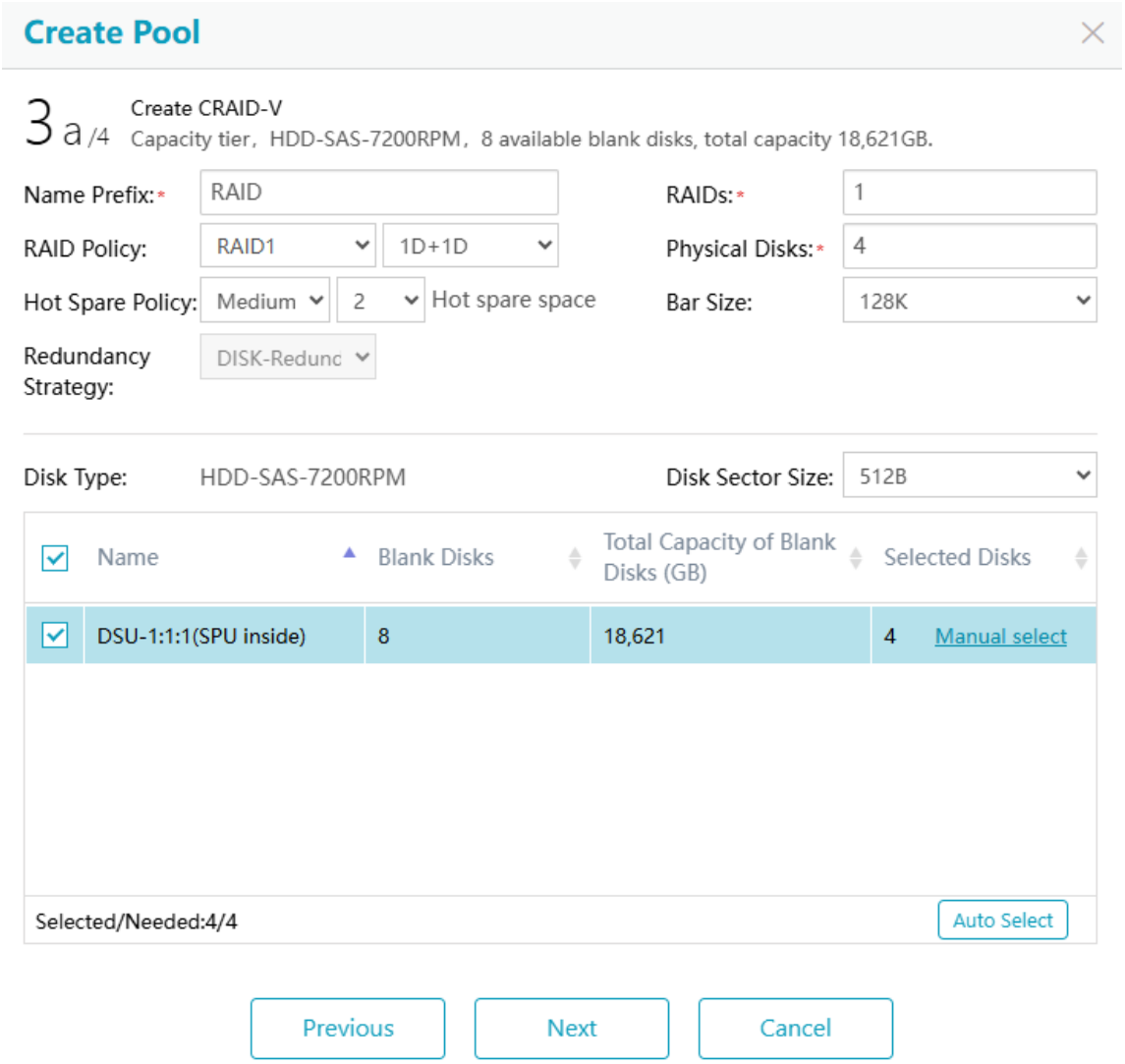

Figure 5-3 Create auto-tiering pool interface (3)

Table 5-2 Description of the parameters for creating auto-tiering pool (3)

Parameter	Description
Name Prefix	It refers to the prefix of RAID's name. • Length: 1-26 characters. • Valid character range: [a-zA-Z0-9.-_:]. • It is recommended that prefix of RAID's name is "RAID".
RAIDs	It refers to the number of RAIDs to be created on the storage tier.
RAID Policy	It refers to the level of each RAID and the configuration of data disk (virtual disk). **NOTE** For CRAID-V, data disk policy is the number of virtual disks. For example, 2D+1P means the number of virtual disks in the CRAID-V is 3.
Physical Disks	It refers to the number of physical disks for each RAID.

Hot Spare Policy	It refers to the hot spare policy for each RAID.
Bar Size	It refers to the bar size for each RAID. **⚠CAUTION** Bar size cannot be modified after the RAID is created. Please set an appropriate value based on actual business requirements.
Redundancy Strategy	It refers to the redundancy strategy of RAID, including disk-redundancy and DSU-redundancy.
Disk Sector Size	It is used to filter disks.

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

5.2.1.2. Enabling Auto-Tiering for Existing Pool

This section explains how to enable auto-tiering for the existing pool.

Prerequisites

- The RAID type in the pool is CRAID-V and the cell size is less than 1GB.
- The pool contains two or three RAIDs with different storage tiers, and each storage tier has only one RAID.

Steps

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

Step 2: Select the desired pool in the information display area, click the <Auto-Tiering> button, and click the <Enable> button in the drop-down menu to open the **Enable Auto-Tiering** wizard.

Step 3: The first step of the **Enable Auto-Tiering** wizard is shown in Figure 5-4 or Figure 5-5. Set auto-tiering IO monitoring policy (see Table 5-3 for details) and click the <Next> button to enter the next step interface.

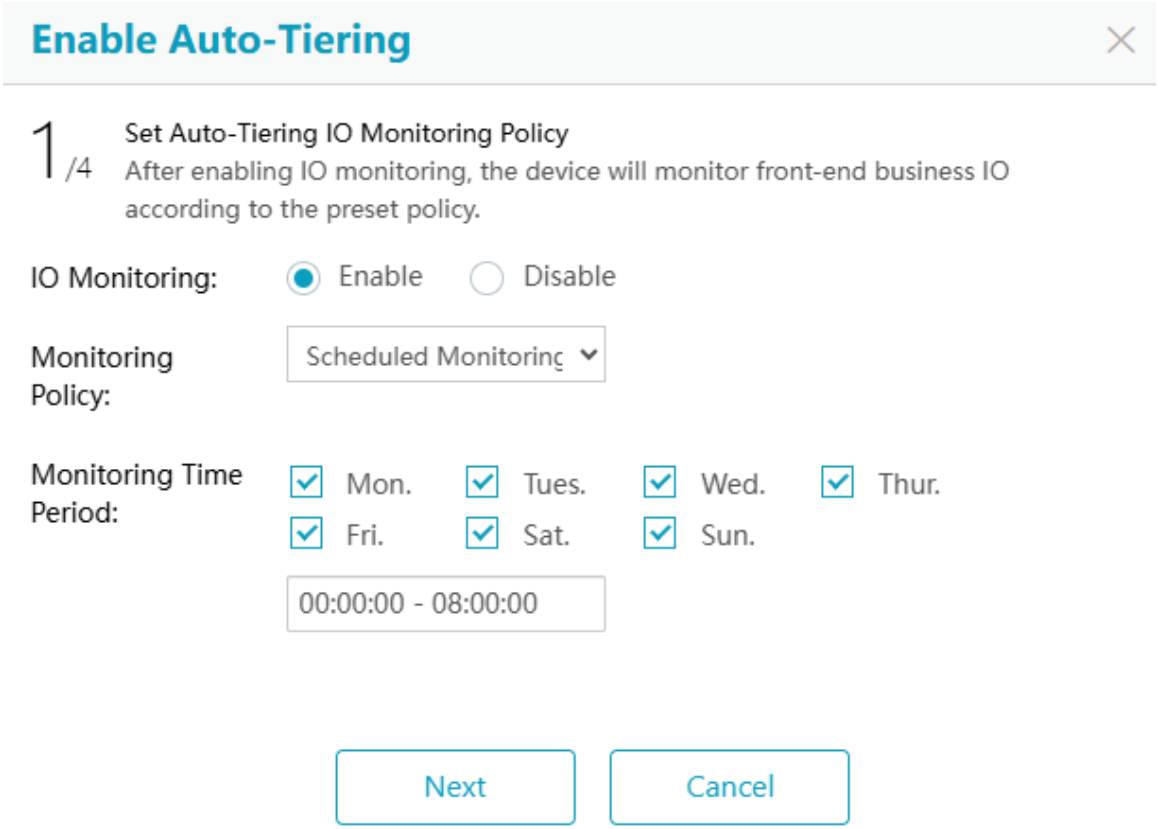

Figure 5-4 Enable auto-tiering (scheduled monitoring) wizard interface (1)

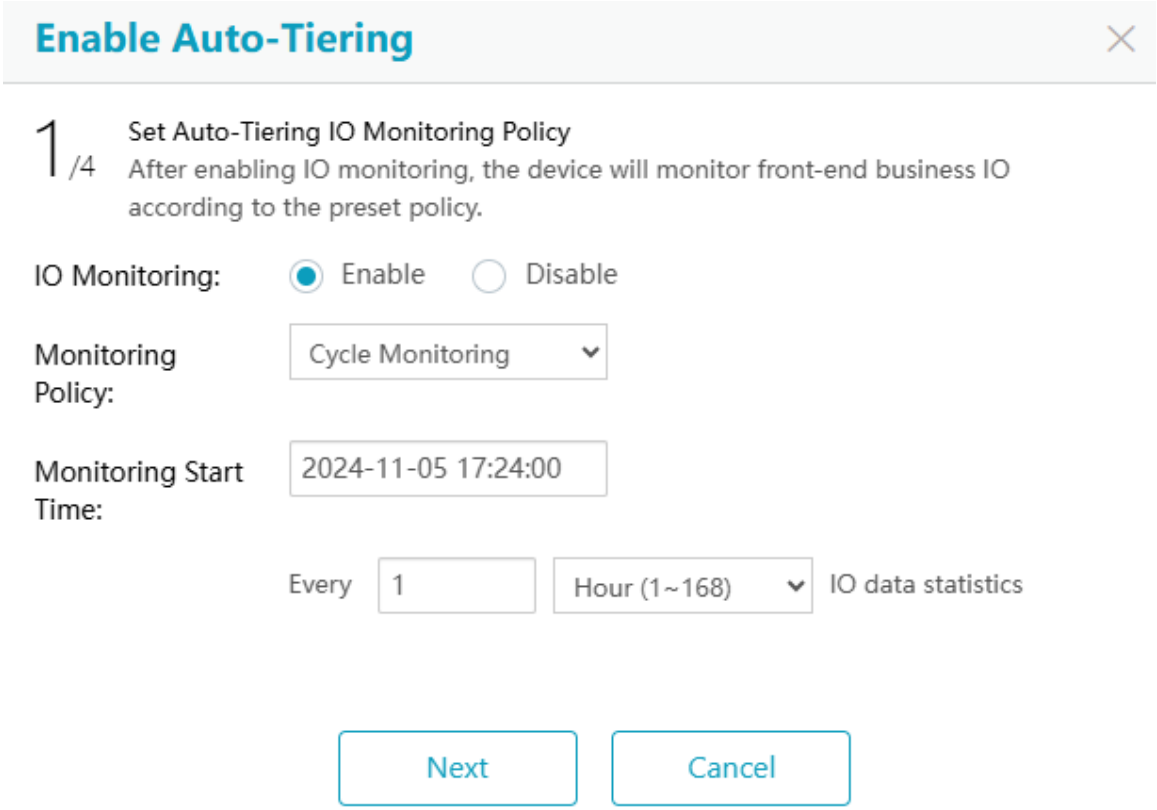

Figure 5-5 Enable auto-tiering (cycle monitoring) wizard interface (1)

Table 5-3 Description of the parameters for enabling auto-tiering wizard interface (1)

Parameter	Description
IO Monitoring	It refers to enabling or disabling IO monitoring.
Monitoring policies and their parameters	The system supports scheduled monitoring policy and cycle monitoring policy. See Table 4-2 for details.

Step 4: The second step of the **Enable Auto-Tiering** wizard is shown in Figure 5-6. Set auto-tiering migration policy (see Table 5-4 for details) and click the <Next> button to enter the next interface.

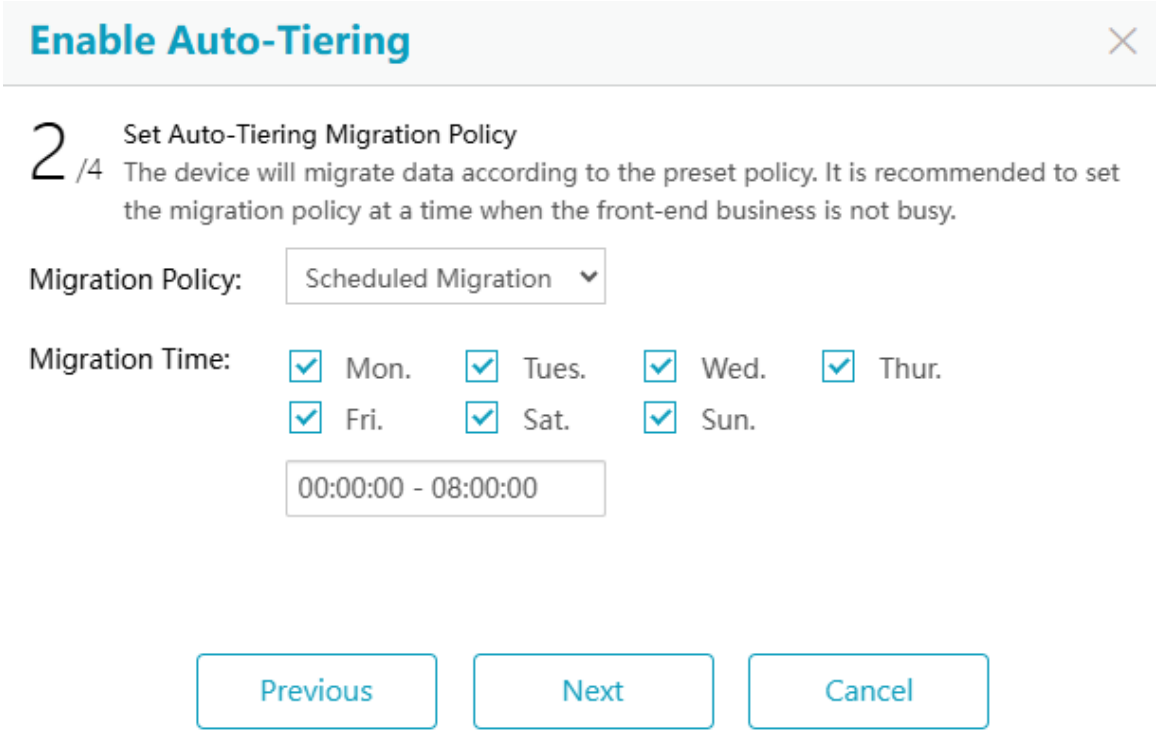

Figure 5-6 Enable auto-tiering wizard interface (2)

Table 5-4 Description of the parameters for enabling auto-tiering wizard interface (2)

Parameter	Description
Migration policies and their parameters	The system supports scheduled migration policy, manual migration policy and cycle migration policy. See Table 4-2 for details.

Step 5: The third step of the **Enable Auto-Tiering** wizard is shown in Figure 5-7. Set auto-tiering parameters (see Table 5-5 for details) and click the <Next> button to enter the next interface.

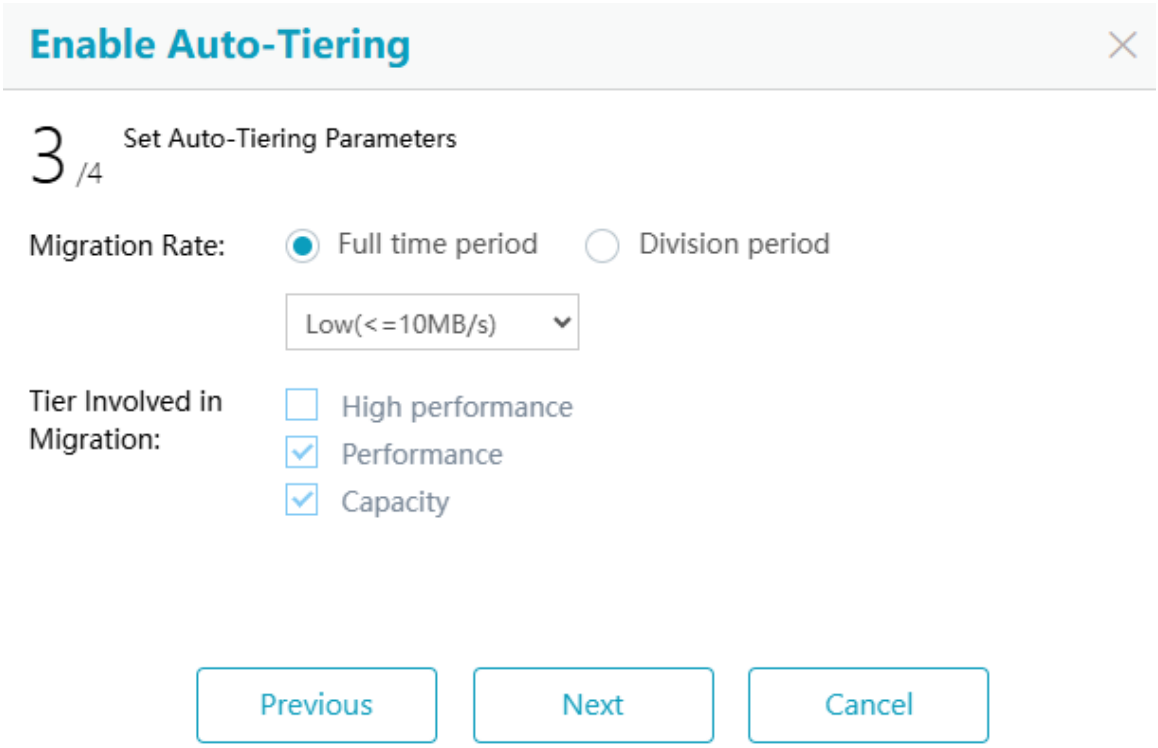

Figure 5-7 Enable auto-tiering wizard interface (3)

Table 5-5 Description of the parameters for enabling auto-tiering wizard interface (3)

Parameter	Description
Migration Rate	Full time period and division period can be set, including the followings: • Low: Data migration rate < = 10MB/s. • Medium: Data migration rate < = 20MB/s. • High: Data migration rate < = 100MB/s.
Tier Involved in Migration	It refers to the storage tiers involved in migration. Please select two tiers at least.

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

5.2.2 Viewing Storage Tier

This section explains how to view storage tier.

Steps

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

Step 2: Select the desired pool in the information display area and click the <Properties> button to open the **Basic Properties** window. You can view the storage tier of the pool in the **Storage Tier** tab.

5.2.3 Disabling Auto-Tiering

This section explains how to disable auto-tiering.

Steps

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

Step 2: Select the desired pool in the information display area, click the <Auto-Tiering> button, click the <Disable> button in the drop-down menu, and click the <OK> button in the pop-up confirmation box to complete the configuration.

5.2.4 Setting Auto-Tiering IO Monitoring Policy

This section explains how to set auto-tiering IO monitoring policy for the pool.

Steps

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

Step 2: Select the desired pool in the information display area and click the <Monitoring Policy> button in the **Auto-Tiering** tab of the extended area to open the **Set Auto-Tiering IO Monitoring Policy** window, as shown in Figure 5-8 or Figure 5-9. Enter relevant parameters (see Table 5-3 for details) and click the <OK> button to complete the configuration.

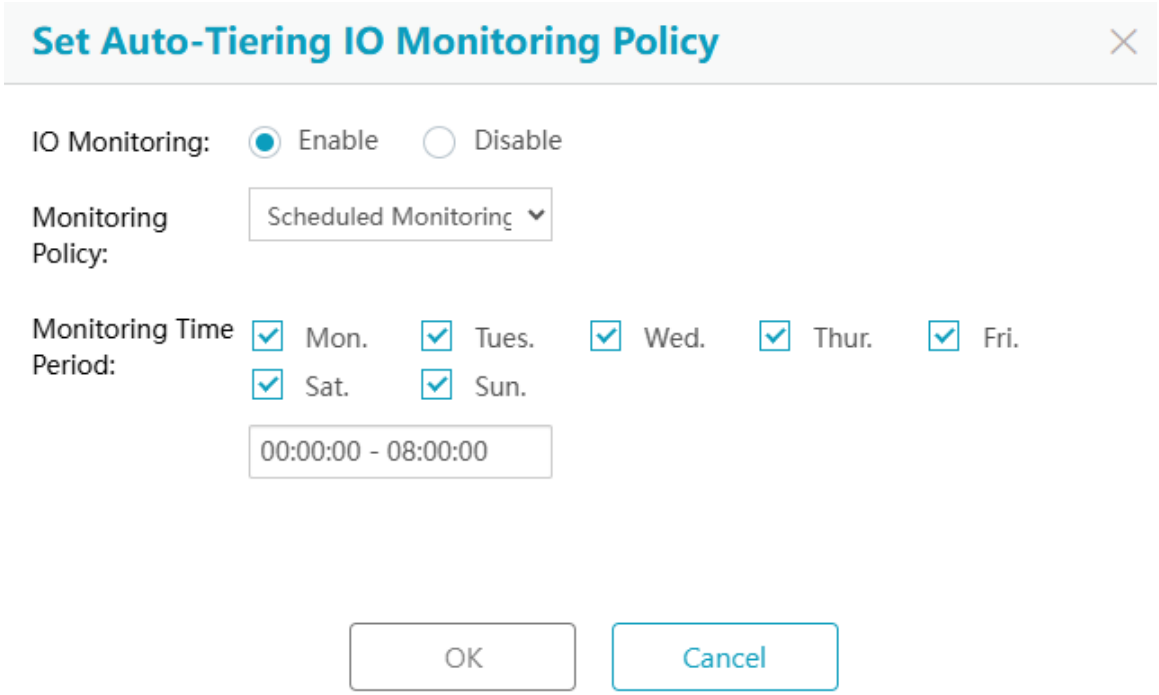

Figure 5-8 Set auto-tiering IO monitoring policy (scheduled monitoring) interface

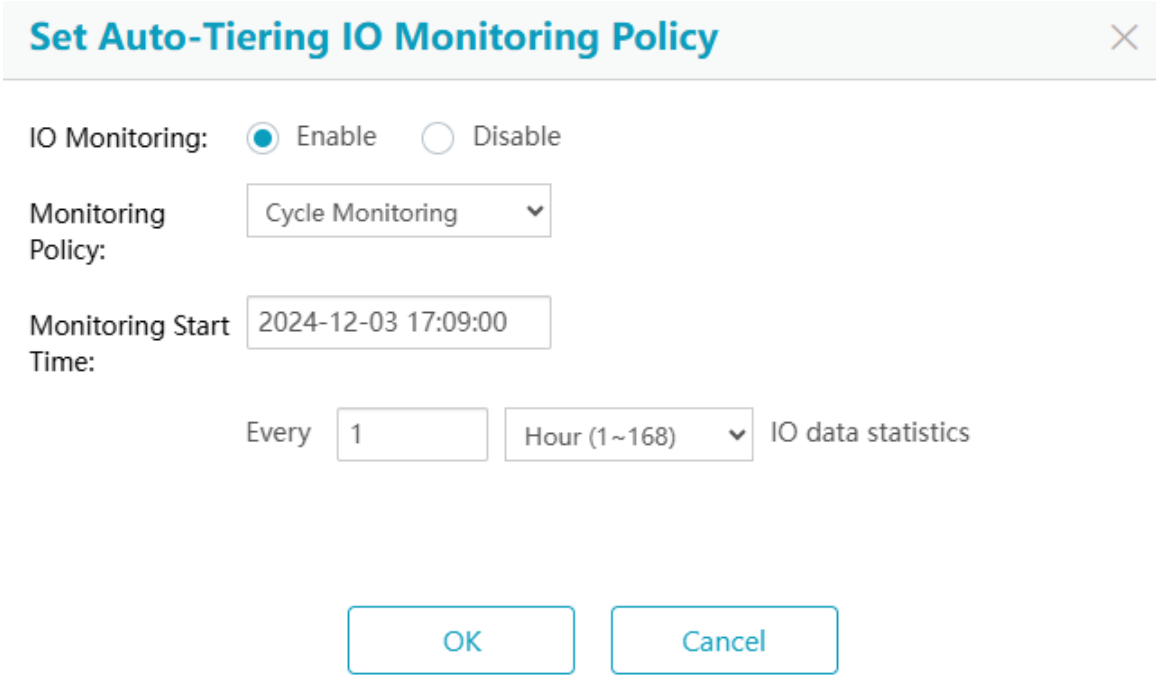

Figure 5-9 Set auto-tiering IO monitoring policy (cycle monitoring) interface

5.2.5 Setting Auto-Tiering Migration Policy

This section explains how to set auto-tiering migration policy for the pool.

Steps

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

Step 2: Select the desired pool in the information display area and click the <Migration Policy> button in the **Auto-Tiering** tab of the extended area to open the **Set Auto-Tiering Migration Policy** window, as shown in Figure 5-10. Enter relevant parameters (see Table 5-6 for details) and click the <OK> button to complete the configuration.

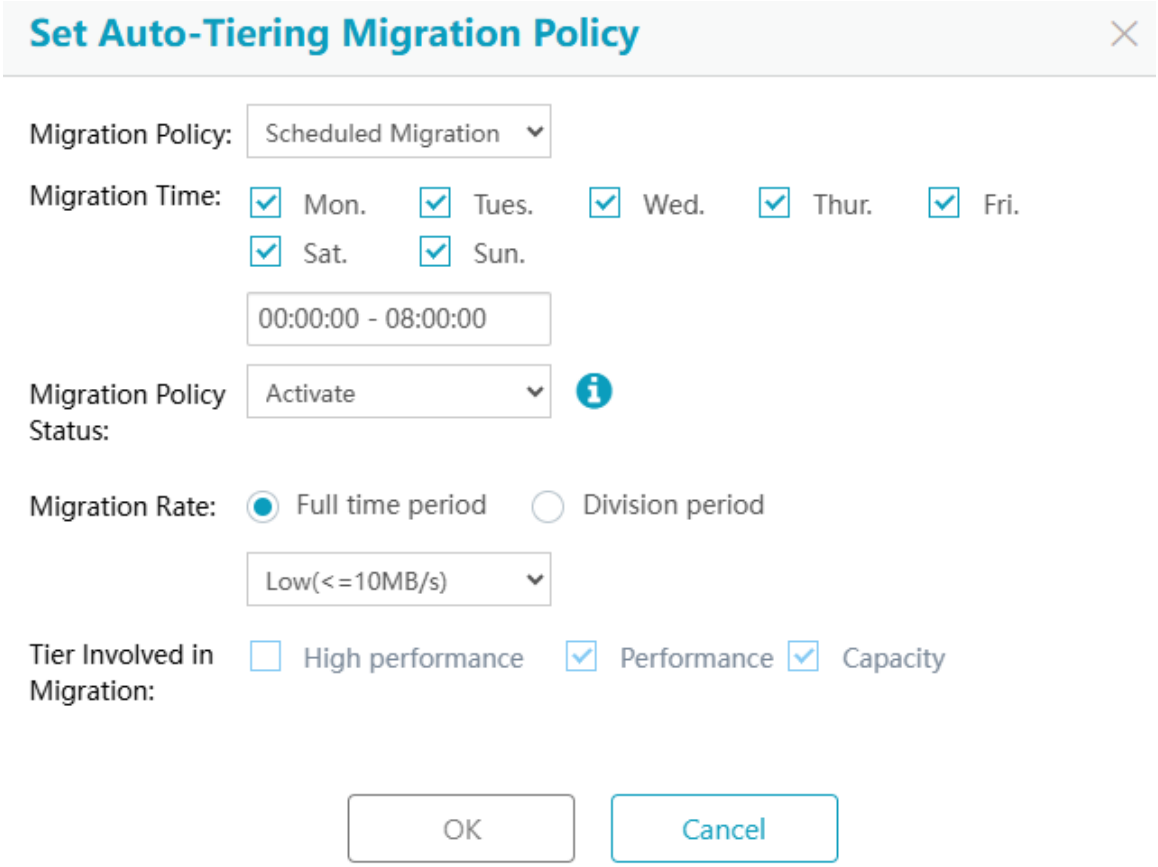

Figure 5-10 Set auto-tiering migration policy interface

Table 5-6 Description of the parameters for setting auto-tiering migration policy

Parameter	Description
Migration policies and their parameters	The system supports scheduled migration policy, manual migration policy and cycle migration policy. See Table 4-2 for details.
Migration Policy Status	It refers to activating or suspending migration. The migration will not be started automatically in the next migration period after being suspended.
Migration Rate	Full time period and division period can be set, including the followings: • Low: Data migration rate < = 10MB/s. • Medium: Data migration rate < = 20MB/s. • High: Data migration rate < = 100MB/s.
Tier Involved in Migration	It refers to the storage tiers involved in migration. Please select two tiers at least.

5.2.6 Managing Migration Task

⚠CAUTION

- The migration will be paused if the migration policy is suspended during the migration process. However, data to be migrated will not be cleared and will be migrated continuously only after the migration policy is activated.
- If the migration is stopped during the migration process, data to be migrated will be cleared.

5.2.6.1. Starting Migration

This section explains how to manually start the migration.

ⓘNOTE

If a scheduled migration policy or cycle migration policy is set, the system will automatically start migration according to the set policy.

Prerequisites

- The migration policy is manual migration and the migration policy status is activated.
- The migration status of all storage tiers is "Idle" and the data needs to be migrated at any tier is not 0.

Steps

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

Step 2: Select the desired pool in the information display area, click the <Start Migration> button in the **Auto-Tiering** tab of the extended area, and click the <OK> button in the pop-up confirmation box and to start the migration manually.

5.2.6.2. Stopping Migration

This section explains how to stop migration.

Prerequisites

There exists a storage tier whose migration status is "Migrating".

Steps

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

Step 2: Select the desired pool in the information display area, click the <Stop Migration> button in the **Auto-Tiering** tab of the extended area, and click the <OK> button in the pop-up confirmation box to complete the configuration.

5.2.7 Setting LUN Migration Policy

5.2.7.1. Setting Migration Policy when Creating LUN

When creating LUNs in an auto-tiering pool:

- If you create a single LUN, the migration policy can be set in the third step of the **Create LUN** wizard, as shown in Figure 5-11; If you create a single Thin-LUN, the migration policy can be set in the second step of the **Create LUN** wizard, as shown in Figure 5-12. Please select the appropriate migration policy according to your needs (see 4.4 Introduction to LUN Migration Policy for details).

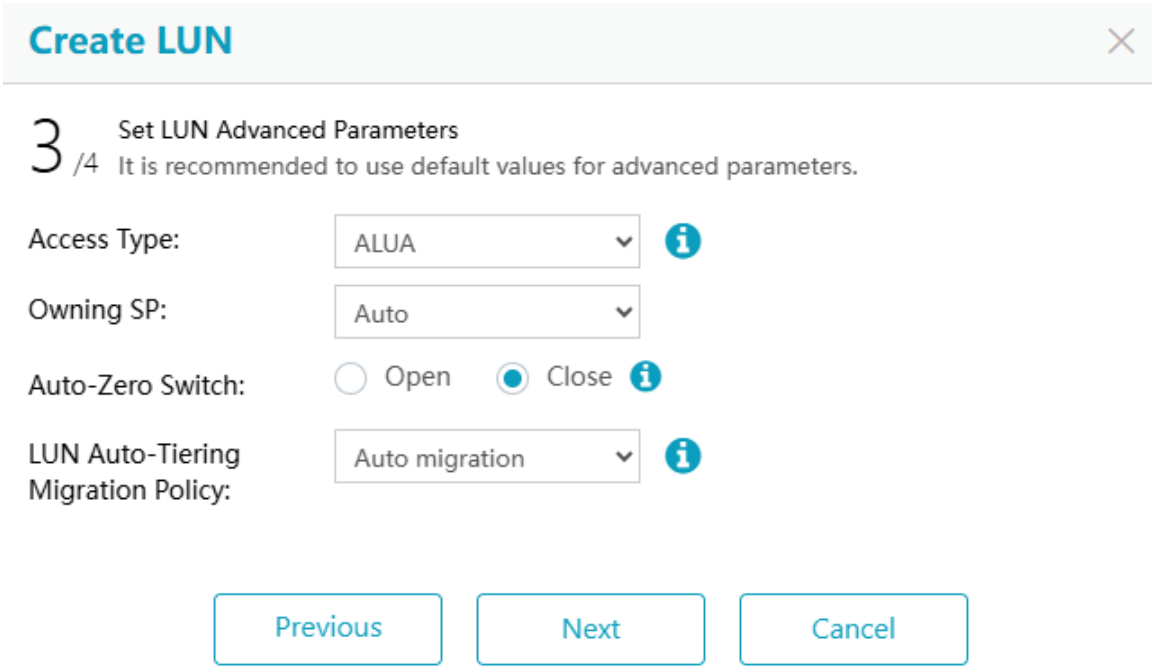

Figure 5-11 The third step of creating a single LUN interface

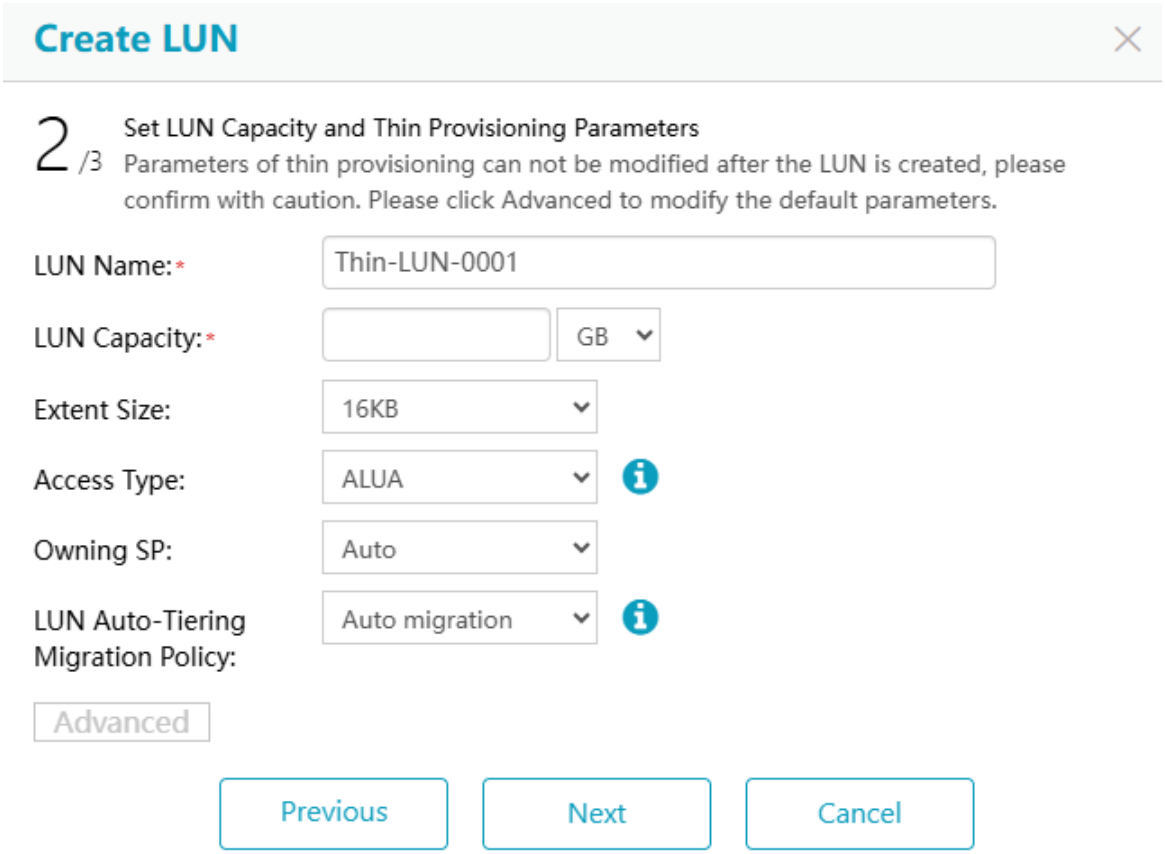

Figure 5-12 The second step of creating a single Thin-LUN interface

- If you create LUNs in batches, the migration policy can be set in the forth step of the **Batch Create LUN** wizard, as shown in Figure 5-13; If you create Thin-LUNs in batches, the migration policy can be set in the third step of the **Batch Create LUN** wizard, as shown in Figure 5-14. Please select the appropriate migration policy according to your needs (see 4.4 Introduction to LUN Migration Policy for details).

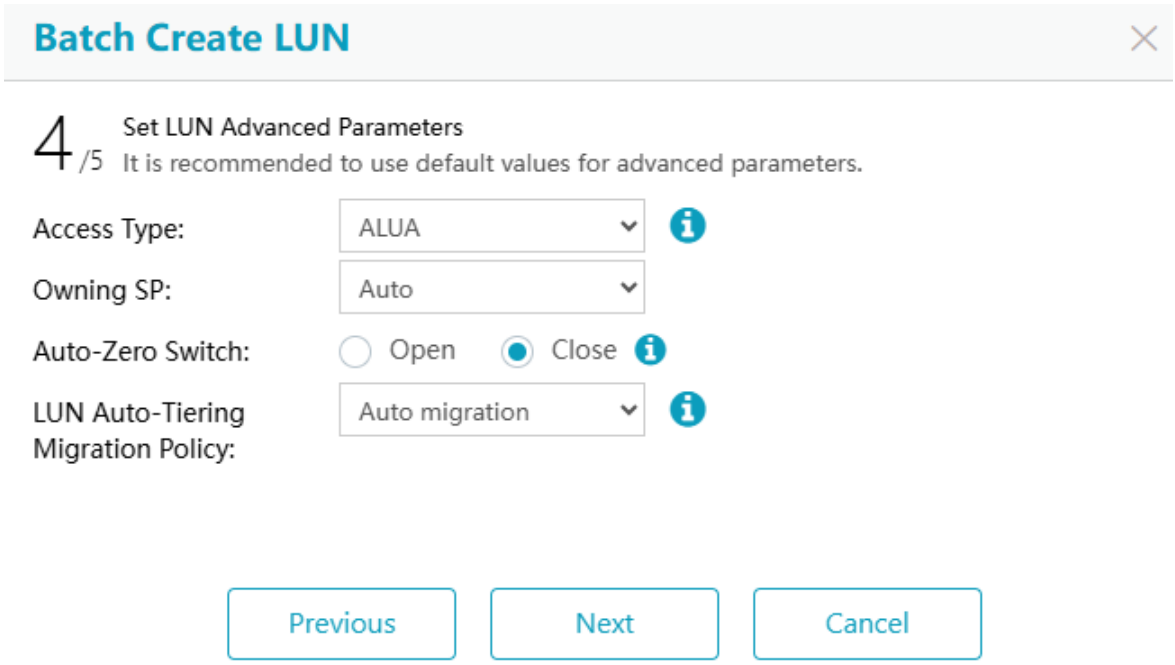

Figure 5-13 The fourth step of batch creating LUNs interface

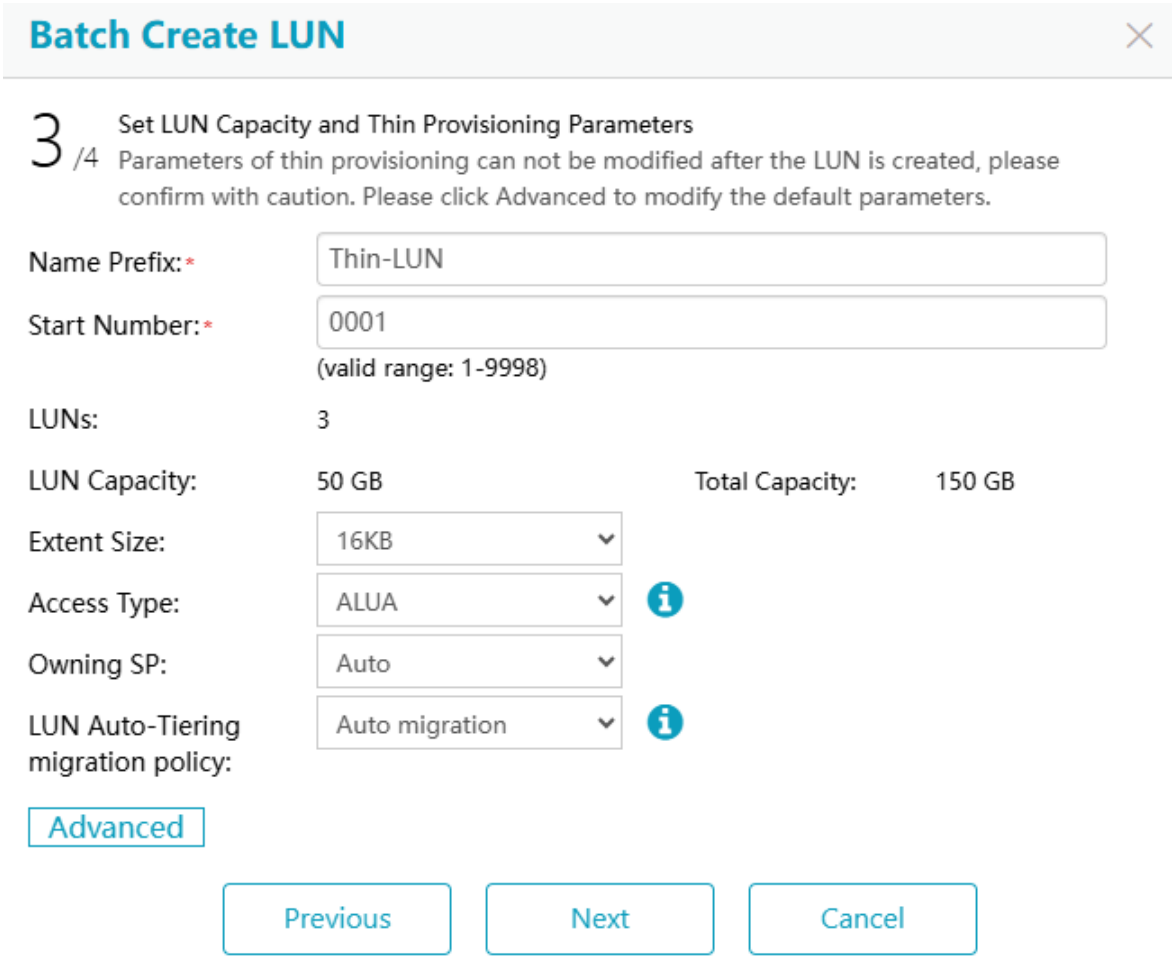

Figure 5-14 The third step of batch creating Thin-LUNs interface

ⓘNOTE

This chapter only describes the content related to auto-tiering. For the steps and parameter descriptions of creating a LUN, please refer to the relevant user manual:

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

5.2.7.2. Modifying Migration Policy for Existing LUN

This section explains how to modify migration policy for the existing LUN.

ⓘNOTE

The migration policy will take effect in the next migration after it is modified.

Steps

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

Step 2: Select the desired LUN in the **LUNs** tab of the information display area and click the <Properties> button to open the **Basic Properties** window. Click the <Show More Information> button, and the **General** tab is shown in Figure 5-15. Modify the LUN migration policy (see 4.4 Introduction to LUN Migration Policy for details) and click the <Apply> button to complete the configuration.

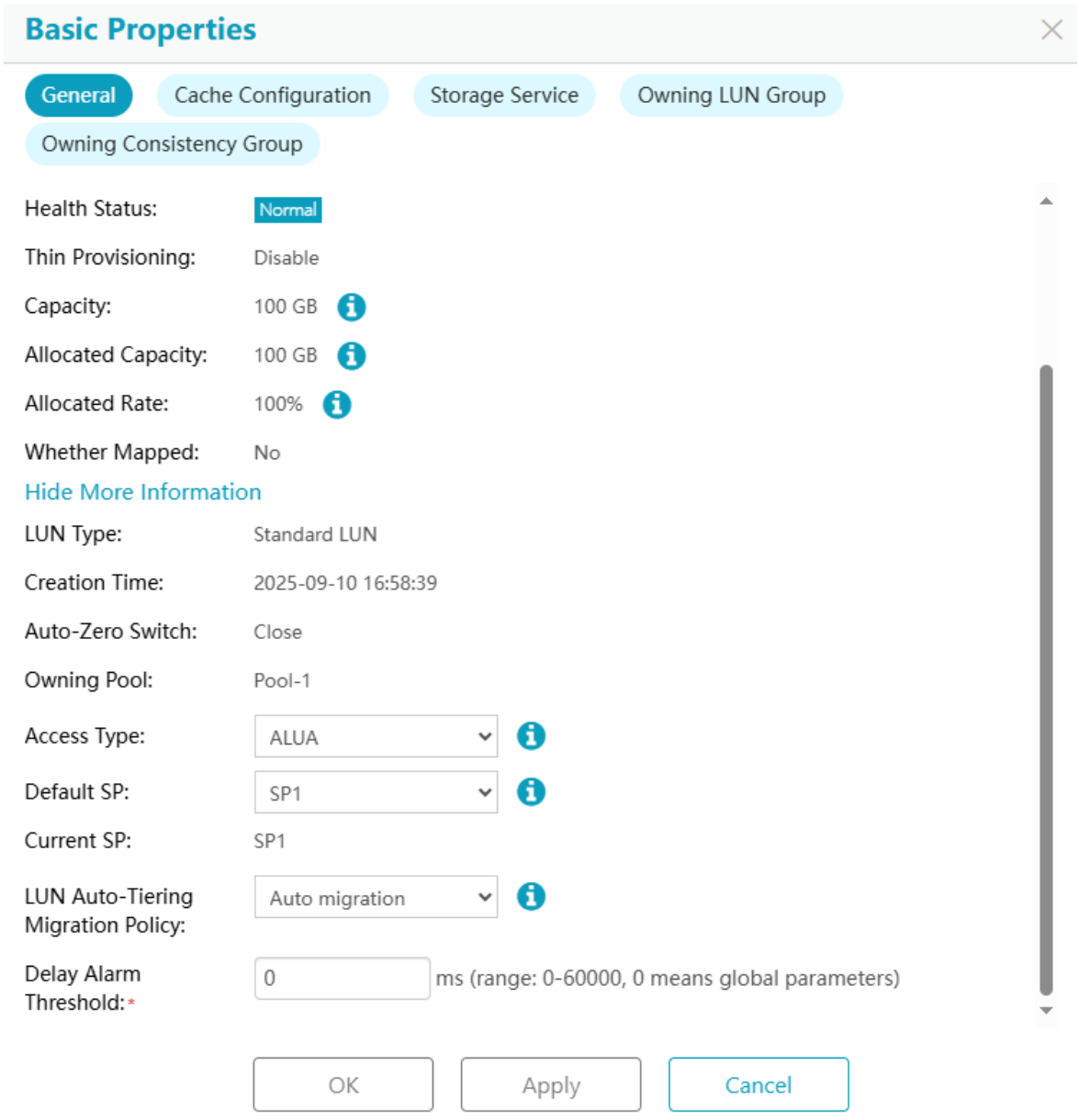

Figure 5-15 LUN basic properties interface

Appendix A. Device Default Configurations

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

Table 5-7 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 5-8.

Table 5-8 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