ETERNUS SF

FUJITSU

ETERNUS SF Storage Cruiser V15.3

Operation Guide
for Optimization Option

Windows/Solaris/Linux

Preface

Purpose

This manual describes Optimization Option, the optional product for ETERNUS SF Storage Cruiser (hereafter referred to as "Storage Cruiser").

Intended readers

This manual is intended for the system administrator and operators using the Optimization Option and managing storage system.

Organization

This manual is composed as follows:

Chapter 1 Overview

> This chapter describes an overview of the Optimization Option.

Chapter 2 Design

> This chapter describes the necessary design-related matters that must be addressed before setting up the Optimization Option.

Chapter 3 Setup

> This chapter describes the setup of the Automated Storage Tiering function.

Chapter 4 Operation

> This chapter describes the operation of the Automated Storage Tiering function.

Chapter 5 Operational Maintenance

> This chapter describes the operational maintenance for the Optimization Option.

Notation

The names, abbreviations, and symbols shown below are used in this manual.

Operating systems

Formal name	Abbreviation	
Microsoft(R) Windows Server(R) 2003, Standard Edition Microsoft(R) Windows Server(R) 2003, Standard x64 Edition Microsoft(R) Windows Server(R) 2003, Enterprise Edition Microsoft(R) Windows Server(R) 2003, Enterprise x64 Edition Microsoft(R) Windows Server(R) 2003 R2, Standard Edition Microsoft(R) Windows Server(R) 2003 R2, Standard x64 Edition Microsoft(R) Windows Server(R) 2003 R2, Enterprise Edition Microsoft(R) Windows Server(R) 2003 R2, Enterprise x64 Edition	Windows Server 2003	Windows
Microsoft(R) Windows Server(R) 2008 Standard (32-bit)(64-bit) Microsoft(R) Windows Server(R) 2008 Standard without Hyper-V(TM) (32-bit)(64-bit) Microsoft(R) Windows Server(R) 2008 Enterprise (32-bit)(64-bit) Microsoft(R) Windows Server(R) 2008 Enterprise without Hyper-V(TM) (32-bit)(64-bit) Microsoft(R) Windows Server(R) 2008 Datacenter (32-bit)(64-bit) Microsoft(R) Windows Server(R) 2008 Datacenter without Hyper-V(TM) (32-bit)(64-bit)	Windows Server 2008	
Microsoft(R) Windows Server(R) 2008 R2 Foundation Microsoft(R) Windows Server(R) 2008 R2 Standard	Windows Server 2008 R2	

Formal name	Abbreviation	
Microsoft(R) Windows Server(R) 2008 R2 Enterprise Microsoft(R) Windows Server(R) 2008 R2 Datacenter		
Microsoft(R) Windows Server(R) 2012 Standard Microsoft(R) Windows Server(R) 2012 Datacenter	Windows Server 2012	
Microsoft(R) Windows(R) XP Professional Edition Microsoft(R) Windows(R) XP Home Edition	Windows XP	
Windows Vista(R) Home Basic Windows Vista(R) Home Premium Windows Vista(R) Business Windows Vista(R) Enterprise Windows Vista(R) Ultimate	Windows Vista	
Windows(R) 7 Home Basic Windows(R) 7 Home Premium Windows(R) 7 Professional Windows(R) 7 Enterprise Windows(R) 7 Ultimate	Windows 7	
Windows(R) 8 Windows(R) 8 Pro	Windows 8	
Solaris(TM) 9 Operating System	Solaris 9	Solaris or Solaris OS
Oracle Solaris 10	Solaris 10	
Oracle Solaris 11	Solaris 11	
Red Hat(R) Enterprise Linux(R) AS (v.4 for x86) Red Hat(R) Enterprise Linux(R) AS (v.4 for EM64T)	RHEL-AS4	Linux
Red Hat(R) Enterprise Linux(R) ES (v.4 for x86) Red Hat(R) Enterprise Linux(R) ES (v.4 for EM64T)	RHEL-ES4	
Red Hat(R) Enterprise Linux(R) 5 (for x86) Red Hat(R) Enterprise Linux(R) 5 (for Intel64)	RHEL5	
Red Hat(R) Enterprise Linux(R) 6 (for x86) Red Hat(R) Enterprise Linux(R) 6 (for Intel64)	RHEL6	
SUSE(R) Linux Enterprise Server 11 for x86 SUSE(R) Linux Enterprise Server 11 for EM64T	SUSE Linux Enterprise Server 11	
HP-UX 11.0 HP-UX 11i v1 HP-UX 11i v2 HP-UX 11i v3	HP-UX	
AIX 5L(TM) V5.1 AIX 5L(TM) V5.2 AIX 5L(TM) V5.3 AIX(R) V6.1 AIX(R) V7.1	AIX	
VMware(R) Infrastructure 3 Foundation VMware(R) Infrastructure 3 Standard VMware(R) Infrastructure 3 Enterprise	VMware Infrastructure 3	VMware
VMware vSphere(R) 4 Essentials Kit VMware vSphere(R) 4 Essentials Plus Kit VMware vSphere(R) 4 Standard Edition(TM) VMware vSphere(R) 4 Standard Plus Data Recovery VMware vSphere(R) 4 Advanced Edition(TM)	VMware vSphere 4	

Formal name	Abbreviation	
VMware vSphere(R) 4 Enterprise Edition(TM) VMware vSphere(R) 4 Enterprise Plus Edition(TM)		
VMware vSphere(R) 5 Essentials Kit VMware vSphere(R) 5 Essentials Plus Kit VMware vSphere(R) 5 Standard Edition(TM) VMware vSphere(R) 5 Standard Plus Data Recovery VMware vSphere(R) 5 Enterprise Edition(TM) VMware vSphere(R) 5 Enterprise Plus Edition(TM)	VMware vSphere 5	

Oracle Solaris might be described as Solaris, Solaris Operating System, or Solaris OS.

Related products with Fujitsu Storage System ETERNUS and Storage Management Software ETERNUS SF

Formal name	Abbreviation			
ETERNUS DX60/DX60 S2 ETERNUS DX80/DX80 S2 ETERNUS DX90/DX90 S2	-		ETERNUS DX series	ETERNUS Disk storage system
ETERNUS DX410 ETERNUS DX440	ETERNUS DX400 series	ETERNUS DX400/DX400 S2 series		
ETERNUS DX410 S2 ETERNUS DX440 S2	ETERNUS DX400 S2 series			
ETERNUS DX8100 ETERNUS DX8400 ETERNUS DX8700	ETERNUS DX8000 series	ETERNUS DX8000/DX8000 S2 series		
ETERNUS DX8100 S2 ETERNUS DX8700 S2	ETERNUS DX8000 S2 series			
ETERNUS2000 ETERNUS4000 ETERNUS8000	-			
Web GUI of ETERNUS DX series	ETERNUS Web GUI			
ETERNUSmgr				
ETERNUS LT20/LT20 S2 ETERNUS LT40/LT40 S2 ETERNUS LT60/LT60 S2 ETERNUS LT200 ETERNUS LT210 ETERNUS LT220 ETERNUS LT230 ETERNUS LT250 ETERNUS LT270	ETERNUS Tape library			

Software products

Formal name	Abbreviation
Microsoft(R) Internet Explorer(R)	Internet Explorer
Mozilla(R) Firefox(R)	Firefox
Microsoft(R) Cluster Service	MSCS
Microsoft(R) Windows Server(R) Failover Clustering	WSFC
Microsoft(R) Exchange Server	Exchange Server
Microsoft(R) SQL Server(TM)	SQL Server

Formal name	Abbreviation
PRIMECLUSTER Global Disk Services	GDS
PRIMECLUSTER Global File Services	GFS
Symfoware Server Enterprise Extended Edition Symfoware Server Enterprise Edition	Symfoware
VMware(R) ESX(R)	VMware ESX
VMware(R) ESXi(TM)	VMware ESXi
VMware(R) vCenter(TM) Server	VMware vCenter Server or vCenter Server

Manuals

Formal name	Abbreviation
ETERNUS SF Express / ETERNUS SF Storage Cruiser / ETERNUS SF AdvancedCopy Manager Release Notes	ETERNUS SF Release Notes
ETERNUS SF Express / ETERNUS SF Storage Cruiser / ETERNUS SF AdvancedCopy Manager Installation and Setup Guide	ETERNUS SF Installation and Setup Guide
ETERNUS SF Express / ETERNUS SF Storage Cruiser / ETERNUS SF AdvancedCopy Manager Migration Guide	ETERNUS SF Migration Guide
ETERNUS SF Express / ETERNUS SF Storage Cruiser / ETERNUS SF AdvancedCopy Manager Web Console Guide	ETERNUS SF Web Console Guide
ETERNUS SF Express / ETERNUS SF AdvancedCopy Manager Operation Guide for Copy Control Module	ETERNUS SF Operation Guide for Copy Control Module
ETERNUS SF Storage Cruiser / ETERNUS SF AdvancedCopy Manager Cluster Environment Setup Guide	ETERNUS SF Cluster Environment Setup Guide
ETERNUS SF Express / ETERNUS SF Storage Cruiser / ETERNUS SF AdvancedCopy Manager Messages	ETERNUS SF Messages
ETERNUS SF Express / ETERNUS SF Storage Cruiser Event Guide	ETERNUS SF Event Guide
ETERNUS SF Express / ETERNUS SF Storage Cruiser / ETERNUS SF AdvancedCopy Manager Glossary	ETERNUS SF Glossary

Others

- In this manual, "ETERNUS4000" does not include ETERNUS4000 models 80 and 100.

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Notes

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Update history

Content of update	Updated section	Revision
Added Oracle Solaris 11, AIX V6.1 and AIX V7.1 in the operating systems.	Notation in Preface	3
Added the explanation for SED-SAS.	1.2, 2.2, 3.6.1, 4.3	
Added Windows Server 2012 and Windows 8 in the operating systems.	Notation in Preface	4
Modified the baseline for volume migration.	2.1	
Added the explanation about items of Tiering policy.	3.5.1	
Modified the explanation about the used ratio for FTV.	3.7	
Added items displayed in the [Overview] of [Automated Storage Tiering] pane.	4.2	
Added the explanation about the relocation processing result and displayed character strings.	4.3	
Added the explanation about reusing the Tiering policy definition.	5.4	
Added command references.	5.5	

Content of update	Updated section	Revision
Added material concerning disk auto-selection and specifying the master CM.	2.2, 3.6, 3.6.1, 3.6.4,4.3	5
Added material concerning simplification of Tiering policy specification.	3.5, 3.5.1	
Added material concerning setting the FTV capacity quota ratio.	3.7, 3.7.1, 3.7.3, 4.3	
Added stopping Automated Storage Tiering.	4.1.4	
Added support device maintenance.	5.5	
Added esfast tierpool setaddress (storage device IP address change command) to Command Reference.	5.6.2	

Manual organization and reading suggestions

Manual organization

The following table describes the Manual organization of Express, Storage Cruiser and AdvancedCopy Manager.

When to read	Related manuals (abbreviated)	Related products (*1)			Explanation
		EXP	SC	ACM	
Before installation	Quick Reference	Yes	Yes	Yes	This manual is unique for each product. The following manuals are available: - Express Quick Reference - Storage Cruiser Quick Reference - AdvancedCopy Manager Quick Reference
	Release Notes	Yes	Yes	Yes	This manual is common for all products.
	Overview	-	-	Yes	This manual is unique for each product.
During installation	Installation and Setup Guide	Yes	Yes	Yes	This manual is common for all products.
	Cluster Environment Setup Guide	-	Yes	Yes	This manual is common for Storage Cruiser and AdvancedCopy Manager.
	Migration Guide	Yes	Yes	Yes	This manual is common for all products.
During operation	Operation Guide	Yes	Yes	Yes	This manual is unique for each product. The following manuals are available: - Express Operation Guide - Storage Cruiser Operation Guide - Storage Cruiser Operation Guide for Optimization Option - AdvancedCopy Manager Operation Guide (for Windows) - AdvancedCopy Manager Operation Guide (for Solaris) - AdvancedCopy Manager Operation Guide (for Linux) - AdvancedCopy Manager Operation Guide (for HP-UX) - AdvancedCopy Manager Operation Guide (for AIX) - AdvancedCopy Manager for Exchange Server Operation Guide

When to read	Related manuals (abbreviated)	Related products (*1)			Explanation
		EXP	SC	ACM	
	Operation Guide for Copy Control Module	Yes	-	Yes	This manual is common for Express and AdvancedCopy Manager.
	Web Console Guide	Yes	Yes	Yes	This manual is common for all products.
Anytime	Event Guide	Yes	Yes	-	This manual is common for Express and Storage Cruiser.
	Messages	Yes	Yes	Yes	This manual is common for all products.
	Glossary	Yes	Yes	Yes	This manual is common for all products.

*1: "EXP" indicates Express, "SC" indicates Storage Cruiser and "ACM" indicates AdvancedCopy Manager.

How to read manuals

Please use the following table to find the most useful information in the Express, Storage Cruiser and AdvancedCopy Manager manuals to answer your inquiry.

Purpose	Related products (*1)	Manual	Main contents	How to read
Acquiring a product overview and basic operation knowledge	EXP	- Express Quick Reference	- Product overview - Installation decision - Overview of the necessary tasks from installation to first use	Please read if you want to acquire a fundamental knowledge of the product and its operation in order to decide to install it or not.
	SC	- Storage Cruiser Quick Reference		
	ACM	- AdvancedCopy Manager Quick Reference		
		- AdvancedCopy Manager Overview	- Main functions - Linkable applications - Procedure overview for Advanced Copy of ETERNUS Disk storage system	
Confirming the updated contents	common	- ETERNUS SF Release Notes	- New function overview - Incompatibilities with previous version - Fixed bugs	Please read if you want to know the updated contents from a previous version and if you perform the upgrade.
Deciding if a version upgrade is required	common	- ETERNUS SF Migration Guide	- Notes and cautions about version upgrade - Version upgrade procedure	Please read if you want to upgrade from a previous version.
Installing and correctly operating the product Setting up operating environment depending on purpose	common	- ETERNUS SF Installation and Setup Guide	- Operating environment - Installation procedure - Setup procedure - Uninstallation procedure	Please read if you want to install and setup the product.
	SC, ACM	- ETERNUS SF Cluster Environment Setup Guide	- Supported cluster software - Installation procedure for a clustered system	Please read if you want to install and setup the product on a clustered system.

Purpose	Related products (*1)	Manual	Main contents	How to read
			- Setup procedure for a clustered system - Uninstallation procedure for a clustered system	
Administration and operation of the installed system	EXP	- Express Operation Guide	- Starting and stopping the software - Device monitoring - Data copy inside the storage system - Necessary tasks after an architectural modification of the system as well as product maintenance	Please read if you want to start or shutdown the system, monitor the operation status, do backup/restore operations, etc.
	SC	- Storage Cruiser Operation Guide	- Starting and stopping the software - Device monitoring - Necessary tasks after an architectural modification of the system as well as product maintenance - Command reference	
		- Storage Cruiser Operation Guide for Optimization Option	- Operating environment construction - Operating status monitoring - Necessary tasks after an architectural modification of the system as well as product maintenance	
	EXP, ACM	- ETERNUS SF Operation Guide for Copy Control Module	- Starting and stopping the software	
	ACM	- AdvancedCopy Manager Operation Guide (for Windows) - AdvancedCopy Manager Operation Guide (for Solaris) - AdvancedCopy Manager Operation Guide (for Linux) - AdvancedCopy Manager Operation Guide (for HP-UX) - AdvancedCopy Manager Operation Guide (for AIX)	- Data backup/restore inside the storage system - Necessary tasks after an architectural modification of the system as well as product maintenance - Command reference	
		- AdvancedCopy Manager for Exchange Server Operation Guide	- Restoring the Exchange Server database using the Restore Wizard	

Purpose	Related products (*1)	Manual	Main contents	How to read
	common	- ETERNUS SF Web Console Guide	- Operating environment - Screen layout description	Please read if you want to understand the ETERNUS SF Web Console.
Dealing with messages issued by the software	common	- ETERNUS SF Messages	- Messages and their explanations - Parameter (variable information) description - System action - Countermeasures	Please read if you want a practical way of investigating and dealing with messages issued by the software.
Dealing with events issued by the software	EXP, SC	- ETERNUS SF Event Guide	- Phenomenon of event - Countermeasures	Please read if you need to find a practical way of investigating and dealing with events.
Researching the meaning of specific terms related to the products and other important terms	common	- ETERNUS SF Glossary	- Product specific terminology explanation - Explanation of important terminology appearing in the manual - Synonyms and related terms - Proper form of abbreviated terms	Please read if you want to learn the meaning of important terms, product specific terms or abbreviations used in the manuals.

*1: "EXP" indicates Express, "SC" indicates Storage Cruiser and "ACM" indicates AdvancedCopy Manager.

Contents

Chapter 1 Overview

This chapter describes an overview of the Optimization Option.

1.1 Explanation of Optimization Option

The Optimization Option is an optional product for Storage Cruiser which provides an Automated Storage Tiering function.

Automated Storage Tiering function

The Automated Storage Tiering function automatically performs, within the same ETERNUS Disk storage system, volume relocation to the ETERNUS Disk storage system volume with content defined by an Automated Storage Tiering policy and Tier pool.
By dynamically moving data to the appropriate tier, the Automated Storage Tiering function can respond to performance changes without interruption. It lightens service and storage administrator workload for performance management and layout design.
Moreover, all operations such as definition of policies or Tier pools, and execution of volume relocation can be controlled from the ETERNUS SF Web Console (hereafter referred to as "Web Console").

📛 Note

The operation for Automated Storage Tiering function must be performed on the same Management Server.
When performed on the multiple Management Servers, Automated Storage Tiering function will not operate correctly.

Figure 1.1 Overview of Automated Storage Tiering function
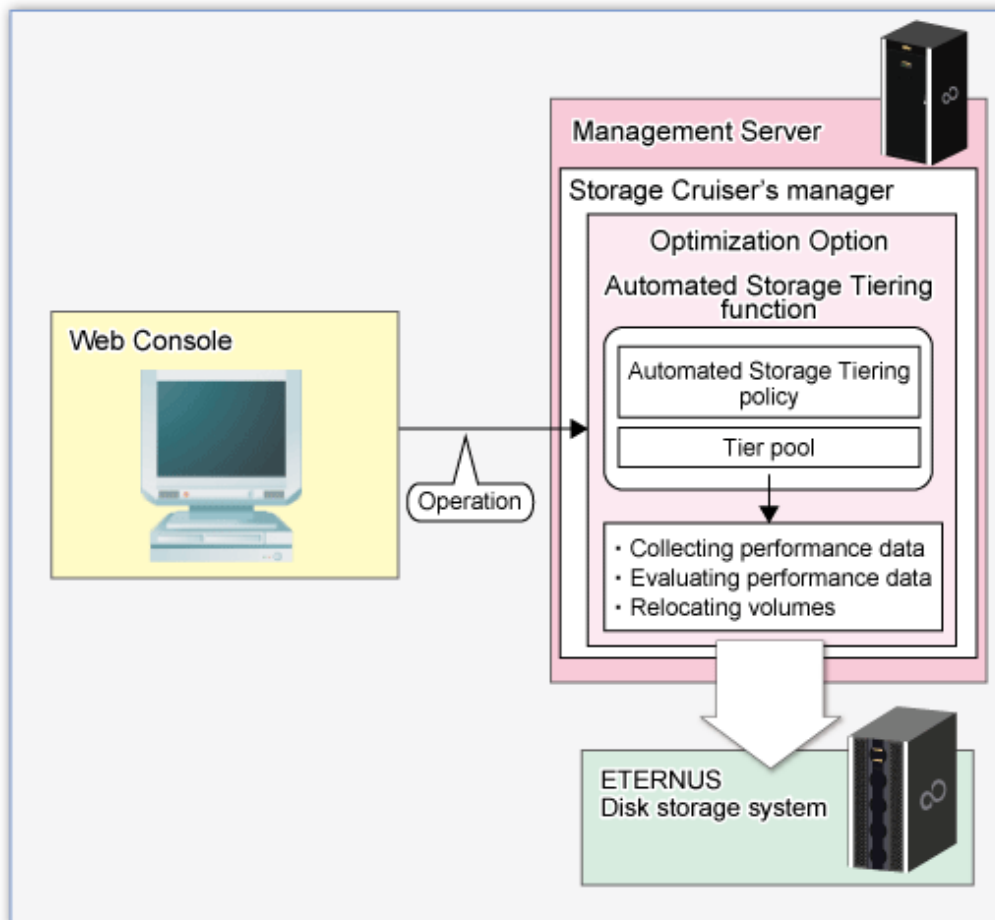
1.2 Operating environment

The Optimization Option can be used in the following environments:

Object	Environment
Platform	Platforms in which ETERNUS SF Manager operates
Required software	ETERNUS SF Storage Cruiser 15.0 or later
Required licenses (software)	- ETERNUS SF Storage Cruiser Standard Edition license - ETERNUS SF Storage Cruiser Optimization Option license
Storage devices (*1) (*4) (hereafter referred to as "Storage device")	- ETERNUS DX80 S2/DX90 S2 - ETERNUS DX400 S2 series - ETERNUS DX8000 S2 series
Required licenses (hardware)	Thin Provisioning license
Connection configuration to servers	No requirements
Target volumes (sources and destinations of migration) (*2)	FTV (Flexible Tier Volume)

*1: The firmware version must be V10L20 or higher. Also Flexible Tier must be activated.

*2: Open volumes and Thin Provisioning Volumes cannot be specified as target volumes.

*3: Flexible Tier Pool supports the following disk types.

Disk type	Use condition
SAS SSD	-
ONLINE SAS	-
NEARLINE SAS	-
SED-SAS	The firmware version must be V10L30 or later

*4: Firmware of V10L50 or later is needed to use the disk auto-select function.

1.3 Explanation of Flexible Tier

Flexible Tier is the function which manages disk drives in the pools and allocates them to virtual logical volumes when the writing from a host occurs. The managed pool is called Flexible Tier pool (FTRP).

FTRP is configured by the tiered sub pools called Tier Sub Pool (FTSP).

The diagram below should give you an idea of a configuration.
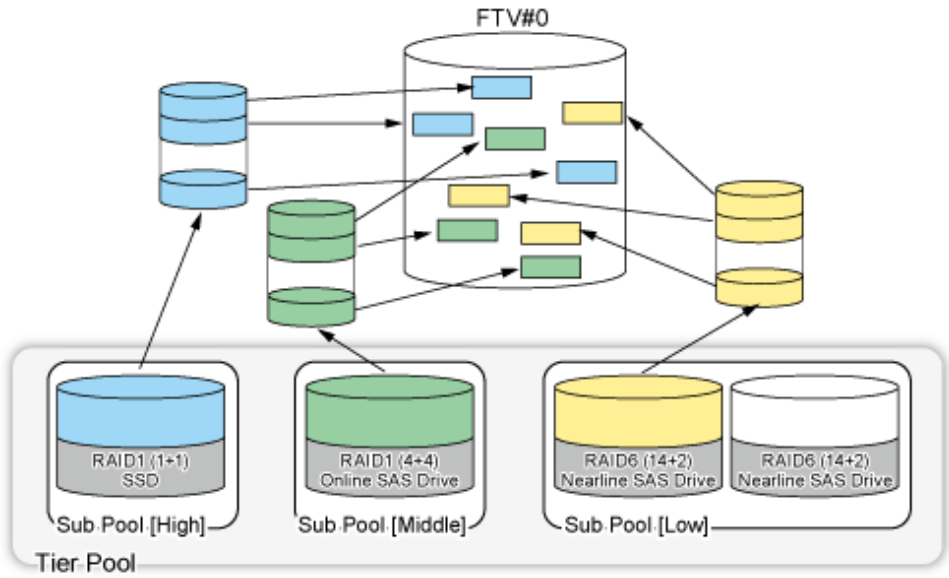
By utilizing Optimization Option, you can easily create FTRPs, FTSPs, and FTVs.

The volumes created in FTRP are subdivided into FTRPs, and are allocated to FTSPs.

By defining a policy, optimization of storage usage is realized by relocated volumes to the appropriate FTSP according to the usage situation from a server.
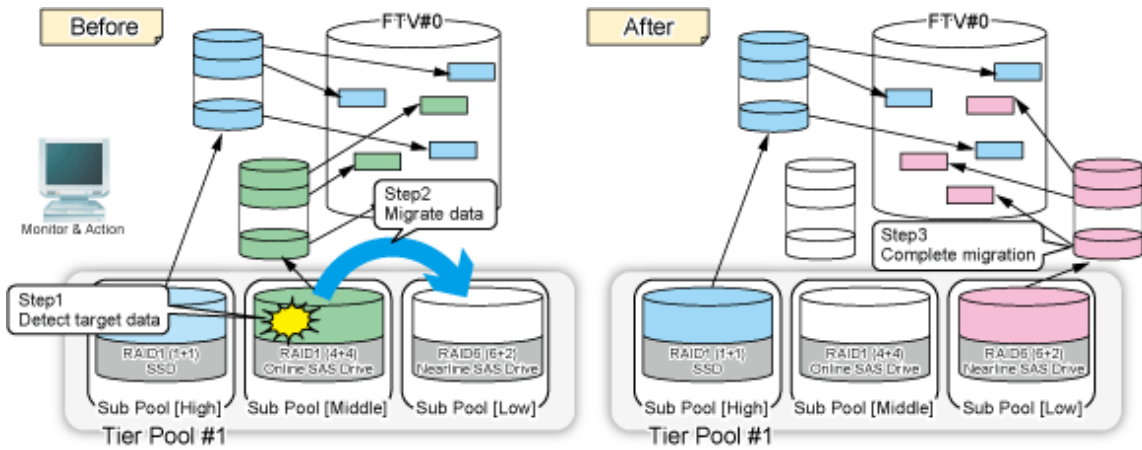
Chapter 2 Design

This chapter describes the design that is required for using the Automated Storage Tiering function.

2.1 Automated Storage Tiering policy

The baseline for migration of volume using the Automated Storage Tiering function is defined as an Automated Storage Tiering policy. The concept of the baseline values to be specified by the Automated Storage Tiering policy is provided below.

- The baseline for volume migration is the "Peak value or average value within the evaluation period for the IOPS of the target volume"
  For the evaluation period, since you can select 4, 6, 8, or 12 hours and 1 to 31 days.
  If you select 1 to 31 days at the evaluation period, you can specify the evaluation time range among 1 day (24 hours).
  Specify an appropriate evaluation period, evaluation time range, and baseline considering their potential impact on transactions that utilize the target volume.

- The baseline for volume migration depends on the system configuration and type of use.
  For this reason, the Automated Storage Tiering function provides 3 operating modes: "Auto", "Semi-Auto", and "Manual".
 By specifying "Semi-Auto" mode or "Manual" mode, you can grasp the target volume and the amount of data on it without volume migration. This is an efficient method for determining or modifying baseline values.
  Description for respective operating modes are as follows:

  - Auto

    All operations are automatically performed in accordance with the policy, from collection and evaluation of performance data required for volume relocation through execution of volume relocation.

  - Semi-Auto

    Collection and evaluation of performance data required for volume relocation are automatically performed in accordance with the policy. However, volume relocation is not performed automatically.

    You need to confirm evaluation results, and manually relocate the volume as necessary.

    This mode is used for modifying the evaluation criteria or selecting an arbitrarily target volume from migration candidate.

  - Manual

    Tiering policy is set to Tier pool. However, nothing is performed automatically.

    You need to confirm evaluation results, and manually relocate the volume as necessary.

    This mode is not used for the periodical operation, but for operation by temporarily changing the baseline value or for determining the validity of the baseline value.

2.2 Tier pool configuration

The Tier pool is configured by the tiered Sub Pools. Delineating different levels of access performance to the Sub Pools ("tiering") allows for appropriate data location depending on the frequency of access.

Access performance to the Sub Pools varies depending on disk types, RAID Levels, and the number of Member Disks of which each Sub Pool consists.

Therefore, besides the disk types "SSD", "Online SAS", "Nearline SAS", and "SED-SAS", etc. Sub Pools can also be configured with different RAID Levels or the number of Member Disks even within the same disk type. Also, by using the disk auto-select function, Sub Pools can be configured by specifying disk capacity instead of the number of Member Disks. Keep the following priorities in mind for the Tier pool configuration as you configure the Sub Pools.

Refer to "*3" at "1.2 Operating environment" for details on the use conditions for respective disk types.

Priority (in descending order of performance)	Disk type	The number of Data Disks	The number of Member Disks	RAID Level			
1	SAS SSD	12	12D+12D	RAID1+0			
2			12D+1P		RAID5		
3		8	8D+8D	RAID1+0			
4			8D+1P		RAID5		
5			8D+2P			RAID6	
6		7	7D+1P		RAID5		
7		6	6D+2P			RAID6	
8		4	4D+4D	RAID1+0			
9			4D+1P		RAID5		
10			4D+2P			RAID6	
11		3	3D+1P		RAID5		
12		2	2D+2P	RAID1+0			
13		1	1D+1D				RAID1
14	ONLINE SAS, SED-SAS	12	12D+12D	RAID1+0			
15			12D+1P		RAID5		
16		8	8D+8D	RAID1+0			
17			8D+1P		RAID5		
18			8D+2P			RAID6	
19		7	7D+1P		RAID5		
20		6	6D+2P			RAID6	
21		4	4D+4D	RAID1+0			
22			4D+1P		RAID5		
23			4D+2P			RAID6	
24		3	3D+1P		RAID5		
25		2	2D+2P	RAID1+0			
26		1	1D+1D				RAID1
27	NEARLINE SAS	12	12D+12D	RAID1+0			
28			12D+1P		RAID5		
29		8	8D+8D	RAID1+0			
30			8D+1P		RAID5		
31			8D+2P			RAID6	
32		7	7D+1P		RAID5		
33		6	6D+2P			RAID6	
34		4	4D+4D	RAID1+0			
35			4D+1P		RAID5		
36			4D+2P			RAID6	
37		3	3D+1P		RAID5		

Priority (in descending order of performance)	Disk type	The number of Data Disks	The number of Member Disks	RAID Level			
38		2	2D+2P	RAID1+0			
39		1	1D+1D				RAID1

Chapter 3 Setup

This chapter describes the setup of Automated Storage Tiering function.

The task flow for the setup of Automated Storage Tiering function is as follows.

Figure 3.1 Task flow for setup of Automated Storage Tiering function
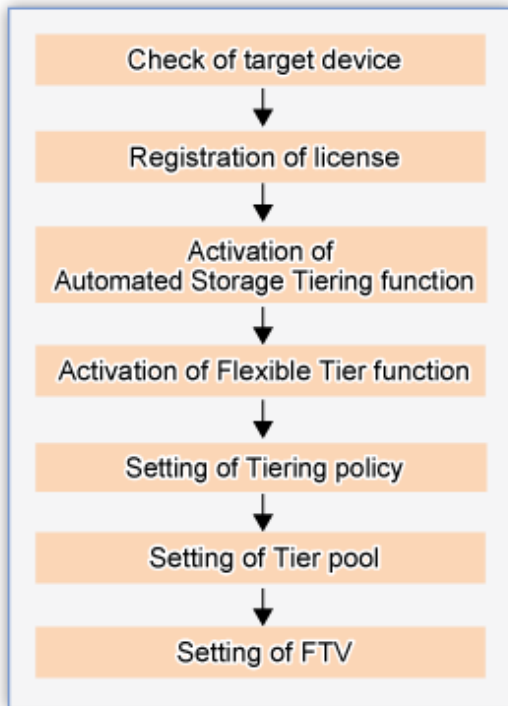
3.1 Check of target device

In order to utilize the Automated Storage Tiering function provided by the Optimization Option, each target storage device must fulfill the following requirements:

- The target device must be registered in ETERNUS SF Manager.

- A Thin Provisioning license must be registered in the target device.

- Firmware version of the target device must be V10L20 or higher.

The above status can be checked in the Web Console. Refer to the following sections in the *ETERNUS SF Web Console Guide* for information on checking methods.

- Check the target device's registration status
  "Display ETERNUS Disk storage system"

- Check the license registration status
  "Display the license"

- Check the firmware version
  "Display ETERNUS Disk storage system"

3.2 Registration of license

The Optimization Option becomes available by registering the license on the server on which ETERNUS SF Manager is installed. No new installation of software is required.

The license registration is performed from the Web Console. Refer to "Register the license" in the *ETERNUS SF Web Console Guide* for information on registration methods.

3.3 Activation of Automated Storage Tiering function

Activate the function for using the Automated Storage Tiering function. Implement the following procedure for the platform which you use.

For Windows:

From the Windows **Services** screen, start the [ETERNUS SF Storage Cruiser Optimization Option] service.

At the time of product installation, the Startup type for this service is set to [Manual]. Change the startup type to [Automatic] on an as needed basis.

For Solaris and Linux:

Run the following command to start the [ETERNUS SF Storage Cruiser Optimization Option] daemon.

```
# /opt/FJSVssast/bin/astctl start
```

During installation of the product, this daemon is not set to start automatically. For starting this daemon automatically, change settings by running the following commands.

- Solaris

```
# /bin/ln -s /etc/init.d/init.FJSVssast /etc/rc0.d/K00FJSVstopFJSVssast
# /bin/ln -s /etc/init.d/init.FJSVssast /etc/rc1.d/K00FJSVstopFJSVssast
# /bin/ln -s /etc/init.d/init.FJSVssast /etc/rc2.d/S99FJSVstartFJSVssast
# /bin/ln -s /etc/init.d/init.FJSVssast /etc/rcS.d/K00FJSVstopFJSVssast
```

- Linux

```
# /sbin/chkconfig startASTManager on
```

3.4 Activation of Flexible Tier function

Activate the function for using the Flexible Tier function.

Flexible Tier function is set from the Web Console.

The setup procedure is as follows:

1. Click **Storage** on the global navigation tab.
   The current registered ETERNUS Disk storage systems are displayed on the Main pane.

2. Select a target ETERNUS Disk storage system on the Main pane.

3. Click **Automated Storage Tiering** on the Category pane.

4. Click **Settings** on the **Automated Storage Tiering** pane.

For the Flexible Tier function, two types of action are available: **On** and **Off**.
On can be selected only when [FTR Function Status] is "Off".
Off can be selected only when [FTR Function Status] is "On".

Note

- When enabling the Flexible Tier function, the work volumes which the Flexible Tier function creates automatically are required.

  When the number of volumes which can be created is insufficient, the Flexible Tier function cannot be enabled.

  The number of work volumes for each model of devices is as follows:

  - For ETERNUS DX80 S2/DX90 S2: 32 volumes

  - For ETERNUS DX400 S2 series: 64 volumes

- For ETERNUS DX8000 S2 series: 64 volumes

- Before disabling the Flexible Tier function, it is necessary to delete all the FTRPs.

3.5 Setting of Tiering policy

In Tiering policies, specify the conditions for implementing Automated Storage Tiering function.

Automated Storage Tiering function automatically reallocates volumes to FTVs in Tier pool within the same device according to the set Tiering policy.

Tiering policies can also be allocated to multiple Tier pools, either within the same or different ETERNUS Disk storage systems.

Tiering policies are set from the Web Console.

The setup procedure is as follows:

1. Click **Storage** on the global navigation tab.
   The current registered ETERNUS Disk storage systems are displayed on the Main pane.

2. Select a target ETERNUS Disk storage system on the Main pane.

3. Click **Automated Storage Tiering** on the Category pane.

4. Click **Tiering policy** on the **Automated Storage Tiering** pane.
   The current registered Tiering policies are displayed on the Main pane.

For Tiering policies, three types of action are available: **Create**, **Delete**, and **Modify**.

If there is no existing Tiering policy in the ETERNUS SF Manager, only **Create** can be selected, while the other actions cannot be selected.

Modify cannot be executed simultaneously for multiple Tiering policies. **Modify** can be selected only when a single Tiering policy is selected. If you select multiple Tiering policies, action is grayed out.

A Tiering policy that is assigned to a Tier pool cannot be deleted.

Likewise, if a Tiering policy is already assigned to a Tier pool and the Automated Storage Tiering function is running, the relevant Tier pool cannot be modified.

Simplification of Tiering policy specification

Setting the range of IOPS values specified for each tier of the Tiering policy can be omitted.

Also, the IOPS value range setting field was added under the "High settings" heading. As for the input range, it is not displayed in the initial display.

The user can create a Tiering policy with no awareness of IOPS range settings.

Setting values other than the policy name as default allows the user to create a Tiering policy just by specifying the policy name.

Also, as before, you can create a Tiering policy that specifies each tier's IOPS value.

When setting the range of IOPS values is omitted, relocation is carried out according to the Pool configuration. The logic for relocation is as follows:

- FTRPE is sorted in ascending order of IOPS value and the FTRPE with the highest IOPS value sorted to the top Sub Pool, and so on.

- In case of Auto mode, all FTRPE are targeted. In Semi-Auto mode and Manual mode, FTRPE included in FTV specified for relocation are targeted. However, effects of relocation on Sub Pool actual I/O are avoided by preparing a reserve domain that corresponds to 10% of the FTSP for each Sub Pool. The size of the reserve domain is 10% of the size of the Sub Pool (fixed). Also, frequent relocation will affect actual I/O performance so FTRPE that is 5% above and below the boundary of each tier is not transfered. Specifically, FTRPE that fulfill the following conditions are not relocated.

  - In FTRPE that falls in the lower 5% range of IOPS, the "Current tier" is one tier below the "Post-transfer tier"

  - In FTRPE that falls in the higher 5% range of IOPS, the "Current tier" is one tier above the "Post-transfer tier"

Figure 3.2 Summary of relocation in accordance with Pool configuration
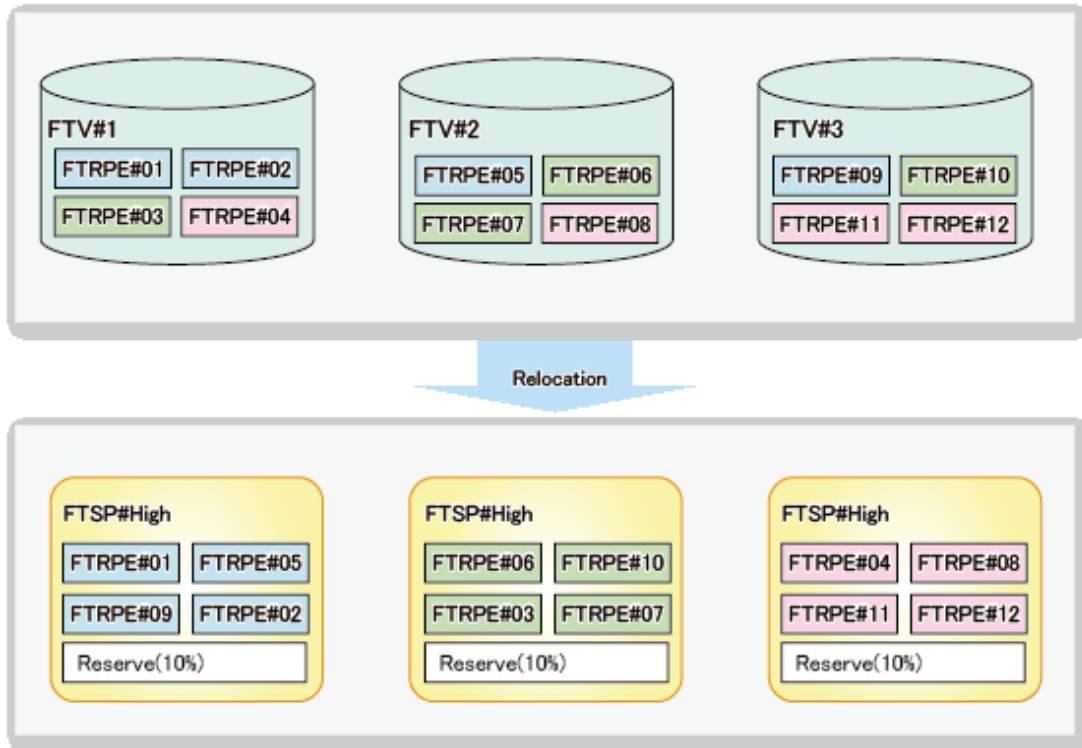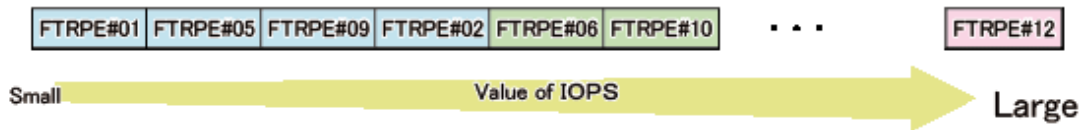
Figure 3.3 FTRPE transfer in the boundary of each Sub Pool
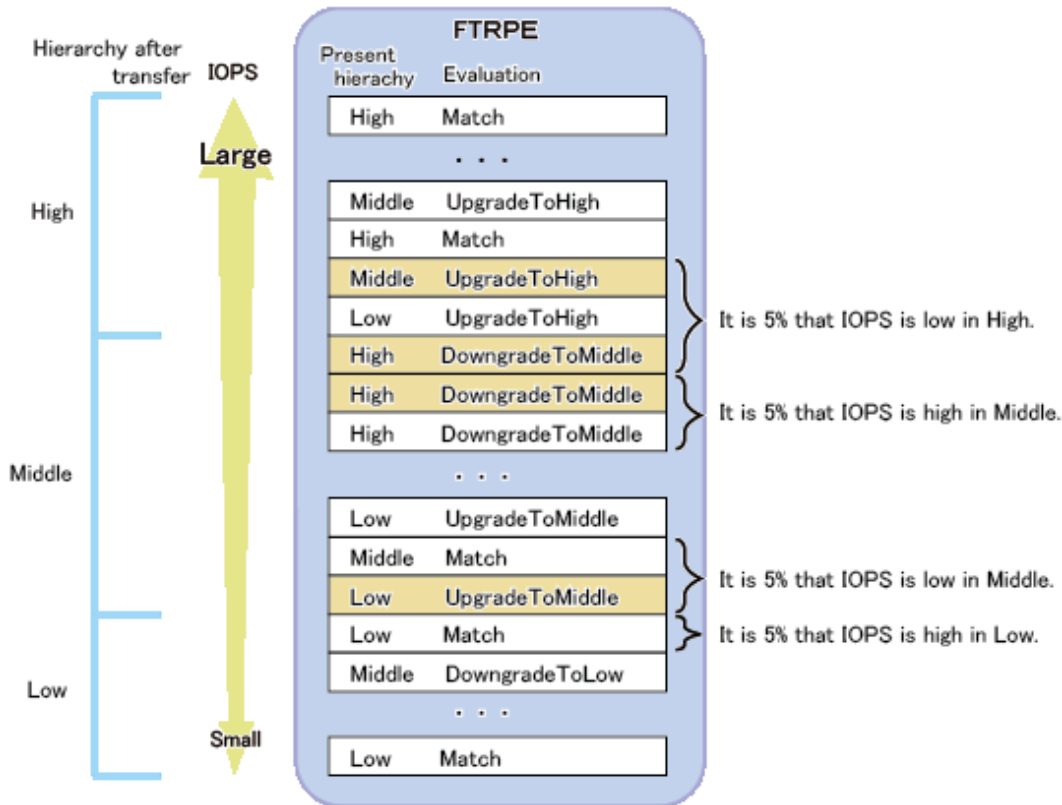
3.5.1 Creation of Tiering policies

You can create multiple Tiering policies, and you can also define the identical Tiering policy to multiple Tier pools.

The following items can be specified in Tiering policy:

No.	Item Name	Specification	Meaning	Input Conventions
1	Policy Name	Required	Name that defines Tiering policy	Specify a unique name overall. You can specify alphanumeric characters, "-", "_", and "#" with length from 1 to 16 characters. Note: The Policy name is not case-sensitive.
2	Execute Mode	Required	Operating mode of Tiering function	Mode in which to execute processing for Tiering function. Select from the following: - Auto - Semi-Auto - Manual The default mode is "Auto".
3	Type	Required	Type of target data	Select "IOPS" from pulldown list.
4	Evaluation Method	Required	Evaluation method of target data	Select "Peak" or "Average" from pulldown list.
5	Interval	Required	Evaluation interval for target data	Select a number and a unit ("Hour" or "Day").

No.	Item Name	Specification	Meaning	Input Conventions
				If the unit is "Hour", you can specify "4", "6", "8", or "12".
				If the unit is "Day", you can specify the number from 1 to 31.
				The default mode is "1day ".
6	Evaluated Timeframe	Required	Evaluation time range	This selection is available only when the unit of [Interval] is "Day". Valid input range: "00" - "23". The default is from "00" to "00". If you specify from "00" to "00", 24 hours are evaluated.
				Note: If the unit of [Interval] is "Hour", execution starts at the specified time ("4", "6", "8", or "12" hours).
7	Execute Time	Required	Time at which to start collection and evaluation of evaluation data, and relocation of volume	This selection is available only when the [Execute Mode] is "Auto" or "Semi-Auto" and the unit of [Interval] is "Day".
				Valid input range: "00:00" - "23:59". The default is "00:00".
				Note: If the unit of [Interval] is "Hour", execution starts at the specified time ("4", "6", "8", or "12" hours).
8	Expire Time	Required	Specification of time for terminating relocation of volume after execution time has elapsed	The default is "00" (no termination).
				If the unit of [Interval] is "Day", you can specify the number from 00 to 24. If the unit of [Interval] is "Hour", you can specify the number from 00 to the value of evaluation interval.
9	Low Range	As needed	Specification of "Low Tier"	Specify the maximum value. You can also specify decimal fractions. The minimum value is set to "0", and "-" is displayed on the Main pane in the Tiering policy.
				If the range has not been set, "-:-" is displayed in the main pane of the Tiering policy.
				Note: If the low range has been specified, the middle range and high range must be specified as well. Also, if the low range has been omitted, the middle range and high range cannot be specified. (*1)
10	Middle Range	As needed	Specification of "Middle Tier"	Specify the minimum and maximum values. You can also specify decimal fractions. If a range is not set, "-:-" is displayed on the Main pane in the Tiering policy.
				Note: Not required in 2-tier configuration.
				Note: If the middle range has been specified, the low range and high range must be specified as well. Also, if the middle range has

No.	Item Name	Specification	Meaning	Input Conventions
				been omitted at 3-tier configuration, the low range and high range cannot be specified (*1).
11	High Range	As needed	Specification of "High Tier"	Specify the minimum value. You can also specify decimal fractions. The maximum value is set to "2147483647", and "-" is displayed on the Main pane in the Tiering policy.
				If the range has not been set, "-:-" is displayed in the main pane of the Tiering policy.
				Note: If the high range has been specified, the low range and middle range must be specified as well. Also, if the high range has been omitted, the low range and middle range cannot be specified (*1).

*1: If the range has not been specified, the system automatically conducts relocation

3.5.2 Deletion of Tiering policies

When registered Tiering policies are no longer necessary, delete them.

You can delete multiple Tiering policies at once.

However, you cannot delete a Tiering policy that is already assigned to a Tier pool.

3.5.3 Modification of Tiering policies

When you modify the operation for registered Tiering policies, modify the contents defined in Tiering policies. You cannot modify multiple Tiering policies at once. If you need to modify multiple Tiering policies, modify them one by one.

Likewise, if a Tiering policy is already assigned to a Tier pool and Automated Storage Tiering function is running, the relevant Tiering policy cannot be modified.

3.6 Setting of Tier pool

Tier pools are registered as FTRPs (Flexible Tier Pools) of the storage devices.

Creating Tier pools creates both FTRPs and FTSPs (Flexible Tier Sub Pools), allowing to also create FTVs.

Tier pool is set from the Web Console.

The setup procedure is as follows:

1. Click **Storage** on the global navigation tab.
   The current registered ETERNUS Disk storage systems are displayed on the Main pane.

2. Select a target ETERNUS Disk storage system on the Main pane.

3. Click **Automated Storage Tiering** on the Category pane.

4. Click **Tier pool** on the **Automated Storage Tiering** pane.
   The current registered Tier pools are displayed on the main pane.

For Tier pools, four types of action are available: **Create**, **Delete**, **Modify**, and **Expand sub-pool capacity**.

If there is no existing Tier pool in the target device, only **Create** can be selected, while the other actions cannot be selected.

Multiple Tier pools can be deleted at once, but Tier pools that contain FTVs cannot be deleted.

You cannot modify multiple Tier pools at once.

Likewise, Tier pools in which Automated Storage Tiering function is running cannot be modified or deleted.

Specifying a master CM

A master CM can be specified when performing the following operations.

- When creating a Tier pool

- When expanding the capacity of the Sub Pool

A master CM is specified with the CM number and CPU number pair.

One or more master CMs can be specified and specifying them for the Tier pool allows specification of a master CM for the entire Tier pool.

If multiple master CMs are specified for the Tier pool, a master CM is set from among the specified master CMs by the round-robin formula.

Also, a master CM can be selected from among the multiple master CMs specified for the Tier pool when each Sub Pool is created.

A master CM is assigned by the round-robin formula when Sub Pool capacity is expanded, accounting for the master CM already assigned to each Sub Pool that was created previously. It can also be specified from the master CMs shown on the master CM list.

If specifying a master CM has been omitted, it is automatically assigned by implementation from the device side, as before.

Configuration when new in case of ETERNUS with 2-CM configuration

No	Tier pool specification	Sub Pool specification			Master CM to be set		
		Low	Middle	High	Low	Middle	High
1	CM#0	-	-	-	CM#0	CM#0	CM#0
2	CM#0,CM#1	-	-	-	CM#0	CM#1	CM#0
3	CM#0,CM#1	CM#1	-	-	CM#1	CM#0	CM#1
4	CM#0,CM#1	-	CM#1	-	CM#0	CM#1	CM#0
5	CM#0,CM#1	-	-	CM#1	CM#0	CM#1	CM#1

Configuration when adding capacity in case of ETERNUS with 2-CM configuration

No	Tier pool specification	Set master CM			Sub Pool to be added	Master CM to be assigned
		Low	Middle	High		
1	CM#0,CM#1	CM#0	CM#1	CM#0	Low	CM#1
2	CM#0,CM#1	CM#1	CM#0	CM#1	Middle	CM#0
3	CM#0,CM#1	CM#0	CM#1	CM#0	High	CM#1
4	CM#0,CM#1	CM#0	CM#1	CM#1	Low1,Low2	CM#0(Low1),CM#0(Low2)

Disk auto-selection

The disk can be automatically selected when performing the following operations.

- When creating a Tier pool

- When expanding the capacity of the Sub Pool

Specify the necessary physical capacity when selecting automatically.

The disk can also be selected manually, as before.

3.6.1 Creation of Tier pools

You can create multiple Tier pools, but you cannot define multiple Tiering policies for a Tier pool.

The following items can be specified for each Tier pool:

No.	Item Name	Specification	Meaning	Input Conventions
1	Pool Name	Required	Tier pool name	Specify a unique name overall. You can specify alphanumeric characters, "-", "_", and "#" with length from 1 to 16 characters. Note: The Pool name is not case-sensitive.
2	Number of tiers	Required	Number of Tier pool tiers to be created	This can only be specified when the Automated Storage Tiering function is enabled. Specify 2 or 3. The default is 2.
3	Policy Name	Required	Name of Tiering policy	Select an already defined Tiering policy.
4	Warning	As needed	Warning threshold value for pool which is received from devices	Specify a decimal number between 5 and 99. Note: You cannot set a value that is smaller than the caution threshold.
5	Caution	As needed	Cautions threshold value for pool which is received from devices	Specify a decimal number between 5 and 80. If you set this value to "0", notification of cautions will be disabled.
6	Encryption	Required	Status of pool encryption	Specify "Yes"(valid) or "No"(invalid). Default is "No"(invalid).
The following settings are made separately for each of the "Low" (required), "Middle" (as needed) and "High" (required) sub pools.				
7	Master CM	As needed	Tier pool master CM	Specify the CM that is on the device. The default is None (Auto).
8	FTSP name	As needed	Sub Pool name	Specify a unique name within the storage device. You can specify alphanumeric characters, "-", "_", and "#" with length from 1 to 16 characters. Not case-sensitive.
9	Disk	Required	Type of disk	Select from "SSD", "Online", "Nearline", and "SED-SAS". Refer to "*3" at "1.2 Operating environment" for details on the use conditions for respective disk types.
10	Reliability	Required	RAID Level of Sub Pool	Select from the following: - High Performance(RAID1+0) - High Capacity(RAID5) - High Reliability(RAID6) - Mirroring(RAID1) - Striping(RAID0)
11	Stripe Depth	As needed	Stripe depth	Specify the size per disk for a stripe in a RAID Group. Select from the following: - 64

No.	Item Name	Specification	Meaning	Input Conventions
				- 128
				- 256
				- 512
				- 1024
				When the selected "Reliability" is Mirroring (RAID1), this item cannot be selected.
12	Disk	Required	Disk in Sub Pool	Choose the disk which constitutes sub pool.
13	Minimum required capacity	As needed	Minimum capacity required for the disk	Specify when selecting the disk automatically. The specification of the decimal is also possible.
14	Disk auto-selection	As needed	Select disk automatically	The disk can be selected automatically. (*1) The default is Manual selection (no check). The minimum required capacity must be specified for automatic selection.
15	CM	As needed	Master CM of the RAID Group to be created	When a master CM has been specified, one RAID Group master CM can be specified from among the specified master CMs. The default is None (Auto). In case of disk auto-selection, two can be specified.

*1: Firmware of V10L50 or later is required to use the disk auto-select function.

3.6.2 Deletion of Tier pools

When deleting Tier pools, multiple Tier pools can be deleted at once. However, Tier pools that contain FTVs cannot be deleted.

Likewise, Tier pools in which Automated Storage Tiering function is running cannot be deleted.

In order to check the current status of a Tier pool, refer to the Tier pool's Overview screen and the detailed screen displayed by selecting a Tier pool number.

3.6.3 Modification of Tier pools

You can modify the contents defining a Tier pool as necessary, but you cannot modify multiple Tier pools at once.

Likewise, Tier pools in which Automated Storage Tiering function is running cannot be modified.

In order to check the current status of a Tier pool, refer to the Tier pool's Overview screen and the detailed screen displayed by selecting a Tier pool number.

The following items can be specified for modifying a Tier pool.

No	Item Name	Specification	Meaning	Input Conventions
1	Warning	Required	Warning threshold value for pool which is received from devices	Specify a decimal number between 5 and 99. Note: You cannot set a value that is smaller than the caution threshold.

No	Item Name	Specification	Meaning	Input Conventions
2	Caution	Required	Cautions threshold value for pool which is received from devices	Specify a decimal number between 5 and 80. If you set this value to "0", notification of cautions will be disabled.

3.6.4 Expansion of Sub Pool capacity

You can increase the capacities of Sub Pools of which a Tier pool consists.

The following items can be specified for expanding Sub Pool capacities:

No.	Item Name	Specification	Meaning	Input Conventions
1	Master CM	As needed	Tier pool master CM	When creating a Tier pool, if a master CM has been specified, a master CM can be added. There is no addition by default.
2	FTSP name	Required	Sub Pool name to be expanded	Same as at the time of creation
3	Minimum required capacity	As needed	Minimum capacity required for the disk	Specify when selecting the disk automatically. The specification of the decimal is also possible.
4	Disk auto-selection	As needed	Select disk automatically	The disk can be selected automatically. (*1) The default is Manual selection (no check). The minimum required capacity must be specified for automatic selection.
5	CM	As needed	Master CM of the RAID Group to be expanded	When a master CM has been specified, one RAID Group master CM can be specified from among the specified master CMs. The default is None (Auto). In case of disk auto-selection, two can be specified.
6	Disk	Required	Disk in Sub Pool	Same as at the time of creation

*1: Firmware of V10L50 or later is required to use the disk auto-select function.

Note

Expanding the capacity of the Sub Pool leads to deviation of data in the Sub Pool and brings about variations in access performance. Perform the Balancing Flexible Tier Pool using the ETERNUS Web GUI or ETERNUS CLI in order to eliminate data deviation. Refer to the ETERNUS Web GUI online help for information on how to perform the Balancing Flexible Tier Pool.

Perform the Balancing Flexible Tier Pool after stopping the Automated Storage Tiering function. Performing the Balancing Flexible Tier Pool with the Automated Storage Tiering function running may cause the Automated Storage Tiering function to malfunction. Refer to "4.1.4 StoppingAutomated Storage Tiering" for information on how to stop the Automated Storage Tiering function.

3.7 Setting of FTV

In a Tier pool, only a FTV (Flexible Tier Volume) can be created.

A FTV is created from the Web Console, it cannot be created from ETERNUS Web GUI.

The setup procedure is as follows:

1. Click **Storage** on the global navigation tab.
   The current registered ETERNUS Disk storage systems are displayed on the Main pane.

2. Select a target ETERNUS Disk storage system on the Main pane.

3. Click **Automated Storage Tiering** on the Category pane.

4. Click **FTV** on the **Automated Storage Tiering** pane.
   The current registered FTVs are displayed on the Main pane.

For a FTV, four types of action are available: **Create**, **Delete**, **Modify**, and **Format**.

If there is no existing FTV, only **Create** can be selected, while the other actions cannot be selected.

Multiple FTVs can be deleted at once. However, FTV which is already assigned to a server cannot be deleted.

Multiple FTVs cannot be modified or formatted.

Ratio for FTV is percentage per tier, based on "100" as the total physical capacity assigned to the FTV.
Since the usage rate of FTV is rounded off to one decimal place, the total may not be 100%.

Setting the FTV capacity quota ratio

You can set the quota ratio for the capacity of each Sub Pool in the Tier pool when creating or making changes to FTV.

For FTV with a set quota ratio, relocation to each Sub Pool is carried out according to the quota ratio.

For FTV for which a quota ratio has not been specified, relocation is carried out according to the Tiering policy specified in the Tier pool.

The logic for the case when the FTV quota ratio has been specified is as follows:

- For FTRPE that constitutes FTV, IOPS values are sorted in ascending order and relocation to the Sub Pool performed so that the specified capacity quota ratio starts with the FTRP with high IOPS values. However, effects of relocation on Sub Pool actual I/O are avoided by preparing a reserve domain that corresponds to 10% of the FTSP for each Sub Pool. The size of the reserve domain is 10% of the size of the Sub Pool (fixed).

- If free space that corresponds to the quota ratio cannot be secured, relocation is performed with as much capacity as can be secured. Therefore, relocation may not proceed according to the specified quota ratio.

Figure 3.4 Relocation according to capacity quota ratio specification
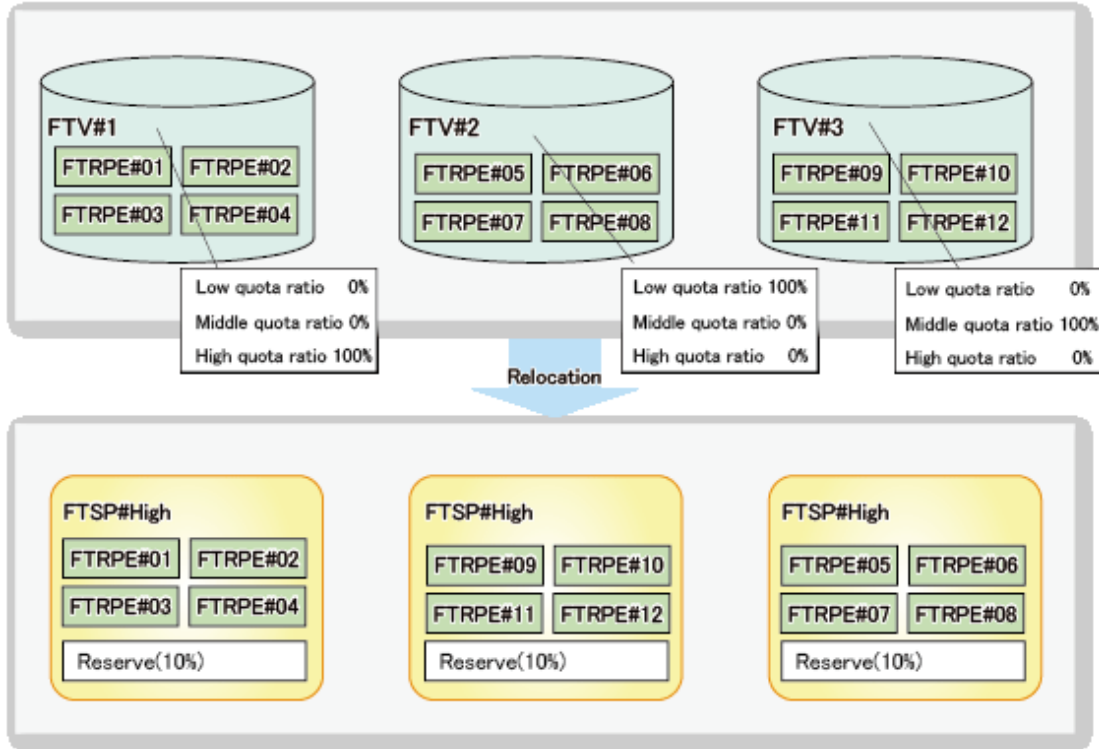
3.7.1 Creation of FTV

Create a FTV.

The following items can be specified for each FTV:

No.	Item Name	Specification	Meaning	Input Conventions
1	Pool Name	Required	Pool name in which a FTV is created	Specify an existing Tier pool name.
2	FTV Name	As needed	FTV name to be created	Specify a unique name within the storage device. You can specify alphanumeric characters and symbols, with length from 1 to 16 characters. (except ".", "?", " ' ", and " " ") Not case-sensitive.
3	Total Capacity	Required	Volume capacity to be created	Available unit is either one of "MB", "GB" or "TB".
4	Number of Volumes	Required	Number of volumes to be created	-
5	Caution	As needed	Caution threshold value	Specify a decimal number between 1 and 200. If not specified, "10%" is set.
6	Priority FTSP	As needed	FTSP name allocated with higher priority	Allocate to given FTSP if not specified otherwise.
7	Low quota ratio	As needed	Low quota ratio when relocating	Specify the low quota ratio (%) when relocating at 0 to 100. When specifying the low quota ratio, middle quota ratio, and high quota ratio, specify so that the total adds up to 100%. Note: If a low quota has been specified, a middle quota ratio and a high quota ratio must

No.	Item Name	Specification	Meaning	Input Conventions
				also be specified. Also, if a low quota ratio has been omitted, a middle quota ratio and a high quota ratio cannot be specified. (*1)
8	Middle quota ratio	As needed	Middle quota ratio when relocating	Specify the middle quota ratio (%) when relocating at 0 to 100. When specifying the low quota ratio, middle quota ratio, and high quota ratio, specify so that the total adds up to 100%. Note: Need not be specified in case of 2-tier configuration. Note: When a middle quota has been specified, a low quota ratio and a high quota ratio must also be specified. Also, when a middle quota ratio has been omitted with 3-tier configuration, a low quota ratio and a high quota ratio cannot be specified. (*1)
9	High quota ratio	As needed	High quota ratio when relocating	Specify the high quota ratio (%) when relocating at 0 to 100. When specifying the low quota ratio, middle quota ratio, and high quota ratio, specify so that the total adds up to 100%. Note: When a high quota has been specified, a low quota ratio and a middle quota ratio must also be specified. Also, when a high quota ratio has been omitted, a low quota ratio and a middle quota ratio cannot be specified. (*1)

*1: The quota ratio is a reference and assignment may not proceed as specified. Also, if the quota ratio has been omitted, relocation will proceed based on the Tiering policy.

3.7.2 Deletion of FTV

To delete a FTV, select the target FTV on the Overview screen, and click **Delete**. Multiple FTVs can be deleted at once, but FTVs that assigned to a server cannot be deleted.

For details on FTV information, check the detailed screen displayed by selecting a FTV number from the Overview screen of FTV.

3.7.3 Modification of FTV

To modify the contents defined in FTVs, select the target FTV on the Overview screen and click **Modify**. You cannot modify the contents defined in multiple FTVs.

For details on FTV information, check the detailed screen displayed by selecting a FTV number from the Overview screen of FTV.

The following items can be modified for each FTV:

No.	Item Name	Specification	Meaning	Input Conventions
1	FTV Name	Required	FTV name to be created	Same as at the time of creation.
2	Total Capacity	Required	Volume capacity to be created	Same as at the time of creation.
3	Caution	Required	Caution threshold value	Specify a decimal number between 1 and 200.
4	Priority FTSP	As needed	FTSP name allocated with higher priority	Same as at the time of creation.
5	Low quota ratio	As needed	Low quota ratio when relocating	Same as at the time of creation.

No.	Item Name	Specification	Meaning	Input Conventions
6	Middle quota ratio	As needed	Middle quota ratio when relocating	Same as at the time of creation.
7	High quota ratio	As needed	High quota ratio when relocating	Same as at the time of creation.

3.7.4 Format of FTV

Format a FTV. During creation of the FTV, format is executed automatically.

To format a FTV, select the target FTV on the Overview screen and click **Format**. Multiple FTVs cannot be formatted at once.

Chapter 4 Operation

This chapter describes operation of Automated Storage Tiering function.

4.1 Operation task flow

Automated Storage Tiering function works differently for each execution mode that is set in the Tiering policy.

In addition, when you update the status of volume relocation, the evaluation result, and the log, the procedure to start is as follows:

1. Click **Storage** on the global navigation tab.
   The current registered ETERNUS Disk storage systems are displayed on the Main pane.

2. Select a target ETERNUS Disk storage system on the Main pane.

3. Click **Automated Storage Tiering** on the Category pane.

4. Click **Overview** on the **Automated Storage Tiering** pane.

5. Click **Reload Status** under **Automated Storage Tiering** on the Action pane.

4.1.1 Operation in "Auto" mode

The procedure to start Auto mode operation is as follows:

1. Click **Storage** on the global navigation tab.
   The current registered ETERNUS Disk storage systems are displayed on the Main pane.

2. Select a target ETERNUS Disk storage system on the Main pane.

3. Click **Automated Storage Tiering** on the Category pane.

4. Click **Tier pool** on the **Automated Storage Tiering** pane.
   The current registered Tier pools are displayed on the Main pane.

5. Check the Tier pool checkbox in which is specified Tiering policy for Auto mode on the Main pane.

6. Click **Start** under **Automated Storage Tiering** on the Action pane.
   The volume relocation begins.

The procedure to check the relocation status of volumes is as follows:

1. Click **Storage** on the global navigation tab.
   The current registered ETERNUS Disk storage systems are displayed on the Main pane.

2. Select a target ETERNUS Disk storage system on the Main pane.

3. Click **Automated Storage Tiering** on the Category pane.

4. Click **Overview** on the **Automated Storage Tiering** pane.
   The relocation status of volumes is displayed on the Main pane.
   The volumes that wait for relocation and whose relocation is in progress are displayed on the Overview screen. The volumes whose relocation has finished are not displayed. Check the relocation result from the log for volume relocation.

The procedure to check the log for volume relocation is as follows:

1. Click **Storage** on the global navigation tab.
   The current registered ETERNUS Disk storage systems are displayed on the Main pane.

2. Select a target ETERNUS Disk storage system on the Main pane.

3. Click **Automated Storage Tiering** on the Category pane.

4. Click **Tier pool** on the **Automated Storage Tiering** pane.
   The current registered Tier pools are displayed on the Main pane.

5. Check the Tier pool checkbox which confirms the volume relocation log on the Main pane.

6. Click the pool number on the Main pane to display detailed information.

7. Click the **History** tab on the Main pane.

4.1.2 Operation in "Semi-Auto" mode

The procedure to start Semi-Auto mode operation is as follows:

1. Click **Storage** on the global navigation tab.
   The current registered ETERNUS Disk storage systems are displayed on the Main pane.

2. Select a target ETERNUS Disk storage system on the Main pane.

3. Click **Automated Storage Tiering** on the Category pane.

4. Click **Tier pool** on the **Automated Storage Tiering** pane.
   The current registered Tier Pools are displayed on the Main pane.

5. Check the Tier pool checkbox in which is specified Tiering policy for Semi-Auto mode on the Main pane.

6. Click **Start** under **Automated Storage Tiering** on the Action pane.

The procedure to check evaluation results and perform volume relocation is as follows:

1. Click **Storage** on the global navigation tab.
   The current registered ETERNUS Disk storage systems are displayed on the Main pane.

2. Select a target ETERNUS Disk storage system on the Main pane.

3. Click **Automated Storage Tiering** on the Category pane.

4. Click **Overview** on the **Automated Storage Tiering** pane.
   The evaluation results are displayed on the Main pane.

5. Check the evaluation results checkbox which performs the volume relocation.

6. Click **Execute** under **Automated Storage Tiering** on the Action pane.
   The volume relocation begins.

4.1.3 Operation in "Manual" mode

The procedure to start Manual mode operation is as follows:

Note

In Manual mode, when you start evaluation within an hour after executing volume relocation, creating Tier pools, or adding/deleting FTVs, the evaluation information may not be sufficient for accurate evaluation.

1. Click **Storage** on the global navigation tab.
   The current registered ETERNUS Disk storage systems are displayed on the Main pane.

2. Select a target ETERNUS Disk storage system on the Main pane.

3. Click **Automated Storage Tiering** on the Category pane.

4. Click **Tier pool** on the **Automated Storage Tiering** pane.
   The current registered Tier pools are displayed on the Main pane.

5. Check the Tier pool checkbox in which is specified Tiering policy for Manual mode on the Main pane.

6. Click **Evaluation** under **Automated Storage Tiering** on the Action pane.

The procedure to check evaluation result and perform volume relocation is as follows:

1. Click **Storage** on the global navigation tab.
   The current registered ETERNUS Disk storage systems are displayed on the Main pane.

2. Select a target ETERNUS Disk storage system on the Main pane.

3. Click **Automated Storage Tiering** on the Category pane.

4. Click **Overview** on the **Automated Storage Tiering** pane.
   The evaluation results are displayed on the Main pane.

5. Check the evaluation result checkbox which performs the volume relocation on the Main pane.

6. Click **Execute** under **Automated Storage Tiering** on the Action pane.
   The volume relocation begins.

4.1.4 StoppingAutomated Storage Tiering

The procedure to stop the Automated Storage Tiering is as follows:

1. Click **Storage** in the global navigation tab.
   The current registered ETERNUS Disk storage systems are displayed on the Main pane.

2. Select a target ETERNUS Disk storage system on the Main pane.

3. Click **Automated Storage Tiering** on the Category pane.

4. Click **Tier pool** on the **Automated Storage Tiering** pane.
   The current registered Tier pools are displayed on the Main pane.

5. Check the Tier pool checkbox in which the Automated Storage Tiering has been started on the Main pane.

6. Click **Stop** under **Automated Storage Tiering** on the Action pane.
   The Automated Storage Tiering stops.

4.2 Relocation of volume

For checking the progress of volume relocation, click **Overview** on the **Automated Storage Tiering** pane.

The following items are displayed in the Overview:

Item	Description
Date	Date and time of evaluating performance data
Tier Pool Name	Tier pool name which contains the volume
FTV Number	Volume number
FTV Name	Volume name
Policy Name	Tiering policy name which is applied to the Tier pool
Execute Mode	Operation mode for Tiering function - Auto - Semi-Auto - Manual
Keep High	Percentage (%) of "High" data that is not migrated
Move to High	Percentage (%) of data to be migrated from "Low" and "Middle" to "High"
Move to Middle(up)	Percentage (%) of data to be migrated from "Low" to "Middle"
Keep Middle	Percentage (%) of "Middle" data that is not migrated
Move to Middle(down)	Percentage (%) of data to be migrated from "High" to "Middle"
Move to Low	Percentage (%) of data to be migrated from "High" and "Middle" to "Low"
Keep Low	Percentage (%) of "Low" data that is not migrated
Status	Current status (progress) of relocation

Item	Description
	- Evaluated: Volume which is a target of relocation in "Semi-Auto" mode
	- Reallocating: Volume for which relocation is currently in progress
	- Waiting: Volume which is a target of relocation and waiting for execution
	- Suspended: Volume which is stop relocation
	The volume whose relocation has finished is not displayed. Check the relocation result from the log for volume relocation. Refer to "4.3 Revision of operation" for information on the log for volume relocation.
Progress	Current progress of volumes

4.2.1 Stop of volume relocation

When the volume relocation status is "Reallocating" or "Waiting", you can stop the volume relocation.

When stop a volume relocation, evaluation must be performed once again.

The procedure to stop volume relocation is as follows:

1. Click **Storage** on the global navigation tab.
   The current registered ETERNUS Disk storage systems are displayed on the Main pane.

2. Select a target ETERNUS Disk storage system on the Main pane.

3. Click **Automated Storage Tiering** on the Category pane.

4. Click **Overview** on the **Automated Storage Tiering** pane.
   The evaluation result is displayed on the Main pane.

5. Check the evaluation result checkbox to be stopped the volume relocation on the Main pane.

6. Click **Stop** under **Automated Storage Tiering** on the Action pane.
   The volume relocation is stopped.

7. Click **Reload Status** under **Automated Storage Tiering** on the Action pane.

   The volume relocation status will be "Suspended".

4.2.2 Deletion of volume relocation

When the volume relocation status is "Evaluated" or "Suspended", you can delete the information of volume relocation.

The procedure to delete the information of volume relocation is as follows:

1. Click **Storage** on the global navigation tab.
   The current registered ETERNUS Disk storage systems are displayed on the Main pane.

2. Select a target ETERNUS Disk storage system on the Main pane.

3. Click **Automated Storage Tiering** on the Category pane.

4. Click **Overview** on the **Automated Storage Tiering** pane.
   The evaluation result is displayed on the Main pane.

5. Check the information of volume relocation checkbox to be deleted on the Main pane.

6. Click **Delete** under **Automated Storage Tiering** on the Action pane.

7. Click **Reload Status** under **Automated Storage Tiering** on the Action pane.

   The information of volume relocation will be deleted.

4.3 Revision of operation

For revising operation, check the log of volumes which is relocated by Automated Storage Tiering function.

Click **Overview** on the **Automated Storage Tiering** pane to check the volume relocation status.

Moreover, you can check the log of past relocations by selecting the **History** tab on the **Tier Pool Details** screen.

The following items are displayed on the **History** tab:

No.	Item Name		Meaning	Remarks
1	FTV Number		Volume number	-
2	FTV Name		Volume alias name	-
3	FTV Capacity		Total capacity of FTV	The unit of display is MB, GB, or TB, according to the actual capacity.
4	Latest	Update	Completion time for migration	-
5		Status	Result of volume relocation	One of the followings is displayed. - Normal Finished - Error Finished - Normal Suspended - Error Suspended - Unexecuted If volume relocation has finished normally, the status is "Normal Finished". If volume relocation is stopped and relocation execution time reaches the expire time elapsed, the status is "Normal Suspended". Other cases display that volume relocation has not finished normally. However, since usually processing is properly done at the next relocation time, there is no problem. However, if the phenomenon that does not finish normally occurs continuously, some problem may be occurring. Collect the information required for troubleshooting and contact a Fujitsu system engineer.
6		Used Ratio	Tier pool usage rate	Display of percentage per tier, based on "100" as the total physical capacity assigned to the FTV.
7	Last Time	Update	Completion time for migration	-
8		Status	Result of volume relocation	One of the followings is displayed. - Normal Finished - Error Finished - Normal Suspended - Error Suspended - Unexecuted - - (hyphen)

No.	Item Name		Meaning	Remarks
9		Used Ratio	Tier pool usage rate	Display of percentage per tier, based on "100" as the total physical capacity assigned to the FTV.

You can revise Tier pool contents by confirming the detailed information on each Tier pool.

Select the relevant Tier pool from the Tier pool overview to display the detailed information on each Tier Pool.

Items that can be displayed are listed below.

The following items are displayed on the **Basic** tab:

No.	Item Name	Meaning	Remarks
1	Pool Number	Flexible Tier Pool number	-
2	Pool Name	Flexible Tier Pool name	-
3	FTRP Status	Flexible Tier Pool status	One of the followings is displayed. - Available - Exposed - Partially Readying - Readying - Maintenance - Broken - Data Lost - No Disk Path - Unknown
4	Total Capacity	Total capacity of Flexible Tier Pool	The unit of display is MB, GB, or TB, according to the actual capacity.
5	Used Capacity	Used capacity of Flexible Tier Pool	The unit of display is MB, GB, or TB, according to the actual capacity.
6	Alarm Status	Alarm status of Flexible Tier Pool	One of the followings is displayed. - Normal - Warning - Caution - N/A
7	Use Rate	Use rate (%) of Flexible Tier Pool	Displays a hyphen "-" if total capacity is "0".
8	Warning	Warning threshold value of Flexible Tier Pool (%)	-
9	Caution	Caution threshold value of Flexible Tier Pool (%)	Displays a hyphen "-" when caution threshold is disabled.
10	Encryption	Encryption status of Flexible Tier Pool	One of the followings is displayed. - Yes - No - Unknown
11	Master CM	Tier pool master CM	Auto or set master CM (comma separated values)

The following items are displayed on the **Sub Pool** tab:

No.	Item Name	Meaning	Remarks
1	FTSP Number	FTSP number and its Sub Pool	-
2	FTSP name	FTSP name	-
3	Disk	Disk attribution	One of the followings is displayed. - SSD - Online - Nearline - SED-SAS - Unknown
4	Reliability	Reliability of FTSP	One of the followings is displayed. - High Performance(RAID1+0) - High Capacity(RAID5) - High Reliability(RAID6) - Mirroring(RAID1) - Striping(RAID0) - Unknown
5	FTSP Status	FTSP status	One of the followings is displayed. - Available - Exposed - Partially Readying - Readying - Maintenance - Broken - Data Lost - No Disk Path - Unknown
6	Total Capacity	Total capacity of FTSP	The unit of display is MB, GB, or TB, according to the actual capacity.
7	Used Capacity	Used capacity of FTSP	The unit of display is MB, GB, or TB, according to the actual capacity.
8	RAID Group NO	RAID Group number included in FTSP	-
9	CM Number	Responsible CM for RAID Group	-
10	RAID Group Status	Status of RAID Group	-
11	Stripe Depth	Stripe depth	One of the followings is displayed. - 64 - 128 - 256 - 512

No.	Item Name	Meaning	Remarks
			- 1024
		- 29 -	- - (hyphen)

The following items are displayed on the **Volume** tab:

No.	Item Name	Meaning	Remarks
1	FTV Number	Volume number	-
2	FTV Name	Volume alias name	-
3	Status	Volume status	Same status as for Open volume is displayed.
4	Encryption	Encryption status of volume	One of the followings is displayed. - Yes - No - Unknown
5	Total Capacity	Total capacity of volume (MB)	-
6	Used Capacity	Used capacity (MB)	-
7	Alarm	Alarm status of volume	One of the followings is displayed. - Normal - Caution - N/A
8	Caution	Caution threshold value	-
9	Priority FTSP	FTSP name allocated with higher priority	Set to "Auto" if not specified otherwise.
10	Low quota ratio	Set low quota ratio	When omitted, "-" is displayed
11	Middle quota ratio	Set middle quota ratio	When omitted, "-" is displayed
12	High quota ratio	Set high quota ratio	When omitted, "-" is displayed

Chapter 5 Operational Maintenance

This chapter describes operational maintenance for the Optimization Option.

5.1 Collect the troubleshooting data

Use the Web Console to collect the troubleshooting data.

Refer to "Collect the troubleshooting data" in the *ETERNUS SF Web Console Guide* for information on how to collect the data.

5.2 Environment backup for Optimization Option

To prepare for possible errors in the Optimization Option environment, back up the environment for the Optimization Option.

Back up Storage Cruiser's manager to back up the Optimization Option environment.
Refer to "Backup of Manager" in the *ETERNUS SF Storage Cruiser Operation Guide* for information on Storage Cruiser's manager backup.

5.3 Environment restoration for Optimization Option

If an error occurs in the Optimization Option environment, restore the Optimization Option environment.

Restore Storage Cruiser's manager to restore the Optimization Option environment.
Refer to "Restoring Manager" in the *ETERNUS SF Storage Cruiser Operation Guide* for information on Storage Cruiser's manager restoration.

For restoring the Optimization Option environment after reinstalling of Storage Cruiser's manager, make sure to fully complete the installation and setup.

Refer to "Installation of ETERNUS SF Manager" and "Setup of ETERNUS SF Manager" in the *ETERNUS SF Installation and Setup Guide* for information on installation and setup procedures.

5.4 Reuse the Tiering policy definition

This is the procedure to use in a new environment the Tiering policy definition used in the old environment or the Tiering policy definition created in other environment.
The Tiering policy definition used in the old environment becomes available without being recreated.

Note

....

If the Tiering policy has been registered in a new environment, the definition in the old environment cannot be reused.
To reuse it, delete all the registered Tiering policy definitions and then perform this procedure again.

....

The setup procedure is as follows:

1. Stop the ETERNUS SF Manager Tomcat Service in the new environment.

   - For Windows version Manager:

     Stop the following service on the **Service** screen in the Windows operating system.

     - ETERNUS SF Manager Tomcat Service

   - For Solaris or Linux version Manager:

     Execute the following shell script to stop the service.

     ```
     /opt/FJSVesfcm/bin/stop-webservice.sh
     ```

2. Save the Tiering policy definition in the old environment.

   Back up the following file.

- For Windows version Manager:

  `$INS_DIR\AST\Manager\etc\opt\FJSVssast\data\policy\TierPolicy.xml`

  $INS_DIR means "Program Directory" specified at the ETERNUS SF Manager installation in the old environment.

- For Solaris or Linux version Manager:

  `/etc/opt/FJSVssast/data/policy/TierPolicy.xml`

3. Reflect the Tiering policy definition to a new environment.

   Place the file backed up in the old environment to the same folder in the new environment.

   - For Windows version Manager:

     `$INS_DIR\AST\Manager\etc\opt\FJSVssast\data\policy\TierPolicy.xml`

     $INS_DIR means "Program Directory" specified at the ETERNUS SF Manager installation in the new environment.

   - For Solaris or Linux version Manager:

     `/etc/opt/FJSVssast/data/policy/TierPolicy.xml`

4. Start the ETERNUS SF Manager Tomcat Service in the new environment.

   - For Windows version Manager:

     Start the following service on the **Service** screen in the Windows operating system.

       - ETERNUS SF Manager Tomcat Service

   - For Solaris or Linux version Manager:

     Execute the following shell script to start the service.

     `/opt/FJSVesfcm/bin/start-webservice.sh`

5. Execute the esfimporttierpolicy command to register the placed Tiering policy.

   Refer to "5.6.1 esfimporttierpolicy (Tiering policy import command)" for information on the command.

5.5 Support device maintenance

This section explains support device maintenance.

5.5.1 Change the IP address of a target device

The following measures are necessary when changing the IP address as part of device maintenance.

- To change the IP address with the device registered, use the Web Console to change the IP address and operations will be passed down to the new IP address.
  Refer to "Change the storage device information" in the *ETERNUS SF Web Console Guide* for the information on how to change an IP address.

- To change the IP address by deleting the device, change the IP address and execute the esfast tierpool setaddress command prior to re-registering.

The setup procedure is as follows:

1. After registering a device for the storage device with a changed IP address, execute the esfast tierpool setaddress command in the Manager environment.
   Refer to "5.6.2 esfast tierpool setaddress (Storage device IP address change command)" for information on the command.

2. On the Web Console, click **Storage** on the global navigation tab and execute [Reload Conf.] for the ETERNUS Disk storage system with a changed IP address.

Another option is to click **Overview** on the **Automated Storage Tiering** pane and click **Reload Status** under **Automated Storage Tiering** on the Action pane.

5.6 Command references

This section explains how to use commands.

5.6.1 esfimporttierpolicy (Tiering policy import command)

NAME

esfimporttierpolicy - Import the Tiering policy of earlier version

SYNOPSIS

Windows environment

```
$INS_DIR\Common\bin\esfimporttierpolicy
```

($INS_DIR means "Program Directory" specified at the ETERNUS SF Manager installation in the new environment.)

Solaris or Linux environment

```
/opt/FJSVesfcm/bin/esfimporttierpolicy
```

DESCRIPTION

This command requests to import the Tiering policy to this product. To execute the command, OS administrator privileges are required. On executing this command, this product starts to import the Tiering policy asynchronously with the command.

OPERANDS

None.

OPTIONS

None.

EXIT STATUS

=0 : Normal end

EXAMPLES

Windows environment

```
> C:\ETERNUS_SF\Common\bin\esfimporttierpolicy
esccs90000 Operation is accepted.
```

Solaris or Linux environment

```
# /opt/FJSVesfcm/bin/esfimporttierpolicy
esccs90000 Operation is accepted.
```

NOTES

- Register the ETERNUS SF Storage Cruiser Optimization Option license before executing this command.
  If the license is not registered, command execution is started, but the import of the Tiering policy terminates with error.

- Check the following are running respectively. If not running, the Tiering policy cannot be imported.

    - Windows environment

        - ETERNUS SF Manager Tomcat service
          If this service is not running, command execution can be accepted, but the import of the Tiering policy is not started.
          Open the Windows **Services** screen and check that the service status is "Started".

        - ETERNUS SF Storage Cruiser Optimization Option service
          If this service is not running, command execution is started, but the import of the Tiering policy terminates with error.
          Open the Windows **Services** screen and check that the service status is "Started".

    - Solaris or Linux environment

        - ETERNUS SF Manager Tomcat daemon
          If this daemon is not running, command execution can be accepted, but the import of the Tiering policy is not started.
          Execute the following command and check that the daemon process exists.

          ```
          # /bin/ps -ef | grep /opt/FJSVesfcm/tomc | grep -v grep
          ```

        - ETERNUS SF Storage Cruiser Optimization Option daemon
          If this daemon is not running, command execution is started, but the import of the Tiering policy terminates with error.
          Execute the following command and check that the daemon process exists.

          ```
          # /bin/ps -ef | grep FJSVssast | grep -v grep
          ```

- You cannot execute a number of this command at the same time. After confirming that one command has completed, re-execute this command.

- The import result of the Tiering policy is output in the operation history on the Web Console. Login to the Web Console to check the operation history. If the import failed, take action according to the message output in the operation history.

5.6.2 esfast tierpool setaddress (Storage device IP address change command)

NAME

esfast tierpool setaddress - Change storage device IP address information

SYNOPSIS

esfast tierpool setaddress -oldaddress *oldIpAddr* -newaddress *newIpAddr*

COMMAND PATH

Windows environment

```
$INS_DIR\AST\Manager\opt\FJSVssast\sbin\esfast tierpool setaddress
```

($INS_DIR means "Program Directory" specified at the ETERNUS SF Manager installation.)

Solaris or Linux environment

```
/opt/FJSVssast/sbin/esfast tierpool setaddress
```

DESCRIPTION

Change IP address information for the storage device of the Optimization Option.
To execute the command, OS administrator privileges are required.

OPERANDS

setaddress

Change the IP address of the storage device that holds a Tier pool.

OPTIONS

Options of the "setaddress" operand

-oldaddress *oldIpAddr*

Specify the storage device pre-change IP address.

-newaddress *newIpAddr*

Specify the storage device post-change IP address.

EXIT STATUS

=0 : Normal end

EXAMPLES

Windows environment

```
> C:\ETERNUS_SF\AST\Manager\opt\FJSVssast\sbin\esfast tierpool setaddress  -oldaddress 10.10.10.10
-newaddress 10.10.10.20
INFO:esast9000:Command terminated normally.
```

Solaris or Linux environment

```
# /opt/FJSVssast/sbin/esfast tierpool setaddress -oldaddress 10.10.10.10 -newaddress 10.10.10.20
INFO:esast9000:Command terminated normally.
```

NOTES

- Register the ETERNUS SF Storage Cruiser Optimization Option license before executing this command.
  If not registered, the command will terminate with an error.

- Check the following are running respectively. If not running, the command will terminate with an error.

    - Windows environment

        - ETERNUS SF Storage Cruiser Optimization Option service
        Open the Windows **Services** screen and check that the service status is "Started".

    - Solaris or Linux environment

        - ETERNUS SF Storage Cruiser Optimization Option daemon
        Execute the following command and check that the daemon process exists.

            ```
            # /bin/ps -ef | grep FJSVssast | grep -v grep
            ```

- The following notes apply when specifying an IP address in the option argument.

    - You cannot specify multiple addresses or use wild cards.

- Specify global address when specifying an IPv6 address.