

FUJITSU Storage ETERNUS SF Storage Cruiser V16.0

Operation Guide for Optimization Function

Windows/Solaris/Linux

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Preface

Purpose

This manual describes Optimization Function, an optional product for FUJITSU Storage ETERNUS SF Storage Cruiser of the following FUJITSU Storage ETERNUS SF products:

- FUJITSU Storage ETERNUS SF Express (hereafter abbreviated as "Express")
- FUJITSU Storage ETERNUS SF Storage Cruiser (hereafter abbreviated as "Storage Cruiser")
- FUJITSU Storage ETERNUS SF AdvancedCopy Manager (hereafter abbreviated as "AdvancedCopy Manager")

To use the one layer Tier pool function of the Automated Storage Tiering, both the ETERNUS SF Storage Cruiser Optimization Option license and the ETERNUS SF Storage Cruiser Quality of Service Management Option license are not required. Refer to "Automated Storage Tiering Management" in the *ETERNUS SF Storage Cruiser Operation Guide* for details.

Intended Readers

This manual is intended for system administrator and operators using the Optimization Function. Also, this is used for managing storage system.

Organization

This manual is composed as follows:

[Chapter 1 Overview of Optimization Functions](#)

This chapter describes an overview of the Optimization Function.

[Chapter 2 Design of Automated Storage Tiering](#)

This chapter describes the necessary design-related matters that must be addressed before setting up the Automated Storage Tiering function.

[Chapter 3 Setup of Automated Storage Tiering](#)

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

[Chapter 4 Operation of Automated Storage Tiering](#)

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

[Chapter 5 Design of Automated QoS Function](#)

This chapter describes the necessary design-related matters that must be addressed before setting up the Automated Quality of Service function.

[Chapter 6 Setup of Automated QoS Function](#)

This chapter describes the setup of the Automated Quality of Service function.

[Chapter 7 Operation of Automated QoS Function](#)

This chapter describes the operation of the Automated Quality of Service function.

[Chapter 8 Operation Maintenance](#)

This chapter describes the operation of the Optimization Function.

[Chapter 9 Command References](#)

This chapter describes the commands used by the Optimization Function.

Notation

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

Operating Systems

Product Name	Notation	
Microsoft(R) Windows Server(R) 2008 Standard (64-bit) Microsoft(R) Windows Server(R) 2008 Standard without Hyper-V(TM) (64-bit) Microsoft(R) Windows Server(R) 2008 Enterprise (64-bit) Microsoft(R) Windows Server(R) 2008 Enterprise without Hyper-V(TM) (64-bit) Microsoft(R) Windows Server(R) 2008 Datacenter (64-bit) Microsoft(R) Windows Server(R) 2008 Datacenter without Hyper-V(TM) (64-bit)	Windows Server 2008	Windows
Microsoft(R) Windows Server(R) 2008 R2 Foundation Microsoft(R) Windows Server(R) 2008 R2 Standard Microsoft(R) Windows Server(R) 2008 R2 Enterprise Microsoft(R) Windows Server(R) 2008 R2 Datacenter	Windows Server 2008 R2	
Microsoft(R) Windows Server(R) 2012 Standard Microsoft(R) Windows Server(R) 2012 Datacenter	Windows Server 2012	
Microsoft(R) Windows Server(R) 2012 R2 Standard Microsoft(R) Windows Server(R) 2012 R2 Datacenter	Windows Server 2012 R2	
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	
Windows(R) 8.1 Windows(R) 8.1 Pro	Windows 8.1	
Oracle Solaris 10	Solaris 10	Solaris or Solaris OS
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 Intel64)	RHEL5	
Red Hat(R) Enterprise Linux(R) 6 (for Intel64)	RHEL6	
HP-UX 11i v1 HP-UX 11i v2 HP-UX 11i v3	HP-UX	
AIX(R) V6.1 AIX(R) V7.1	AIX	
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	VMware

Product Name	Notation	
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.

FUJITSU Storage ETERNUS

Formal Name	Abbreviation		
FUJITSU Storage ETERNUS DX60/DX60 S2 FUJITSU Storage ETERNUS DX80/DX80 S2 FUJITSU Storage ETERNUS DX90/DX90 S2	-		ETERNUS DX series or ETERNUS Disk storage system
FUJITSU Storage ETERNUS DX100 S3 FUJITSU Storage ETERNUS DX200 S3	-		
FUJITSU Storage ETERNUS DX410 FUJITSU Storage ETERNUS DX440	ETERNUS DX400 series	ETERNUS DX400/ DX400 S2 series	
FUJITSU Storage ETERNUS DX410 S2 FUJITSU Storage ETERNUS DX440 S2	ETERNUS DX400 S2 series		
FUJITSU Storage ETERNUS DX500 S3 FUJITSU Storage ETERNUS DX600 S3	-		
FUJITSU Storage ETERNUS DX8100 FUJITSU Storage ETERNUS DX8400 FUJITSU Storage ETERNUS DX8700	ETERNUS DX8000 series	ETERNUS DX8000/ DX8000 S2 series	
FUJITSU Storage ETERNUS DX8100 S2 FUJITSU Storage ETERNUS DX8700 S2	ETERNUS DX8000 S2 series		
FUJITSU Storage ETERNUS DX200F	-		
FUJITSU Storage ETERNUS LT20/LT20 S2 FUJITSU Storage ETERNUS LT40/LT40 S2 FUJITSU Storage ETERNUS LT60/LT60 S2 FUJITSU Storage ETERNUS LT200 FUJITSU Storage ETERNUS LT210 FUJITSU Storage ETERNUS LT220 FUJITSU Storage ETERNUS LT230 FUJITSU Storage ETERNUS LT250 FUJITSU Storage ETERNUS LT270	ETERNUS Tape library		

Each individual device name in this document is listed with "FUJITSU Storage" omitted from it.

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

Formal Name	Abbreviation
Microsoft(R) SQL Server(R)	SQL Server
VMware(R) ESX(R)	VMware ESX
VMware(R) ESXi(TM)	VMware ESXi
VMware(R) vCenter(TM) Server	VMware vCenter Server or vCenter Server
FUJITSU Software PRIMECLUSTER Global Disk Services	GDS
FUJITSU Software PRIMECLUSTER Global File Services	GFS
FUJITSU Software Symfoware Server Enterprise Extended Edition FUJITSU Software Symfoware Server Enterprise Edition	Symfoware

Manuals

Formal Name	Abbreviation
FUJITSU Storage ETERNUS SF Express / ETERNUS SF Storage Cruiser / ETERNUS SF AdvancedCopy Manager Quick Reference	ETERNUS SF Quick Reference
FUJITSU Storage ETERNUS SF Express / ETERNUS SF Storage Cruiser / ETERNUS SF AdvancedCopy Manager Release Notes	ETERNUS SF Release Notes
FUJITSU Storage ETERNUS SF Express / ETERNUS SF Storage Cruiser / ETERNUS SF AdvancedCopy Manager Installation and Setup Guide	ETERNUS SF Installation and Setup Guide
FUJITSU Storage ETERNUS SF Express / ETERNUS SF Storage Cruiser / ETERNUS SF AdvancedCopy Manager Migration Guide	ETERNUS SF Migration Guide
FUJITSU Storage ETERNUS SF Express / ETERNUS SF Storage Cruiser / ETERNUS SF AdvancedCopy Manager Web Console Guide	ETERNUS SF Web Console Guide
FUJITSU Storage ETERNUS SF Storage Cruiser / ETERNUS SF AdvancedCopy Manager Cluster Environment Setup Guide	ETERNUS SF Cluster Environment Setup Guide
FUJITSU Storage ETERNUS SF Express / ETERNUS SF Storage Cruiser / ETERNUS SF AdvancedCopy Manager Messages	ETERNUS SF Messages
FUJITSU Storage ETERNUS SF Express / ETERNUS SF Storage Cruiser Event Guide	ETERNUS SF Event Guide
FUJITSU Storage ETERNUS SF Express / ETERNUS SF Storage Cruiser / ETERNUS SF AdvancedCopy Manager Glossary	ETERNUS SF Glossary

The description of each manual in the sentence besides the above-mentioned omits "FUJITSU Storage".

Others

- Quality of Service is abbreviated as "QoS".
- In this document, unless there is a special explanatory note, ETERNUS DX200 S3 indicates ETERNUS DX200 S3 and ETERNUS DX200F. In addition, ETERNUS Disk storage system includes ETERNUS DX200F All Flash Arrays. However, the following functions are not supported in ETERNUS DX200F:
 - Energy saving operation for storage device
 - NAS operation for storage device
 - Automated Storage Tiering operation at multiple tiers (two or more)

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May 2014	1.1	B1FW-6008-01ENZ0(01)	B1FW-6008-01ENZ2(01)

Notes

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Update History

Content of Update	Updated Section	Revision
The information related to ETERNUS DX200F was described.	"Others" in Preface	1.1

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 common for all products.
	Release Notes	Yes	Yes	Yes	This manual is common for all products.
	Overview	-	-	Yes	This manual is unique for the 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: <ul style="list-style-type: none"> - Express Operation Guide - Storage Cruiser Operation Guide - Storage Cruiser Operation Guide for Optimization Function - 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 Operation Guide for Copy Control Module
	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	Manual	Main Contents	How to Read
Acquiring a product overview and basic operation knowledge	Quick Reference	<ul style="list-style-type: none"> - 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.
	AdvancedCopy Manager Overview	<ul style="list-style-type: none"> - Main functions 	

Purpose	Manual	Main Contents	How to Read
		<ul style="list-style-type: none"> - Linkable applications - Procedure overview for Advanced Copy of ETERNUS Disk storage system 	
Confirming the updated contents	Release Notes	<ul style="list-style-type: none"> - 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	Migration Guide	<ul style="list-style-type: none"> - 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	Installation and Setup Guide	<ul style="list-style-type: none"> - Operating environment - Installation procedure - Setup procedure - Uninstallation procedure 	Please read if you want to install and setup the product.
	Cluster Environment Setup Guide	<ul style="list-style-type: none"> - Supported cluster software - Installation procedure for a clustered system - Setup procedure for a clustered system - Uninstallation procedure for a clustered system 	Please read if you want to install and setup the product on a clustered system.
Administration and operation of the installed system	Express Operation Guide	<ul style="list-style-type: none"> - 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.
	Storage Cruiser Operation Guide	<ul style="list-style-type: none"> - 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 Function	<ul style="list-style-type: none"> - Operating environment construction - Operating status monitoring - Necessary tasks after an architectural modification of 	

Purpose	Manual	Main Contents	How to Read
		<ul style="list-style-type: none"> the system as well as product maintenance - Command reference 	
	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 Operation Guide for Copy Control Module	<ul style="list-style-type: none"> - Starting and stopping the software - Data backup/restore inside the storage system - Necessary tasks after an architectural modification of the system as well as product maintenance - Command reference 	
	Web Console Guide	<ul style="list-style-type: none"> - Operating environment - Screen layout description 	Please read if you want to understand the ETERNUS SF Web Console.
Dealing with messages issued by the software	Messages	<ul style="list-style-type: none"> - 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	Event Guide	<ul style="list-style-type: none"> - 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	Glossary	<ul style="list-style-type: none"> - 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.

Contents

Chapter 1 Overview of Optimization Functions.....	1
1.1 Function Overview.....	1
1.1.1 Automated Storage Tiering.....	1
1.1.2 Automated QoS Function.....	3
1.2 Operating Environment.....	4
Chapter 2 Design of Automated Storage Tiering.....	6
2.1 Tiering Policies.....	6
2.2 Configuration of Tier Pool.....	7
Chapter 3 Setup of Automated Storage Tiering.....	9
3.1 Check of Target Device.....	9
3.2 Registration of License.....	9
3.3 Activation of Automated Storage Tiering.....	10
3.4 Setting of Tiering Policy.....	10
3.4.1 Creation of Tiering Policy.....	12
3.4.2 Change of Tiering Policy.....	14
3.4.3 Deletion of Tiering Policy.....	15
3.5 Setting of Tier Pool.....	15
3.5.1 Creation of Tier Pool.....	17
3.5.2 Recycling of Tier Pool Made in Storage Device.....	19
3.5.3 Change of Tier Pool.....	19
3.5.4 Change Number of Layers of Tier Pool.....	20
3.5.5 Deletion of Tier Pool.....	20
3.5.6 Expansion of Capacity of Sub-Pool.....	20
3.6 Setting of FTV.....	21
3.6.1 Creation of FTV.....	26
3.6.2 Changing of FTV.....	26
3.6.3 Format of FTV.....	27
3.6.4 Deletion of FTV.....	27
3.7 Relation Between Threshold of Tier pool and Threshold of FTV.....	27
3.8 Test Run of Evaluation and Relocation.....	28
Chapter 4 Operation of Automated Storage Tiering.....	32
4.1 Confirmation of Execution Results of Relocation.....	32
4.2 Confirmation of Configuration Details of Tier Pool.....	33
4.3 Suspension of Relocation.....	35
4.4 Deletion of Evaluation Result.....	36
4.5 Reuse of Tiering Policy Definitions.....	36
Chapter 5 Design of Automated QoS Function.....	38
5.1 Decision of Target Values.....	38
5.2 Structure of Automatic Tuning.....	40
5.3 Affected Range of Automatic Tuning.....	41
5.4 Determining Achievement of Performance Target.....	43
5.5 Activation Trigger for Automatic Tuning.....	44
Chapter 6 Setup of Automated QoS Function.....	45
6.1 Confirmation of Subject Volume.....	45
6.2 License Registration.....	46
6.3 Enabling Automated QoS Function.....	46
6.4 Configuration of Target Response Time.....	47
6.4.1 Configuration From FTV Creating Wizard.....	47
6.4.2 Configuration From FTV Changing Wizard.....	47
6.4.3 Operation Using Commands.....	48
6.5 Confirmation of Performance Information.....	48

Chapter 7 Operation of Automated QoS Function.....	49
7.1 Tuning of Performance Target.....	49
7.2 Operation After Completion of Tuning.....	49
Chapter 8 Operation Maintenance.....	50
8.1 Collect the Troubleshooting information.....	50
8.2 Backup of Operating Environment.....	50
8.3 Restoration Operating Environment.....	50
8.4 Maintenance of Supported Device.....	50
8.4.1 Change IP Address of Target Device.....	50
8.4.2 Measures to Be Taken When Tier Pool Configuration Has Been Changed With Managed Devices.....	51
Chapter 9 Command References.....	52
9.1 Commands of Automated Storage Tiering.....	52
9.1.1 esfadm tierpolicy import (Tiering policy import command)	52
9.1.2 esfast tierpool setaddress (Storage device IP address change command).....	53
9.1.3 esfast tierpool delete (Tier pool deletion command).....	55
9.2 Commands of Automated QoS Function.....	57
9.2.1 esfadm volume qosset (Target response time configuration / changing command).....	57
9.2.2 esfadm volume qosclear (Target response time clear command).....	59
9.2.3 esfadm volume qosinfo (Target response times listed display command).....	61

Chapter 1 Overview of Optimization Functions

This chapter explains an overview of Optimization functions.

1.1 Function Overview

This section explains an overview of the Automated Storage Tiering and Automated QoS functions.

1.1.1 Automated Storage Tiering

Automated Storage Tiering is a function of the storage device wherein, the data is stored in different tiers depending on access metric's. Using this function allows performance and costs to be optimized by storing the data on the appropriate media depending on access characteristic.

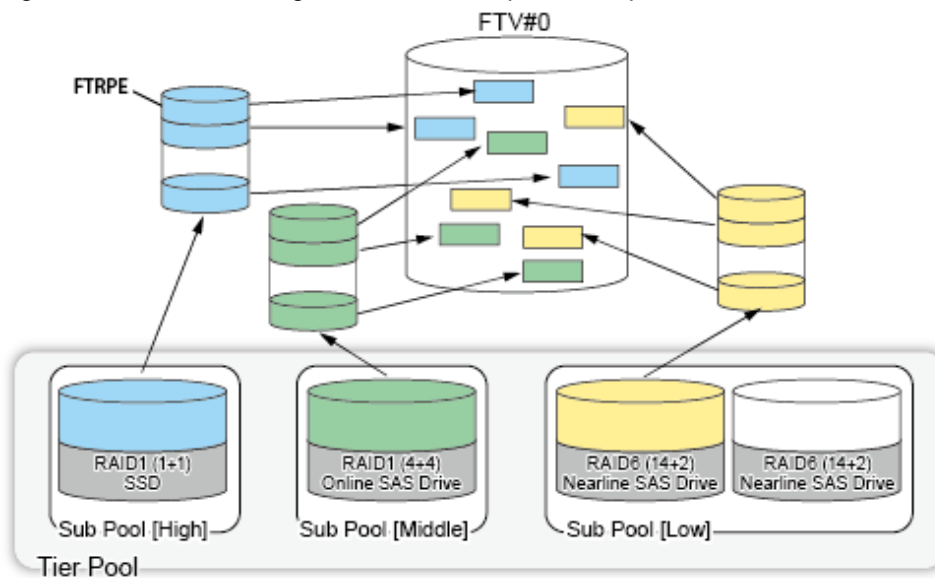
The managed pool is referred to as "Tier pool" or "Flexible Tier Pool (FTRP)". The virtual logical volume allocated in the Tier pool is called "Flexible Tier Volume (FTV)".

The Tier pool is configured of sub-pools that are provided with differences in performance. The sub-pool might be called "Flexible Tier Sub Pool (FTSP)".

The sub-pool is configured of assignment units referred to as "Flexible Tier Pool Element (FTRPE)", and the evaluation of access status in order to perform the Automated Storage Tiering is conducted with every FTRPE.

The relation of the FTV, Tier pool, sub-pool, and FTRPE are as illustrated below.

Figure 1.1 Relational Diagram of FTV, Tier pool, Sub-pool, and FTRPE



With Automated Storage Tiering, there are the following methods for the relocation of data within the volume.

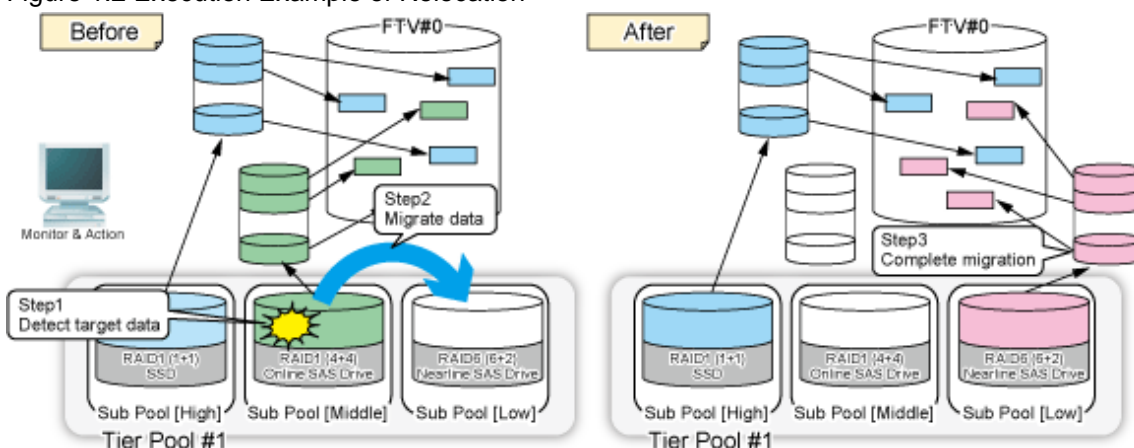
No	Method of Data Relocation	Specification of IOPS of Tiering Policies	Specification of FTV Capacity Allocation Ratio	Actions	Characteristics
1	When you easily use the Automated Storage Tiering	None (omitted value)	Not specified	Relocated in a packed manner from higher positioned sub-pools in order of those with a higher IOPS	Design is easy. Enables maximized utilization of higher positioned sub-pools.
2		None (omitted value)	Specified	Relocated according to the capacity assignment rates specified for each sub-pool,	Design is easy. The sub-pool with a high capacity allocation ratio can be maximum used. The performance of each

No	Method of Data Relocation	Specification of IOPS of Tiering Policies	Specification of FTV Capacity Allocation Ratio	Actions	Characteristics
				in order of those with a higher IOPS	volume can be set in one Tier pool.
3	When you control the Automated Storage Tiering in detail	IOPS Specified	Not specified	Arranged according to the range of thresholds of the IOPS between layer levels	Capable of relocation by IOPS according to operation. Requires design of IOPS.

Relocation according to the access status is performed in the following manner.

- Once Automated Storage Tiering begins in relation to a Tier pool, the access status of each FTRPE is collected each time a predetermined time elapses.
This collection is performed until the evaluation time is reached, for every Evaluation Period, by accumulating the values of the evaluation standard (peak value or average value) of every FTRPE.
- At the evaluation time, an evaluation is implemented by using the accumulated data.
- By comparing the value of every FTRPE against the ranges configured to the sub-pools, whether to move the data, and the destination sub-pool if the data is to be moved are decided and the relocation is executed.
Relocation according to evaluations and the results of the evaluations is performed either automatically or manually depending on the Execution Mode.

Figure 1.2 Execution Example of Relocation



With this product, the evaluation time, Evaluation Period, evaluation standard, and Execution Mode can be selected as "Tiering policies". Refer to "2.1 Tiering Policies" for information on designing the Tiering policy, and "3.4.1 Creation of Tiering Policy" for information on items of the Tiering policy.

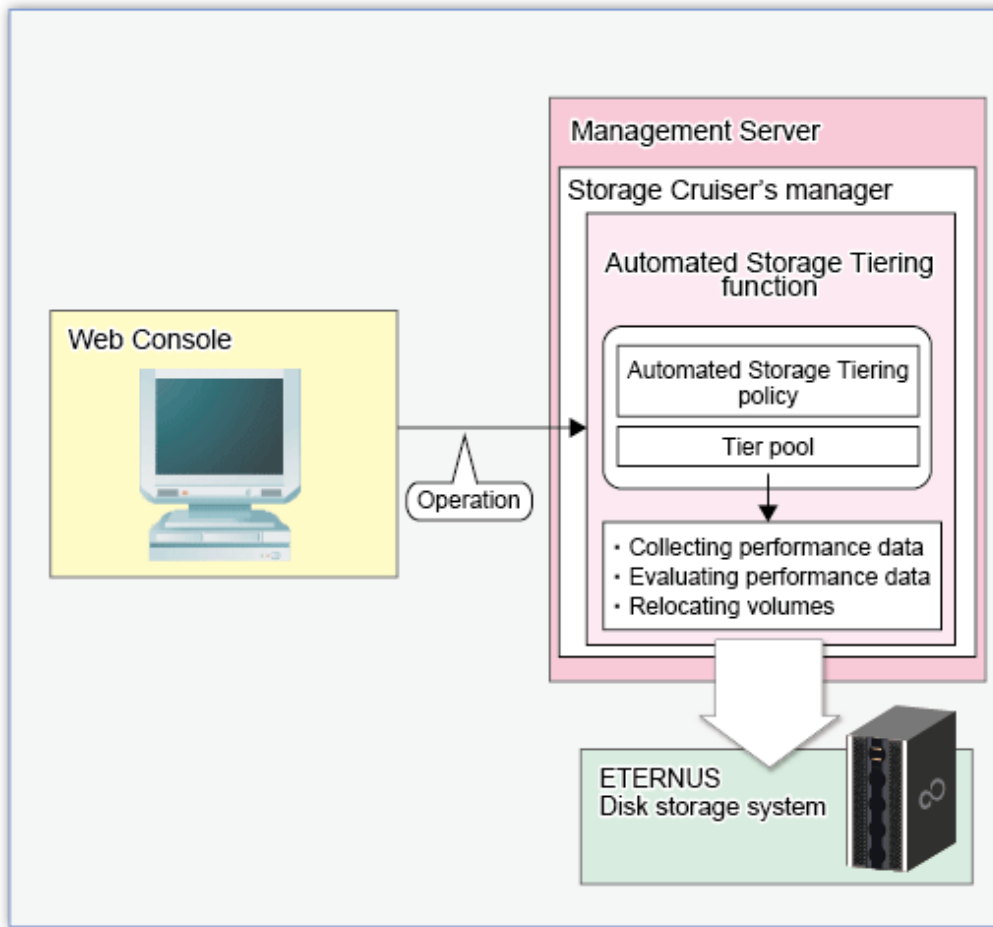
By collecting and evaluating access status data from the server, based on Tiering policies, and automatically relocating configuration units of the volume (FTRPE) to the appropriate sub-pool, this product realizes optimized utilization of storage resources.

When an Execution Mode that automatically performs the evaluation and relocation is specified, these will be performed automatically. By dynamically altering the data arrangement even during the operation of tasks, it is possible to correspond to the changes of performance status during the operation of tasks. For this reason, upfront performance estimations and arrangement designs become unnecessary, reducing the work load of task administrators and storage administrators.

When specifying a manual Execution Mode, confirm the access status and execute the evaluation and relocation. Before starting operation of Automated Storage Tiering, it is advised that test runs of evaluation and relocation are performed in order to decide the values for the evaluation time, Evaluation Period, evaluation standard, Execution Mode, and ranges of the sub-pools.

All operations of Automated Storage Tiering can be implemented from the ETERNUS SF Web Console (hereinafter abbreviated as "Web Console").

Figure 1.3 System Configuration



Point

Be sure to perform all operations of Automated Storage Tiering on the same Management Server. Operation on multiple Management Servers may cause cases where the function does not operate correctly.

Overview of the steps for utilizing the Automated Storage Tiering is as follows:

1. Setup of Environment
 - a. Enable Automated Storage Tiering on storage devices.
 - b. Create Tiering policies, Tier pools, and virtual logical volumes (FTVs)
2. Starting Automated Storage Tiering
 - a. Start Automated Storage Tiering for the Tier pool to be used.
(With this operation, the access status data from during the configured period will be collected automatically)
 - b. Evaluate the collected access status data and relocate data according to Tiering policies.
(In the Execution Mode where evaluation and relocation are performed automatically, this will be implemented automatically by the system)

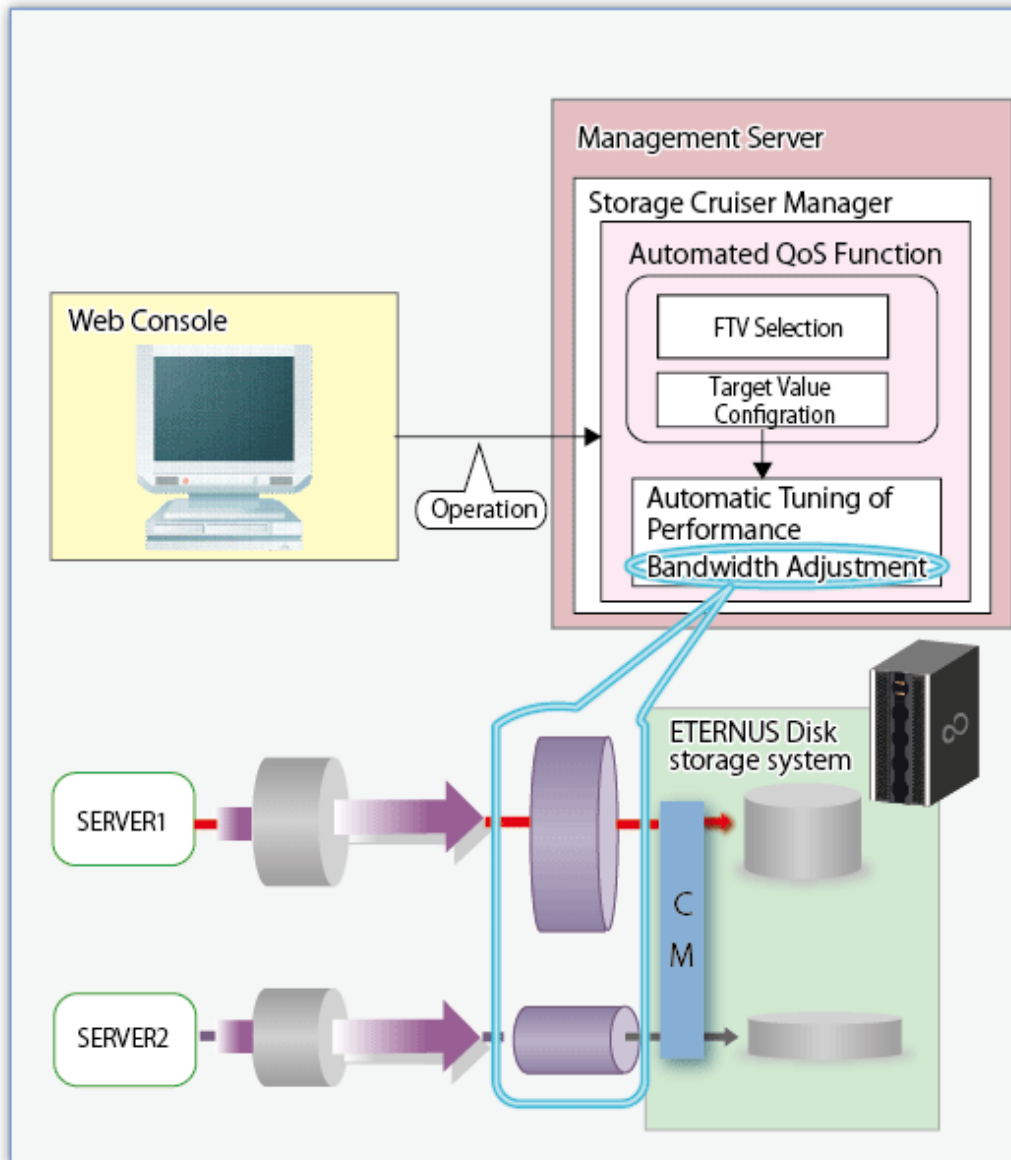
1.1.2 Automated QoS Function

Automated QoS function is a function wherein, by a user configuring target value (Target Response Time in millisecond) for every volume according to the priority of tasks, the bandwidth is automatically adjusted to satisfy target value and automatic tuning of performance is

performed. The target value can be configured with each volume. The volumes to which target value can be configured are Flexible Tier Volumes (FTVs). There is no upper limit to the number of FTVs to which target value can be configured.

Furthermore, all operations of Automated QoS function such as control of activation and stop, or configuration and changing of target value are performed with the Web Console or Command Line Interface.

Figure 1.4 Overview of Automated QoS Function



1.2 Operating Environment

The Optimization Function can be used in the following environments.

Object	Environment
Platform	Platforms on which the ETERNUS SF Manager can be operated
Required Software	ETERNUS SF Storage Cruiser 16.0 or later

Object	Environment
Required Licenses (Software)	ETERNUS SF Storage Cruiser Standard Edition
Optional Licenses (Software)	- ETERNUS SF Storage Cruiser Optimization Option (when utilizing Automated Storage Tiering) - ETERNUS SF Storage Cruiser Quality of Service Management Option (when utilizing Automated QoS function)
Storage Devices (*3) (hereinafter referred to as "storage devices")	- ETERNUS DX80 S2/DX90 S2 (*1, *4, *5, *6) - ETERNUS DX100 S3/DX200 S3 - ETERNUS DX400 S2 series (*1, *4, *5, *6) - ETERNUS DX500 S3/DX600 S3 - ETERNUS DX8000 S2 series (*1, *4, *5, *6)
Form of Connection with Business Server	There are no conditions.
Target Volume (*2)	FTV (Flexible Tier Volume)

*1: Firmware of V10L20 or later is required. In addition, it is required that the Flexible Tier function of the storage device is enabled.

*2: Open volumes and TPV are not supported.

*3: Disks that may be used as a Flexible Tier Pool are as follows.

Usable Disks	Terms of Usage
SAS SSD	-
ONLINE SAS	-
NEARLINE SAS	-
SED-SAS	When using ETERNUS DX80 S2/DX90 S2, DX400 S2 series, DX8000 S2 series, firmware of V10L30 or later is required.

*4: In order to utilize the automatic disk selection function, firmware of V10L50 or later is required.

*5: Thin Provisioning license is required for the device.

*6: The Automated QoS function is not supported.

Chapter 2 Design of Automated Storage Tiering

This chapter describes designs necessary in order to use Automated Storage Tiering.

2.1 Tiering Policies

Standard for moving data within the volume by Automated Storage Tiering is defined as "Tiering policy". The approach in relation to the configuration of Tiering policy is described below.

Evaluation Standard

The "peak value" or "average value" within the evaluation period of IOPS in relation to the target volume, taking into account the access status in order to move data within the volume.

In order to place data with a high IOPS value, even for a short period of time in the evaluation period, onto a rapid disk, "peak value" should be selected. In order to place data with a constantly high IOPS value, "average value" should be selected.

Make a selection according to the state of access to the data of the target volume.

Evaluation Period

This is the period during which the state of access to the data within the target volume is evaluated. Depending on the system configuration and form of utilization, the following may be selected.

- Hour Units (2, 4, 6, 8, or 12 hours)
- Day Units (1-31 days)

When a value for day units has been selected, during one day (24 hours), the time of the day to perform the evaluation can be specified. In addition, the time to start evaluation and repositioning of access status data (Automated Storage Tiering Execution Time) can be specified as well.

Upon taking into account the effect on tasks utilizing the target volume, configure an appropriate evaluation period, time frame subject to evaluation, and time to start the relocation.

The optimal value for Evaluation Standard and Evaluation Period depends on the system configuration and form of utilization. For this reason, Automated Storage Tiering has prepared three types of execution modes (Auto, Semi-Auto, and Manual). The "Semi-Auto" and "Manual" execution modes may be used to test the Tiering policy without actually moving data in the target volume. Use these modes to decide the value for IOPS when controlling tiering in detail. The following explains each of the execution modes.

Execution Mode	Details of Execution		Purpose of Selection
	Subject of Automated Execution According to Tiering Policy	Tasks That Require Manual Operation	
Auto	<ul style="list-style-type: none"> - Collection and evaluation of access status data necessary for relocation of data within a volume - Relocation of data within a volume 	-	Selected for standard operation.
Semi-Auto	<ul style="list-style-type: none"> - Collection and evaluation of access status data necessary for relocation of data within a volume 	<ul style="list-style-type: none"> - Confirmation of evaluation results, and as needed, relocation of data within a volume 	Selected in the following cases: <ul style="list-style-type: none"> - Used to review evaluation standards - Used to select which data is to be moved.
Manual	<ul style="list-style-type: none"> - Collection of access status data necessary for relocation of data within a volume 	<ul style="list-style-type: none"> - Evaluation of access status data - Confirmation of evaluation results, and as needed, 	Selected in the following cases: <ul style="list-style-type: none"> - Used to execute with standard values of the evaluation temporarily changed

Execution Mode	Details of Execution		Purpose of Selection
	Subject of Automated Execution According to Tiering Policy	Tasks That Require Manual Operation	
		relocation of data within a volume	- Used to determine the appropriateness of standard values

Of the access status data for moving the data within the volume, the day of the week subject to evaluation and the days to exclude from evaluation can be specified. Make a specification when configuring subjects of evaluation in detail according to tasks.

For the day of the week subject to evaluation, a day of the week that is to be a subject of the evaluation of the access status data is specified.

For the days to exclude from evaluation, days that are to not be included in the subject of evaluation of the access status data is specified.

Note

When the summer time function of the OS is effective, do not configure the time at which the switching of summer time takes place as the Automated Storage Tiering Execution Time. Doing so will prevent evaluation of the access status data and relocation of data within the volume from being performed properly.

2.2 Configuration of Tier Pool

The Tier pool is configured by tiering sub-pools.

By setting differences in (tiering) the access performance of the sub-pools, appropriate data location according to access frequency is possible.

The access performance of sub-pools differs depending on the types of disks that configure the sub-pool, the RAID level, and the number of disks.

For this reason, it is possible to configure a sub-pools with not only the type of disk such as SSD, Online SAS, Nearline SAS, SED-SAS, but with identical disk types having different RAID levels or numbers of Member Disks.

In addition, by using the automatic disk selection function, instead of selecting the number of Member Disks, it is possible to configure sub-pools by specifying the disk capacity.

In creating the Tier pool, configure sub-pools while taking into account the priorities listed below.

Refer to *3 of "1.2 Operating Environment" for the terms of use of each type of disk.

Priority (In Order of High Performance)	Disk Type	Number of Data Disks	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		

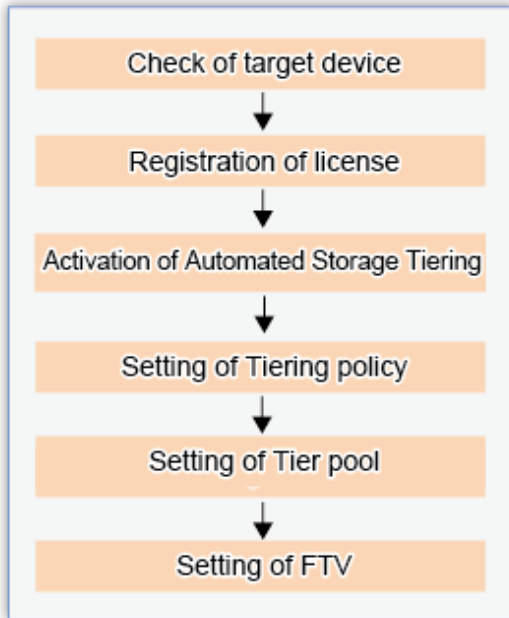
Priority (In Order of High Performan ce)	Disk Type	Number of Data Disks	Number of Member Disks	RAID Level			
12	Online SAS, SED-SAS	2	2D+2P	RAID1+0			
13		1	1D+1D				RAID1
14		12	12D+12D	RAID1+0			
15					RAID5		
16			8	8D+8D	RAID1+0		
17				8D+1P		RAID5	
18				8D+2P			RAID6
19			7	7D+1P		RAID5	
20			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	
38	2		2D+2P	RAID1+0			
39	1	1D+1D				RAID1	

Chapter 3 Setup of Automated Storage Tiering

This chapter explains the setup of Automated Storage Tiering.

The flow of the setup of Automated Storage Tiering is described below.

Figure 3.1 Flow of Setup of Automated Storage Tiering



3.1 Check of Target Device

In order to utilize Automated Storage Tiering, there are the following conditions for the target storage device.

- The target device is registered with the ETERNUS SF Manager.
- The requirements listed in "1.2 Operating Environment" are fulfilled.

The status of the above items can be confirmed from the Web Console. Refer to the following sections in the *ETERNUS SF Web Console Guide* for information on how to confirm each item.

- Confirmation of the registration status of the target device:
"Display ETERNUS Disk Storage System"
- Confirmation of the registration status of the license:
"Display License"
- Confirmation of the firmware version:
"Display ETERNUS Disk Storage System"

3.2 Registration of License

Utilization of Automated Storage Tiering is made possible by registering the license with the ETERNUS SF Manager. It is not necessary to install new software.

The license is registered from the Web Console. Refer to "Register License" in the *ETERNUS SF Web Console Guide* for information on how to perform the registration.



See

Refer to "1.2 Operating Environment" for information on the license.

3.3 Activation of Automated Storage Tiering

In order to utilize Automated Storage Tiering of the storage device, it is necessary to enable Automated Storage Tiering on the storage device.

Refer to "Enable/Disable Automated Storage Tiering" in the *ETERNUS SF Web Console Guide* for information on procedures of enabling this feature.



Point

The subject of the enabling operation is a storage device.

In order to enable Automated Storage Tiering of multiple storage devices, it is necessary to perform this operation in relation to each storage device.

3.4 Setting of Tiering Policy

The terms for execution of Automated Storage Tiering are configured as a Tiering policy.

According to the configured Tiering policy, Automated Storage Tiering automatically performs, in relation to FTV present in the Tier pool, relocation of data within the same device.

A Tiering policy can be assigned in relation to multiple Tier pools of either the same storage device or different storage devices.



Point

When the same Tiering policy is allocated in two or more Tier pools, the layer organization should be the same in all Tier pools of the allocation object.

Simplification of Tiering Policy Specification

The configuration of the range of IOPS values specified to each layer of the Tiering policy may be omitted.

It is also possible to specify the IOPS value of each layer.

The field for the configuration of the range of IOPS values is located under "Advanced Configuration of Tiering Policies" in the Create Tiering policy screen. In its initial state, the input range is not displayed.

The user can create a Tiering policy without being conscious of the configuration of the range of IOPS values.

In addition, Tiering policy can be created simply by specifying only the policy name. At this time, default values will be configured to other items of the Tiering policy. Refer to "Create Tiering Policy" in the *ETERNUS SF Web Console Guide* for information on the values that are configured.

If the range of IOPS setting is omitted, relocation is carried out according to the pool configuration. The logic for relocation is as follows.

- FTRPEs are sorted in ascending order of IOPS value and the FTRPE with the highest IOPS value sorted to the top sub-pool, and so on.
- When the Execution Mode is "Auto", all FTRPEs will be targeted. When the Execution Mode is "Semi-Auto" or "Manual", the FTRPEs contained in the FTVs to which relocation has been instructed will be targeted. However, a reserved region of approximately 10% will be prepared in each sub-pool in order to prevent the actual I/O of the sub-pools from being affected by relocation. The size of the reserved region is approximately 10% (fixed) of the size of the sub-pool. Moreover, as effects on performance of the actual I/O occur if relocation is performed frequently, FTRPEs that are present within approximately 5% of the boundaries of each layer do not move. Specifically, relocation is not performed with FTRPEs that fall under the following conditions.
 - Of FTRPEs which are applicable to the approximate 5% having a low IOPS, current layer is one layer higher than the layer after being moved.

- Of FTRPEs which are applicable to the approximate 5% having a high IOPS, current layer is one layer lower than the layer after being moved.

 **Note**

The reserved region is a region that is secured for the writing of new I/O data. When I/O is generated, data is written into the reserved region and located in such manner that approximately 10% is made empty upon relocation.

The overview of relocation, in cases when specification of the range of IOPS has been omitted, is as follows.

Figure 3.2 Summary of Relocation in Accordance with Pool Configuration

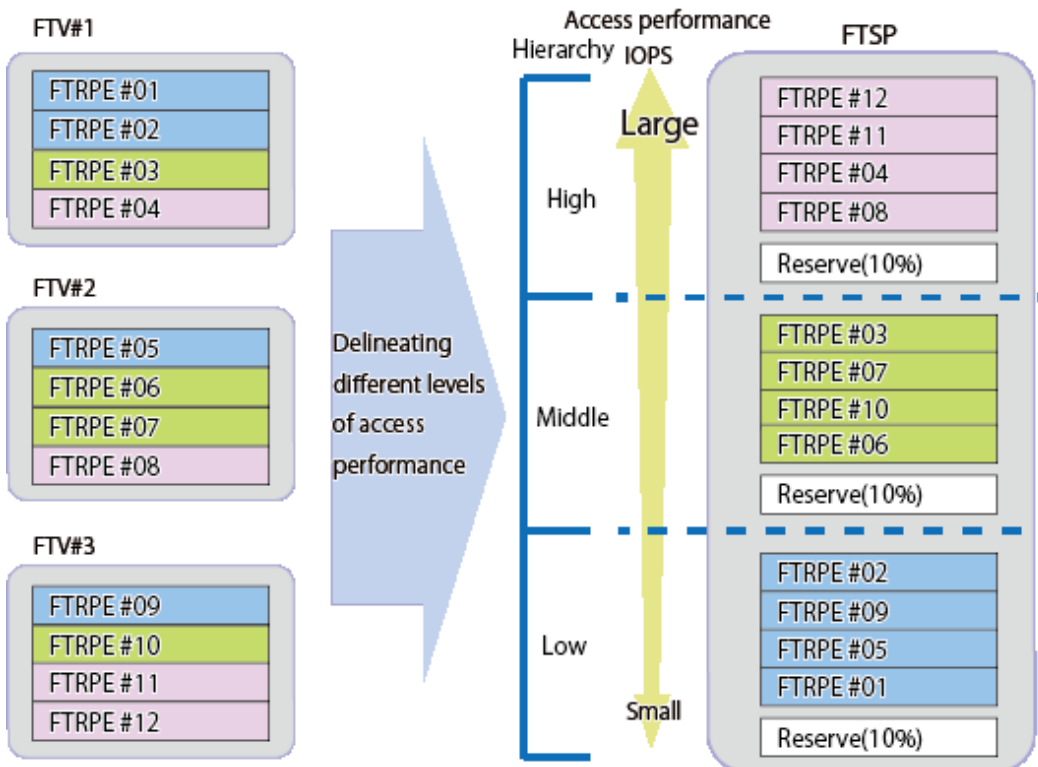
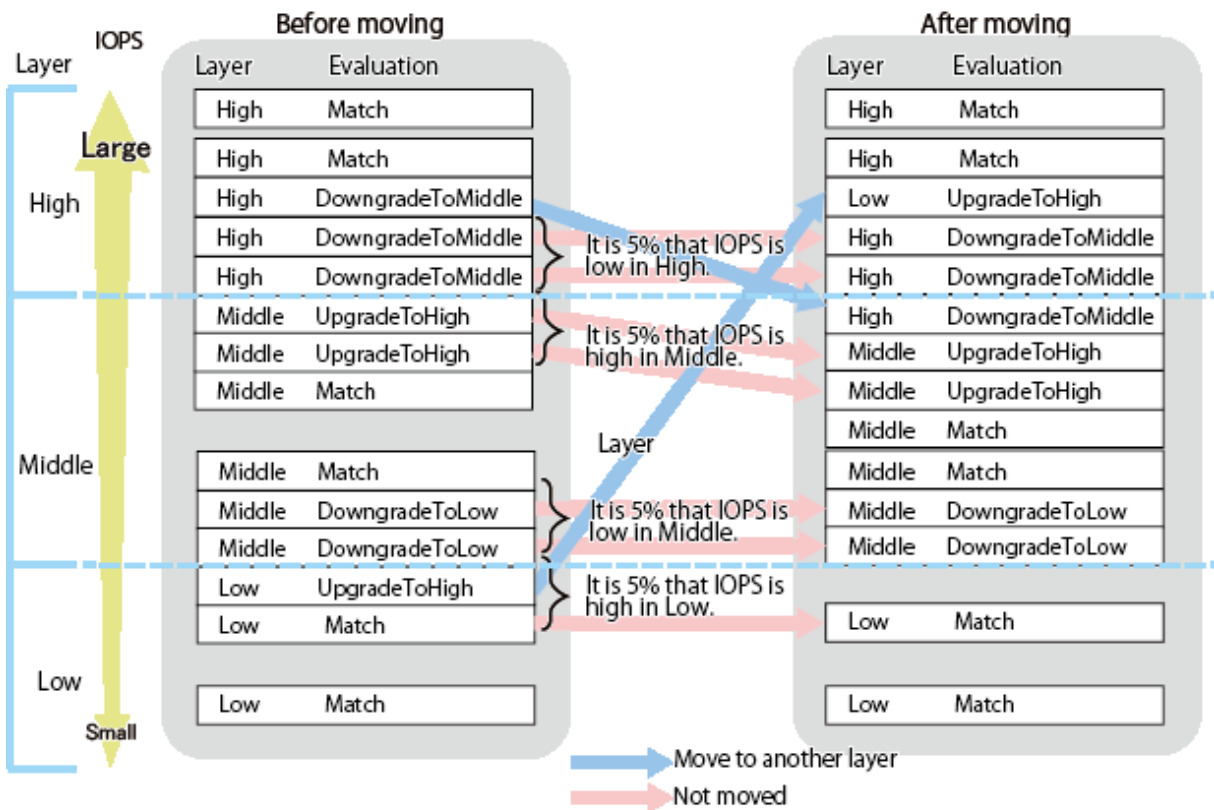


Figure 3.3 FTRPE Moving in Boundary of Each Sub-Pool



Detailed Configuration According to "Days of the Week subject to Evaluation" and "Days to exclude from Evaluation"

When creating a Tiering policy, it is possible to specify the "Days of the Week subject to Evaluation" and the "Days to exclude from Evaluation".

By specifying these items, it is possible to perform detailed operation of Automated Storage Tiering.

3.4.1 Creation of Tiering Policy

Multiple Tiering policies can be created. It is also possible to define the same Tiering policy to multiple Tier pools.

The items which can be specified as Tiering policy are as follows.

Item	Specification (*1)	Explanation
Policy Name	Required	This is the name of the Tiering policy.
Execution Mode	Optional	This is the Execution Mode that specifies the mode of operation of the Automated Storage Tiering. There are three Execution Modes (Auto, Semi-Auto, and Manual).
Evaluation Period	Optional	This is the period of which access status data will be evaluated. A value can be specified in units of hours (2, 4, 6, 8, or 12 hours) or in units of days (1-31 days).
Evaluation Standard	Optional	This is the standard for evaluation of the access status data. Peak (peak value) or Average (average value) can be specified.

Item	Specification (*1)	Explanation
Automated Storage Tiering Execution Time	Optional	This is the time at which evaluation of access status data, and relocation of data within the volume will be started.
Automated Storage Tiering Time Limit	Optional	This is the time that will need to elapse from the Automated Storage Tiering Execution Time for relocation of the data within the volume to be discontinued.
Days of the Week subject to Evaluation	Optional	These are the days of the week to be subject to evaluation when evaluating the access status data.
Time of the Day subject to Evaluation	Optional	This is the time of the day to be subject to evaluation when evaluating the access status data.
Configuration of Days to exclude from Evaluation	Optional	These are the days to be excluded from being subject to evaluation of the access status data.
Data Type	Optional	This is the type of access status data. Currently, this is fixed as being IOPS.
Data Range of Tier Level	Optional	This is the specification of whether to manually configure the data range of each sub-pool or to automatically configure these with the system. When "Automatic Configuration" (recommended) is specified, the system will automatically decide the standards for relocation of the data within the volume.
Data Range of Low	Optional	This is the range of IOPS values to act as a standard upon location to the Low sub-pool of the Tier pool. (*2)
Data Range of Middle	Optional	This is the range of IOPS values to act as a standard upon location to the Middle sub-pool of the Tier pool. (*2)
Data Range of High	Optional	This is the range of IOPS values to act as a standard upon location to the High sub-pool of the Tier pool. (*2)

*1: When a specification is omitted for the item of which specification is "Optional", a default value will be configured.

*2: In cases when a range has not been specified, relocation will be performed automatically by the system.

Refer to "Create Tiering Policy" in the *ETERNUS SF Web Console Guide* for information on how to create Tiering policies.

Point

When the **Execution Mode** is set to "Auto" and the **Data Range of Tier Level** is set to "Automatic Configuration", the system will automatically decide the standards for relocation of data within the volume, and optimally perform the relocation. Normally, specification with this combination is recommended.

When setting the **Data Range of Tier Level** to the manual configuration, in order to assess the optimal value for the data range of each sub-pool, it is recommended that the **Execution Mode** is set to "Semi-Auto" or "Manual" and test runs of evaluation and relocation are performed.

Example

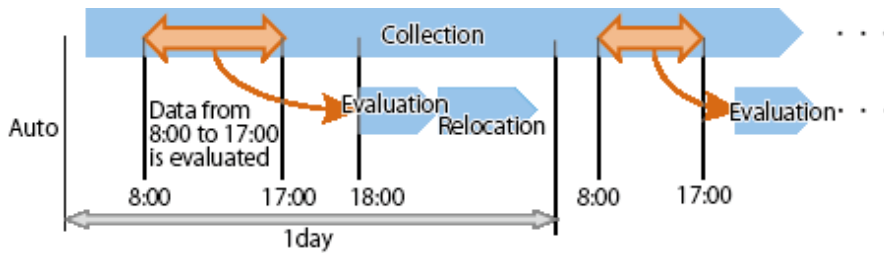
It explains timing from which the evaluation and relocation are executed according to the Tiering policy by using the following examples.

Setting Example 1

It is an example of executing the Automated Storage Tiering based on the access status at 8:00-17:00 at 18 o'clock every day.

Evaluation Period is set to "1Day", **Time of the Day subject to Evaluation** is set at 8:00-17:00, and **Automated Storage Tiering Execution Time** is set to 18:00.

The evaluation to the access situation data of 8:00-17:00 is begun at 18:00 every day.

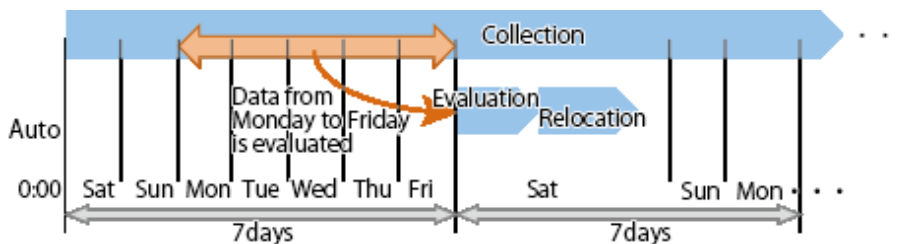


Setting Example 2

It is an example of executing the Automated Storage Tiering among one week based on the access status from Monday to Friday at 0 o'clock of Saturday.

Evaluation Period is set to "7Day", **Day of the Week subject to Evaluation** is set on Monday - Friday, and **Automated Storage Tiering Execution Time** is set to 0:00.

The evaluation to the access situation data of Monday - Friday is begun at 0:00 the following Saturday on the seventh every week when Automated Storage Tiering to the Tier pool of 0:00 of Saturday begins.



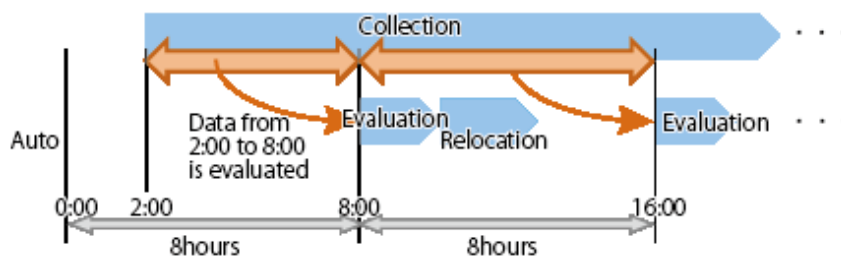
Setting Example 3

It is an example of executing the Automated Storage Tiering based on the access status of eight hours every eight hours.

Evaluation Period is set to "8Hour".

The evaluation to the access situation data of six hours from 2:00 to 8:00 is begun at 8:00 when Automated Storage Tiering to the Tier pool of 2:00 begins to make 0:00 a starting point for the Evaluation Period. Eight hours until 16:00-24:00 are evaluated to 24:00 for eight hours until 8:00-16:00 at 16:00

after that.



3.4.2 Change of Tiering Policy

To change the operation of the registered Tiering policy, change the definition of the Tiering policy.

Refer to "Change Tiering Policy" in the *ETERNUS SF Web Console Guide* for information on how to change a Tiering policy.

Point

- It is not possible to change the definition of multiple Tiering policies at once. When changing the definition of multiple Tiering policies, make changes to the each Tiering policy at a time.
- An evaluation exclusion day previous from the 32nd is automatically deleted on the day when the Tiering policy was changed when the **Days to exclude from Evaluation** is set to the Tiering policy of the operational object regardless of whether **Configuration of**

Days to exclude from Evaluation of the Tiering policy is enabled or disabled. The 32nd is days in which a day was added the 31st that is the maximum Evaluation Period in consideration of summer time.

- When the Tiering policy allocated in the Tier pool where the Automated Storage Tiering begins is changed, the collected access status data might be deleted according to the value of the **Execution Mode** of the Tiering policy.

Table 3.1 Value of Execution Mode

Before Change	After Change		
	Auto	Semi-Auto	Manual
Auto	Case2	Case2	Case1
Semi-Auto	Case2	Case2	Case1
Manual	Case1	Case1	Case2

Case1

Regardless of change of other items of the Tiering policy, the access status data collected for Tier pools which are using the Tiering policy is deleted and the collection of new access status data is begun. In this case, the evaluation period is a period from the change of the Tiering policy.

Case2

If any of the following items of the Tiering policy is changed, the access status data collected for Tier pools which are using the Tiering policy is deleted and the collection of new access status data is begun. In this case, the evaluation period is a period from the change of the Tiering policy.

- Evaluation Period
- Evaluation Standard
- Automated Storage Tiering Execution Time
- Time of the Day subject to Evaluation

3.4.3 Deletion of Tiering Policy

Before deleting the Tiering policy, display the detailed information of the Tiering policies that you are about to delete and confirm that deleting these will not be a problem. Refer to "Display Tiering Policy" in the *ETERNUS SF Web Console Guide* for information on how to display the detailed information of the Tiering policies.

Refer to "Delete Tiering Policy" in the *ETERNUS SF Web Console Guide* for information on how to delete a Tiering policy.



Point

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

3.5 Setting of Tier Pool

A Tier pool is registered as an FTRP of the storage device.

When a Tier pool is created from the Web Console, an FTRP and FTSPs are both created in the storage device. Furthermore, from the Web Console, it becomes possible to create an FTV in the storage device.

Specifying Master CM

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

- When creating a Tier pool
- When changing a layer number of Tier pool
- When expanding the capacity of the sub-pool



For the changing a layer number of the Tier pool and the expanding capacity of the sub-pool, the Master CM can be added only when the Master CM has been specified at the time the Tier pool was made.

As there is an effect on performance of access to the sub-pool due to the Master CM, it is recommended that all sub-pools contained in the Tier pool are assigned to the same Master CM.

The Master CM is specified as a pair formed by a CM number and a CPU number (or only the CM number when using the ETERNUS DX100 S3/DX200 S3, DX500 S3/DX600 S3).

It is possible to specify more than one Master CM, and by specifying a Master CM in relation to the Tier pool, it is possible to specify a Master CM of the entire Tier pool.

When multiple Master CMs are specified to the Tier pool, the Master CM is decided from the specified Master CMs using the round-robin method.

When creating a sub-pool in the Tier pool, it is possible to specify a Master CM of the sub-pool from the multiple Master CMs specified to the Tier pool.

When expanding the capacity of the sub-pool, take into account the master CMs that have already been assigned to each sub-pool that has already been created, and assign a Master CM using the round-robin method. It is also possible to make a specification from the Master CM which is displayed in the Master CM list.

When a specification of a Master CM has been omitted, this will automatically be assigned according to the implementation of the storage device.

Table 3.2 CM Allocation Logic During New Creation in Storage Device Having 2 CMs

Specification of Tier Pool	Sub-Pool Specification			Master CM to Be Set			Explanation
	Low	Middle	High	Low	Middle	High	
CM#0	-	-	-	CM#0	CM#0	CM#0	Configure CM#0 according to specification of pool
CM#0, CM#1	-	-	-	CM#0	CM#1	CM#0	With Low as CM#0, Middle and High are configured with the round-robin method
CM#0, CM#1	CM#1	-	-	CM#1	CM#0	CM#1	Explicitly specify CM#1 for Low while Middle and High are configured with the round-robin method
CM#0, CM#1	-	CM#1	-	CM#0	CM#1	CM#0	With Low as CM#0, explicitly specify CM#1 for Middle while High is configured with the round-robin method
CM#0, CM#1	-	-	CM#1	CM#0	CM#1	CM#1	With Low as CM#0, Middle is configured with the round-robin method while explicitly specifying CM#1 for High

Table 3.3 CM Allocation Logic During Capacity Expansion in Storage Device Having 2 CMs

Specification of Tier Pool	Set Master CM			Sub-Pools to Add	Master CM Which Are Assigned	Explanation
	Low	Middle	High			
CM#0, CM#1	CM#0	CM#1	CM#0	Low	CM#1	As 2 cases with CM#0 and 1 case with CM#1 have already been configured, configure CM#1
CM#0, CM#1	CM#1	CM#0	CM#1	Middle	CM#0	As 1 case with CM#0 and 1 case with CM#1 have already been configured, configure CM#0

Specification of Tier Pool	Set Master CM			Sub-Pools to Add	Master CM Which Are Assigned	Explanation
	Low	Middle	High			
CM#0, CM#1	CM#0	CM#1	CM#0	High	CM#1	As 2 cases with CM#0 and 1 case with CM#1 have already been configured, configure CM#1
CM#0, CM#1	CM#0	CM#1	CM#1	Low#1, Low#2	CM#0 (Low#1), CM#0 (Low#2)	As 1 cases with CM#0 and 2 cases with CM#1 have already been configured, configure CM#0

Even when the configuration is of that other than 2CMs, the allocation can be performed similarly using the round-robin method.

Disk Auto-Selection

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

- When creating a Tier pool
- When changing a layer number of 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.

3.5.1 Creation of Tier Pool

The items which can be specified to the Tier pool are as follows.

Basic Configuration Items of Tier Pool

Item	Specification (*1)	Explanation
Tier Pool Name	Required	This is a name of the Tier pool. It is necessary that this is a name that will be unique in the ETERNUS SF system.
Policy Name	Optional	This is the Tiering policy that is associated with the Tier pool.
Warning Threshold of Pool	Optional	This is the threshold (%) of the usage rate of the Tier pool in order to monitor the available capacity of the Tier pool. It is necessary to specify a value that is greater than Caution Threshold of Pool . When this threshold is exceeded, a warning will be notified by the SNMP Trap.
Caution Threshold of Pool	Optional	This is the threshold (%) of the usage rate of the Tier pool in order to monitor the available capacity of the Tier pool. It is necessary to specify a value that is smaller than Warning Threshold of Pool . When this threshold is exceeded, a caution will be notified by the SNMP Trap. It is also possible to not configure this item.
Encryption Status	Required	This is the configuration for whether or not the Tier pool is to be encrypted.
Specify a Master CM	Optional	This is the specification of the Master CM of a Tier pool.
Number of Tiers	Optional	This is the number of layers. A setting of either 2 or 3 can be specified. When "2" is specified, it is necessary to create 2 sub-pools (Low / High). When "3" is specified, it is necessary to create 3 sub-pools (Low / Middle / High).
Disk Selection	Optional	This is the selection method of the disks that configure the sub-pools. There is automatic selection (Auto) and manual selection (Manual).

Item	Specification (*1)	Explanation
		When the storage device is ETERNUS DX80 S2/DX90 S2, DX400 S2 series, DX8000 S2 series, in order to specify automatic selection (Auto), it is required that the firmware is V10L50 or later.

*1: When a specification is omitted for the item of which specification is "Optional", a default value will be configured.

Configuration Items of Sub-Pool

Item	Specification (*1)	Explanation
FTSP Name	Optional	This is a name of the sub-pool. It is necessary that this is a name that will be unique in the storage device.
Disk Type	Required	These are the types of disks that configure the sub-pool. Online, Nearline, SSD, or SED-SAS can be selected. When the storage device is ETERNUS DX80 S2/DX90 S2, DX400 S2 series, DX8000 S2 series, in order to utilize SED-SAS, it is required that the firmware is V10L30 or later.
Reliability	Required	This is the RAID level of the sub-pool.
Minimum Required Capacity	Required	This is the Minimum Required Capacity as a sub-pool. When automatic selection (Auto) has been specified for Disk Selection of " Basic Configuration Items of Tier Pool ", specification of this item is necessary.
Disk	Required	These are the disks of the RAID group that configure the sub-pool. The required number of disks will differ depending on the reliability of the RAID group. When manual selection (Manual) has been specified for Disk Selection of " Basic Configuration Items of Tier Pool ", specification of this item is necessary.
Stripe Depth	Optional	This is the size (KB) per disk in 1 stripe of the RAID groups configuring the sub-pool. The stripe depths that can be specified depend on the Reliability and the number of disks of the RAID group. When manual selection (Manual) has been specified for Disk Selection of " Basic Configuration Items of Tier Pool ", it is possible to specify this item.
Specify a CM	Optional	This is the specification of the Master CM of the RAID group configuring the sub-pool.

*1: When a specification is omitted for the item of which specification is "Optional", a default value will be configured.

Refer to "Create Tier Pool" in the *ETERNUS SF Web Console Guide* for information on how to create a Tier pool.

Point

- Multiple Tier pools can be created in one ETERNUS SF system.
- Only one Tiering policy can be configured to one Tier pool.

It is also possible to recycle the made Tier pool having registered the storage device. Refer to "[3.5.2 Recycling of Tier Pool Made in Storage Device](#)" for details.

3.5.2 Recycling of Tier Pool Made in Storage Device

Tier pool (FTRP) made in the storage device is registered in this product by updating status, and comes to be displayed in the Web Console. Refer to "Register Tier Pool" in the *ETERNUS SF Web Console Guide* for information on how to update status.

Note

- In a state where a Tier pool made to the storage device is only registered to this product, Automated Storage Tiering in relation to this Tier pool cannot be started. Refer to "Change Tier Pool" in the *ETERNUS SF Web Console Guide* and configure the following items in relation to the Tier pool.
 - Policy Name
 - FTSP Number in relation to Sub-Pool (Layer level)
 - When multiple storage devices are being managed, a Tier pool with the same name as another Tier pool present on a different storage device will not be imported to this product.
Reutilize a Tier pool that has already been made in the storage device by using the ETERNUS CLI and changing the name of the Tier pool to a name that is not redundant in one ETERNUS SF system.
 - A Tier pool that is configured of either 0 (zero) sub-pool, or 4 or more sub-pools will not be imported to this product.
The sub-pool configurations within Tier pool which can be managed by this product are those of 1 to 3 units.
Using the ETERNUS CLI, either changes the configuration to a Tier pool configuration that can be managed by this product, or after deleting the Tier pool, implement reloading of the Tier pool.
 - When the Tier pool made in the storage device is registered in this product, a Master CM allocated in the made sub-pool is set to Master CM of the Tier pool. When the following work is executed, Master CM can be added.
 - When changing a layer number of Tier pool
 - When expanding the capacity of the sub-pool
-

3.5.3 Change of Tier Pool

To change the operation of the Tier pool, change the definition of the Tier pool.

The items that are capable of being changed are as follows. For explanations of items other than the "FTSP Number", refer to "[3.5.1 Creation of Tier Pool](#)".

- Policy Name
- Warning Threshold of Pool
- Caution Threshold of Pool
- FTSP Number (Layer level)
This is the layer level (Low / Middle / High) of the sub-pool.
In changing of one layer Tier pool, the pull-down menu of the FTSP Number will not be displayed.
It is not possible to configure multiple sub-pools to be of the same Tier layer.
- FTSP Name
The FTSP name cannot be changed. Changing refers to, in a situation where the Low sub-pool name is "sub-1" and the High sub-pool name is "sub-2", changing the Low sub-pool name to "sub-2" and the High sub-pool name to "sub-1".

Refer to "Change Tier Pool" in the *ETERNUS SF Web Console Guide* for information on how to change the Tier pool.

Point

- It is not possible to change the definition of multiple Tier pools at once. When changing the definition of multiple Tier pools, make changes to the each Tier pool at a time.
 - The definition of a Tier pool in which Automated Storage Tiering has already been started cannot be changed.
-

3.5.4 Change Number of Layers of Tier Pool

By changing from the Tier pool of one layer to the Tier pool of two or three layers, the Automated Storage Tiering can be operated. Moreover, the Tier pool of two layers can be changed to the Tier pool of three layers.

Point

- As for the sub-pool of one layer, the layer level is set to High (fixation) beforehand.
 - As for the sub-pool of two layers, the layer level becomes set of Low and High (fixation).
-

The procedures to change the layer number and begin the Automated Storage Tiering are as follows.

1. Stop the Automated Storage Tiering for the target Tier pool.
Refer to "Start/Stop Automated Storage Tiering for Tier Pool" in the *ETERNUS SF Web Console Guide* for the operational procedure.
2. Create a Tiering policy.
Refer to "Create Tiering Policy" in the *ETERNUS SF Web Console Guide* for the creating method.
If use the Tiering policy that has already been created, this step is unnecessary.
3. Change the layer number of the target Tier pool.
Refer to "Change Number of Layers of Tier Pool" in the *ETERNUS SF Web Console Guide* to execute the following tasks.
 - Add the Low sub-pool when changing from one layer to two layers.
 - Add the two sub-pools in order of the Low sub-pool and the Middle sub-pool when changing from one layer to three layers.
 - Add the Middle sub-pool when changing from two layers to three layers.
4. Change the layer level of each layer and the sub-pool name, and set the corresponding Tiering policy if necessary.
Refer to "Change Tier Pool" in the *ETERNUS SF Web Console Guide* for the operational procedure.
5. Start the Automated Storage Tiering for the target Tier pool.
Refer to "Start/Stop Automated Storage Tiering for Tier Pool" in the *ETERNUS SF Web Console Guide* for the operational procedure.

3.5.5 Deletion of Tier Pool

Before operating the deletion, display the detailed information of the Tier pool that you are about to delete and confirm that deleting this will not be a problem. Refer to "Display Tier Pool" in the *ETERNUS SF Web Console Guide* for information on how to display the detailed information of a Tier pool.

Refer to "Delete Tier Pool" in the *ETERNUS SF Web Console Guide* for information on how to delete a Tier pool.

Point

- Multiple Tier pools can be deleted at once.
 - The following Tier pools cannot be deleted.
 - Tier pools on which FTVs are present
 - Tier pools in which Automated Storage Tiering has already been started
-

3.5.6 Expansion of Capacity of Sub-Pool

It is possible to expand the capacity of the sub-pools which configure a Tier pool.

The items which can be specified in sub-pool capacity expansion are as follows.

Basic Configuration Items of Tier Pool

Item	Specification	Explanation
Master CM	Optional	This is the specification of the Master CM of a Tier pool. A Master CM can be added only when the Master CM is specified upon creation of the Tier pool.
Disk Selection	Optional	This is the selection method of the disks that configure the sub-pools. There is automatic selection (Auto) and manual selection (Manual). When the storage device is ETERNUS DX80 S2/DX90 S2, DX400 S2 series, DX8000 S2 series, in order to specify automatic selection (Auto), it is required that the firmware is V10L50 or later.

Configuration Items of Sub-Pool

Item	Specification	Explanation
FTSP Name	Required	This is the name of the sub-pool of which the capacity is to be expanded. Although the name of the sub-pool subject to operation is displayed by default, it is possible to change the name of the sub-pool. When changing the name, it is necessary to specify a name that will be unique within the storage device.
Minimum Required Capacity	Required	This is the Minimum Required Capacity (capacity of sub-pool after expansion) as a sub-pool. When automatic selection (Auto) has been specified for Disk Selection of " Basic Configuration Items of Tier Pool ", specification of this item is necessary.
Disk	Required	These are the disks of the RAID group that configure the sub-pool. The required number of disks will differ depending on the reliability of the RAID group. When manual selection (Manual) has been specified for Disk Selection of " Basic Configuration Items of Tier Pool ", specification of this item is necessary.
Specify a CM	Optional	This is the specification of the Master CM of the RAID group configuring the sub-pool.

Refer to "Expand Capacity of Sub Pool in Tier Pool" in the *ETERNUS SF Web Console Guide* for information on how to expand the capacity of a sub-pool.

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 Flexible Tier Pool Balancing using 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 Flexible Tier Pool Balancing.

Perform the Flexible Tier Pool Balancing after stopping Automated Storage Tiering in relation to the target Tier pool. When the Flexible Tier Pool Balancing is performed during the operation of Automated Storage Tiering, this may cause cases where Automated Storage Tiering does not operate properly. Refer to "Start/Stop Automated Storage Tiering for Tier Pool" in the *ETERNUS SF Web Console Guide* for information on how to stop Automated Storage Tiering of a Tier pool.

3.6 Setting of FTV

FTVs only can be created in a Tier Pool.

Configuration of FTV is performed with the Web Console. This cannot be performed with the ETERNUS Web GUI.

The FTV usage rate is the proportion of each layer when the total physical capacity assigned to the FTV is expressed as 100. As values are displayed upon rounding of the second decimal place, there may be cases when the total does not add up to 100%.

Setting FTV Capacity Quota Share

You can set the quota share for the capacity of each sub-pool in the Tier pool when creating or making changes to FTV.

For FTV with a set quota share, relocation to each sub-pool is carried out according to the quota share.

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

The relocation logic for the case when the FTV quota share 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 share 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% 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 share cannot be secured, relocation is performed with as much capacity as can be secured. Therefore, relocation may not proceed according to the specified quota share.

Figure 3.4 Relocation When Capacity Quota Share Is Specified For Each Layer

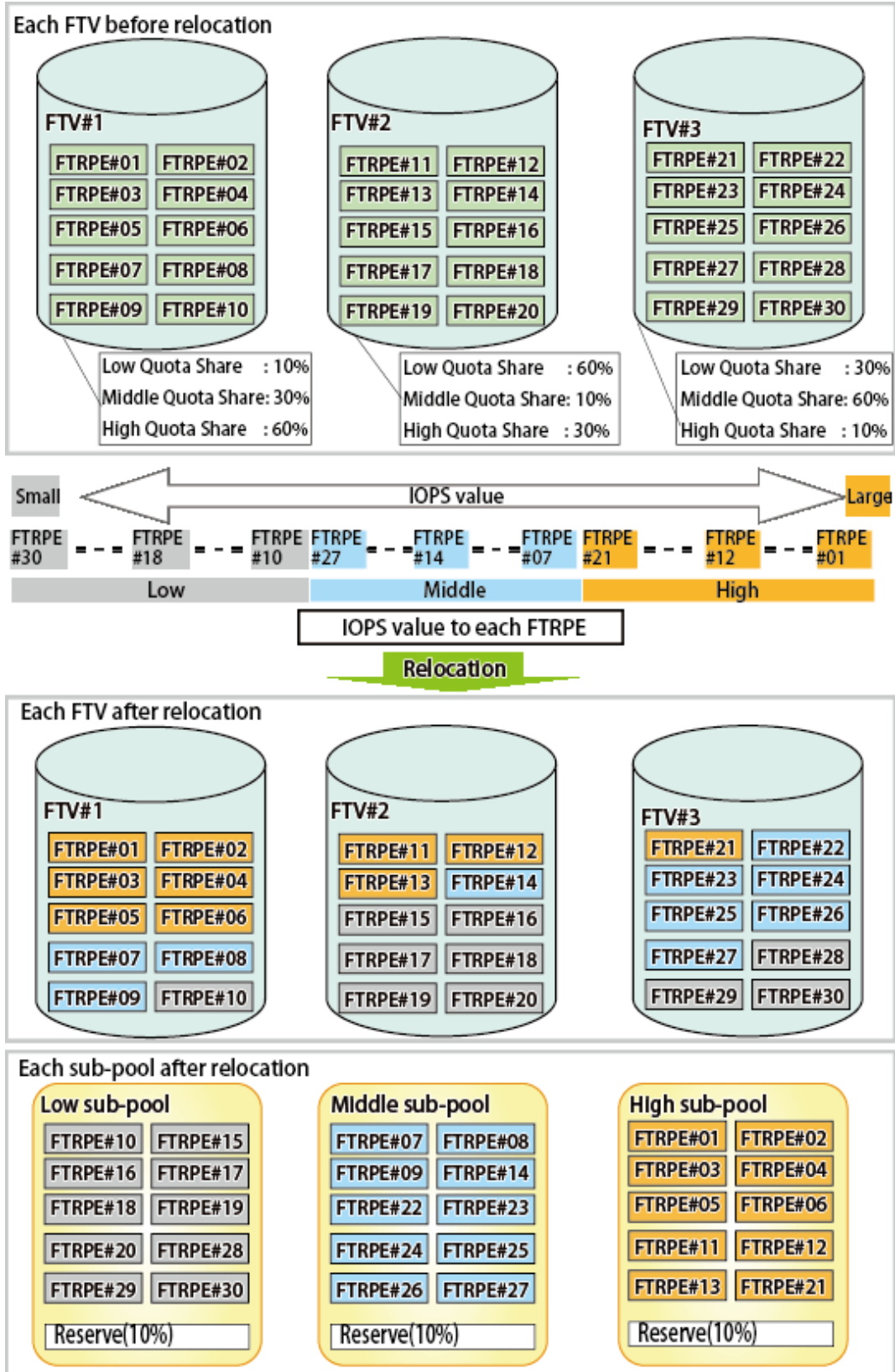


Figure 3.5 Relocation When Free Space Corresponding To Specification Of Capacity Quota Share Cannot Be Secured

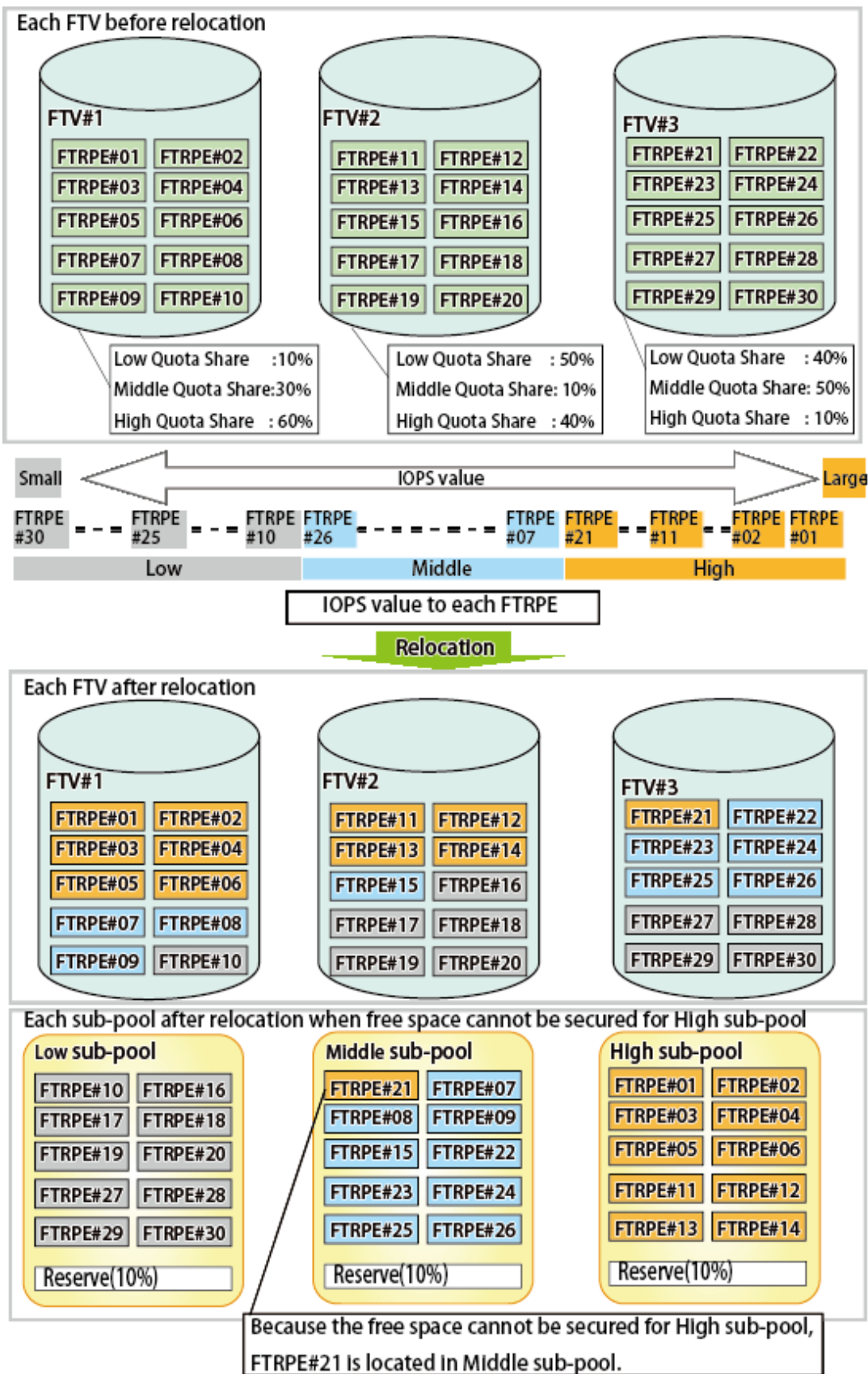
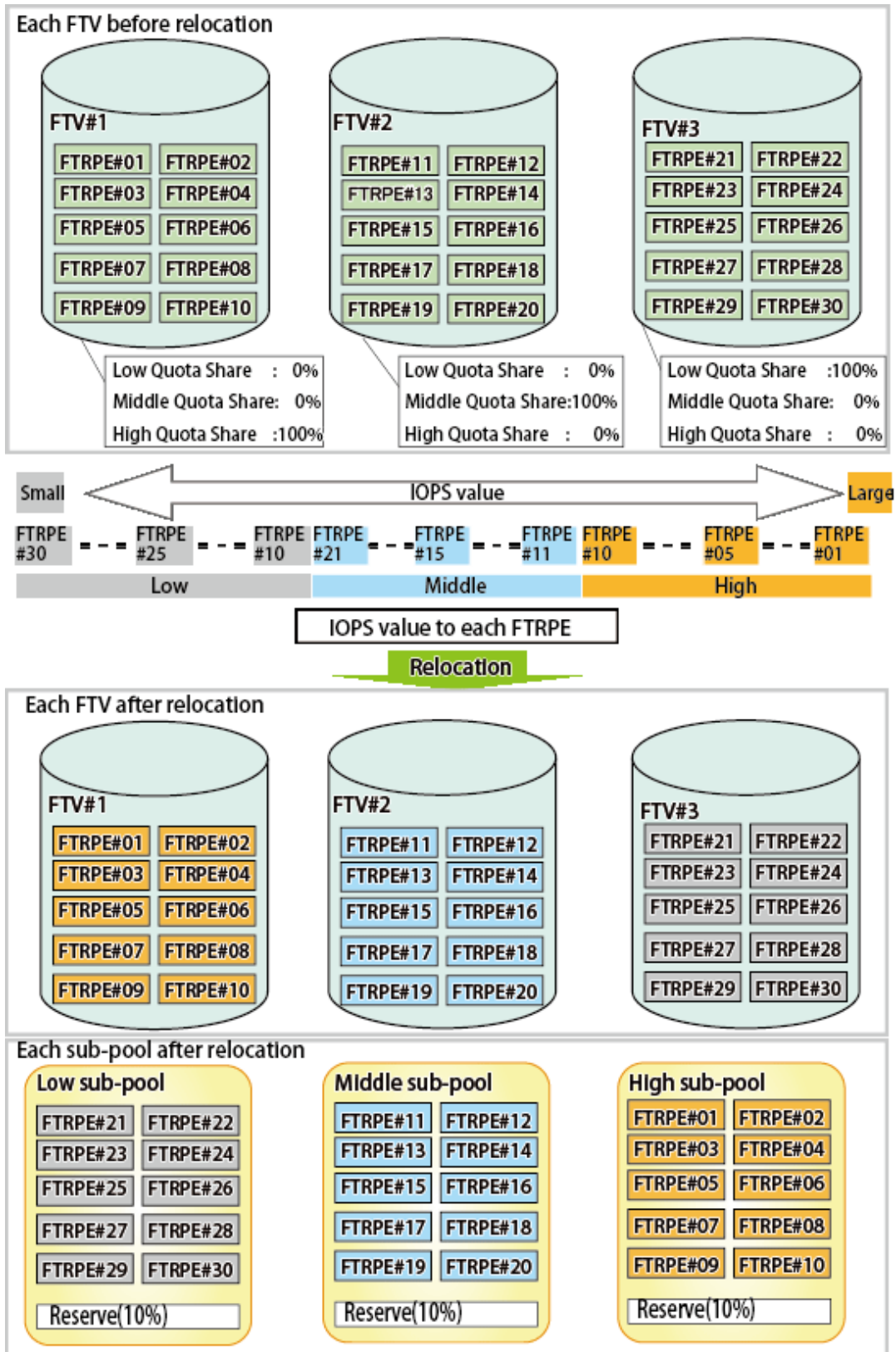


Figure 3.6 Relocation When Capacity Quota Share Is Specified For Specific Layer





Implement the changing / deletion / formatting of an FTV after updating the administration information of the FTV.
 In order to update the administration information of an FTV, in relation to the ETERNUS Disk storage system of which the IP address thereof has been changed, perform the procedures listed under "Reload ETERNUS Disk Storage System Configuration Information" in the *ETERNUS SF Web Console Guide*.

3.6.1 Creation of FTV

This will create an FTV.

The items which can be specified during creation of an FTV are as follows.

Item	Specification	Explanation
Tier Pool Name	Required	This is the name of the Tier pool in which the FTV will be created.
FTV Name	Optional	This is the name of the FTV.
Total Capacity	Required	This is the capacity of the volume that will be created.
Volume Number	Required	This is the number of volumes that will be created.
Caution Threshold of FTV	Optional	This is the threshold of the ratio of the usage capacity at which caution is notified. - For ETERNUS DX100 S3/DX200 S3, DX500 S3/DX600 S3: Specify a threshold (%) at which a caution will be sent when the ratio of the physically assigned capacity in relation to the total capacity of the FTV exceeds this threshold. - For ETERNUS Disk storage systems other than those listed above: Specify a threshold (%) at which a caution will be sent when the ratio of the available capacity of the pool in relation to the remaining physically available capacity exceeds this threshold.
Priority FTSP	Optional	Select the sub-pool used when new allocation is required. If space is not available another sub-pool will be used.
Low Quota Share	Optional	This is the share to be assigned to the Low sub-pool upon relocation. (*1, *2)
Middle Quota Share	Optional	This is the share to be assigned to the Middle sub-pool upon relocation. (*1, *2)
High Quota Share	Optional	This is the share to be assigned to the High sub-pool upon relocation. (*1, *2)
Target Response Time (*3)	Optional	This is the target value of the response time of the volume the user will be using.

*1: When Tiering policy is not set to the Tier pool where FTV is made, this item cannot be set.

*2: The assignment share is an approximation, and there are cases when data is not assigned exactly according to specification. When the assignment share has been omitted, relocation is performed according to the Tiering policy.

*3: This can be specified when utilizing the Automated QoS function.

Refer to "Create FTV" in the *ETERNUS SF Web Console Guide* for information on how to create an FTV.

3.6.2 Changing of FTV

It is possible to change the details of the definition of an FTV.

The following items can be changed. Refer to "[3.6.1 Creation of FTV](#)" for an explanation of the items.

- FTV Name
- Total Capacity
- Caution Threshold of FTV
- Priority FTSP
- Low Quota Share
- Middle Quota Share
- High Quota Share
- Target Response Time (only when utilizing the Automated QoS function)

Refer to "Change FTV" in the *ETERNUS SF Web Console Guide* for information on how to perform changes.

 **Point**

- When a Tiering policy is not set to the Tier pool where the target FTV exists, the following items cannot be set.
 - Low Quota Share
 - Middle Quota Share
 - High Quota Share
- The current details of the definition of an FTV can be confirmed by following the procedures listed under "Display FTV" in the *ETERNUS SF Web Console Guide*.
- It is not possible to change the definition of multiple FTVs at once.

3.6.3 Format of FTV

Refer to "Format FTV" in the *ETERNUS SF Web Console Guide* for information on how to format an FTV. Furthermore, as an FTV is automatically formatted when being created, it is unnecessary to format a newly created FTV.

 **Point**

It is not possible to format multiple FTVs at once.

3.6.4 Deletion of FTV

Before operating the deletion, display the detailed information of the FTV that you are about to delete and confirm that deleting this will not be a problem. Refer to "Display FTV" in the *ETERNUS SF Web Console Guide* for information on how to display the detailed information of an FTV.

Refer to "Delete FTV" in the *ETERNUS SF Web Console Guide* for information on how to perform the deletion.

 **Point**

- Multiple FTVs can be deleted at once.
- An FTV that is currently assigned to a server cannot be deleted.

3.7 Relation Between Threshold of Tier pool and Threshold of FTV

As for the attention threshold of attention threshold/warning threshold of the Tier pool and FTV, each meaning is different.

It explains each meaning as follows.

Figure 3.7 Caution Threshold and Warning Threshold of Tier pool

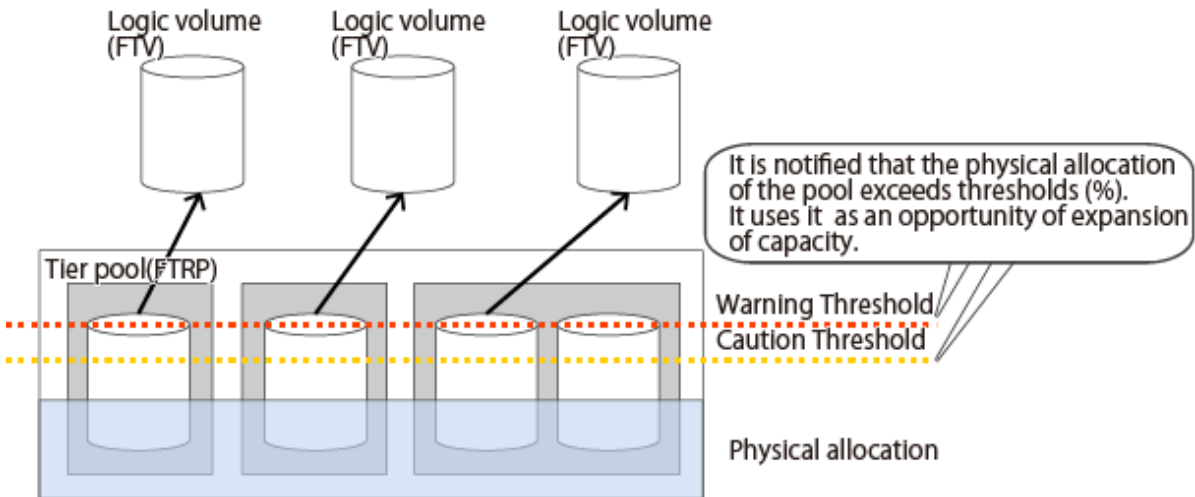
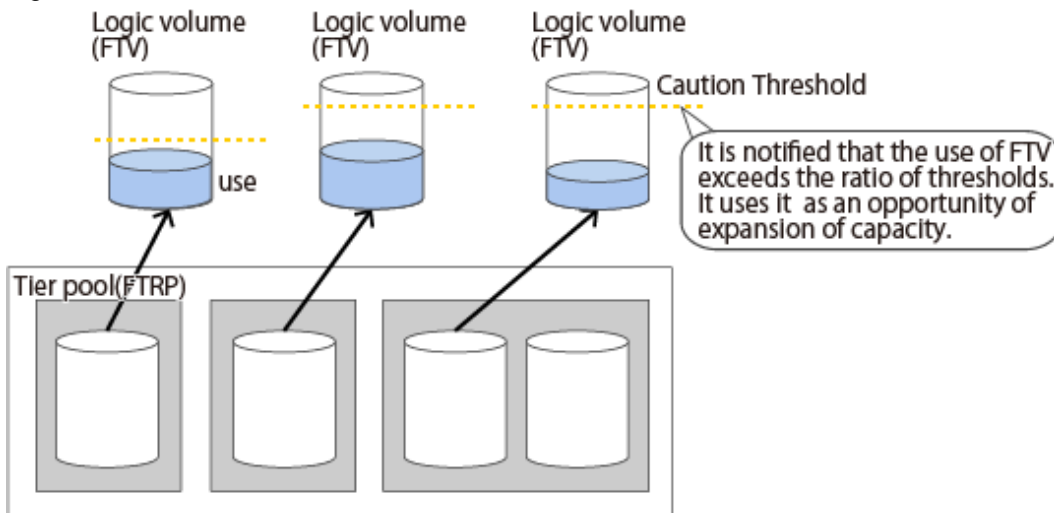


Figure 3.8 Caution Threshold of FTV



Information

The explanation in the above-mentioned figure is ETERNUS DX100 S3/DX200 S3, DX500 S3/DX600 S3.

3.8 Test Run of Evaluation and Relocation

With this product, Automated Storage Tiering is implemented based on a Tiering policy.

When a Tiering policy is configured to the following, in relation to the Tier pools using its Tiering policy, the system will automatically decide the standards for relocation of data within the volume, and optimally perform the relocation.

- Execution Mode: Auto
- Data Range of Tier Level: Automatic Configuration

The following explains the flow of tasks when setting the **Execution Mode** to "Semi-Auto" or "Manual" and conducting a test run of evaluation and relocation in order to assess the optimal value for the data range of each sub-pool.

Procedures of Tasks When Execution Mode Is "Semi-Auto"

The overview of the procedures of tasks from the test run to the start of operation is as follows:

1. Start Automated Storage Tiering in relation to the Tier pool that is subject to the test run.

Refer to "Start/Stop Automated Storage Tiering for Tier Pool" in the *ETERNUS SF Web Console Guide* for information on procedures of operation.

Once Automated Storage Tiering in relation to the Tier pool has been started, collection / evaluation of performance data necessary for relocation of data within the volume will be performed.

2. Confirm the evaluation results.

The evaluation results can be confirmed by following the procedures listed under "Display Relocation Target Volume" in the *ETERNUS SF Web Console Guide*.

Item	Contents
Evaluation Date	This is the time and date when the performance data was evaluated.
Tier Pool Name	This is the name of the Tier pool in which the volume is present.
FTV Number	This is the volume number.
FTV Name	This is the name of the volume.
Policy Name	This is the Tiering policy specified to the Tier pool.
Execution Mode	This is the Execution Mode of the Automated Storage Tiering.
Keep High	This is the proportion (%) of data of High that is not to be moved.
Up to High	This is the proportion (%) of data to be moved from Low / Middle to High.
Up to Middle	This is the proportion (%) of data to be moved from Low to Middle.
Keep Middle	This is the proportion (%) of data of Middle that is not to be moved.
Down to Middle	This is the proportion (%) of data to be moved from High to Middle.
Down to Low	This is the proportion (%) of data to be moved from High / Middle to Low.
Keep Low	This is the proportion (%) of data of Low that is not to be moved.
Status	<p>This is the execution status of relocation.</p> <ul style="list-style-type: none"> - Evaluated: volumes of the Execution Mode of "Semi-Auto" that are subject to relocation - Reallocating: volumes that are executing relocation - Waiting: volumes that are subject to relocation and are waiting to execute relocation - Suspended: volumes in which relocation has been suspended <p>Volumes in which relocation has been completed will not be displayed. Completed results can be confirmed from the relocation history.</p>
Progress Rate	This is the progress rate of the volumes that are executing relocation.

3. Perform the following tasks according to the evaluation results.

When There Are No Problems With Evaluation Results:

Execute the relocation of data within the volume.

Refer to "Start/Stop Relocation" in *ETERNUS SF Web Console Guide* for information on how to perform the execution.

When There Is Problem With Evaluation Results:

Continue the collection and the evaluation of the performance data after changing the Tiering policy related to the Tier pool to be tried. Refer to "Change Tiering Policy" in the *ETERNUS SF Web Console Guide* for information on how to change a Tiering policy.

Procedures of Tasks When Execution Mode Is "Manual"

The overview of the procedures of tasks from the test run to the start of operation is as follows.

Note

When the Execution Mode is "Manual", if the evaluation is started within one hour after performing the following tasks, there may be cases when correct evaluation information cannot be obtained.

- Relocation of Data within Volume
- Creation of Tier Pool
- Addition of FTV
- Deletion of FTV

1. Start Automated Storage Tiering in relation to the Tier pool that is subject to the test run.

Refer to "Start/Stop Automated Storage Tiering for Tier Pool" in the *ETERNUS SF Web Console Guide* for information on procedures of operation.

Once Automated Storage Tiering in relation to the Tier pool has been started, collection of performance data necessary for relocation of data within the volume will be performed.

2. Evaluate the collected performance data.

Refer to "Evaluate Access Status Data for Tier Pool" in the *ETERNUS SF Web Console Guide* for information on how to perform the evaluation.

3. Confirm the evaluation results.

The evaluation results can be confirmed by following the procedures listed under "Display Relocation Target Volume" in the *ETERNUS SF Web Console Guide*. Refer to the table of step 2 of "[Procedures of Tasks When Execution Mode Is "Semi-Auto"](#)" for an explanation of the displayed information.

4. Perform the following tasks according to the evaluation results.

When There Are No Problems With Evaluation Results:

Execute the relocation of data within the volume.

Refer to "Start/Stop Relocation" in *ETERNUS SF Web Console Guide* for information on how to perform the execution.

When There Is Problem With Evaluation Results:

Continue the collection and the evaluation of the performance data after changing the Tiering policy related to the Tier pool to be tried. Refer to "Change Tiering Policy" in the *ETERNUS SF Web Console Guide* for information on how to change a Tiering policy.

Point

Once it has been confirmed that there are no problems in the test run of evaluation and relocation, it is recommended that Automated Storage Tiering is operated upon changing the **Execution Mode** of the Tiering policy to "Auto".

Note

Automated Storage Tiering might relocate to the same disk type of the same layer when defining it on the following conditions.

- Each layer of the Tier pool is made by the same disk type.
- When FTV is made, **Priority FTSP** is specified with "Auto" or sub-pool that is the same disk type.

The value is displayed in **Keep Low**, **Keep Middle**, and **Keep High**, and when the relocation result is displayed because the movement of the layer is not generated in the relocation of the same layer to the same disk type, and "0" might be displayed in **Up to High**, **Up to Middle**, **Down to Middle**, and **Down to Low**.

Chapter 4 Operation of Automated Storage Tiering

This chapter explains the work that will become necessary after starting operation of Automated Storage Tiering based on the Tiering policy that has been decided.

4.1 Confirmation of Execution Results of Relocation

The execution results of relocation can be confirmed by referring to the relocation history.

Refer to "Display Tier Pool" in the *ETERNUS SF Web Console Guide* for information on how to display the relocation history.

The items that are displayed as part of the history are as listed below.

Item		Meaning
FTV Number		This is the volume number.
FTV Name		This is the alias name of the volume.
FTV Capacity		This is the total capacity of the FTV. This will be displayed in units of MB, GB, or TB according to the capacity.
Most Recent History	Time of Update	This is the time when relocation has been completed.
	Relocation Results	These are the execution results of relocation. One of the following will be displayed. <ul style="list-style-type: none"> - Normal Finished - Error Finished - Normal Suspended - Error Suspended - Unexecuted <p>"Normal Finished" will be displayed when relocation has been completed successfully. "Normal Suspended" will display when suspension of relocation has been performed, or when the executed time of the relocation has reached the elapsed time for discontinuation. In other cases, although there will be a display indicating that relocation was not completed successfully, usually this will not be a problem as the processing will be performed successfully in the next occasion of relocation. However, if cases where relocation is not completed successfully continue to occur, gather materials for inspection and contact Fujitsu Technical Support as there is the possibility that a problem has occurred.</p>
	Usage Share	This is the usage share of the Tier Pool. The proportion of every tier level is displayed in respect to the total physical capacity assigned to FTV being 100.
Previous History	Time of Update	This is the time when relocation has been completed.
	Relocation Results	These are the execution results of relocation. One of the following will be displayed. <ul style="list-style-type: none"> - Normal Finished - Error Finished - Normal Suspended - Error Suspended - Unexecuted - - (hyphen)
	Usage Share	This is the usage share of the Tier Pool.

Item	Meaning
	The proportion of every tier level is displayed in respect to the total physical capacity assigned to FTV being 100.

4.2 Confirmation of Configuration Details of Tier Pool

In order to review the configuration details of the Tier pool, it is necessary to confirm the detailed information of the Tier pool.

Refer to "Display Tier Pool" in the *ETERNUS SF Web Console Guide* for information on how to display the detailed information of the Tier pool.

The items that are displayed are as listed below.

Items Displayed Under Basics Tab

Item	Meaning
Pool Number	This is the Flexible Tier Pool number.
Tier Pool Name	This is the Flexible Tier Pool name.
Pool Status	This is the status of the Flexible Tier Pool. One of the following will be displayed. <ul style="list-style-type: none"> - Available - Exposed - Partially Ready - Ready - Maintenance - Broken - Data Lost - No Disk Path - Unknown
Total Capacity	This is the total capacity of the Flexible Tier Pool. This will be displayed in units of MB, GB, or TB according to the capacity.
Usage Capacity	This is the usage capacity of the Flexible Tier Pool. This will be displayed in units of MB, GB, or TB according to the capacity.
Alarm Status	This is the alarm status of the Flexible Tier Pool. One of the following will be displayed. <ul style="list-style-type: none"> - Normal - Warning - Caution - N/A
Usage Proportion	This is the usage proportion (%) of the Flexible Tier Pool. When the total capacity is 0, a "-" (hyphen) will be displayed.
Warning Threshold of Pool	This is the warning alarm notification threshold (%) of the Flexible Tier Pool.
Caution Threshold of Pool	This is the caution alarm notification threshold (%) of the Flexible Tier Pool. When the caution alarm notification threshold is configured to be "disabled", a "-" (hyphen) will be displayed.
Encryption Status	This is the encryption status of the Flexible Tier Pool. One of the following will be displayed. <ul style="list-style-type: none"> - Yes

Item	Meaning
	<ul style="list-style-type: none"> - No - Unknown
Master CM	<p>This is the master CM of the Tier Pool.</p> <p>"Auto" or the configured master CM (separated with commas) will be displayed.</p>

Items Displayed Under Sub-Pool Tab

Item	Meaning
FTSP Number	This is the sub-pool number and the sub-pool to which it belongs.
FTSP Name	This is the sub-pool name.
Disk Type	<p>This is the disk categorization. One of the following will be displayed.</p> <ul style="list-style-type: none"> - SSD - Online - Nearline - SED-SAS - Unknown
Reliability	<p>This is the reliability of the sub-pool. One of the following will be displayed.</p> <ul style="list-style-type: none"> - High Performance(RAID1+0) - High Capacity(RAID5) - High Reliability(RAID6) - Mirroring(RAID1) - Striping(RAID0) - Unknown
FTSP Status	<p>This is the status of the sub-pool. One of the following will be displayed.</p> <ul style="list-style-type: none"> - Available - Exposed - Partially Ready - Ready - Maintenance - Broken - Data Lost - No Disk Path - Unknown
Total Capacity of FTSP	<p>This is the total capacity of the sub-pool.</p> <p>This will be displayed in units of MB, GB, or TB according to the capacity.</p>
Usage Capacity	<p>This is the usage capacity of the sub-pool.</p> <p>This will be displayed in units of MB, GB, or TB according to the capacity.</p>
RAID Group Number	This is the RAID group number included in the sub-pool.
CM	This is the master CM of the RAID group.

Item	Meaning
RAID Group Status	This is the status of the RAID group.
Stripe Depth	This is the stripe depth. One of the following will be displayed. <ul style="list-style-type: none"> - 64 - 128 - 256 - 512 - 1024 - - (hyphen)

Items Displayed Under Volume Tab

Item	Meaning
FTV Number	This is the volume number.
FTV Name	This is the alias name of the volume.
Status	This is the status of the volume. A status which is the same as that of the Open volume will be displayed.
Encryption Status	This is the encryption status of the volume. One of the following will be displayed. <ul style="list-style-type: none"> - Yes - No - Unknown
Total Capacity	This is the logical capacity (MB) of the volume.
Usage Capacity	This is the usage capacity (MB).
Alarm Status	This is the alarm status of the volume. One of the following will be displayed. <ul style="list-style-type: none"> - Normal - Caution - N/A
Caution Threshold of FTV	This is the caution alarm notification value.
Priority FTSP	This is the name of the sub-pool configured as a prioritized assignment destination. "Auto" will be displayed when this is not specified.
Low quota share	This is the configured Low quota share. When being omitted, a "-" (hyphen) will be displayed.
Middle quota share	This is the configured Middle quota share. When being omitted, a "-" (hyphen) will be displayed.
High quota share	This is the configured High quota share. When being omitted, a "-" (hyphen) will be displayed.

4.3 Suspension of Relocation

Suspension of relocation is the process of creating, in relation to a volume of which the **Status** thereof is "Reallocating" or "Waiting" in the overview of Automated Storage Tiering, a state where relocation of data within the volume is not executed.

Relocation will be suspended in the following cases. Refer to "Start/Stop Relocation" in the *ETERNUS SF Web Console Guide* for information on how to perform the suspension.

- When wanting to implement the process in relation to a subject volume (for example, backup / restoration of data within the volume)
- When wanting to review the Tiering policy as the access status of the subject volume is starting to differ from original estimates

Point

When relocation is suspended, be sure to re-implement evaluation of the access status data.

Upon reimplementation of evaluation, if a volume is evaluated as a subject of relocation, such volume again becomes a volume that is subject to relocation.

4.4 Deletion of Evaluation Result

If you do not execute relocation based on the evaluation result after confirming the evaluation result, it is necessary to delete the evaluation result information.

Refer to "Confirm Evaluation Result/Relocation Information and Delete Evaluation Result" in the *ETERNUS SF Web Console Guide* for information on how to delete the evaluation result information.

Point

Volumes of which the evaluation result or relocation history information can be deleted are those volumes where the **Status** is "Evaluated" or "Suspended" in the overview of Automated Storage Tiering.

4.5 Reuse of Tiering Policy Definitions

These are the procedures for taking Tiering policy definitions created with a separate environment and reusing them with a new environment.

This enables Tiering policy definitions utilized in a separate environment to be reused as is without having to be created again.

Note

When Tiering policies have been registered with the new environment, definitions of a separate environment cannot be reused. In order to enable reuse, re-perform this procedure after deleting the Tiering policy definitions that have already been registered.

The procedures of the configuration are as follows:

1. Stop the ETERNUS SF Manager Tomcat service of the new environment.

- When using the Manager for Windows:

Stop the following service in the Windows Services screen.

- ETERNUS SF Manager Tomcat Service

- When using the Manager for Solaris or Linux:

Execute the following shell script to stop the service.

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

2. Back up the Tiering policy definitions of the separate environment.

Perform a backup of the following files.

- When using the Manager for Windows:

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

```
$ENV_DIR\AST\Manager\etc\opt\FJSVssast\data\policy\tierPolicyName.xml
```

\$ENV_DIR is the "environment configuration directory" of when the ETERNUS SF Manager was installed on the separate environment.

- When using the Manager for Solaris or Linux:

```
/etc/opt/FJSVssat/data/policy/TierPolicy.xml  
/etc/opt/FJSVssat/data/policy/tierPolicyName.xml
```

3. Reflect the tiering policy definitions to the new environment.

Place files that have been backed up from the separate environment into the same folder of the new environment.

- When using the Manager for Windows:

```
$ENV_DIR\AST\Manager\etc\opt\FJSVssat\data\policy\TierPolicy.xml  
$ENV_DIR\AST\Manager\etc\opt\FJSVssat\data\policy\tierPolicyName.xml
```

\$ENV_DIR is the "environment configuration directory" of when the ETERNUS SF Manager was installed on the new environment.

- When using the Manager for Solaris or Linux:

```
/etc/opt/FJSVssat/data/policy/TierPolicy.xml  
/etc/opt/FJSVssat/data/policy/tierPolicyName.xml
```

4. Start the ETERNUS SF Manager Tomcat service of the new environment.

- When using the Manager for Windows:

Start the following service in the Windows Services screen.

- ETERNUS SF Manager Tomcat Service

- When using the Manager for Solaris or Linux:

Execute the following shell script to start the service.

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

5. Execute the [9.1.1 esfadm tierpolicy import \(Tiering policy import command\)](#) to register the placed Tiering policies.

Chapter 5 Design of Automated QoS Function

This chapter explains the Automated QoS function.

The Automated QoS function, in respect to target values of response time (hereinafter referred to as "target response time") configured by the user in relation to volumes being used, performs automatic tuning in such manner that the actual measured response times reached the targeted values.

For the target response time, the average of all Read + Write response time for the volume per unit time should be specified.

The target values configured with this function are target values in relation to the volumes being used by applications. Even when a volume has reached its performance target, as it is possible that the performance target has not been achieved as an application, while configuring target values for the performance of volumes, it is necessary for the user to confirm whether the application has achieved its performance target. When the performance target of the application has not been reached, it is necessary to reconfigure the performance target values of the volumes.

5.1 Decision of Target Values

The object and the value in which the targeted value is set are decided by the following procedures.

1. Extract the volume that the business application uses.
2. Decide the target response time (unit of millisecond) of the extracted volume.

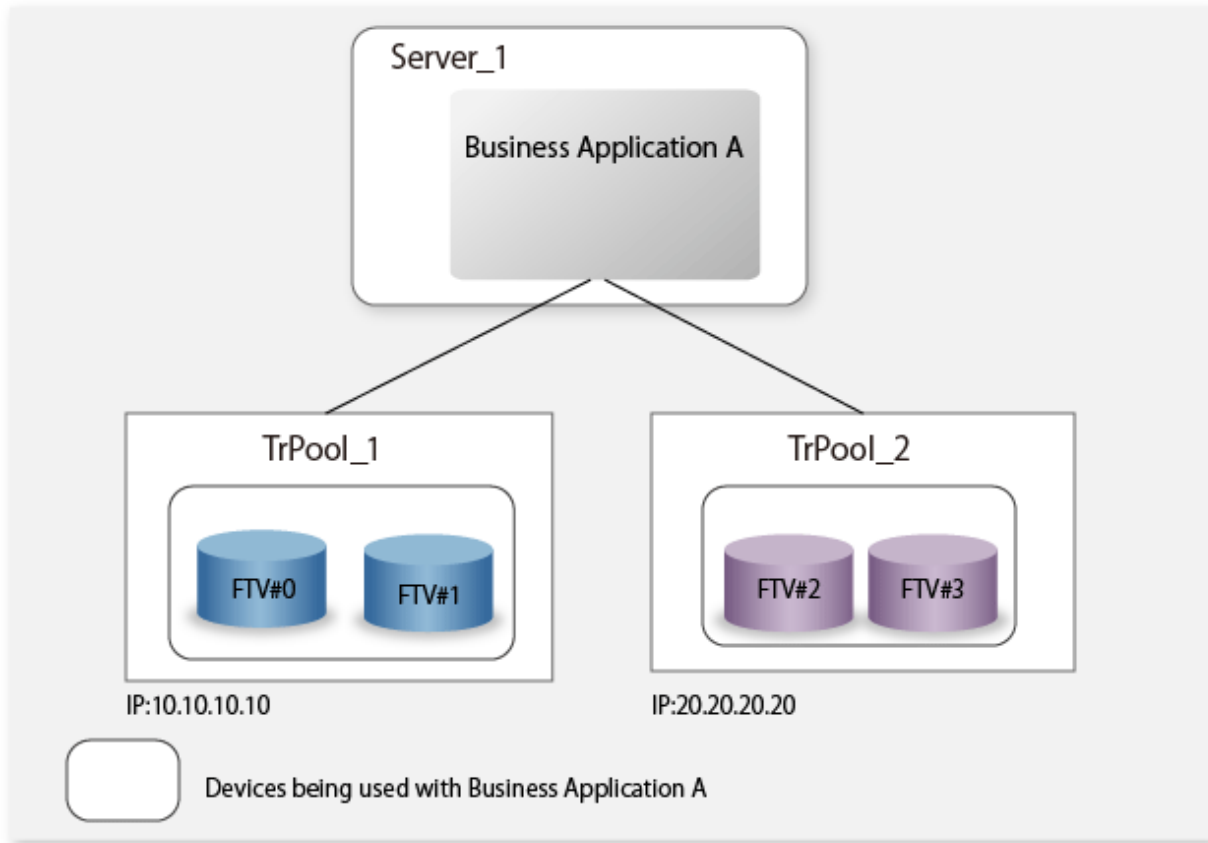
Examples are as follows.

Configuration Example of Target Values of Business Application

This explains the introduction of automatic tuning with performance target values, in relation to the following environment that is operating business applications.

- As a regular business, business application A is being operated on server Server_1.
- The Tier pools that business application A uses are TrPool_1 and TrPool_2
- FTV#0 and FTV#1 are present in TrPool_1, and business application A uses FTV#0 and FTV#1.
- FTV#2 and FTV#3 are present in TrPool_2, and business application A uses FTV#2 and FTV#3.

Figure 5.1 Operation Model of Business Application



In relation to the above volumes, configure the target response time from the following perspectives.

- Performance requirements of business application
- Current performance value, interpreted from the performance graph

Configuration Example of Target Values

The target response time that each volume needs is decided from the performance requirement for business application A. In the example, it makes it to the target response time indicated in the following tables.

Tier Pool Name	FTV Name	Target Response Time
TrPool_1	FTV#0	10 msec
	FTV#1	20 msec
TrPool_2	FTV#2	-
	FTV#3	100 msec

In accordance with the performance adjustments of the volumes to which target response times have been configured, the performance of other volumes sharing resources with these are also controlled.

The decided target response times are configured to the volumes and performance adjustments are conducted, and until the user determines that performance sufficient for the operation of business applications is reached, the configuration of target response times are repeated.

Command Execution Examples

Command execution examples for Windows are described below.

- A target response time of 10 msec will be configured in relation to FTV#0 present in TrPool_1.

```
>$INS_DIR\Common\bin\esfadm volume qosset -ipaddr 10.10.10.10 -volume 0 -resptime 10
```

- A target response time of 20 msec will be configured in relation to FTV#1 present in TrPool_1.

```
>$INS_DIR\Common\bin\esfadm volume qosset -ipaddr 10.10.10.10 -volume 1 -resptime 20
```

- A target response time of 100 msec will be configured in relation to FTV#3 present in TrPool_2.

```
>$INS_DIR\Common\bin\esfadm volume qosset -ipaddr 20.20.20.20 -volume 3 -resptime 100
```

5.2 Structure of Automatic Tuning

The automated tuning of the Automated QoS function is realized by adjusting bandwidth so that the volume in which the target is set may achieve a target. At this time, the bandwidth of the volume in which the target is not set is adjusted automatically at the same time.

Evaluation is performed based on actual measured Read + Write response time for the volume.

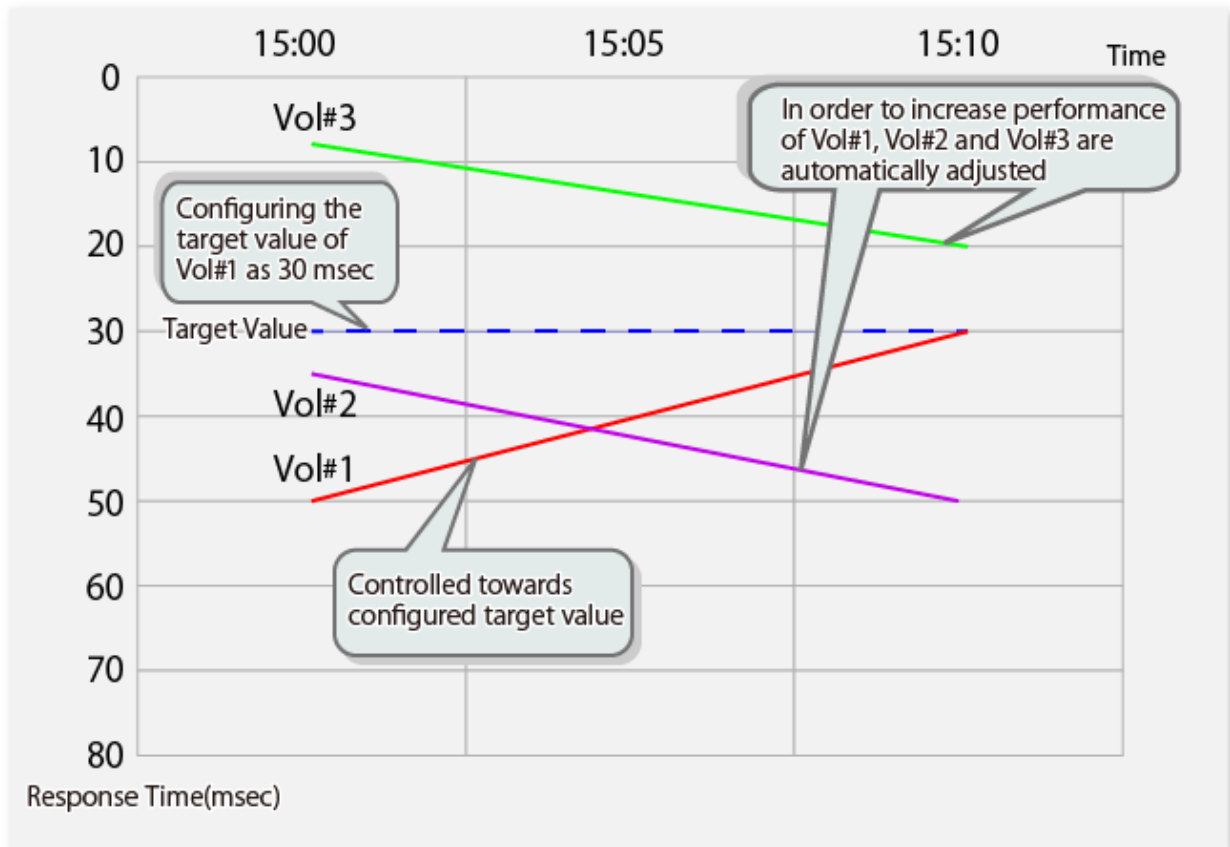
Furthermore, tuning is performed in the range of hardware marginal performance. The set target value is not ensured.

Automatic Tuning Example

Implementation example of automatic tuning is described below.

1. When it is determined from the performance of tasks that the performance of volume 1 (Vol#1) is insufficient, as the actual measured value for the response time is 50 msec, the user, in order to make this faster than 50 msec, configures a target value of 30 msec. Target values will not be configured to the other volumes (Vol#2, Vol#3).
2. As a result, the bandwidth of Vol#1 expands, the bandwidths of volume 2 (Vol#2) and volume 3 (Vol#3) are narrowed, and automatic tuning aimed at the target value is performed.
3. As a result of the adjustments of bandwidths, the response time of Vol#1 reaches the target.

Figure 5.2 Structure of Bandwidth Adjustments



Structure of Automatic Tuning

The QoS function of ETERNUS Disk storage system sets the bandwidth limiting by 16 levels from 60IOPS and 5MB/s to unrestricted. The Automated QoS function adjusts the performance by changing bandwidth by using this function.

Immediately after a target value is set to a target volume for the first time, the performance is tuned from the initial value step by step, thus the effectiveness may not be seen soon.

Automatic tuning is realized by retrieving performance information at every evaluation interval (1 minute) and repeating the following processes.

1. The shared resource (CM, Port, switch Port, pool) having the highest Busy-rate is located.
2. The bandwidth is adjusted between the volumes sharing the resource having the highest Busy-rate. The details of the adjustment are as follows:
 - The bandwidths of volumes of which actual measured performance exceed the targeted performance are narrowed by one level.
 - The bandwidths of volumes with actual measured performance lower than the targeted performance and subject to narrowed bandwidths due to QoS are expanded by one level.
 - Adjustments for the shortages occurring from the above are made to the volumes to which target performance values have not been configured.



Note

The Automated QoS function references the performance information of the storages to which the FTV subject to performance adjustments belong, and the performance information of the switches.

Although the Automated QoS function can be utilized even when the performance management function of the switches are disabled, in such case, shared resources related to CM and pools will be the only subjects of performance adjustments.

Consideration of System in Low Load State

In business operation, the state of load differing depending on the time of the day can be considered.

When being in a low load state, the actual measured response time will be the fastest since throughput is low. As a result, the actual measured response time will exceed the target response time, and the bandwidth thereof will be in its narrowest state due to automatic tuning. From this state, when the time of the day of a high load state is entered and throughput increases, there is the possibility of response time worsening in an extreme manner.

When the actual measured response time of a volume to which a target value has been configured exceeds the target response time, only when the actual measured response time of another volume, to which a target value have been configured and is subordinate to a shared resource with a high Busy-rate, is lower than the target response time, the bandwidth is narrowed. When all volumes subordinate to the shared resource exceed the target response time, the bandwidths are not adjusted.

Even if there is no load on a volume from business operation, the bandwidth of the volume is not adjusted.

In addition, if there is no workload and there is some spare space in bandwidth, this bandwidth is temporarily supplied to other volumes short of bandwidth to cover shortfall. In this way, even when a target response time is satisfied, if there is spare space in bandwidth on any other volume, performance more than the target response time may be achieved.

5.3 Affected Range of Automatic Tuning

The volumes to which target values have been configured will be subject to automatic adjustments of their bandwidths in order for the targets to be reached. In the range of the shared resources, due to the effect of bandwidths being adjusted in order to increase the response time of the volumes to which target values have been configured, there are cases when the response time of volumes to which target values have not been configured decrease.

The shared resources of the volumes consist of the four following types.

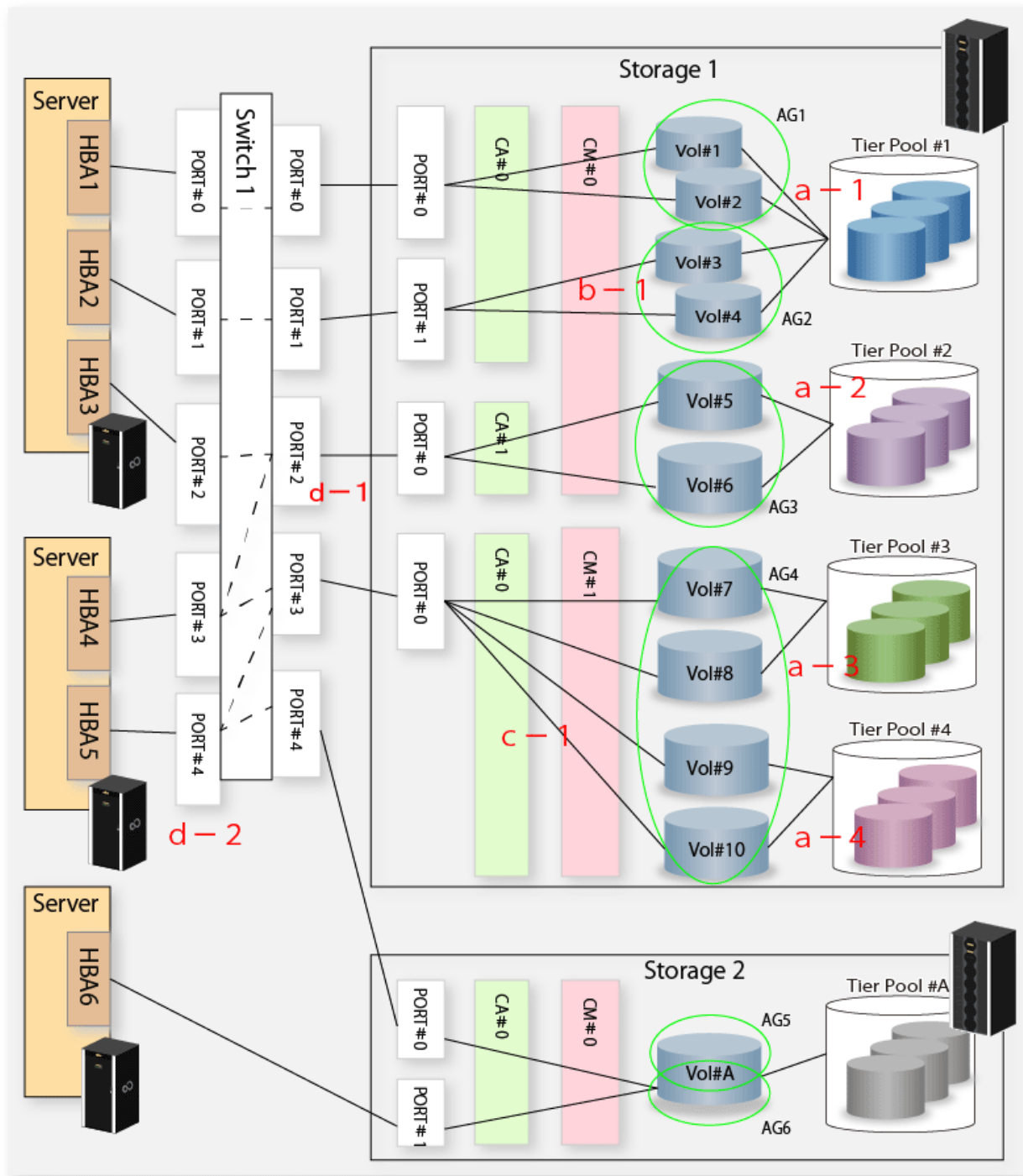
- Tier pools
- CMs

- CA/CM ports
- Switch ports

The pattern of the shared resources of the volumes is explained based on configuration examples.

- Contention of Tier pools
 - Vol#1, Vol#2, Vol#3, and Vol#4 share Tier Pool#1 (a-1)
 - Vol#5 and Vol#6 share Tier Pool#2 (a-2)
 - Vol#7 and Vol#8 share Tier Pool#3 (a-3)
 - Vol#9 and Vol#10 share Tier Pool#4 (a-4)
- Contention of CMs
 - Vol#1, Vol#2, Vol#3, Vol#4, Vol#5, and Vol#6 share CM#0 (b-1)
- Contention of CA/CM ports
 - Vol#7, Vol#8, Vol#9, and Vol#10 share CM#1-CA#0-PORT#0 (c-1)
- Contention of Switch ports
 - Vol#5 and Vol#6 share PORT#2 of the Switch port on the storage side (d-1)
 - Vol#7, Vol#8, Vol#9, Vol#10, and Vol#A share PORT#4 of the Switch port on the server side (d-2)

Figure 5.3 Shared Resources of Volumes



5.4 Determining Achievement of Performance Target

In the Automated QoS function, the performance configuration values of the storage device are automatically adjusted in order to achieve the performance target that the subject volume is configured with. Whether the performance target has been achieved is determined based on the following information.

- Actual measured peak response time (automatically collected with the performance management function of Storage Cruiser)
- Target response time (configured by the user)

When the performance target cannot be achieved by some factors, it is necessary to review the hard composition. Or sets the performance target value again.

5.5 Activation Trigger for Automatic Tuning

The Automated QoS function is started at the same time the ETERNUS SF Manager is started, and will continue to be active until the ETERNUS SF Manager is stopped.

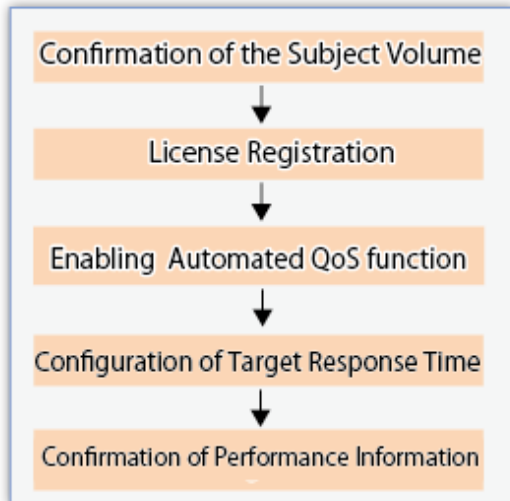
When starting the ETERNUS SF Manager, the performance configuration values of the storage device registered with the ETERNUS SF Storage Cruiser Quality of Service Management Option license will be returns to the value when last ETERNUS SF Manager is stopped.

Chapter 6 Setup of Automated QoS Function

This chapter explains the setup of the Automated QoS function.

With the Automated QoS function, the FTVs defined using Automated Storage Tiering are volumes subject to automatic tuning. Refer to "[Chapter 3 Setup of Automated Storage Tiering](#)" and be sure to configure the FTV in advance.

Figure 6.1 Setup Flow of Automated QoS Function



6.1 Confirmation of Subject Volume

The volumes subject to automatic tuning are the FTVs that satisfy all of the following conditions. With respect to FTVs that fall under the following, bandwidths will be adjusted according to whether target values have been configured and the achievement status thereof.

- The performance management function is in a started state
- The FTV is a volume subject to the performance management function
- The license for this function (refer to "[6.2 License Registration](#)") has been registered
- The FTV is a volume displayed in the correlation management
- The FTV is a volume that belongs to a storage device with which the Automated QoS is "Active"

The above status can be confirmed with the Web Console. Refer to the following sections in the *ETERNUS SF Web Console Guide* for information on how to confirm each item.

- Confirmation of the registration status of the subject device:
"Display ETERNUS Disk Storage System"
- Confirmation of whether the performance administration function is in a started state:
"Display Performance Monitoring Status" listed under "Operations for Performance Management of Storage Device"
- Confirmation of the registration status of the license:
"Display License"
- Confirmation of host affinity settings:
"Display Host Affinity"
- Confirmation of activation of Automated QoS:
From the list of storages that are displayed after clicking **Storage** on the global navigation tab, the Main pane that is displayed when clicking a storage name

Furthermore, when the performance management function of the switches connecting the subject volumes and the servers are not in a started state, although the automatic performance adjustment of the subject volumes will be executed, only the contending volumes in regard to the CM and pool will be subject to the performance adjustment.

Refer to "Display FC Switch List" in the *ETERNUS SF Web Console Guide* for information on how to confirm the status of the performance management function of switches.

An example of the affected range of automatic tuning is as follows (corresponding to the numbers in the figure):

1. Only the FTV of the volumes subject to performance management will be subject to bandwidth adjustment.
2. The volumes other than those subject to performance management will not be subject to bandwidth adjustment.

Figure 6.2 Example of Subject Volumes

Performance being Measured	Volume Number	Volume Type	Configured Target Response Time	Subject to Bandwidth Adjustment
○	101	Standard		×
○	102	FTV	10 msec	○
○	103	TPV		×
○	104	Standard		×
○	105	FTV	—	○
○	106	TPV		×
○	107	Standard		×
○	108	FTV	—	○
×	109	TPV		×
×	110	Standard		×
×	111	FTV	10 msec	×
×	112	FTV	—	×

① Only the FTVs in the performance measurement are adjusted

② The volumes in which the performance is not measured do not adjust bandwidth

6.2 License Registration

The Automated QoS function is made available by registering the license with the server on which ETERNUS SF Manager has been installed. It is not necessary to install any additional software.

Registration of the license is performed from the Web Console. Refer to "Register License" in the *ETERNUS SF Web Console Guide* for information on how to register the license.



See

Refer to "[1.2 Operating Environment](#)" for information on the license.

6.3 Enabling Automated QoS Function

In order to utilize the Automated QoS function, start the Automated QoS function to enable the function. Startup of the Automated QoS function is performed for each storage that will be utilizing the function.

Startup of the Automated QoS function is performed from the Web Console. Refer to "Enable/Disable Automated QoS Function" in the *ETERNUS SF Web Console Guide* for information on how to perform the start up.

6.4 Configuration of Target Response Time

The target response time is configured with one of the following.

- Configuration during creation of FTV
- Configuration with the FTV Changing Wizard in relation to an existing FTV

6.4.1 Configuration From FTV Creating Wizard

The target response time is configured from the Web Console during the creation of an FTV. The procedures are as follows.

1. On the global navigation tab, click **Storage**.
The registered ETERNUS Disk storage systems are displayed on the Main pane.
2. On the Main pane, click the target ETERNUS Disk storage system.
3. On the Category pane, click **Automated Storage Tiering**.
The items of the Category pane change into the items concerning Automated Storage Tiering.
4. On the Category pane, click **FTV**.
The registered FTVs are displayed on the Main pane.
5. On the Action pane, click **Create** under **FTV**.
This will proceed to step 1 of the Creating Wizard.
6. Create an FTV. Refer to "[3.6.1 Creation of FTV](#)" for information on items to specify.
Configure the target response time.
7. Click **Next**.
This will proceed to step 2 of the Creation Confirmation Wizard.
8. Click **Create**.
Operate it as follows. Automatic tuning according to the configured target response time will begin.
 - Newly created FTV should be assigned to a server through host affinity.
 - The performance management function should be restarted after creating a new FTV.

6.4.2 Configuration From FTV Changing Wizard

The target response time is configured in relation to an existing FTV from the Web Console. The procedures are as follows.

1. On the global navigation tab, click **Storage**.
The registered ETERNUS Disk storage systems are displayed on the Main pane.
2. On the Main pane, click the target ETERNUS Disk storage system.
3. On the Category pane, click **Automated Storage Tiering**.
The items of the Category pane change into the items concerning Automated Storage Tiering.
4. On the Category pane, click **FTV**.
The registered FTVs are displayed on the Main pane.
5. On the Action pane, click **Modify** under **FTV**.
This will proceed to the FTV Changing Wizard.
6. Configure the target response time.
7. Click **Modify**.
Automatic tuning will be started with the changed performance target values.

6.4.3 Operation Using Commands

It is only possible to configure a target response time to an existing FTV. Refer to "[3.6 Setting of FTV](#)" of Automated Storage Tiering for information on how to create an FTV.

The target response time is configured with the [esfadm volume qosset command](#). Refer to "[9.2 Commands of Automated QoS Function](#)" for information on the command.

6.5 Confirmation of Performance Information

After configuring the target response time, confirm the performance information with the performance graph. Display of the performance graph is conducted from the Web Console. Refer to "Display Performance Information Graph" in the *ETERNUS SF Web Console Guide* for information on how to display the performance graph.

Chapter 7 Operation of Automated QoS Function

This chapter explains the operation of the Automated QoS function.

7.1 Tuning of Performance Target

When the target response time is not achieved, or when the targeted performance as an application is not achieved regardless of the volume achieving targeted performance, it is necessary for the user to change the target response time.

In addition, when I/O characteristics (read, write, random access, sequential access) are significantly biased, the target value may not be achieved. For this reason, it is necessary to set a target value based on the hardware performance information in accordance with the I/O characteristics.

Furthermore, when using Advanced Copy, the error is caused by mass copying in the performance tuning. For this reason, it is recommended to stop the Automated QoS function during the initial copying of QuickOPC and REC.

Change the target response time of the volume that the application uses when you cannot achieve the performance target as an application. When an actual response time does not reach at the target response time after the change, it is necessary to review the hard composition.

- When utilizing the Web Console:

Refer to "Change Target Response Time" in the *ETERNUS SF Web Console Guide*.

- When utilizing the Command Line Interface:

Execute the `esfadm volume qosset command`.

After changing the target response time, confirm performance information with the performance graph. Refer to "[6.5 Confirmation of Performance Information](#)" for information on how to confirm details.

7.2 Operation After Completion of Tuning

Because the load always changes, the automated tuning keeps always changing bandwidth. Stop the Automated QoS function since achieving the performance target as the application when you want to fix by current bandwidth.

Stopping of the Automated QoS function is performed through the Web Console. Refer to "Enable/Disable Automated QoS Function" in the *ETERNUS SF Web Console Guide* for information on how to stop the Automated QoS function.

Furthermore, when restarting the Automated QoS function, in step 3 of "Enable/Disable Automated QoS Function", click **Activate** under **Automated QoS**.

Chapter 8 Operation Maintenance

This chapter explains the operation maintenance of the Optimization functions.

8.1 Collect the Troubleshooting information

Troubleshooting information is collected with the Web Console.

Refer to "Collecting Troubleshooting Information" of the *ETERNUS SF Web Console Guide* for information on how to collect the troubleshooting data.

8.2 Backup of Operating Environment

In order to be prepared for when an error occurs with the operating environment of the Optimization functions, perform a backup of the operating environment.

In order to back up the operation environment of the Optimization functions, perform a backup of the Storage Cruiser's manager. Refer to "Backup of Manager" in the *ETERNUS SF Storage Cruiser Operation Guide* for information on how to perform a backup of the Storage Cruiser's manager.

8.3 Restoration Operating Environment

When an error occurs with the operating environment of the Optimization function, restore the operating environment.

In order to restore the operating environment of the Optimization functions, restore the Storage Cruiser's manager. Refer to "Restoring Manager" in the *ETERNUS SF Storage Cruiser Operation Guide* for information on how to restore the Storage Cruiser's manager.

Furthermore, when performing the restoration upon reinstalling the manager, be sure to implement the restoration after completing 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 procedures for installation and setup.

8.4 Maintenance of Supported Device

This section explains support device maintenance.

8.4.1 Change IP Address of 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 Storage Device Information" in the *ETERNUS SF Web Console Guide* for information on how to change the IP address.
- When deleting the device once and changing the IP address, be sure to execute the [esfast tierpool setaddress command](#) after changing the IP address and re-registration. The procedures of the configuration are as follows.
 1. After performing registration of the device in relation to the storage device of which the IP address has been changed, execute the [esfast tierpool setaddress command](#) with the manager environment.
 2. In the Web Console, click **Storage** on the global navigation tab, and execute the **Reloading of Configurations** in relation to the ETERNUS Disk storage system of which the IP address has been changed.
Alternatively, click **Automated Storage Tiering > Overview**, and click **Status Update** under **Automated Storage Tiering** on the Action pane.

8.4.2 Measures to Be Taken When Tier Pool Configuration Has Been Changed With Managed Devices

When the configuration of the Tier pool to be managed is changed, there is a possibility that a difference will occur between the Tier pool information present on the ETERNUS SF Manager and the Tier pool information of the device. When status update of Automated Storage Tiering is performed while in a state where there is a difference, the esast3101 message will be output to the operation log.

When the esast3101 message has been output to the operation log, perform the following actions.

1. Execute the [esfast tierpool delete command](#) and delete only the information of the Tier pool subject to the esast3101 message.

```
> esfast tierpool delete -name name -mode file -s
```

For the *name*, specify the name of the tier pool subject to the esast3101 message.

2. In the Web Console, click **Automated Storage Tiering > Overview**, and click **Status Update** under **Automated Storage Tiering** on the Action pane.

Chapter 9 Command References

This section explains how to use certain commands.

9.1 Commands of Automated Storage Tiering

9.1.1 esfadm tierpolicy import (Tiering policy import command)

NAME

esfadm tierpolicy import - migration of Tiering policies

SYNOPSIS

esfadm tierpolicy import -all

COMMAND PATH

Windows Environment

```
$INS_DIR\Common\bin\esfadm tierpolicy import -all
```

(\$INS_DIR is the "Program directory" of when ETERNUS SF Manager has been installed to a new environment.)

Solaris or Linux Environment

```
/opt/FJVSvesfcm/bin/esfadm tierpolicy import -all
```

DESCRIPTION

A request for migration of Tiering policies will be made to this product. In order to execute the command, the administrator privilege of the OS is required.

OPERAND

import

Tiering policies of a separate environment will be migrated.

OPTIONS

Options of the "import" operand

-all

All Tiering policies of a separate environment will be migrated.

EXIT STATUS

=0: Completed successfully

>0: Terminated abnormally

EXAMPLES

Windows Environment

```
> C:\ETERNUS_SF\Common\bin\esfadm tierpolicy import -all  
esfadm00000 The command ended normally.
```

Solaris or Linux Environment

```
# /opt/FJSVesfcm/bin/esfadm tierpolicy import -all  
esfadm00000 The command ended normally.
```

NOTES

- Before executing this command, be sure to register the ETERNUS SF Storage Cruiser Optimization Option license. If registration has not been performed, although the execution of the command will be started, migration of Tiering policies will terminate in an error.
- Confirm that the following has been activated. If the following has not been activated, the Tiering policies cannot be migrated.
 - Windows environment
 - If the service of the ETERNUS SF system has not been activated, execution of the command will not be accepted. Confirm that it is possible to login to the Web Console, and then confirm that the escs10000 message has been output in the event log screen of the Web Console.
 - If the ETERNUS SF Storage Cruiser Optimization Option service has not been activated, although the execution of the command will be started, migration of Tiering policies will end in an error. Open the Windows Services screen and confirm that the service is "started" state.
 - Solaris or Linux environment
 - If the daemon of the ETERNUS SF system has not been activated, execution of the command will not be accepted. Confirm that it is possible to login to the Web Console, and then confirm that the escs10000 message has been output in the event log screen of the Web Console.
 - If the ETERNUS SF Storage Cruiser Optimization Option daemon has not been activated, although the execution of the command will be started, migration of Tiering policies will terminate in an error. Execute the following command and confirm whether the process is present.

```
# /bin/ps -ef | grep FJSVssast | grep -v grep
```
- It is not possible to execute this command at the same time. After confirming that the execution of the command has been completed, re-execute the command.
- The results of the migration of Tiering policies will be output to the operation history of the Web Console. Login to the Web Console and confirm the operation history. If migration has failed, implement measures for the message that has been output to the operation history.

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

NAME

esfast tierpool setaddress - changing the IP address information of a storage device

SYNOPSIS

```
esfast tierpool setaddress -oldaddress oldIpAddr -newaddress newIpAddr [-s]
```

COMMAND PATH

Windows Environment

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

(*\$INS_DIR* is the "Program directory" when ETERNUS SF Manager has been installed.)

Solaris or Linux Environment

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

DESCRIPTION

The IP address information of the storage device that the Optimization option is holding will be changed. In order to execute the command, the administrator privilege of the OS is 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.

-s

The process will be continued without the output of a confirmation message.

EXIT STATUS

=0: 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

- Before executing this command, be sure to register the ETERNUS SF Storage Cruiser Optimization Option license. If not registered, the command will terminate with an error.
- Confirm that the following has been activated. If they are not running, the command will terminate with an error.
 - Windows environment
 - ETERNUS SF Storage Cruiser Optimization Option service
Open the Windows Services screen and confirm that the service is "started" state.
 - Solaris or Linux environment
 - ETERNUS SF Storage Cruiser Optimization Option daemon
Execute the following command and confirm whether the process is present.

```
# /bin/ps -ef | grep FJSVssast | grep -v grep
```
- The following notes apply when specifying an IP address in the option.
 - You cannot specify multiple addresses or use wildcards.
 - When specifying an Ipv6 address, be sure to specify a global address.

9.1.3 esfast tierpool delete (Tier pool deletion command)

NAME

esfast tierpool delete - Deletion of Tier pool

SYNOPSIS

esfast tierpool delete -name *name* [-mode *deleteMode*] [-s]

COMMAND PATH

Windows Environment

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

(\$INS_DIR is the "Program directory" when ETERNUS SF Manager has been installed.)

Solaris or Linux Environment

```
/opt/FJSVssast/sbin/esfast tierpool delete
```

DESCRIPTION

The Tier pool will be deleted. In order to execute the command, the administrator privilege of the OS is required.

OPERANDS

delete

The Tier pool will be deleted.

OPTIONS

Options of the "delete" operand

-name *name*

Specify the name of the Tier pool to delete.

The values that can be specified are as follows.

Specify the name of a Tier pool that has already been created on the character sequence screen of 1-16 characters comprising alphanumeric characters and the "#" (pound), "-" (hyphen), and "_" (underscore) symbols.

Upper- and lower-case characters will not be distinguished.

-mode *deleteMode*

The mode during deletion of the Tier pool will be specified. The values that can be specified are as follows.

file

Information on the Tier pool on the ETERNUS SF Manager is deleted. The Tier pool on the device will not be deleted.

-s

The process will be continued without the output of a confirmation message.

EXIT STATUS

The following end status will be returned.

=0: Completed successfully

>0: Terminated abnormally

EXIT STATUS	Meaning
0	Completed successfully
1	The specified command cannot be found
2	The specified command is invalid
3	The specified parameter is invalid
4	The specified option is invalid
5	The format of the specified parameter value is invalid
22	esfast tierpool command execution errors
254	Internal error
255	Unexpected error

EXAMPLES

- The Tier pool [TrPool1] on the device will be deleted with the silent mode.

Windows environment

```
> C:\ETERNUS_SF\AST\Manager\opt\FJSVssast\sbin\esfast tierpool delete -name TrPool1 -s  
INFO:esast9000:Command terminated normally.
```

Solaris or Linux environment

```
# /opt/FJSVssast/sbin/esfast tierpool delete -name TrPool1 -s  
INFO:esast9000:Command terminated normally.
```

- The Tier pool [TrPool1] on the device will be kept and only the data held by the Manager will be deleted with the silent mode.

Windows environment

```
> C:\ETERNUS_SF\AST\Manager\opt\FJSVssast\sbin\esfast tierpool delete -name TrPool1 -mode file
-s
INFO:esast9000:Command terminated normally.
```

Solaris or Linux environment

```
# /opt/FJSVssast/sbin/esfast tierpool delete -name TrPool1 -mode file -s
INFO:esast9000:Command terminated normally.
```

NOTES

- Confirm that the following has been activated. If they are not running, the command will terminate with an error.
 - Windows environment
 - ETERNUS SF Storage Cruiser Optimization Option service
Open the Windows Services screen and confirm that the service is "started" state.
 - Solaris or Linux environment
 - ETERNUS SF Storage Cruiser Optimization Option daemon
Execute the following command and confirm whether the process is present.

```
# /bin/ps -ef | grep FJSVssast | grep -v grep
```
- If a virtual volume (FTV) is present in the Tier pool, the Tier pool cannot be deleted. Delete the Tier pool after deleting the virtual volume (FTV) with the "storageadm volume delete" command.
- When a Tier pool is deleted, the Flexible Tier Sub Pools configured to the Tier pool will be deleted at the same time.

9.2 Commands of Automated QoS Function

9.2.1 esfadm volume qosset (Target response time configuration / changing command)

NAME

esfadm volume qosset - configuring or changing the target response time

SYNOPSIS

esfadm volume qosset -ipaddr *ipAddress* -volume *volumeNumber* -resptime *targetResponseTime*

COMMAND PATH

Windows Environment

```
$INS_DIR\Common\bin\esfadm volume qosset
```

(\$INS_DIR is the "Program directory" when ETERNUS SF Manager has been installed.)

Solaris or Linux Environment

```
/opt/FJSVesfcm/bin/esfadm volume qosset
```

DESCRIPTION

With respect to the specified FTV, configuration or changing of the target response time will be performed. If this command is executed in a state where the target response time has been configured, the target response time will be changed.

OPERANDS

qosset

Configuration or changing of the target response time will be performed.

OPTIONS

Options of the "qosset" operand

-ipaddr *ipAddress*

The IP address of the ETERNUS Disk storage system will be specified. You cannot specify multiple addresses or use wildcards.

-volume *volumeNumber*

The FTV Number to which the target response time is configured will be specified in decimal notation. Only a single volume can be specified.

-resptime *targetResponseTime*

This will specify the target response time. Specify an integer from 0 to 10000. The unit of it is millisecond.
When 0 is specified, the bandwidth of the volume becomes unrestricted.

OUTPUT INFORMATION

Operation History of ETERNUS SF

The following execution history information will be output to the operation history of the Web Console.

Output Items	Output Details
Date	Process execution date
User ID	Execution user
Action	Set QoS(CLI)
Status	Submit, Start, or Complete
Results	Success, Failed, or Warning
Target	-
Details	Detailed information
Message	Error message

EXIT STATUS

=0: Completed successfully

other than 0: Terminated abnormally

EXAMPLES

When configuring a target response time of 10 msec in relation to FTV#0

Windows Environment

```
> C:\ETERNUS_SF\Common\bin\esfadm volume qosset -ipaddr 10.10.10.10 -volume 0 -resptime 10  
esqos0002 The target response time has been set normally.
```

Solaris or Linux Environment

```
# /opt/FJSVesfcm/bin/esfadm volume qosset -ipaddr 10.10.10.10 -volume 0 -resptime 10  
esqos0002 The target response time has been set normally.
```

NOTES

- Before executing this command, be sure to register the ETERNUS SF Storage Cruiser Quality of Service Management Option license. If not registered, the command will terminate with an error.
- Execution privilege
In order to execute the command, the following administrator privilege of the server OS is required.
 - Windows environment
 - Users of the Administrators group
 - Solaris or Linux environment
 - OS administrator privilege (root group)

9.2.2 esfadm volume qoscLEAR (Target response time clear command)

NAME

esfadm volume qoscLEAR - clearing the target response time

SYNOPSIS

esfadm volume qoscLEAR -ipaddr *ipAddress* -volume *volumeNumber*

COMMAND PATH

Windows Environment

```
$INS_DIR\Common\bin\esfadm volume qoscLEAR
```

(\$INS_DIR is the "Program directory" when ETERNUS SF Manager has been installed.)

Solaris or Linux Environment

```
/opt/FJSVesfcm/bin/esfadm volume qoscLEAR
```

DESCRIPTION

With respect to the specified FTV, clearing of the target response time will be performed.

OPERANDS

qoscLEAR

Clearing of the target response time will be performed.

OPTIONS

Options of the "qosclear" operand

`-ipaddr ipAddress`

The IP address of the ETERNUS Disk storage system will be specified. You cannot specify multiple addresses or use wildcards.

`-volume volumeNumber`

The FTV Number of which the target response time is cleared will be specified in decimal notation. Only a single volume can be specified.

OUTPUT INFORMATION

Operation History of ETERNUS SF

The following execution history information will be output to the operation history of the Web Console.

Output Items	Output Details
Date	Process execution date
User ID	Execution user
Action	Clear QoS(CLI)
Status	Submit, Start, or Complete
Results	Success, Failed, or Warning
Target	-
Details	Detailed information
Message	Error message

EXIT STATUS

=0: Completed successfully

other than 0: Terminated abnormally

EXAMPLES

When clearing the target response time in relation to FTV#0

Windows Environment

```
> C:\ETERNUS_SF\Common\bin\esfadm volume qosclear -ipaddr 10.10.10.10 -volume 0  
esqos0003 The target response time cleared normally.
```

Solaris or Linux Environment

```
# /opt/FJSVesfcm/bin/esfadm volume qosclear -ipaddr 10.10.10.10 -volume 0  
esqos0003 The target response time cleared normally.
```

NOTES

- Before executing this command, be sure to register the ETERNUS SF Storage Cruiser Quality of Service Management Option license. If not registered, the command will terminate with an error.

- Execution privilege

In order to execute the command, the following administrator privilege of the server OS is required.

- Windows environment
 - Users of the Administrators group
- Solaris or Linux environment
 - OS administrator privilege (root group)

9.2.3 esfadm volume qosinfo (Target response times listed display command)

NAME

esfadm volume qosinfo - list display at target response times

SYNOPSIS

esfadm volume qosinfo -ipaddr *ipAddress*

COMMAND PATH

Windows Environment

```
$INS_DIR\Common\bin\esfadm volume qosinfo
```

(*\$INS_DIR* is the "Program directory" when ETERNUS SF Manager has been installed.)

Solaris or Linux Environment

```
/opt/FJSVesfcm/bin/esfadm volume qosinfo
```

DESCRIPTION

The target response time (msec) will be displayed. The output file is CSV format. All of the FTV present on the ETERNUS Disk storage system of the specified IP address will be displayed in a list.

When a target response time has not been configured to the FTV, a "-" (hyphen) will be displayed in the field of the target response time.

OPERANDS

qosinfo

The target responses times list will be displayed.

OPTIONS

Options of the "qosinfo" operand

-ipaddr *ipAddress*

The IP address of the ETERNUS Disk storage system will be specified. You cannot specify multiple addresses or use wildcards.

EXIT STATUS

=0: Completed successfully
other than 0: Terminated abnormally

EXAMPLES

When displaying all of the target response times

Windows Environment

```
> C:\ETERNUS_SF\Common\bin\esfadm volume qosinfo -ipaddr 10.10.10.10
IP ADDRESS,POOL NAME,VOLUME NUMBER,RESPONSE TIME
10.10.10.10,TestTier1,0,10
10.10.10.10,TestTier1,1,-
10.10.10.10,TestTier1,2,50
10.10.10.10,TestTier2,5,10
10.10.10.10,TestTier2,10,-
10.10.10.10,TestTier3,8,-
```

Solaris or Linux Environment

```
# /opt/FJSVesfcm/bin/esfadm volume qosinfo -ipaddr 10.10.10.10
IP ADDRESS,POOL NAME,VOLUME NUMBER,RESPONSE TIME
10.10.10.10,TestTier1,0,10
10.10.10.10,TestTier1,1,-
10.10.10.10,TestTier1,2,50
10.10.10.10,TestTier2,5,10
10.10.10.10,TestTier2,10,-
10.10.10.10,TestTier3,8,-
```

The meaning of each of the items is as follows:

IP ADDRESS

IP address of the ETERNUS Disk storage system.

POOL NAME

Name of the Tier pool.

VOLUME NUMBER

Volume number.

RESPONSE TIME

Target response time (msec). When a target response time has not been configured, a "-" (hyphen) will be displayed.

NOTES

- Execution privilege
In order to execute the command, the following administrator privilege of the server OS is required.
 - Windows environment
 - Users of the Administrators group
 - Solaris or Linux environment
 - OS administrator privilege (root group)