FUJITSU

FUJITSU Storage
ETERNUS SF Storage Cruiser V16.3

Operation Guide
 for Optimization Function

Windows/Solaris/Linux

Preface

Purpose

This manual describes Optimization Function, an optional product for FUJITSU Storage ETERNUS SF Storage Cruiser of the following 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 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	Windows
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	
Windows(R) 10 Home Windows(R) 10 Pro Windows(R) 10 Mobile	Windows 10	
Oracle Solaris 10	Solaris 10	Solaris or Solaris OS
Oracle Solaris 11	Solaris 11	
Red Hat(R) Enterprise Linux(R) 5 (for Intel64)	RHEL5	Linux
Red Hat(R) Enterprise Linux(R) 6 (for Intel64)	RHEL6	
Red Hat(R) Enterprise Linux(R) 7 (for Intel64)	RHEL7	
SUSE(R) Linux Enterprise Server 11 for x86 SUSE(R) Linux Enterprise Server 11 for EM64T	SUSE Linux Enterprise Server 11	
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	VMware vSphere 4	VMware
VMware vSphere(R) 5	VMware vSphere 5	
VMware vSphere(R) 6	VMware vSphere 6	

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

FUJITSU Storage ETERNUS

Formal Name	Abbreviation		
FUJITSU Storage ETERNUS DX60 FUJITSU Storage ETERNUS DX80 FUJITSU Storage ETERNUS DX90	-	-	ETERNUS DX series or ETERNUS Disk storage system
FUJITSU Storage ETERNUS DX410 FUJITSU Storage ETERNUS DX440	ETERNUS DX400 series		
FUJITSU Storage ETERNUS DX8100 FUJITSU Storage ETERNUS DX8400 FUJITSU Storage ETERNUS DX8700	ETERNUS DX8000 series		
FUJITSU Storage ETERNUS DX60 S2 FUJITSU Storage ETERNUS DX80 S2 FUJITSU Storage ETERNUS DX90 S2	-	ETERNUS DX S2 series	
FUJITSU Storage ETERNUS DX410 S2 FUJITSU Storage ETERNUS DX440 S2	ETERNUS DX400 S2 series		
FUJITSU Storage ETERNUS DX8100 S2 FUJITSU Storage ETERNUS DX8700 S2	ETERNUS DX8000 S2 series		
FUJITSU Storage ETERNUS DX60 S3 FUJITSU Storage ETERNUS DX100 S3 FUJITSU Storage ETERNUS DX200 S3	-	ETERNUS DX S3 series	
FUJITSU Storage ETERNUS DX500 S3 FUJITSU Storage ETERNUS DX600 S3	-		
FUJITSU Storage ETERNUS DX8700 S3 FUJITSU Storage ETERNUS DX8900 S3	ETERNUS DX8000 S3 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
Windows(R) Internet Explorer(R)	Internet Explorer
Mozilla(R) Firefox(R)	Firefox
Microsoft(R) Windows Server(R) Failover Clustering	WSFC
Microsoft(R) Exchange Server	Exchange Server
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

Formal Name	Abbreviation
FUJITSU Software PRIMECLUSTER Global File Services	GFS

Manuals

Formal Name	Abbreviation
FUJITSU Storage ETERNUS SF Express / Storage Cruiser / AdvancedCopy Manager Quick Reference	ETERNUS SF Quick Reference
FUJITSU Storage ETERNUS SF Express / Storage Cruiser / AdvancedCopy Manager Release Notes	ETERNUS SF Release Notes
FUJITSU Storage ETERNUS SF Express / Storage Cruiser / AdvancedCopy Manager Installation and Setup Guide	ETERNUS SF Installation and Setup Guide
FUJITSU Storage ETERNUS SF Express / Storage Cruiser / AdvancedCopy Manager Migration Guide	ETERNUS SF Migration Guide
FUJITSU Storage ETERNUS SF Express / Storage Cruiser / AdvancedCopy Manager Web Console Guide	ETERNUS SF Web Console Guide
FUJITSU Storage ETERNUS SF Storage Cruiser / AdvancedCopy Manager Cluster Environment Setup Guide	ETERNUS SF Cluster Environment Setup Guide
FUJITSU Storage ETERNUS SF Storage Cruiser / AdvancedCopy Manager Operation Guide for VMware vSphere Virtual Volumes	ETERNUS SF Operation Guide for VMware vSphere Virtual Volumes
FUJITSU Storage ETERNUS SF Express / Storage Cruiser / AdvancedCopy Manager Messages	ETERNUS SF Messages
FUJITSU Storage ETERNUS SF Express / Storage Cruiser Event Guide	ETERNUS SF Event Guide
FUJITSU Storage ETERNUS SF Express / Storage Cruiser / 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 Disk storage system includes ETERNUS DX200F All Flash Arrays.
  However, the following functions are not supported in ETERNUS DX200F All Flash Arrays:

  - Energy saving operation for storage device

  - NAS operation for storage device

  - Automated Storage Tiering operation at multiple tiers (two or more)

Export Controls

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Trademarks

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Shipment Date	Revision	Document Part Number	
		PDF	HTML
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June 2016	4.2	B1FW-6008-04ENZ0(02)	B1FW-6008-04ENZ2(02)

Notes

Copyright

Update history

Content of Update	Updated Section	Revision
The information related to ETERNUS DX200F is described.	"Others" in Preface	1.1
Priority is specified for Automated QoS function to add the function of performance tuning.	1.1.2, 3.6.1, 3.6.2, 4.2, Chapter 5-Chapter 7	2
Evaluation period and Evaluation Day as intra-volume data movement basis by Automated Storage Tiering are added.	2.1, 3.4, 4.1	
Description of Tier pool capacity management is added.	4.6	
Description of confirming whether ETERNUS SF Storage Cruiser Optimization Option is started is transferred from Chapter 9.	8.5	
Description of the operation to reflect the output of Automated Storage Tiering command to the Web Console is added.	9.1	

Content of Update	Updated Section	Revision
Newly supported command references are listed.	9.1.2~9.1.9, 9.2.1~9.2.5	
Information related to the ETERNUS DX200F is modified.	"Others" in Preface, 1.2, 3.5, 3.6.1	3
Supported volumes for the Automated QoS function are added.	1.1.2, Chapter 5 - Chapter 6, 9.2.3, 9.2.4	
Operating conditions for Automated Storage Tiering are modified.	1.2, 3.3	
The description for Automated Storage Tiering is modified.	2.1, 2.2, 3.4.1, 3.6, 3.8, 4.6	
Descriptions of the functions for the ETERNUS DX S3 series and ETERNUS DX200F are added.	2.2, 3.6.1, 3.6.2, 4.2	
The description of the Tiering policy's "Evaluation Period" that was set during the Automated Storage Tiering setup is modified.	3.4.1	
A description of the Tier pool balancing function is added.	3.5.6, 3.6.2, 4.2, 4.7, 9.1.2	
The description of the "Warning Threshold of Pool" item that was specified when creating the Tier pool is modified.	3.5.1	
Notes for Virtual Volumes are added.	3.5.5, 3.6.3, 3.6.4, 9.1.13	
The description of the Automated QoS function is changed as follows: - The item name "Automated QoS: Tiering Control" is changed to "Tune by Quota Share". - The "-tierctrl" option of the esfadm volume qosset command is changed to "-quotatune". - The output item name "TIER CONTROL" of the esfadm volume qosinfo command is changed to "TUNE BY QUOTA SHARE".	3.6.1, 3.6.2, 5.4, 7.1.2, 9.2.1, 9.2.2, 9.2.3	
The description for the configuration and operation of the Storage Cluster function is added.	3.9, 4.8, 9.1.6 - 9.1.7	
The term "VMware Virtual Volumes" is changed to "VMware vSphere Virtual Volumes" according to the terms used by VMware, Inc.	Throughout this manual	3.1
Information related to VMware vSphere(R) 6 is added.	"Notation" in Preface	
Information related to ETERNUS DX8700 S3/DX8900 S3 is added.	"Notation" in Preface, 1.2, 3.6.1, 3.7	3.2
Description of the total number of used capacity of Tier pools that can be managed/evaluated by Automated Storage Tiering is added.	1.1.1, 3.8	
The description of "Setting of Tier Pool" is modified.	3.5	
Information related to Windows Server 2003 is deleted.	"Notation" in Preface	4
Information related to Windows 10 is added.	"Notation" in Preface	
Disk types that are newly supported are added.	1.2, 2.2, 4.2	
The explanation in the tables are modified.	3.4.1, 3.5.1, 3.5.4, 3.5.6, 3.6.1, 9.1.8	
The Point is modified.	3.5.3	
Information about the access status chart is added.	3.10, 4.1	
A note is added.	4.1	
Information related to relocation is added.	4.2	
The explanation of the capacity management is modified.	4.6	

Content of Update	Updated Section	Revision
A troubleshooting section is added.	4.10, 7.4	
Description of change in reserved area required for access status data evaluation/ relocation is added. In addition, unnecessary description is deleted.	2.2, 3.8, 4.10.1	4.1
The strings that express the encryption status of Tier pool and volume are modified.	4.3	
[Information] is added.	3.10, 4.2	4.2

Manual Organization and Reading Suggestions

Manual Organization

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

When to Read	Related Manuals (Abbreviated)	Related Products (*1)			Explanation
		EXP	SC	ACM	
Before installation	Quick Reference	Yes	Yes	Yes	This manual is 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: - 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 - Storage Cruiser / AdvancedCopy Manager Operation Guide for VMware vSphere Virtual Volumes
	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.

When to Read	Related Manuals (Abbreviated)	Related Products (*1)			Explanation
		EXP	SC	ACM	
	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

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	- Product overview - Installation decision - Overview of the necessary tasks from installation to first use	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	- Main functions - Linkable applications - Procedure overview for Advanced Copy of ETERNUS Disk storage system	
Confirming the updated contents	Release Notes	- New function overview - Incompatibilities with previous version - Fixed bugs	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	- Notes and cautions about version upgrade - Version upgrade procedure	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	- Operating environment - Installation procedure - Setup procedure - Uninstallation procedure	Read if you want to install and setup the product.
	Cluster Environment Setup Guide	- Supported cluster software - Installation procedure for a clustered system - Setup procedure for a clustered system - Uninstallation procedure for a clustered system	Read if you want to install and setup the product on a clustered system.
Administration and operation	Express Operation Guide	- Starting and stopping the software - Device monitoring	Read if you want to start or shutdown the system, monitor the operation

Purpose	Manual	Main Contents	How to Read
of the installed system		- Data copy inside the storage system - Necessary tasks after an architectural modification of the system as well as product maintenance	status, do backup/restore operations, etc.
	Storage Cruiser Operation Guide	- Starting and stopping the software - Device monitoring - Necessary tasks after an architectural modification of the system as well as product maintenance - Command reference	
	Storage Cruiser Operation Guide for Optimization Function	- Operating environment construction - Operating status monitoring - Necessary tasks after an architectural modification of 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	- 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	
	Storage Cruiser / AdvancedCopy Manager Operation Guide for VMware vSphere Virtual Volumes	- Operating environment construction - Virtual machine operation using a virtual volume - Backup/restore of the virtual machine - Necessary tasks after an architectural modification of the system as well as product maintenance	

Purpose	Manual	Main Contents	How to Read
	Web Console Guide	- Operating environment - Screen layout description	Read if you want to understand the ETERNUS SF Web Console.
Dealing with messages issued by the software	Messages	- Messages and their explanations - Parameter (variable information) description - System action - Countermeasures	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	- Phenomenon of event - Countermeasures	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	- Product specific terminology explanation - Explanation of important terminology appearing in the manual - Synonyms and related terms - Proper form of abbreviated terms	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   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.

There is an upper limit to the number and total capacity of Tier pools that can be managed by Automated Storage Tiering.

See
. . . .
Refer to "Upper Limit of Automated Storage Tiering" in the ETERNUS SF Installation and Setup Guide for the number and total capacity of Tier pools that can be managed by Automated Storage Tiering.
. . . .

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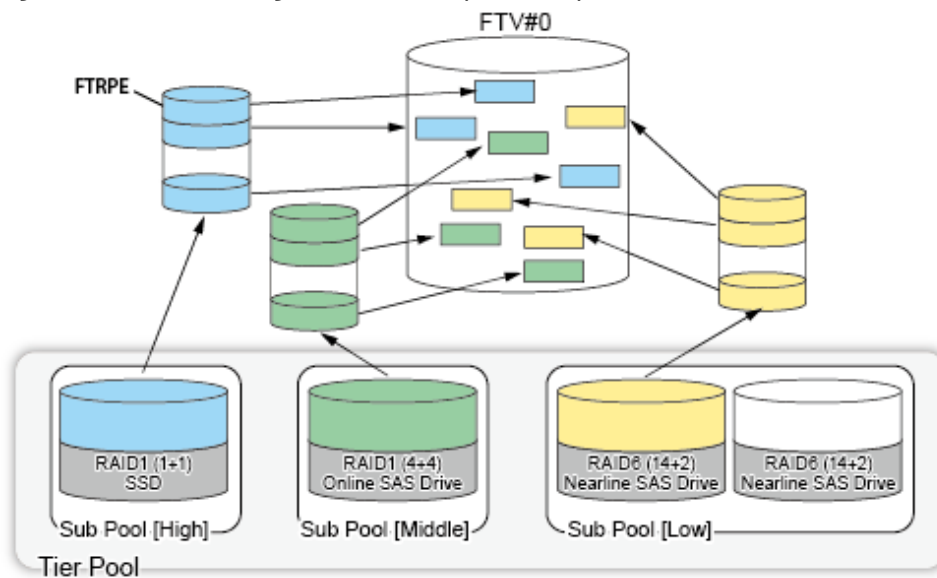
With Automated Storage Tiering, there are the following methods for the relocation of data within the volume.

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, in order of those with a higher IOPS	Design is easy. The sub-pool with a high capacity allocation ratio can be maximum used. The performance of each 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.

1. 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.

2. At the evaluation time, an evaluation is implemented by using the accumulated data.

3. 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
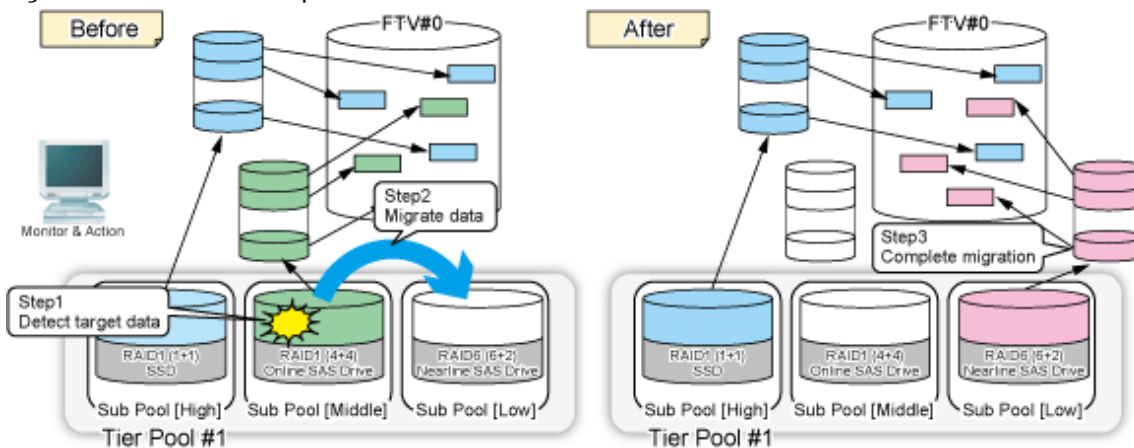
With this product, the evaluation time, Evaluation Period, evaluation standard, and Execution Mode can be selected as "Tiering policies ".

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 are 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
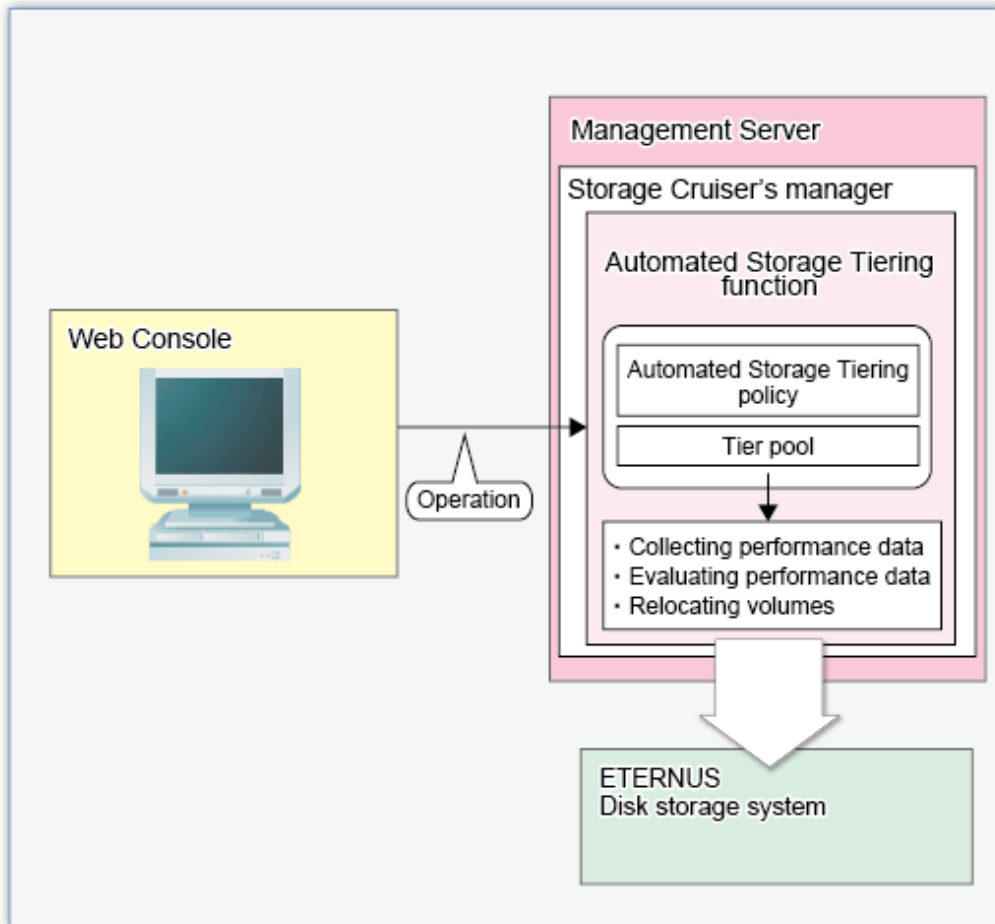
Point

. . . .

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 is 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 is implemented automatically by the system)

1.1.2 Automated QoS Function

The Automated QoS function automatically adjusts the bandwidth and performs an automatic tuning of the I/O performance so that the target I/O performance that was set by the operator can be achieved. The target value for the volume priority (Automated QoS Priority) or objective response time (Target Response Time) can be set for the volume.

The volume type that can be set for the target value is Flexible Tier Volume (FTV). The target value can be configured with each volume. There is no upper limit for the number of FTVs that can be set for the target value, but there is an upper limit for the number of FTVs that can be operated. Refer to "Upper Limit of Automated QoS Function" in the *ETERNUS SF Installation and Setup Guide* for the upper limit of the number of FTV that can be operated. Refer to "Chapter 5 Design of Automated QoS Function" for details of the target values set.

All operations that are related to the Automated QoS function (such as enabling/disabling the function, and setting/changing the target value) are performed with the Web Console or commands.

Figure 1.4 Overview of Automated QoS Function
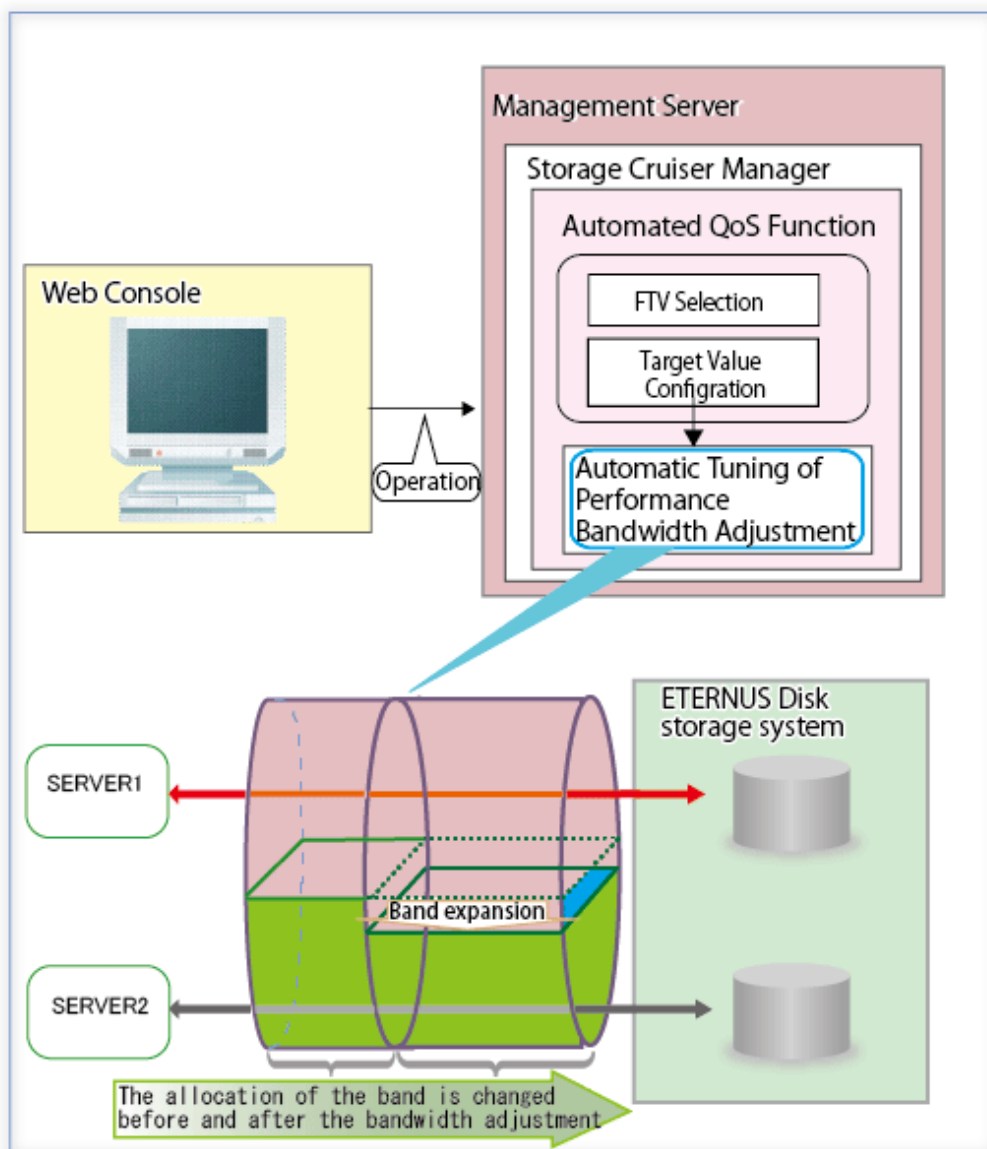
1.2 Operating Environment

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
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 DX S2 series (excluding DX60 S2) (*1,*4,*5) - ETERNUS DX S3 series (excluding DX60 S3) (*1,*6) - ETERNUS DX200F (*6,*7)
Form of Connection with Business Server	There are no conditions.
Target Volume (*2)	FTV (Flexible Tier Volume)

*1: The following firmwares are necessary to use Automated Storage Tiering. In addition, Automated Storage Tiering of the storage device should be enabled.

Storage Device	Compatible Firmware Version	Remarks
ETERNUS DX S2 series (excluding DX60 S2)	V10L54 or later	-
ETERNUS DX100 S3/DX200 S3 ETERNUS DX500 S3/DX600 S3	V10L13 or later	-
ETERNUS DX8700 S3/DX8900 S3	All versions	-

*2: Open volumes and TPV are not supported.

*3: The following disk types can be used for Tier pool.

Disk Type	Terms of Usage
SAS SSD	There are no conditions.
ONLINE SAS	There are no conditions.
NEARLINE SAS	There are no conditions.
SED-SAS	There are no conditions.
Online SED	There are no conditions.
SSD SED	There are no conditions.
Nearline SED	There are no conditions.

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

*5: The Automated QoS function is not supported.

*6: Thin Provisioning function of the storage device should be enabled.

*7: In ETERNUS DX200F, only one layer Tier pool function is possible. Automated Storage Tiering operation at multiple tiers (two or more) cannot be done.

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)

> - Week Unit (1 week)

> 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.

> When a value for week unit is selected, accessed data is evaluated during a period from Sunday through Saturday. The day of the week for evaluation is specified in "Days of the Week subject to Evaluation". In addition to day units, "Evaluation Day" can be specified.
> 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.

📷 Example
・・・

If a system that business hours are 9:00 - 17:00 and the backup is 0:00 - 2:00 at night, and if the target for Automated Storage Tiering is only the business I/O, a daily relocation is set to perform as follows:

Item Name	Specification
Evaluation Period	1day
Time of the Day subject to Evaluation	9:00-17:00
Automated Storage Tiering Execution Time	2:00

・・・

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	- 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	- Collection and evaluation of access status data necessary for relocation of data within a volume	- Confirmation of evaluation results, and as needed, relocation of data within a volume	Selected in the following cases: - Used to review evaluation standards - Used to select which data is to be moved.
Manual	- Collection of access status data necessary for relocation of data within a volume	- Evaluation of access status data - Confirmation of evaluation results, and as needed, relocation of data within a volume	Selected in the following cases: - Used to execute with standard values of the evaluation temporarily changed - 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 Configure Evaluation Excluded Day 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 Configure Evaluation Excluded Day, 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 prevents 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, Online SED, SSD SED, Nearline SED, 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	20	(4D+2P)*5+1HS					RAID6-FR
2		24	(8D+2P)*3+1HS					RAID6-FR
3		12	(6D+2P)*2+1HS					RAID6-FR
4			12D+12D	RAID1+0				
5			12D+1P		RAID5			
6		8	(4D+2P)*2+1HS					RAID6-FR
7			8D+8D	RAID1+0				
8			8D+1P		RAID5			
9			8D+2P			RAID6		
10		7	7D+1P		RAID5			
11		6	6D+2P			RAID6		
12		4	4D+4D	RAID1+0				
13			4D+1P		RAID5			
14			4D+2P			RAID6		
15		3	3D+1P		RAID5			
16		2	2D+2P	RAID1+0				
17		1	1D+1D				RAID1	
18	ONLINE SAS	20	(4D+2P)*5+1HS					RAID6-FR
19		24	(8D+2P)*3+1HS					RAID6-FR
20		12	(6D+2P)*2+1HS					RAID6-FR
21			12D+12D	RAID1+0				
22			12D+1P		RAID5			
23		8	(4D+2P)*2+1HS					RAID6-FR
24			8D+8D	RAID1+0				
25			8D+1P		RAID5			
26			8D+2P			RAID6		
27		7	7D+1P		RAID5			
28		6	6D+2P			RAID6		
29		4	4D+4D	RAID1+0				
30			4D+1P		RAID5			
31			4D+2P			RAID6		
32		3	3D+1P		RAID5			
33		2	2D+2P	RAID1+0				
34		1	1D+1D				RAID1	
35	NEARLINE SAS	20	(4D+2P)*5+1HS					RAID6-FR

Priority (In Order of High Performance)	Disk Type	Number of Data Disks	Number of Member Disks	RAID Level				
36		24	(8D+2P)*3+1HS					RAID6-FR
37			(6D+2P)*2+1HS					RAID6-FR
38		12	12D+12D	RAID1+0				
39			12D+1P		RAID5			
40			(4D+2P)*2+1HS					RAID6-FR
41		8	8D+8D	RAID1+0				
42			8D+1P		RAID5			
43			8D+2P			RAID6		
44		7	7D+1P		RAID5			
45		6	6D+2P			RAID6		
46			4D+4D	RAID1+0				
47		4	4D+1P		RAID5			
48			4D+2P			RAID6		
49		3	3D+1P		RAID5			
50		2	2D+2P	RAID1+0				
51		1	1D+1D				RAID1	

Free space of the reserved area size required for evaluation/relocation is required for each sub-pool in a Tier pool. If free space cannot be allocated, evaluation/relocation fail.
The reserved area required for evaluation/relocation varies with the storage device as follows.

Storage Device	Reserved Area Required for Evaluation/Relocation
ETERNUS DX S2 series (excluding DX60 S2)	(Total capacity of Tier pool) * 10 %
ETERNUS DX S3 series (excluding DX60 S3)	7.88 GB * (Number of layers of Tier pool)

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
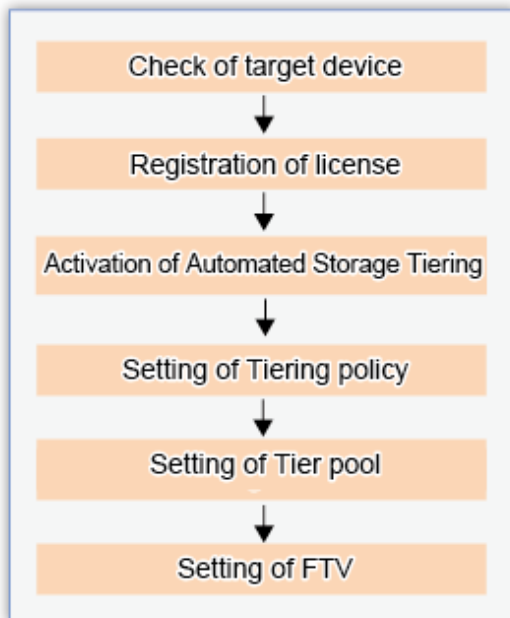
3.1   Check of Target Device

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.

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.

- To enable Automated Storage Tiering, the Thin Provisioning function of the storage device must be enabled.

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 are 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 are targeted. When the Execution Mode is "Semi-Auto" or "Manual", the FTRPEs contained in the FTVs to which relocation has been instructed are targeted. 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.

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
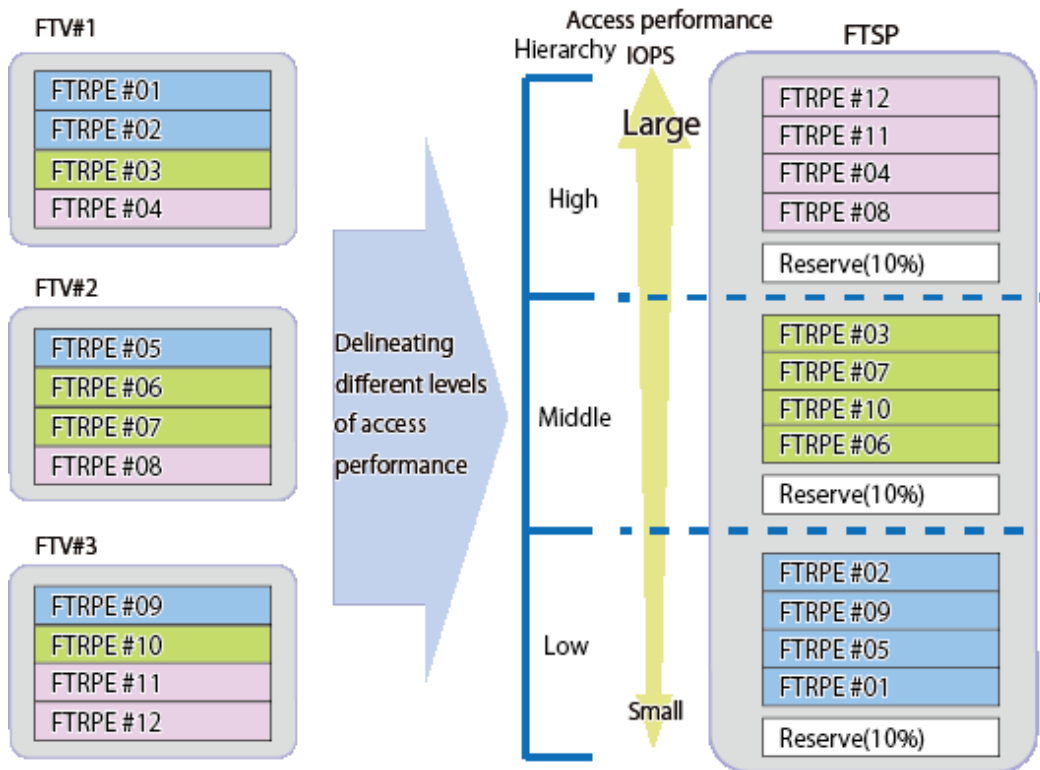
Figure 3.3 FTRPE Moving in Boundary of Each Sub-Pool
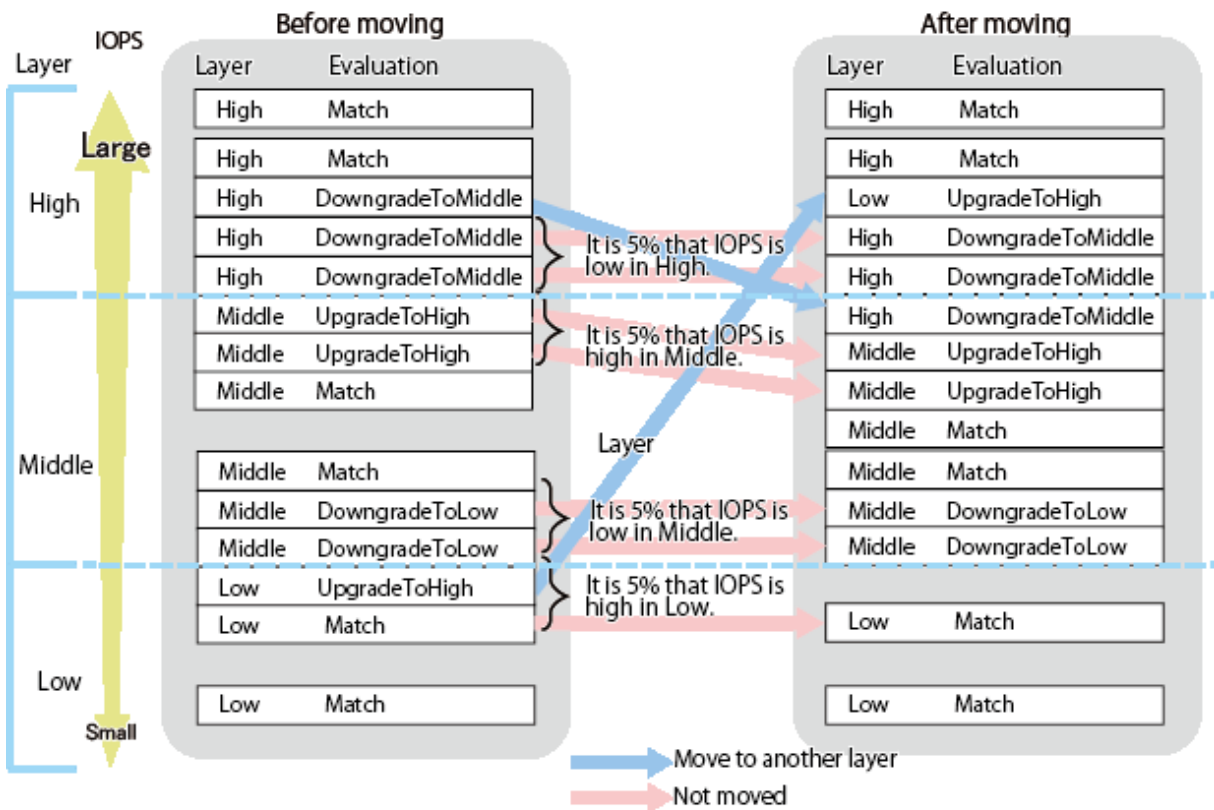
Detailed Configuration According to "Days of the Week subject to Evaluation" and "Configure Evaluation Excluded Day"

When creating a Tiering policy, it is possible to specify the "Days of the Week subject to Evaluation" and the "Configure Evaluation Excluded Day".
By specifying these items, it is possible to perform detailed operation of Automated Storage Tiering.

Evaluation and Relocation According to Specified Evaluation Day

When a weekly Tiering policy is created, "Evaluation Day" can be specified.
When this item is specified, evaluation and relocation are performed on the specified day. If this item is none, evaluation and relocation are performed on a per week basis from the day when Automated Storage Tiering was started.

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	Specify a name (that is unique within the ETERNUS SF system) for the Tiering policy that is being created. Any alphanumeric character (1 - 16 characters), a hyphen (-), an underscore (_), and a pound symbol (#) may be specified. The letters to be specified are not case sensitive.

Item	Specification (*1)	Explanation

Execution Mode	Optional	Specify the execution mode which specifies the method for operation of Automated Storage Tiering. The three following execution modes may be selected. The default setting is "Auto".
		
		 - Auto
		
		   The performance data for Automated Storage Tiering is collected and evaluated, and the volume relocation is executed automatically.
		
		 - Semi-Auto
		
		   The performance data for Automated Storage Tiering is collected and evaluated. It is necessary to manually perform the volume relocation.
		
		 - Manual
		
		   The performance data for Automated Storage Tiering is collected. It is necessary to evaluate the performance data and perform the volume relocation both manually.

Evaluation Period	Optional	Specify the evaluation range of the performance data for Automated Storage Tiering. Select a number and a unit ("Hour", "Day", or "Week"). The default setting is "1 Day". When the unit is "Hour", 2, 4, 6, 8, or 12 may be specified. The starting point of the evaluation period varies depending on the setting of **Execution Mode**. If **Execution Mode** is "Auto" or "Semi-Auto", the starting point of the evaluation period is 0:00. For example, if "6 Hour" is specified, the evaluation is conducted from 0:00 - 6:00, 6:00 - 12:00, 12:00 - 18:00, and 18:00 - 24:00. If **Execution Mode** is "Manual", the starting point of the evaluation period is the time when an evaluation of the access status for the Tier pool has been executed. For example, if "6Hour" is selected and an evaluation of the access status for the Tier pool was executed at 9:00, the evaluation is done at 3:00 - 9:00. When the selected unit is "Day", a value within the range of 1 - 31 may be specified. When the selected unit is "Week", 1 may be specified.

Evaluation Standard	Optional	Specify the standards for the evaluation of the performance for Automated Storage Tiering. From the pull-down list, select either of the following:
		
		 - Peak
		
		   From within the evaluation period, the evaluation is performed with the maximum peak value of the performance data (IOPS value) for Automated Storage Tiering.
		
		 - Average
		
		   From within the evaluation period, the evaluation is performed with the average of the performance data (IOPS value) for Automated Storage Tiering.

Evaluation Day	Optional	Specify the day of the week to start evaluation of the access status data. The default setting is "None" (start evaluation at **Automated Storage Tiering Execution Time** after the **Evaluation Period** has elapsed from the completion of the operation to start Automated Storage Tiering).

Item	Specification (*1)	Explanation
		This can be specified only when **Execution Mode** is set to "Auto" or "Semi-Auto" and the unit of **Evaluation Period** is set to "Week".
		When the **Evaluated from initial specified day (Evaluated despite insufficient Evaluation Period)** checkbox is checked, even if the evaluation period is insufficient, an evaluation is performed using access status data that exists by the specified day of the week for the first time. Check this checkbox when it is desirable to immediately start operation of Automated Storage Tiering. The default setting for this checkbox is not checked (recommended). When this checkbox is not checked, an evaluation is not performed on the specified day of the week for the first time, and from the next specified day of the week, evaluations is always performed using access status data for the evaluation period.
Automated Storage Tiering Execution Time	Optional	Specify the time, within the range of 0:00 - 23:59, to start collection, evaluation, and relocation of performance data for Automate Storage Tiering. This can be specified only when **Execution Mode** is set to "Auto" or "Semi-Auto" and the unit of **Evaluation Period** is set to "Day" or "Week". When the unit of **Evaluation Period** is set to "Hour", the process is executed at the time after the specified number of hours (2, 4, 6, 8, or 12 hours) has elapsed from 0:00.
Automated Storage Tiering Time Limit	Optional	Specify the time to discontinue the volume relocation as elapsed time from the time specified in **Automated Storage Tiering Execution Time**. The default setting is "no limit" (process is not discontinued). When the unit of **Evaluation Period** is "Day" or "Week", a value from 00 through 24 may be specified. When the unit of **Evaluation Period** is "Hour", a value from 00 up to the value specified with **Evaluation Period** may be specified.
Days of the Week subject to Evaluation	Optional	Upon execution of relocation, specify the day of the week to collect performance data for Automated Storage Tiering that is subject to evaluation. This can be specified only when the unit of **Evaluation Period** is set to "Day" or "Week". In the default setting, all days of the week are subject to evaluation. The days of the week that are checked off are excluded from being subject to evaluation.
Time of the Day subject to Evaluation	Optional	Specify the time of the day to collect and evaluate performance data for Automated Storage Tiering. This can be specified only when the unit of **Evaluation Period** is set to "Day" or "Week". The default setting is "24 Hours" (the 24 hours from 0:00 to 0:00). For both the starting time and the ending time of evaluation, a value from 0:00 to 23:00 may be specified.
Configure Evaluation Excluded Day	Optional	Specify the day, with a calendar, to be subject to evaluation of performance data for Automated Storage Tiering. This can be specified only when the unit of **Evaluation Period** is set to "Day" or "Week". In the default setting, the **Enable** checkbox is checked on. While in this state, the date to be subject to evaluation may be specified with the calendar that is displayed by clicking **Edit Evaluation Excluded Day**. When the **Enable** checkbox is checked off, the configuration of evaluation excluded day becomes void.

Item	Specification (*1)	Explanation
Data Type	Optional	Select the type of performance data used for evaluating Automated Storage Tiering. Only IOPS (read/write operations per second) can be specified.
Data Range of Layer	Optional	Specify whether to manually configure the data range of each layer or to have the system automatically configure this. In the default setting, the **Automatic Configuration** checkbox is checked on. When set to automatic configuration, **Data Range of Low**, **Data Range of Middle**, and **Data Range of High** cannot be specified. The system automatically decides relocation standards. When the **Automatic Configuration** checkbox is checked off, the date range for each layer can be manually configured.
Data Range of Low	Optional	Specify the range of the IOPS values to use as standards for location to the Low sub-pool of the Tier pool. For this item, specify a maximum value. It is also possible to input a decimal value. The minimum value is fixed at "0", and a "-" is displayed in the Main pane of the Tiering policy. When this specification has been omitted, a "-:-" is displayed in the Main pane of the Tiering policy. (*2)
Data Range of Middle	Optional	Specify the range of the IOPS values to use as standards for location to the Middle sub-pool of the Tier pool. For this item, specify a minimum value and a maximum value. It is also possible to input a decimal value. When this specification has been omitted, a "-:-" is displayed in the Main pane of the Tiering policy. (*2)
Data Range of High	Optional	Specify the range of the IOPS values to use as standards for location to the High sub-pool of the Tier pool. For this item, specify a minimum value. It is also possible to input a decimal value. The maximum value is fixed at "2,147,483,647", and a "-" is displayed in the Main pane of the Tiering policies. When this specification has been omitted, a "-:-" is displayed in the Main pane of the Tiering policy. (*2)

*1: When a specification is omitted for the item of which specification is "Optional", a default value is configured.
*2: In cases when a range has not been specified, relocation is 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

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When the **Execution Mode** is set to "Auto" and the **Data Range of Layer** is set to "Automatic Configuration", the system automatically decides 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 Layer** 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.

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🗒 Example
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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.
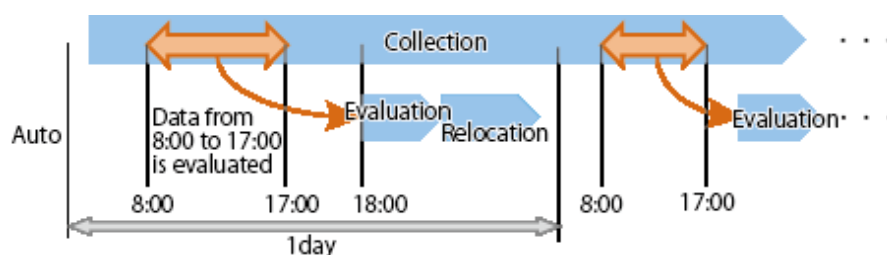
Setting Example 2

> 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.
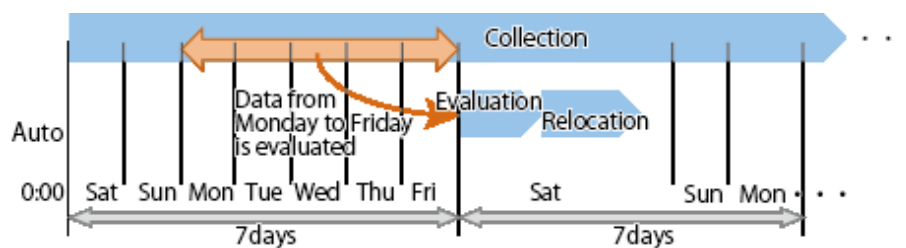
Setting Example 3

> 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.
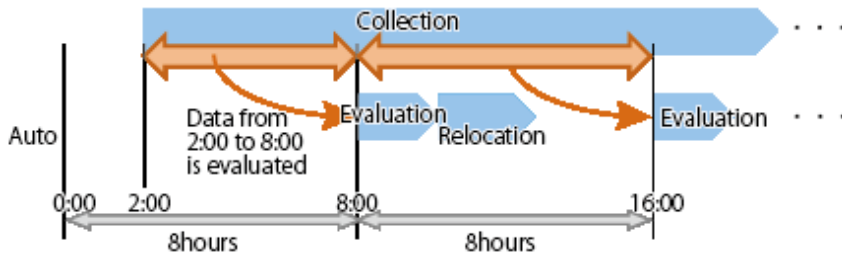
Setting Example 4

This is an example of executing Automated Storage Tiering at 0:00 on Saturdays based on access status from Monday through Friday.
Specify 1 week for **Evaluation Period**, Monday through Friday for **Days of the Week subject to Evaluation** and 0:00 for **Automated Storage Tiering Execution Time**. Regardless of the date and time that Automated Storage Tiering is started, evaluation is not performed on the first Saturday but started at 0:00 the following Saturday based on the access status for one week from Monday through Friday from the first Saturday.

If Automated Storage Tiering is started on Tier pool at 0:00 of Thursday, the result is as follows:
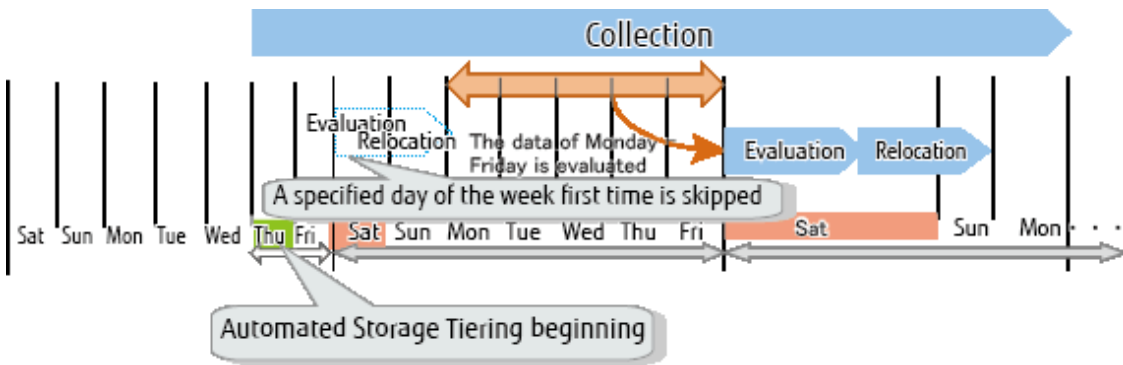
To use Automated Storage Tiering immediately after starting Automated Storage Tiering, specify **Evaluated from initial specified day (Evaluated despite insufficient evaluation period)**.
If Automated Storage Tiering is started on Tier pool at 0:00 of Thursday, the result is as follows:
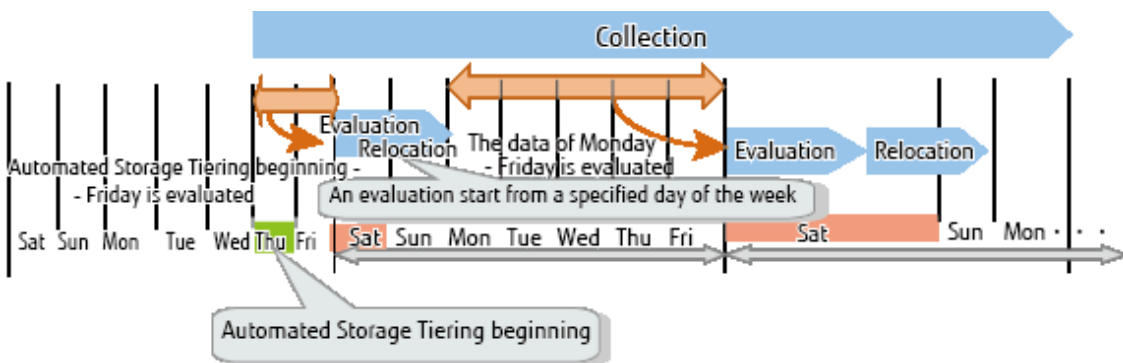
Evaluation of access status data for 2 days from when Automated Storage Tiering was started until the first Saturday is started at 0:00 of the first Saturday. The evaluation from the next time on is started at 0:00 of every Saturday for access status data for 5 days from Monday through Friday.

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💡 Note
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Evaluation Day can be specified only when **Execution Mode** is Auto or Semi-Auto and the unit of **Evaluation Period** is Week.

If **Evaluated from initial specified day (Evaluated despite insufficient evaluation period)** is specified and evaluation is executed in shorter than evaluation period, unintended consequences of evaluation may be output due to a small amount of access status data.

Even if **Evaluated from initial specified day (Evaluated despite insufficient evaluation period)** is specified to start Automated Storage Tiering, evaluation and relocation are not performed in the following cases:

- Access status data is not collected for one or more days (24 hours).

- Period of collecting access status data is all specified for Configure Evaluation Excluded Day.

- Period of collecting access status data is all specified for Evaluation Day.

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.

- **Configure Evaluation Excluded Day** previous from the 32nd is automatically deleted on the day when the Tiering policy was changed when the **Configure Evaluation Excluded Day** is set to the Tiering policy of the operational object regardless of whether **Configure Evaluation Excluded Day** 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

   - Evaluation Day(*1)

*1: If only the value of **Evaluated from initial specified day (Evaluated despite insufficient evaluation period)** is changed, this is not applied.

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 are not 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 Assigned CM

An Assigned 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

🅿 Point

For the changing a layer number of the Tier pool and the expanding capacity of the sub-pool, the Assigned CM can be added only when the Assigned 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 Assigned CM, it is recommended that all sub-pools contained in the Tier pool are assigned to the same Assigned CM.

It is possible to specify more than one Assigned CM, and by specifying an Assigned CM in relation to the Tier pool, it is possible to specify an Assigned CM of the entire Tier pool.
When multiple Assigned CMs are specified to the Tier pool, the Assigned CM is decided from the specified Assigned CMs using the round-robin method.

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

When a specification of an Assigned CM has been omitted, this is automatically 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			Assigned 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 Assigned CM			Sub-Pools to Add	Assigned CM Which Are Set	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#0 have already been configured, configure CM#0
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 to be created. This name must be unique across all the ETERNUS Disk storage system registered in Storage Cruiser. Any alphanumeric character (1 - 16 characters), a hyphen (-), an underscore (_), and a pound symbol (#) may be specified. The letters to be specified are not case sensitive.
Policy Name	Optional	Specify the Tiering policy to associate with the Tier pool that is being created. Make a selection from the Tiering policies that have been defined and are displayed in the pull-down list. (*2)
Warning Threshold of Pool	Optional	To monitor the available capacity of the Tier pool, specify a threshold (%) of the usage rate of the Tier pool as a decimal figure in the range of 5 - 99. The default setting is "90". Specify a value that is greater than **Caution Threshold of Pool**. When this threshold is exceeded, a warning is notified by the SNMP Trap. When the usage rate of the Tier pool exceeds 90 %, the Tier pool can be used but evaluation and relocation cannot be completed properly.
Caution Threshold of Pool	Optional	To monitor the available capacity of the Tier pool, specify a threshold (%) of the usage rate of the Tier pool as 0 or as a decimal figure in the range of 5 - 80. The default setting is "75". Specify a value that is less than **Warning Threshold of Pool**. When this threshold is exceeded, a caution is notified by the SNMP Trap. When "0" is specified or the **Set no Caution Threshold of pool** checkbox is checked on, the value of this item is disabled.
Encryption Status	Required	Specify whether to make the Tier pool being created an encrypted Tier pool. The default setting is "No" (do not encrypt). When setting this as an encrypted Tier pool, select "Yes".
Specify Assigned CM	Optional	As needed, specify the CM which takes charge of the Tier pool being created. The checkbox is not checked by default (a CM in charge is not specified). To specify a CM which takes charge of the Tier pool, check the checkbox. All of the CMs present on the storage device are displayed, make a selection from these.
Number of Layers	Optional	Specify the number of layers of the Tier pool that is being created. 2 or 3 may be selected. The default setting is "2". (*2)
Disk Selection	Optional	Specify the disk selection method for configuring the sub-pool. "Auto" (automatic selection) or "Manual" (manual selection) can be selected. The default setting is "Auto". If "Auto" is selected, in the screen for configuring the Low sub-pool, the Middle sub-pool, and the High sub-pool, the required minimum capacity must be specified for each sub-pool.

Item	Specification (*1)	Explanation
		If "Manual" is selected, in the screen for configuring the Low sub-pool, the Middle sub-pool, and the High sub-pool, the disks for configuring each sub-pool must be specified.

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

*2: This cannot be specified when creating a one layer Tier pool.

Configuration Items of Sub-Pool

- If "Auto" is selected for **Disk Selection** in "Basic Configuration Items of Tier Pool":

Item	Specification (*1)	Explanation
FTSP Name	Optional	Specify a name (that is unique within the ETERNUS SF system) for the sub-pool. Any alphanumeric character (1 - 16 characters), a hyphen (-), an underscore (_), and a pound symbol (#) may be specified. The letters to be specified are not case sensitive.
Disk Type	Required	Specify the type of disk for configuring the sub-pool. Make a selection from the disk types (Online, Nearline, SSD, SED-SAS, Online SED, Nearline SED, and SSD SED) that are displayed in the pull-down list.
Reliability	Required	Specify the RAID level of the sub-pool. Make a selection from one of the following that are displayed in the pull-down list: - High Performance(RAID1+0) - High Capacity(RAID5) - High Reliability(RAID6) - High Reliability(RAID6-FR) - Mirroring(RAID1) - Striping(RAID0)
Select Disks	Optional	When "High Reliability (RAID6-FR)" is selected for **Reliability**, specify one of the following methods for automatically selecting RAID group disks for configuring the sub-pool: - Minimize number of using disks - Prioritize rebuild rate When a level other than "High Reliability (RAID6-FR)" is selected for **Reliability**, this item does not need to be specified.
Minimum Required Capacity	Required	Specify the capacity required at a minimum for the sub-pool. A capacity of 1 MB or more may be specified. It is also possible to input a decimal value.
Specify Assigned CM	Optional	Only when a CM in charge has been specified for **Specify Assigned CM** of "Basic Configuration Items of Tier Pool", as needed, specify the CM which takes charge of the RAID group configuring the sub-pool. The checkbox is not checked by default (a CM in charge is not specified). Any CM in charge can be configured from the CM in charge specified to the Tier pool.

Item	Specification (*1)	Explanation
		To specify a CM in charge, check the checkbox. All of the CMs specified for **Specify Assigned CM** of "Basic Configuration Items of Tier Pool" are displayed, make a selection from these. Up to 2 CMs may be specified.

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

- If "Manual" is selected for **Disk Selection** in "Basic Configuration Items of Tier Pool":

Item	Specification (*1)	Explanation
FTSP Name	Optional	Specify a name (that is unique within the ETERNUS SF system) for the sub-pool. Any alphanumeric character (1 - 16 characters), a hyphen (-), an underscore (_), and a pound symbol (#) may be specified. The letters to be specified are not case sensitive.
Disk Type	Required	Specify the type of disk for configuring the sub-pool. Make a selection from the disk types (Online, Nearline, SSD, SED-SAS, Online SED, Nearline SED, and SSD SED) that are displayed in the pull-down list.
Reliability	Required	Specify the RAID level of the sub-pool. Make a selection from one of the following that are displayed in the pull-down list: - High Performance(RAID1+0) - High Capacity(RAID5) - High Reliability(RAID6) - High Reliability(RAID6-FR) - Mirroring(RAID1) - Striping(RAID0)
Fast Recovery Configuration	Optional	When selecting "High Reliability(RAID6-FR)" for **Reliability**, select Fast Recovery configuration. Creating RAID groups based on the number of disks for the specified configuration is required. When a level other than "High Reliability(RAID6-FR)" is selected for **Reliability**, this item does not need to be specified.
Disk	Required	Specify the disk of the RAID group that configures the sub-pool. The number of disks required differs depending on the reliability and Fast Recovery configuration of the RAID group.
Stripe Depth	Optional	Specify the size (KB) per disk in 1 stripe of the RAID group configuring the sub-pool. The default setting is "64". The stripe depth that can be specified depends on **Reliability** and the number of disks of the RAID group. - High Performance(RAID1+0): 64/128/256/512/1024 - High Capacity(RAID5) (from 2D+1P to 4D+1P): 64/128/256/512 - High Capacity(RAID5) (from 5D+1P to 8D+1P): 64/128/256 - High Capacity(RAID5) (from 9D+1P to 15D+1P): 64/128 - High Reliability(RAID6): 64

Item	Specification (*1)	Explanation
		- High Reliability(RAID6-FR): 64 - Mirroring(RAID1): Cannot be specified - Striping(RAID0): 64/128/256/512/1024
Specify Assigned CM	Optional	Only when a CM in charge has been specified for **Specify Assigned CM** of "Basic Configuration Items of Tier Pool", as needed, specify the CM which takes charge of the RAID group configuring the sub-pool. The checkbox is not checked by default (a CM in charge is not specified). Any CM in charge can be configured from the CM in charge specified to the Tier pool. To specify a CM in charge, check the checkbox. All of the CMs specified for **Specify Assigned CM** of "Basic Configuration Items of Tier Pool" are displayed, make a selection from these. Up to 2 CMs may be specified.

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

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

Point
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- Multiple Tier pools can be created in one ETERNUS SF system.

- Only one Tiering policy can be configured to one Tier pool.
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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
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- 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 is not 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 is not 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, an Assigned CM allocated in the made sub-pool is set to Assigned CM of the Tier pool. When the following work is executed, Assigned 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 is not 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.

- The policy name cannot be changed for the one layer Tier pool.

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.
   The items which can be specified when changing the number of layers of the Tier Pool are as follows.

Item Name	Specification (*1)	Explanation
Policy Name	Optional	Specify the Tiering policy to associate with the Tier pool. Make a selection from the Tiering policies that have been defined and are displayed in the pull-down list. The Tiering policies that cannot be applied to the Tier pool configuration after the change are not displayed.
Assigned CM	Optional	Only when a CM in charge has been specified at the time of the Tier pool creation, the CM in charge can be added. As needed, specify the CM which takes charge of the Tier pool being created. The checkbox is not checked by default (a CM in charge is not specified). To specify a CM which takes charge of the Tier pool, check the checkbox. All of the CMs present on the storage device are displayed, make a selection from these.
Number of Layers	Required	Specify the number of layers of the Tier pool. Only increasing the number of layers is possible. - Add a Low sub-pool when changing from one layer to two layers. - Add 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.
Disk Selection	Required	Specify the method for the selection of disks that configure the sub-pool. The default setting is "Auto" (automatic selection). When "Auto" is selected, in the screen to configure the Low sub-pool and Middle sub-pool, it is necessary to specify a minimum required capacity for each of the sub-pools. When "Manual" is selected, in the screen to configure the Low sub-pool and Middle sub-pool, it is necessary to specify the disks that configure each of the sub-pools.

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

Refer to "Change Number of Layers of Tier Pool" in the *ETERNUS SF Web Console Guide* for the operational procedure.

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 is not 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.

P Point
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- Multiple Tier pools can be deleted at once.

- The following Tier pools cannot be deleted.

    - Tier pools on which FTVs are present

    - Tier pools that have Virtual Volumes

    - Tier pools in which Automated Storage Tiering has already been started

    - Tier pools that have configured VVOL datastores

    - Tier pools that have configured Clone backup VVOL datastores

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See
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Virtual Volume is a volume that is created with the VMware vSphere Virtual Volumes function. With ETERNUS SF, multiple Tier pools are combined into a single VVOL datastore (logical area for configuring Virtual Volumes that are generated under the control of the VM guest).
Refer to the *ETERNUS SF Operation Guide for VMware vSphere Virtual Volumes* for details of the VMware vSphere Virtual Volumes function.

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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
Assigned CM	Optional	Only for the Tier pool that the CM in charge has been specified, a CM in charge can be added. The checkbox is not checked by default (a CM in charge is not added). To add a CM which takes charge of the Tier pool, check off the checkbox.
Disk Selection	Optional	Specify the method for the selection of disks that configure the sub-pool. The default setting is "Auto" (automatic selection). When "Auto" is selected, in the screen to configure the sub-pool, it is necessary to specify a minimum required capacity for the sub-pool. When "Manual" is selected, in the screen to configure the sub-pool, it is necessary to specify the disks that configure the sub-pool.

Configuration Items of Sub-Pool

- If "Auto" is selected for **Disk Selection** of "Basic Configuration Items of Tier Pool":

Item	Specification (*1)	Explanation
FTSP Name	Required	Specify a name for the sub-pool that the capacity is being expanded.

Item	Specification (*1)	Explanation
		In the default setting, the name of the target sub-pool is displayed. However, its name can be changed. When change the name, specify a name that is unique within the storage device. Any alphanumeric character (1 - 16 characters), a hyphen (-), an underscore (_), and a pound symbol (#) may be specified. The letters to be specified are not case sensitive.
Balancing	Optional	Specify the implementation of Tier pool balancing. The checkbox is not checked by default (Tier pool balancing is not implemented). Check the checkbox when starting the Tier pool balancing simultaneously with the sub-pool capacity expansion.
Minimum Required Capacity	Required	Specify the capacity required at a minimum for the sub-pool. A capacity of 1 MB or more may be specified. It is also possible to input a decimal value.
Specify Assigned CM	Optional	As needed, specify the CM which takes charge of the RAID group configuring the sub-pool. The checkbox is not checked by default (a CM in charge is not specified). Any CM in charge can be configured from the CM in charge specified to the Tier pool. To specify a CM in charge, check the checkbox.

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

- If "Manual" is selected for **Disk Selection** of "Basic Configuration Items of Tier Pool":

Item	Specification (*1)	Explanation
FTSP Name	Required	Specify a name for the sub-pool that the capacity is being expanded. In the default setting, the name of the target sub-pool is displayed. However, its name can be changed. When change the name, specify a name that is unique within the storage device. Any alphanumeric character (1 - 16 characters), a hyphen (-), an underscore (_), and a pound symbol (#) may be specified. The letters to be specified are not case sensitive.
Balancing	Optional	Specify the implementation of Tier pool balancing. The checkbox is not checked by default (Tier pool balancing is not implemented). Check the checkbox when starting the Tier pool balancing simultaneously with the sub-pool capacity expansion.
Disk	Required	Specify the disk of the RAID group that configures the sub-pool. The number of disks required differs depending on the reliability of the RAID group.
Specify Assigned CM	Optional	As needed, specify the CM which takes charge of the RAID group configuring the sub-pool.

Item	Specification (*1)	Explanation
		The checkbox is not checked by default (a CM in charge is not specified). Any CM in charge can be configured from the CM in charge specified to the Tier pool. To specify a CM in charge, check the checkbox.

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

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

If a sub-pool capacity expansion is performed, data bias occurs in the sub-pool, and differences may appear in access performance. To eliminate the data bias, perform a Tier pool balancing.
A Tier pool balancing can be carried out after extending the sub-pool capacity as well as when extending sub-pool capacity. Refer to the "Start/Stop Tier Pool Balancing" in the *ETERNUS SF Web Console Guide* for information on how to perform a Tier pool balancing.

See

Refer to "4.8 Tier Pool Balancing " for details of the Tier pool balancing.

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.

When the total capacity of the FTV (Thick) is specified for the allocation of the physical area with the Allocation setting during volume creation, the physical area (FTRPE) of the total capacity is allocated. For that reason, regardless of whether data is written, evaluation/relocation of the access status data is always performed for the total capacity of the FTRPE in FTVs where the Allocation is "Thick".

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.

Example

If the FTVs do not need high-speed response in the business though accessed frequently, set 100% to Low Quota Share of the FTVs.

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.

- 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
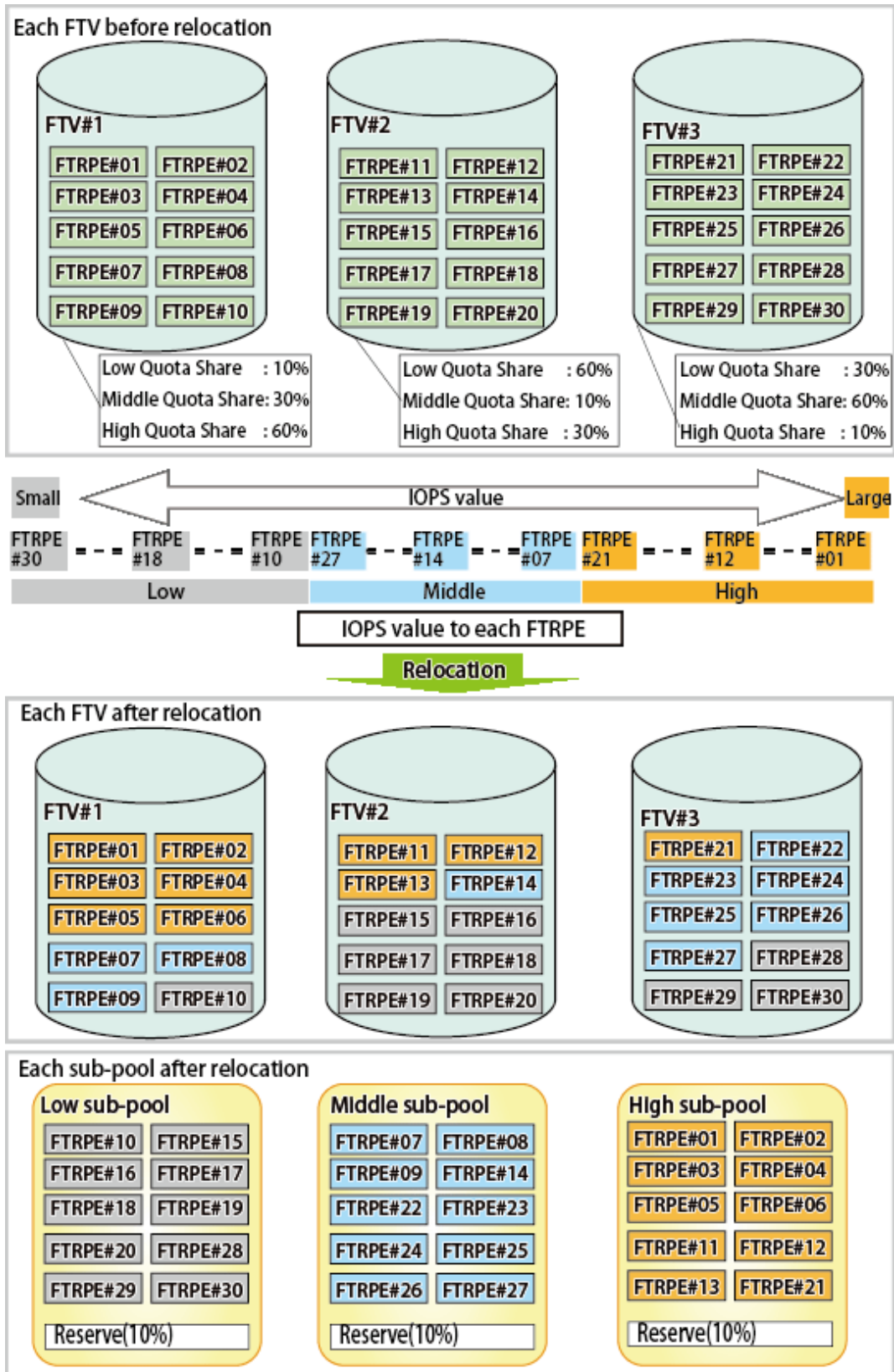
Figure 3.5 Relocation When Free Space Corresponding to Specification of Capacity Quota Share Cannot Be Secured
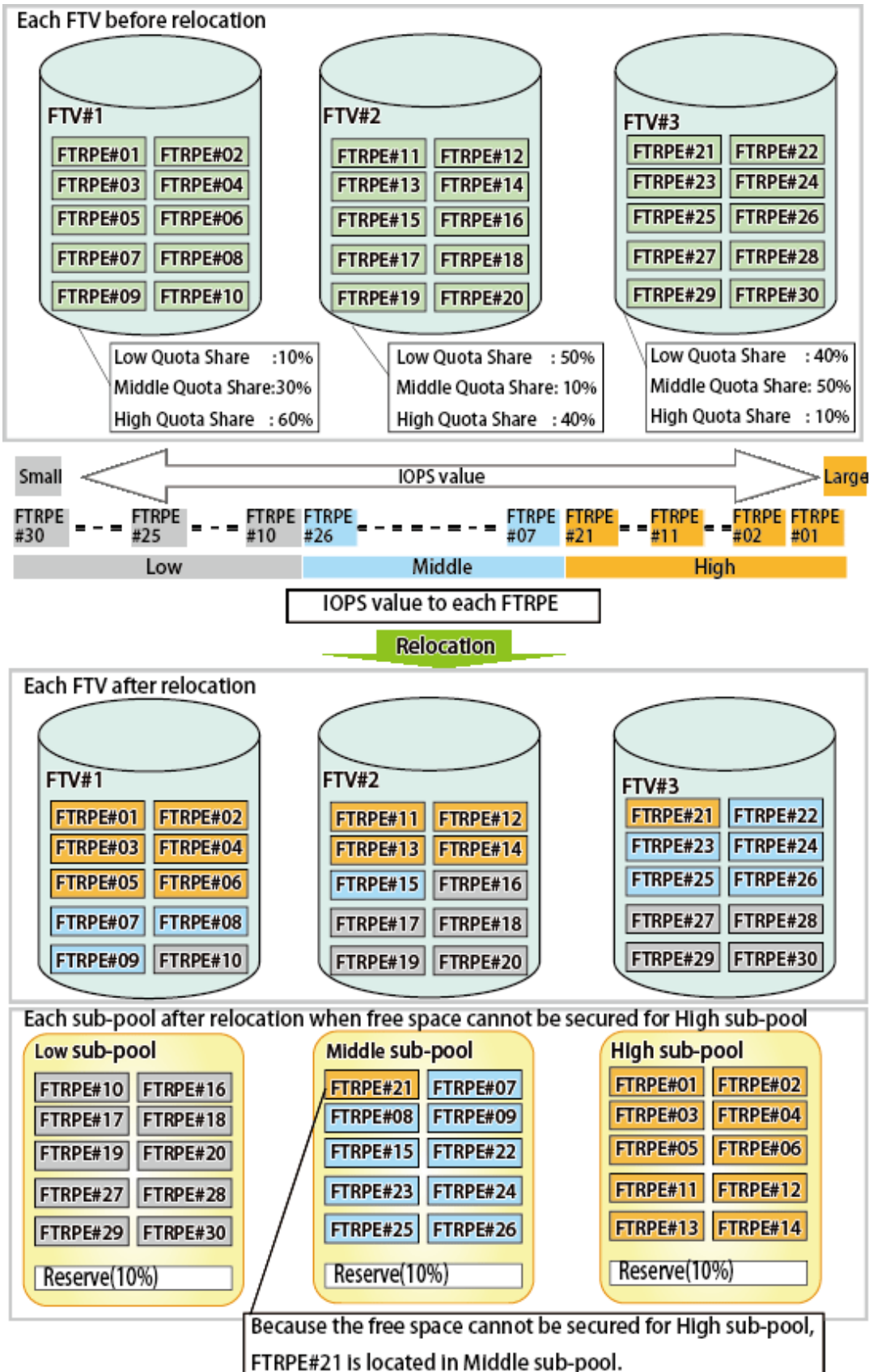
Figure 3.6 Relocation When Capacity Quota Share Is Specified for Specific Layer

Note
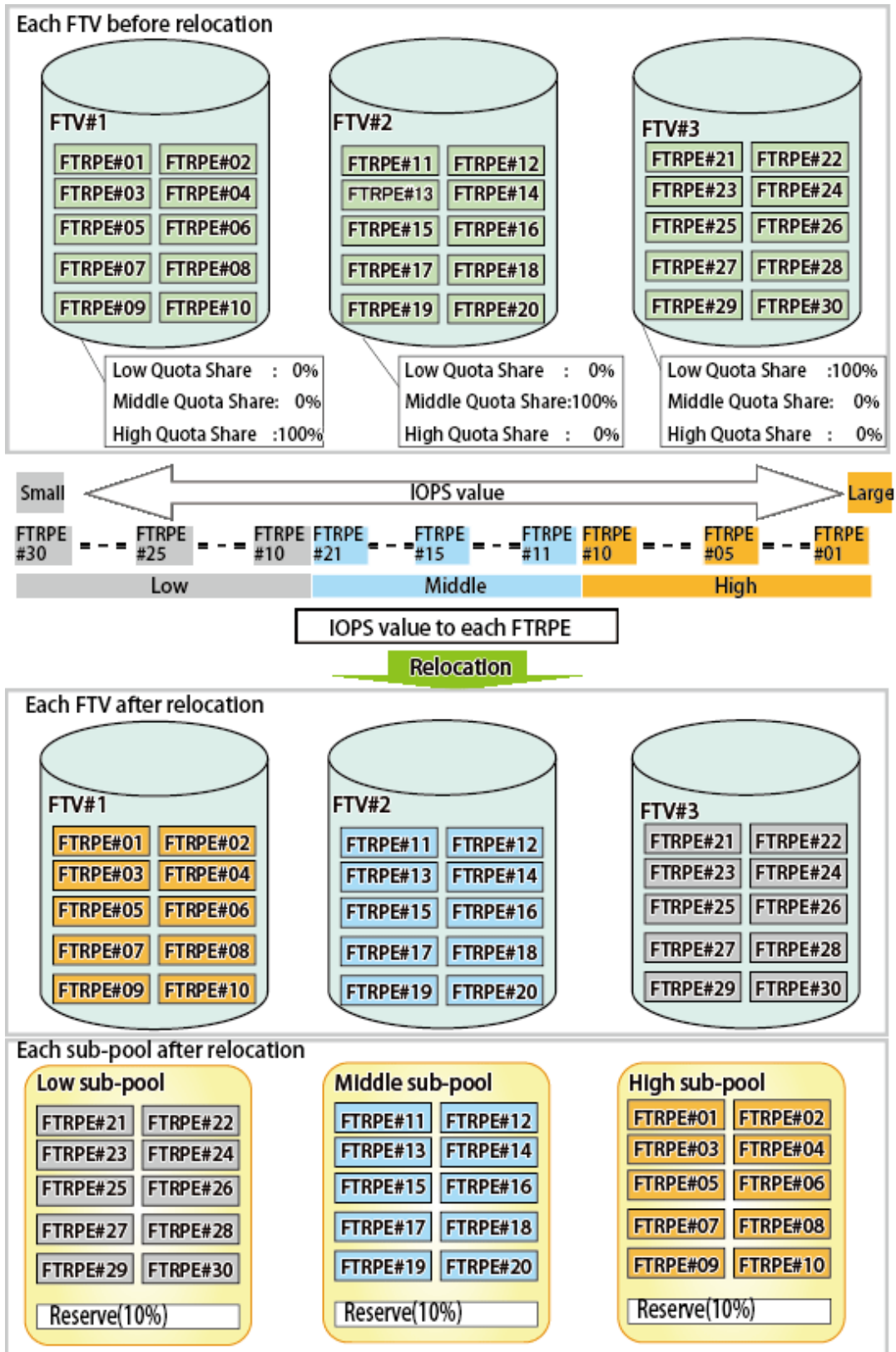
- Implement the changing / deletion / formatting of an FTV after updating the administration information of the FTV.
  If FTV configuration has been changed on the ETERNUS Disk storage system side, perform for the target ETERNUS Disk storage system the operations described in "Reload ETERNUS Disk Storage System Configuration Information" in the *ETERNUS SF Web Console Guide* in order to make the management information of FTV up-to-date.

- Physical allocation to the FTV is on a per block basis.
  The capacity displayed for usage share (capacity) of the FTV is calculated from the number of blocks allocated by each layer. For this reason, the total usage capacity of each layer may not correspond to the used capacity of the FTV.

Storage Device	Capacity Per Block
ETERNUS DX S2 series (excluding DX60 S2)	1,344 MB
ETERNUS DX S3 series (excluding DX60 S3)	21 MB

3.6.1   Creation of FTV

This creates an FTV.

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

Item	Specification	Explanation
Tier Pool Name	Required	Specify the name of the Tier pool in which to create the FTV.
FTV Name	Optional	Specify a volume name (that is unique within the storage device) for the FTV to create. Any alphanumeric character (1 - 16 characters), except for a period (.), a question mark (?), single quote ('), or double quote (") may be specified. The letters to be specified are not case sensitive.
Total Capacity	Required	Specify the volume capacity of the FTV that is to be created. The units that may be specified are MB (megabytes), GB (gigabytes), or TB (terabytes).
Volume Number	Required	Specify the number of volumes of the FTV that is to be created. When multiple volumes are created, the volumes are assigned a name that adds "_*x*" (*x* is a consecutive number from 0) to the volume name specified with **FTV Name**.
Allocation	Required	Select the Allocation setting of the FTV to be created. If "Thin" is selected, the physical area to be used is allocated as needed when I/O are issued. If "Thick" is selected, the physical area of the volume capacity is allocated when the volume is being created. This item can only be set for ETERNUS Disk storage systems that support the Allocation function.
Caution Threshold of FTV	Optional	Specify the threshold value, as a ratio of the used capacity. A set standard of this item is as follows: - For ETERNUS DX S3 series (excluding DX60 S3), ETERNUS DX200F: `[Total capacity of FTV] * [Caution threshold] < [Used capacity of FTV]` Specifies a threshold (%) for the storage device to report a host sense. Specify a decimal value in the range of 1 - 100.

Item	Specification	Explanation

		If specification is omitted, 80 % that is the recommended value of the storage device is set.
		
		- For ETERNUS Disk storage systems other than those listed above:
		
		`[Free capacity of FTV] * [Caution threshold] >`
		`[Free capacity of Tier pool]`
		
		Specifies a threshold (%) for **Alarm Status** of FTV information to be changed. Specify a decimal value in the range of 1 - 200.
		If specification is omitted, 10 % that is the recommended value of the storage device is set.
		Note that the free capacity of FTV is a value of the total capacity of FTV subtracted by usage.
		
		If the ratio of usage reaches the caution threshold that has been set, **Alarm Status** below turns "Caution".
		
		- **Alarm Status** of the **Volume** tab screen in details of the Tier pool
		
		- **Alarm Status** of the **Basic** tab screen in details of FTV

Priority FTSP	Optional	This item specifies whether to assign priority to a sub-pool of the Tier pool when newly assigning data. When data is not assigned to the specified sub-pool, the data is assigned to a different sub-pool. If omitted, data is assigned in the following order: When the same type of SED disks exist, normal disks are allocated by priority. (1) Sub-pool that configured with Online disks (2) Sub-pool that configured with Nearline disks (3) Sub-pool that configured with SSDs In the case of creating an FTV of one layer Tier pool, the process after the Tier pool is changed from one layer to two or three layers can be specified beforehand. If continue to use the one layer Tier pool, the specification is not required.
Low Quota Share	Optional	Specify the ratio (%) of the capacity of the volume to assign to the Low sub-pool upon relocation within an integer from 0 - 100. (*1, *2) If specify **Low Quota Share**, **Middle Quota Share**, and **High Quota Share**, it is necessary to specify values so that the sum of these values is 100 %. If omitted, the relocation is performed based on the Tiering policy.
Middle Quota Share	Optional	Specify the ratio (%) of the capacity of the volume to assign to the Middle sub-pool upon relocation within an integer from 0 - 100. (*1, *2) If specify **Low Quota Share**, **Middle Quota Share**, and **High Quota Share**, it is necessary to specify values so that the sum of these values is 100 %. If omitted, the relocation is performed based on the Tiering policy.
High Quota Share	Optional	Specify the ratio (%) of the capacity of the volume to assign to the High sub-pool upon relocation within an integer from 0 - 100. (*1, *2)

Item	Specification	Explanation
		If specify **Low Quota Share**, **Middle Quota Share**, and **High Quota Share**, it is necessary to specify values so that the sum of these values is 100 %. If omitted, the relocation is performed based on the Tiering policy.

Automated QoS:Enable/Disable (*3)	Required	This is to enable Automated QoS tuning for volumes to be created. Specify either of the following:
		
		Enable
		
		    Specify this when enabling Automated QoS tuning.
		    By selecting "Enable", if **Automated QoS:Priority** or **Target Response Time** is not specified, the device is affected by the adjustments of the Automated QoS function for other volumes that are set with those items.
		
		Disable
		
		    Specify this when not enabling Automated QoS tuning.
		    By selecting "Disable", the values set in **Automated QoS:Priority**, **Target Response Time**, or **Tune by Quota Share** are discarded and the QoS performance setting of the ETERNUS Disk storage system is set to Limitless (0).
		
		The default setting is "Disable".

Automated QoS:Priority (*3)	Optional	This is Automated QoS Priority of volumes to be created.
		By simply setting "Low", "Middle", or "High" to the volume used by the user, automatic tuning is performed in accordance with the current load. For priority, select any of the following according to business requirements. If target response time is specified, this item is disabled:
		
		Unlimited
		
		    Specify this when you do not want to limit I/O performance.
		    If "Unlimited" is selected, it is the highest priority, and the highest performance of the volumes sharing resources.
		
		High
		
		    Specify this when high I/O performance is required.
		
		Middle
		
		    If high I/O performance is required, but other volume exists for which High is specified for priority and I/O competes at the same time, specify this when it does not matter that I/O performance is limited.
		
		Low
		
		    Specify this when giving priority to others and it does not matter that I/O performance is low.
		
		No Set
		
		    Specify this when a target of I/O performance need not be specified and it does not matter that performance is limited for I/O performance tuning of other volumes sharing resources.
		    If "No Set" is selected, there is no priority and I/O performance is tuned to be made slow by being affected by other volumes for which Automated QoS Priority or target response time is specified.

Target Response Time (*3)	Optional	This is the target value of the response time of the volume the user is using.

Item	Specification	Explanation
		Specify an integer from 0 - 10,000. If "0" has been specified, the bandwidth of that volume is unlimited. Although a space may be entered, if a space has been entered, a target response time is not configured for that volume. Therefore, the response time depends on the configured values for the target response times of the other volumes, and may become faster or slower. If "No Set" is selected for Automated QoS Priority and this item is not specified, I/O performance is tuned to be made slow by being affected by other volumes for which Automated QoS Priority or target response time is specified. The target response time is specified for each volume. Furthermore, **Automated QoS:Priority** cannot be set if this item has been set.

Tune by Quota Share (*3)	Optional	This is to enable cooperation between Automated QoS and Automated Storage Tiering for volumes to be created.
		
		Simply by specifying together with **Automated QoS:Priority** or **Target Response Time**, automatic tuning of performance is performed through utilization of the Automated QoS function and Automated Storage Tiering.
		
		Specify either of the following:
		
		On
		
		    Specify this when performing a cooperation.
		    If "On" is specified, both Automated QoS and Automated Storage Tiering are used to tune the I/O performance automatically.
		
		Off
		
		    Specify this when not performing a cooperation.
		
		This can only be specified when all of the following conditions have been satisfied:
		
		- A value other than "Unlimited" and "No Set" is specified for **Automated QoS:Priority**. Alternatively, a value other than "0" is specified for **Target Response Time**.
		
		- The execution mode of the Tier pool specified for Tier Pool Name is "Auto".

*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.

*4: Free space of FTV = Total FTV capacity - FTV used capacity

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

Point

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- Refer to "Set Volume Allocation" in the *ETERNUS SF Web Console Guide* for the Allocation settings.

- When Allocation is changed to "Thick" from "Thin", the physical area is allocated to an unallocated area within the total capacity of the FTV.

- When Allocation is changed to "Thin" from "Thick", the physical area that was set in the Total Capacity of the FTV remains allocated.

- When operating with 1 layer, **Low Quota Share**, **Middle Quota Share**, and **High Quota Share** cannot be specified.

- When operating with 2 layers, it is necessary to either specify both the 2 fields of **Low Quota Share** and **High Quota Share**, or omit the specification for both of these.

- When operating with 3 layers, it is necessary to either specify all 3 fields of **Low Quota Share**, **Middle Quota Share**, and **High Quota Share**, or omit the specification for all of these.

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

- Automated QoS:Enable/Disable (only when utilizing the Automated QoS function)

- Automated QoS:Priority (only when utilizing the Automated QoS function)

- Target Response Time (only when utilizing the Automated QoS function)

- Tune by Quota Share (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.

- If the balancing status for the Tier pool where the target FTV exists is "Stop", the total capacity can be changed.

- When the total capacity is increased by changing the FTV, physical area is allocated according to the Allocation settings.

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.

-   Virtual Volumes cannot be formatted.

See

Virtual Volume is a volume that is created with the VMware vSphere Virtual Volumes function. Refer to the *ETERNUS SF Operation Guide for VMware vSphere Virtual Volumes* for details of the VMware vSphere Virtual Volumes function.

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 is not 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.

-   Virtual Volumes cannot be deleted.
    As an exception, Virtual Volumes with an "Unknown" VVOL type can be deleted. When deleting multiple Virtual Volumes, each one must be deleted individually since a batch delete is not possible.

See

Refer to the *ETERNUS SF Operation Guide for VMware vSphere Virtual Volumes* for details of the VVOL types.

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
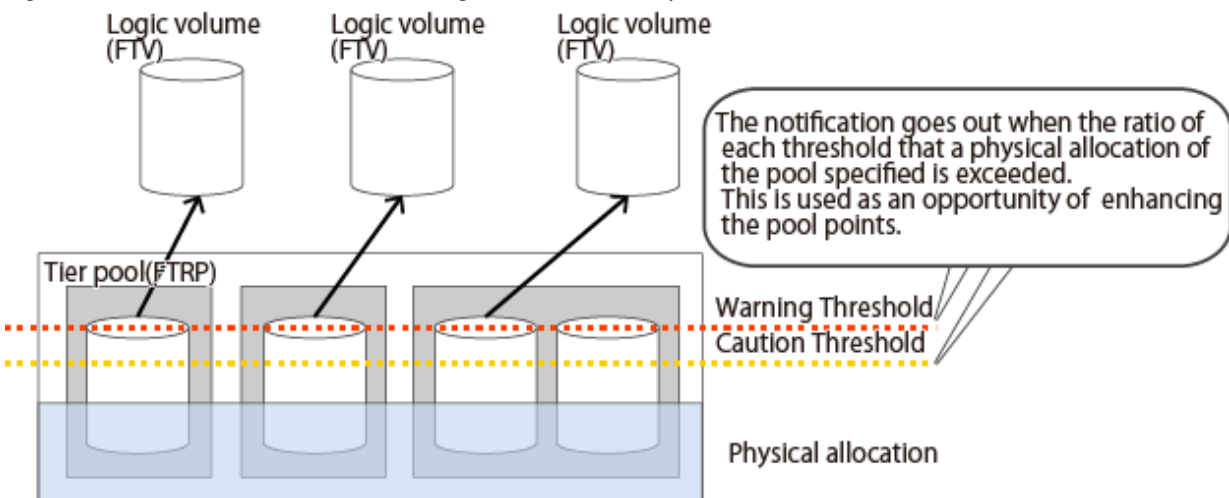
Figure 3.8 Caution Threshold of FTV
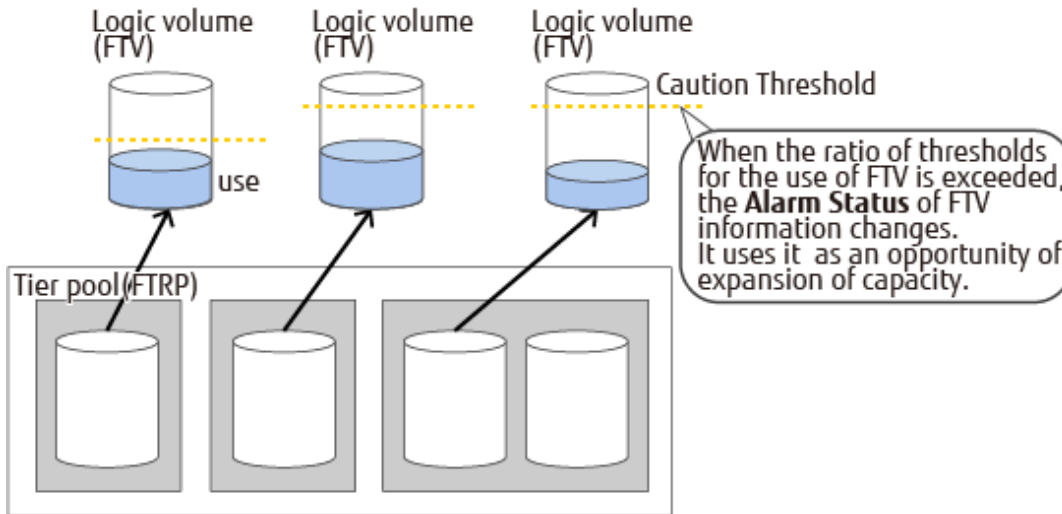
📖Information
....
The explanation in the above-mentioned figure is ETERNUS DX S3 series (excluding DX60 S3).
....

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 automatically decides the standards for relocation of data within the volume, and optimally perform the relocation.

- Execution Mode: Auto

- Data Range of Layer: Automatic Configuration

Automated Storage Tiering relocates so that free space to write new I/O data in is secured in each sub-pool during or after relocation. Evaluation/relocation behaviors vary with the Tier pool usage.

Storage Device	Behavior of Evaluation/Relocation
ETERNUS DX S2 series (excluding DX60 S2)	- When Tier pool usage rate is 90 % or less Evaluation/relocation are performed so that free space of about 10 % or more is secured in each sub-pool. - When Tier pool usage rate exceeds 90 % Evaluation/relocation fail.
ETERNUS DX S3 series (excluding DX60 S3)	- When Tier pool usage rate is 90 % or less Evaluation/relocation are performed so that free space of about 10 % or more is secured in each sub-pool. For behavior example, refer to "Figure 3.9 Behavior Example of Evaluation/Relocation When Tier Pool Usage Rate Is 90 % or Less". - When Tier pool usage rate exceeds 90 % Evaluation/relocation are performed so that free space of each sub-pool is secured for the following rate (unit: %). `100 - (Tier pool usage rate)`

Storage Device	Behavior of Evaluation/Relocation
	For behavior example, refer to "Figure 3.10 Behavior Example of Evaluation/Relocation When Tier Pool Usage Rate Is 95 %".

For the ETERNUS DX S3 series (excluding DX60 S3), the behavior outline of evaluation/relocation is as follows.

Figure 3.9 Behavior Example of Evaluation/Relocation When Tier Pool Usage Rate Is 90 % or Less
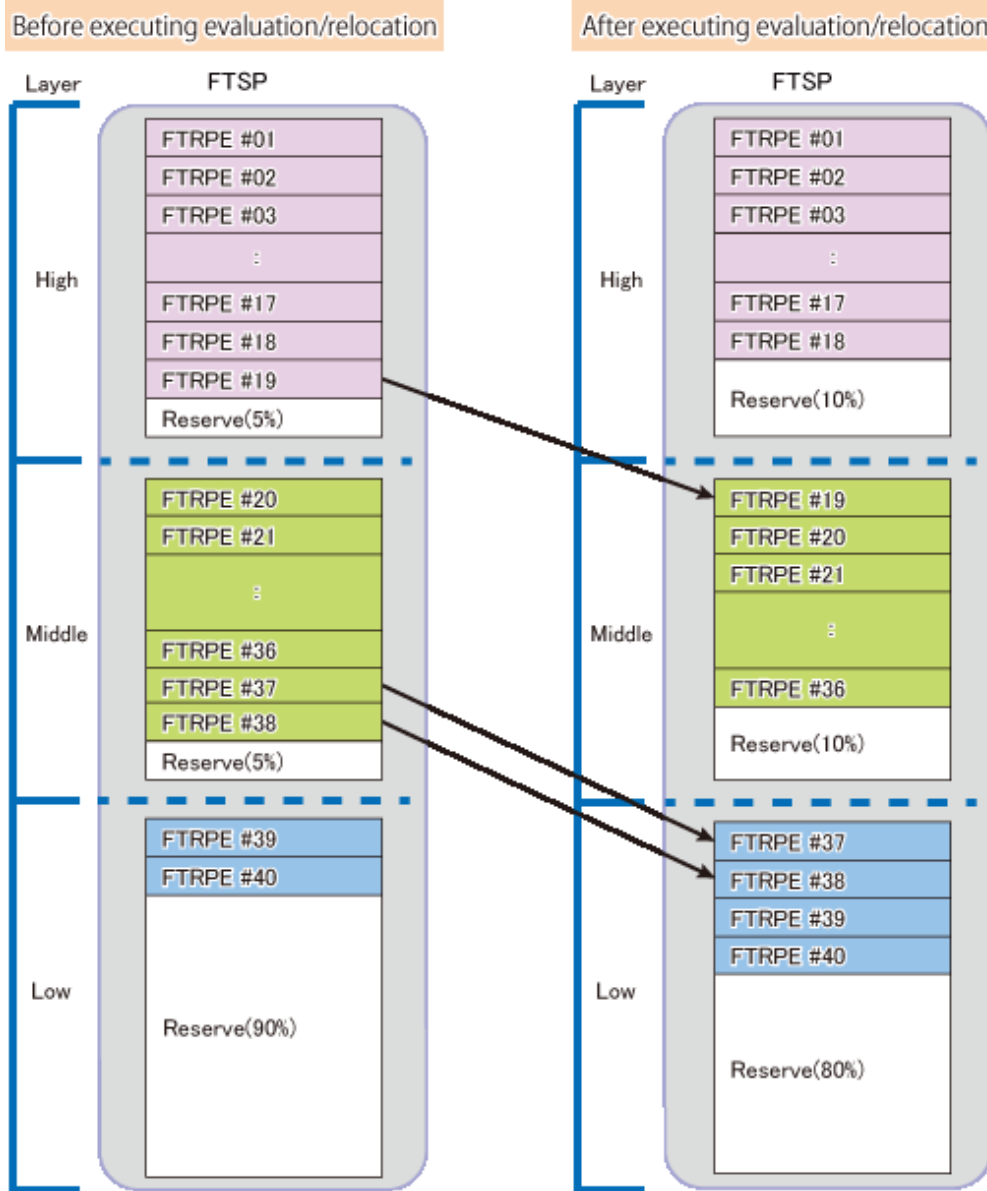
Figure 3.10 Behavior Example of Evaluation/Relocation When Tier Pool Usage Rate Is 95 %
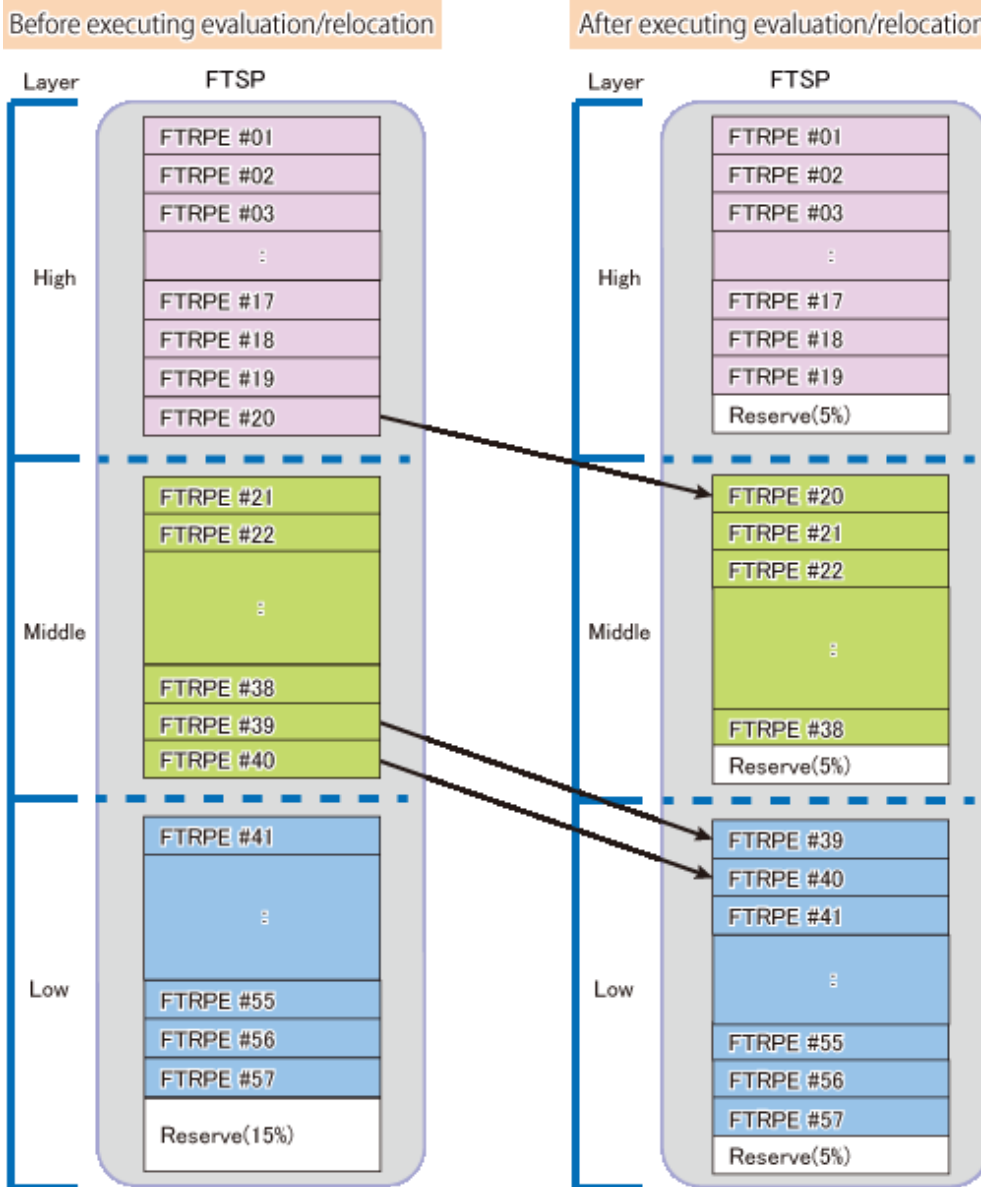
Point

If free space of the reserved area size required for evaluation/relocation does not exist in Tier pools, evaluation/relocation fail. In that case, after expanding Tier pool capacity or referring to "2.2 Configuration of Tier Pool" to secure the reserved area required for evaluation/relocation, execute evaluation/relocation.

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 is 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 volume name of the FTV.
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	This is the execution status of relocation. - Evaluated: volumes of the Execution Mode of "Semi-Auto" or "Manual" 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 Volumes in which relocation has been completed are not displayed. Completed results can be confirmed from the relocation history.
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 *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

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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

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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 is 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

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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".

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Note

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- There is an upper limit for the total number of used capacity of Tier pools that can be simultaneously evaluated by ETERNUS SF Manager.
  Refer to "Upper Limit of Automated Storage Tiering" in the *ETERNUS SF Installation and Setup Guide* for the total number of used capacity of Tier pools that can be simultaneously evaluated.

- 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**.

- If approximately 10% in the Tier pool capacity does not exist as the reserved area, evaluation/relocation does not complete normally. For relocation, each sub-pool must set aside about 10% (fixed) for use as a reserved area.

3.9 Access Status Data Synchronization

When setting the FTV as the synchronization target volume using the Storage Cluster function, the access status data of the Active side FTV and the Standby side FTV are synchronized. This process is referred to as "access status data synchronization". With this process, evaluation/relocation that was optimized for the I/O access status from the Active side FTV is possible even for the Standby side FTV, and enables operations for maintaining pre-failover access performance even after a failover.

Refer to "Storage Cluster Function" in the *ETERNUS SF Storage Cruiser Operation Guide* for details of the Storage Cluster function.

Figure 3.11 Overview of Access Status Data Synchronization
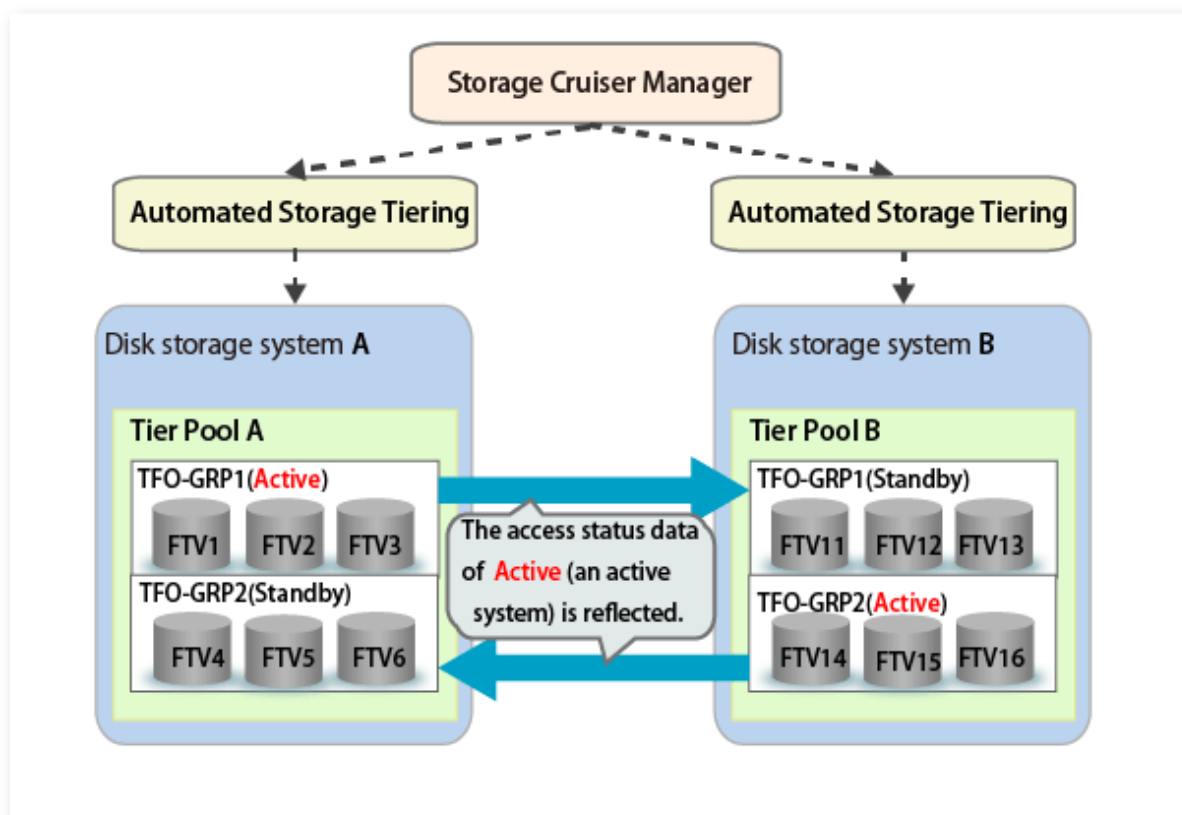
3.9.1 Enabling Access Status Data Synchronization

Point

- Access status data synchronization function is enabled by default. For this reason, if the synchronization function is not changed to disable, this setting is unnecessary.

- When enabling the access status data synchronization function, FTVs for all Tier pools that are registered in ETERNUS SF Manager become targets for the synchronization process.

To enable the access status data synchronization function, execute the esfast heatmapsync set command as follows:

```
esfast heatmapsync set –mode enable
```

3.9.2   Starting Access Status Data Synchronization

To start the access status data synchronization process, the settings for the Primary storage and the Secondary storage of the Storage Cluster environment must satisfy the following conditions:

- The FTV that is defined in the TFO group is included in the Tier pool that has a one-to-one relationship.

- Automated Storage Tiering of the another Tier pool where the access status data is synchronized is running.

When the access status data synchronization is set to "enable" and all the above conditions are satisfied, if Automated Storage Tiering is started, the access status data synchronization process between Tier pools is started.

🅿 Point
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If the access status data synchronization process has started, the Tier pool name that started Automated Storage Tiering is added to the operations log when Automated Storage Tiering for Tier pool was started and the Tier pool name of the another synchronization target is displayed.

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📝 Example
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Configuration examples of when access status data synchronization is executed/not executed are shown below.

- Environment example for performing access status data synchronization

  a. For a single TFO group, the Tier pool is in a one-to-one relationship
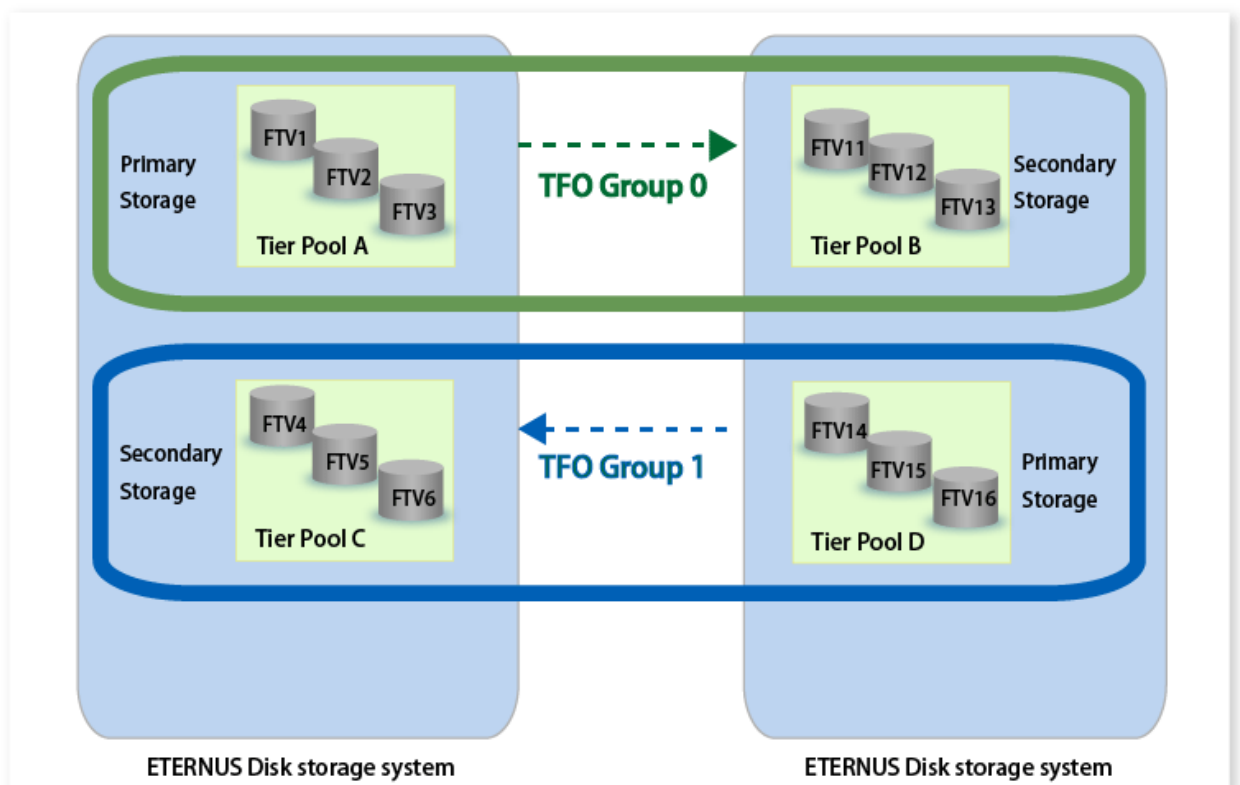
b. For multiple TFO groups, the Tier pool is in a one-to-one relationship
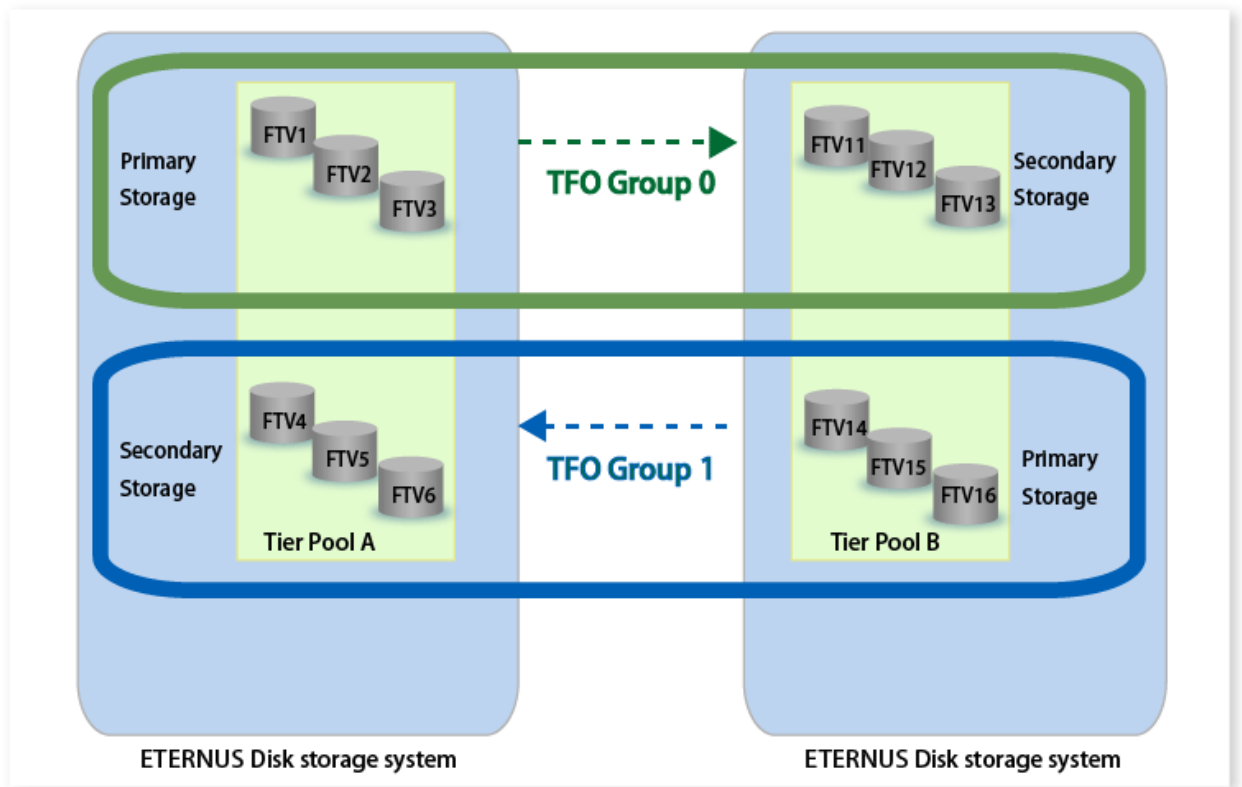
- Environment example where the access status data synchronization is not performed

    a. For a single TFO group, the Tier pool is in a one-to-N relationship
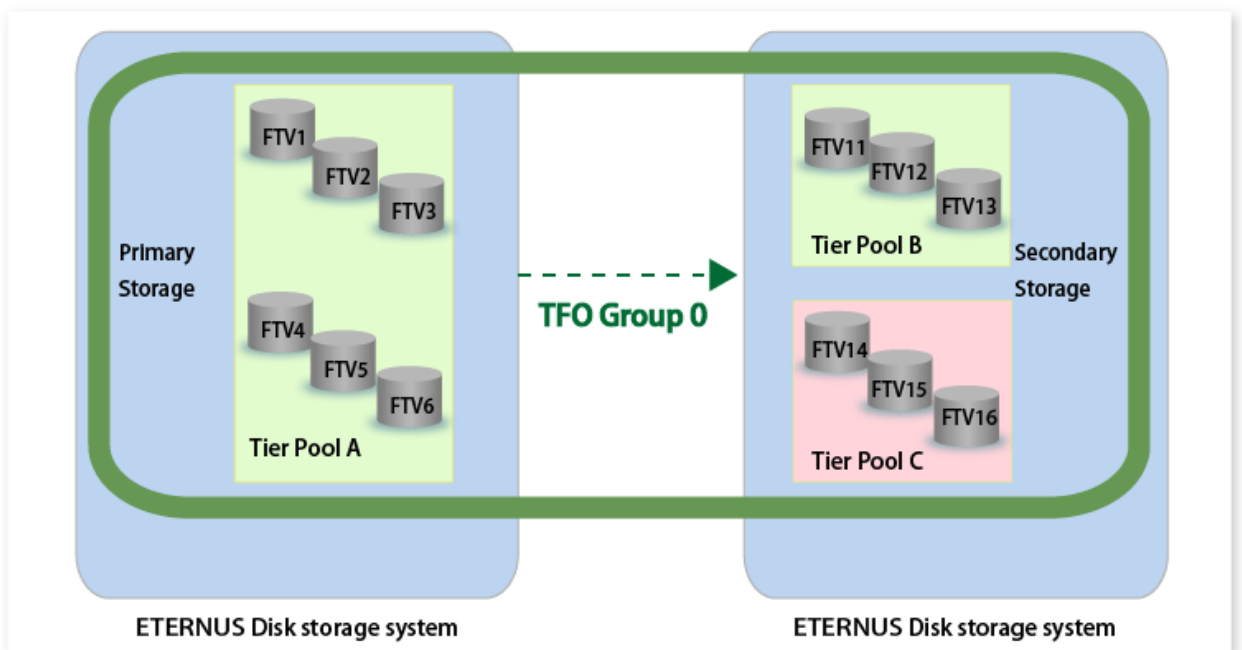
b. For multiple TFO groups, the Tier pool is in a one-to-N relationship
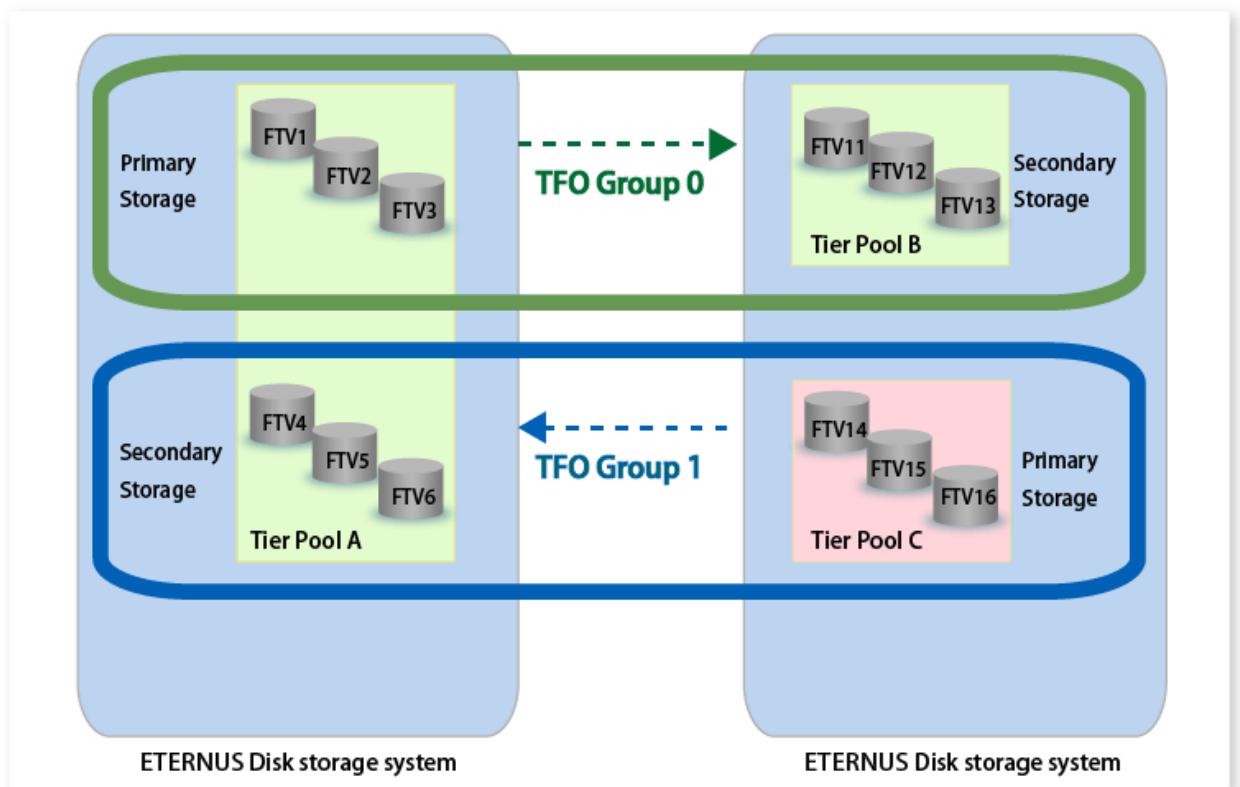
3.9.3   Stopping Access status data Synchronization

If Automated Storage Tiering for the Tier pool that is operating an access status data synchronization process is stopped, the access status data synchronization process is stopped.

3.9.4   Disabling Access Status Data Synchronization

If access status data synchronization is not used, disable the settings of the access status data synchronization function. To disable the access status data synchronization, execute the esfast heatmapsync set commands as follows:

```
esfast heatmapsync set -mode disable
```

🅿 Point

If the access status data synchronization function is set to disable, because the access status data synchronization process is not performed, the FTV access status data of the Primary Storage (active system) is not reflected in the access status data of the Secondary Storage (standby system). Using the access status data that was obtained from the Tier pool for each storage device, evaluation/relocation is performed by Automated Storage Tiering.

Therefore, immediately after a failover of the storage device, maintaining pre-failover access performance may not be possible.

3.10   Access Status Chart Settings

The access status chart graphs the access status data (IOPS value) that occurs in the Tier pool or FTV. By referring to the access status chart and by confirming the trend in the IOPS value, you can determine that the use of Automated Storage Tiering can achieve a performance increase and disk usage optimization.

Information

Even if the settings of an access status chart are changed, the access status data collected before changing the settings is not deleted. If the access status data collected before changing the settings exists in the generations of the access status data stored in the ETERNUS SF system, when displaying the pre-settings change access status data after having changed the settings, an access status chart may be displayed that does not match the changed settings.

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3.10.1   Settings When Using One Layer Tier Pool

By starting Automated Storage Tiering, the one layer Tier pool information can be displayed on the Access Status Chart panel of the Dashboard. For the start method of Automated Storage Tiering, refer to "Start/Stop Automated Storage Tiering for Tier Pool" in the *ETERNUS SF Web Console Guide*.

If you display the one layer Tier pool information on the Access Status Chart panel, the average for the IOPS values that occur over a one day period is displayed on the graph.

When you want to change the IOPS calculation period and evaluation standard in a one layer Tier pool, modify the configuration file. The configuration file is stored in the following location of the Management Server.

OS Type of Management Server	Absolute Path Name
Windows	$ENV_DIR\AST\Manager\etc\opt\FJSVssast\data\astchart\astchart.properties ($ENV_DIR is "Environment Directory" specified at the ETERNUS SF Manager installation.)
Solaris, Linux	/etc/opt/FJSVssast/data/astchart/astchart.properties

How to Reflect Configuration File

The modified content is automatically reflected at the next IOPS calculation time (at 2:00 the next day).

Customization

DAY_UNIT

Set an IOPS calculation period on a one to seven day basis. The default value is set with one.
If set with a value outside the specified range, the default value is used.

```
Example:
DAY_UNIT = 1
```

EVALUATE_VALUE

Set an IOPS evaluation standard with 1 (average) or 2 (peak value). The default value is set with one.
If set with a value outside the specified range, the default value is used.

```
Example:
EVALUATE_VALUE = 1
```

DAY_OF_WEEK

When an IOPS evaluation period is set to seven days, you can specify the day of the week to start the evaluation.
The evaluation start day the can be set is "SUN" (Sunday), "MON" (Monday), "TUE" (Tuesday), "WED" (Wednesday), "THU" (Thursday), "FRI" (Friday), "SAT" (Saturday), or "" (unspecified). The default value that is set is "".
If set with a string other than those listed above, the default value is used.

```
Example:
DAY_OF_WEEK = SUN
```

Note

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These settings are the common settings in all one layer Tier pools managed by ETERNUS SF Manager. Because of that, the settings cannot be changed for each Tier pool.

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3.10.2 Settings When Using Multiple Layer Tier Pool

The graph data of an access status chart is calculated based on the values set in **Evaluation Period** and **Evaluation Standard** in the policy for Tier pool. For this reason, the settings to display the access status chart are not required.

Point

. . . .

When a Tiering policy has been changed, the settings are reflected from the next evaluation of Automated Storage Tiering. When the Tiering policy has been changed, collected access status data may be discarded. Refer to "3.4.2 Change of Tiering Policy" for details. Refer to "Change of Tiering Policy" in the *ETERNUS SF Web Console Guide* for information on how to change the Tiering policy.

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Chapter 4   Operation of Automated Storage Tiering

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

4.1 Checking Access Status Chart

IOPS on a device using Automated Storage Tiering can be checked from an access status chart. The access status data is displayed as a graph of FTRPE where the IOPS values are sorted in descending order.

Refer to "Operations for Automated Storage Tiering" in "Operations for Dashboard" in the *ETERNUS SF Web Console Guide* for information on how to display access status chart.

📝 Note

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- Graph data of the access status chart is created at the following moments:

    - For one layer Tier pools
      At 2:00 after Automated Storage Tiering starts. (The time listed on the left or later is an interval of IOPS calculation period.)

    - For multiple layer Tier pools
      Upon completion of the evaluation of Automated Storage Tiering.

    However, no data of the access status chart is displayed for the following cases:

    - If data has never been created.

    - If no access status data exists in the IOPS calculation period or evaluation period.

- Since the access status chart displays only the data of an I/O generated area, the maximum capacity value on the horizontal axis may not agree with the used capacity in a pool or FTV.

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4.1.1 Access Status Chart of One Layer Tier Pool

Referencing the Tier pool access status chart to check the tendency of the IOPS value can evaluate whether performance can be improved and disk usage can be optimized with the introduction of Automated Storage Tiering.

Clicking the graph area displays a vertical auxiliary line at that location, and in **Capacity** and **I/O Rate** at the top right panel, the total value from the left of the auxiliary line is displayed. High sub-pool capacities required to move to a multiple-layer (two or more) Tier pool can be checked from **Capacity**. Also, from **I/O Rate**, the rate of IOPS that can be processed a High tiering level can be checked.

When FTRPEs with high IOPSs are concentrated in a single part of the graph area, performance improvements can be expected by introducing Automated Storage Tiering.

📋 Example

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The following example describes how to calculate the High sub-pool capacity required to move to a multiple-layer Tier pool.

When designing so that 90 % of IOPS produced in a target Tier pool can be processed in High sub-pool
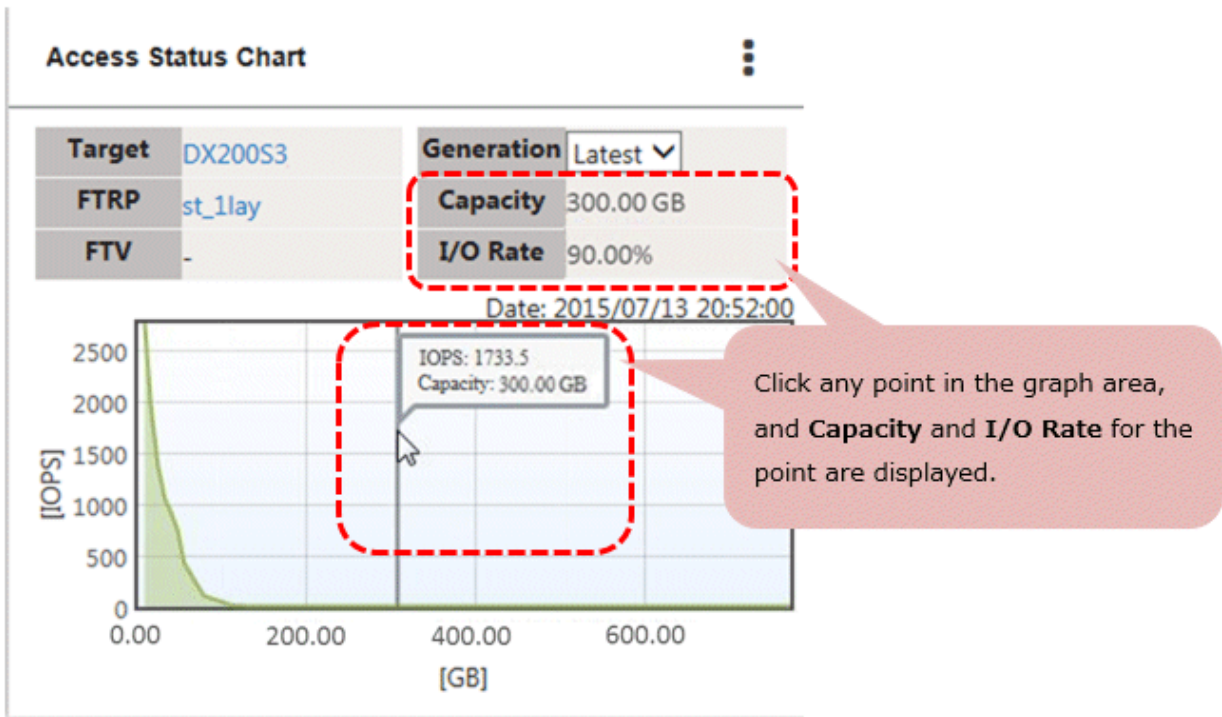
1. Click the graph area to search for a part where the **I/O Rate** is 90 %.

2. Check the value displayed in **Capacity**. That value is the required capacity for the High sub-pool.

⚑ Note

In an FTV access status chart, only the IOPS produced in the target FTV can be checked.

4.1.2 Access Status Chart of Multiple Layer Tier Pool

You can evaluate the validity of the currently set Tiering policy from the access status chart.

The lower limit of **Data Range of High** and the lower limit of **Data Range of Middle** set in a Tiering policy are displayed as auxiliary lines on the graph. From the intersected point between the graph and auxiliary lines, the disk capacity that is required to achieve the currently set Tiering policy can be found.

🅿 Point

- The rate displayed in the graph area indicates the ratio of IOPS per tier to the total IOPS of a specified pool or FTV. Since the value rounded up to one decimal place is displayed, the total value of the ratio of IOPS per tier causes a maximum of 0.2 % error.

- The percent "%" displayed on the horizontal axis of a FTV access status chart indicates a rate of capacity against FTV used capacity. The value set in **High Quota Share** is displayed in a red line. For a three layer Tier pool, the boundary line between the value set in **Middle Quota Share** and the value set in **Low Quota Share** is displayed in blue.

📑 Example

The following example describes how to evaluate the validity of a Tiering policy.

When actual used capacity (approx. 400 GB) is less than capacity prepared for High sub-pool (500 GB)
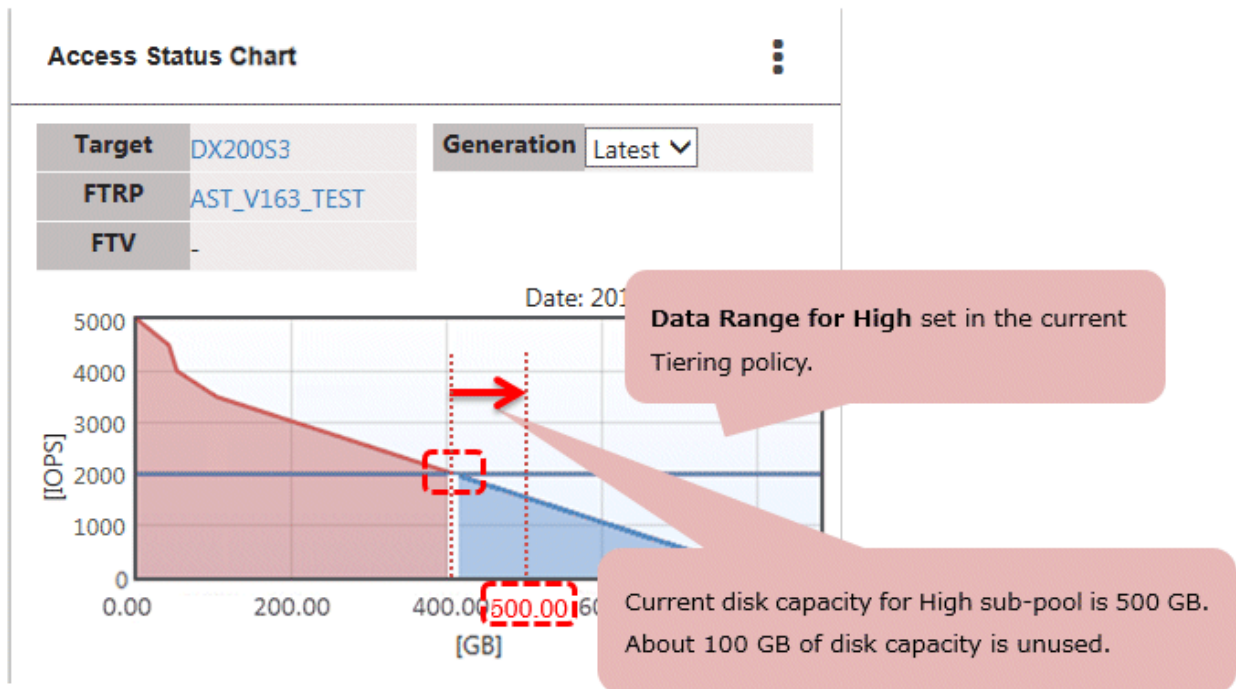
Although the High sub-pool capacity that is required to achieve the specified Tiering policy is 400 GB, the capacity is actually available up to 500 GB.

If you want to increase the I/Os processed in the High sub-pool, set **Data Range of Layer** to "Automatic Configuration", or change the lower limit of **Data Range of High** to "1500".

When High sub-pool capacity (500 GB) is less than required disk capacity (600 GB)
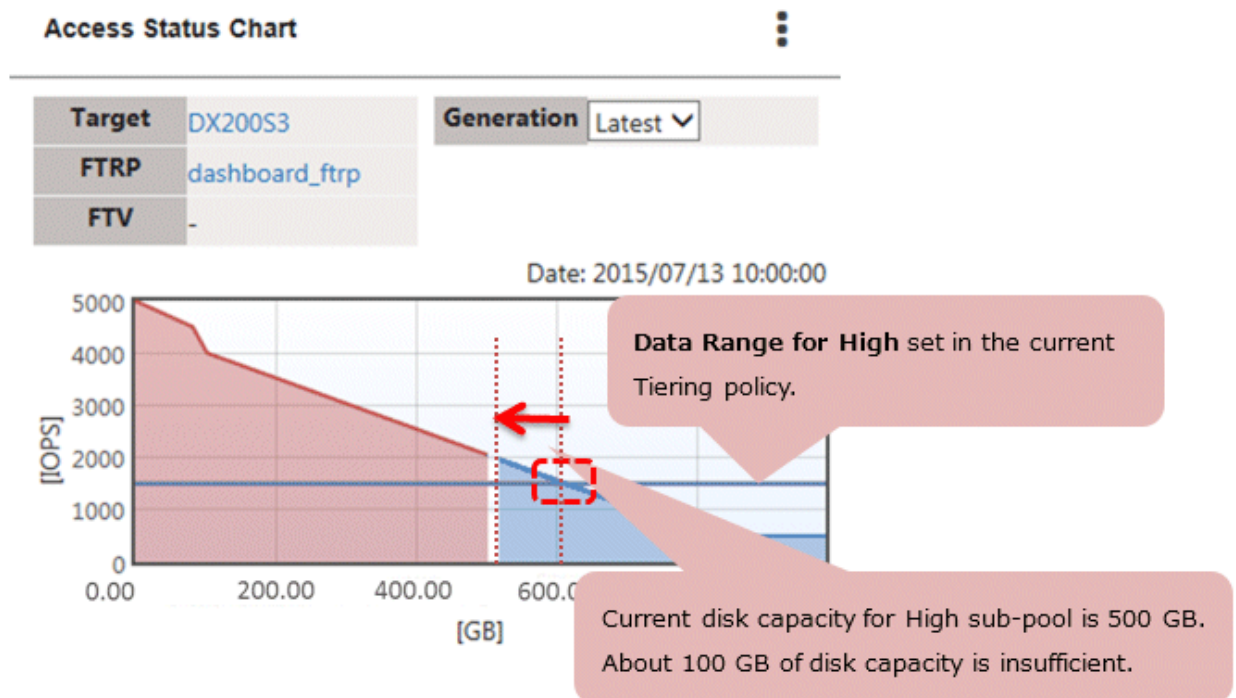
The disk capacity that is required to achieve the current Tiering policy settings is insufficient. In this case, set **Data Range of Layer** to "Automatic Configuration", or change the lower limit of **Data Range of High** to "2000".

If you do not change the Tiering policy, expand the sub-pool capacity by 100 GB.

From an FTV access status chart, you can evaluate the validity of the FTV quota share.

The boundary line of each tier determined from **High Quota Share** and **Middle Quota Share** that was set to the FTV is displayed on a graph.

📝 Example

The following example describe how to evaluate the validity of the FTV quota share.

When the boundary line (FTV quota share) that is displayed on the graph differs from the actual boundary value
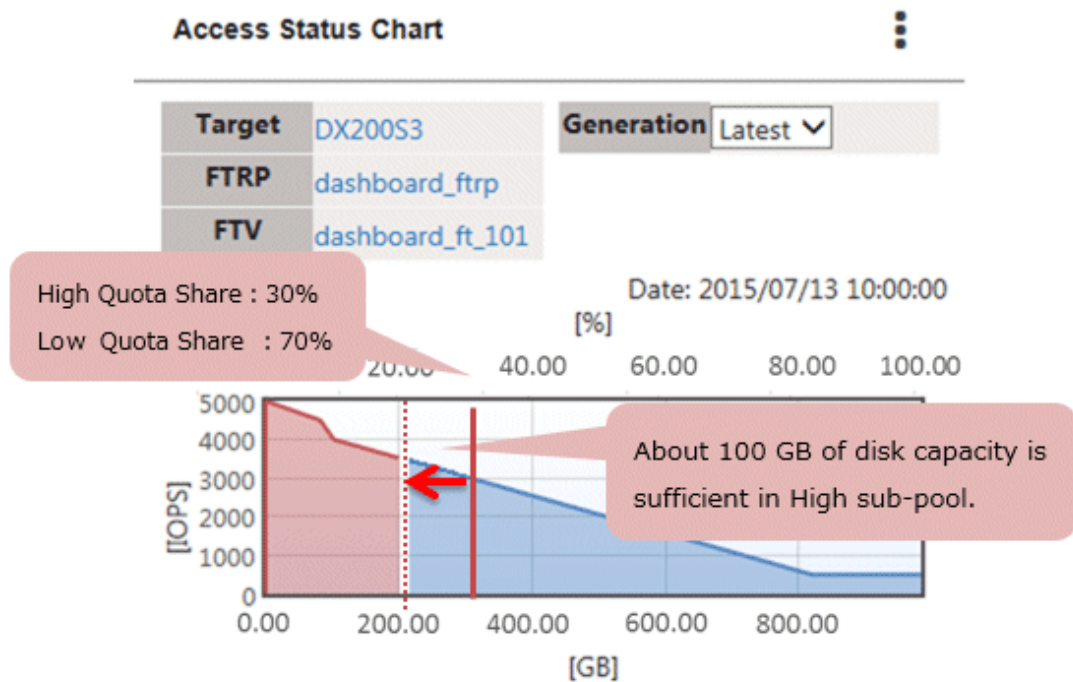
If an actual High/Low boundary value is to the left of a capacity boundary value specified for FTV quota share, the required capacity for the High area is insufficient. In that case, change **High Quota Share** to 20 %.

If you do not change the FTV quota share, secure free space in the High sub-pool and prepare 100 GB of High capacity that can be allocated to the FTV. If free space cannot be secured, expand the sub-pool capacity by 100 GB.

4.1.3 Downloading Access Status Chart

The graph data that is displayed in the access status chart can be downloaded to a CSV file.
Refer to "Panel Area" in the *ETERNUS SF Web Console Guide* for information on how to download.

The following information is output to a CSV file.

Item	Explanation
File Name	pool.csv or *xxxxx*.csv pool.csv is the data for the access status chart of the Tier pool. *xxxxx*.csv is the data for the access status chart of the volume. *xxxxx* indicates a volume number.

Item	Explanation
Header Line	yyyy/MM/dd HH:mm:ss IOPS,TierLevel,Capacity(MB) yyyy/MM/dd HH:mm:ss indicates the evaluation execution date and time.
Data Line	*IOPS,TierLevel,Capacity* The information output in each field is as follows. *IOPS* is the IOPS value in the graph plot point. *TierLevel* is the tier level. Either H (High), M (Middle), or L (Low) is output. *Capacity* is the capacity in the graph plot point. This is displayed in units of MB.

```
Example:
2015/01/01 00:00:00
IOPS,TierLevel,Capacity(MB)
1000.0,H,252
500.0,M,504
200.0,L,756
```

4.2 Confirmation of Execution Results of Relocation

The execution results of relocation can be confirmed by referring to the relocation history. Refer to "Display Capacity Detail Information" in the *ETERNUS SF Web Console Guide* for how to display relocation history of Tier pool or FTV.

Information

If relocation is not executed on completion of Automated Storage Tiering evaluation for a multiple layer Tier pool, no relocation history based on the evaluation result exists and the generation of evaluation result displayed in the access status chart does not match the generation of relocation history.

The following table shows the generation relation when relocation is not executed for the evaluation result of one generation earlier than the latest generation.

	Relation Between Generation of Evaluation Result Displayed in Access Status Chart and Generation of Relocation History				
Generation of evaluation result displays in access status chart	Four generations earlier	Three generations earlier	Two generations earlier	One generation earlier	Latest generation
Execution of relocation after Automated Storage Tiering evaluation	Done	Done	Done	Not done	Done
Generation of relocation history	Three generations earlier	Two generations earlier	One generations earlier	-	Latest generation

In this table, if you specify "1 generation ago" for **Generation** on the Access Status Chart panel, an access status chart based on the evaluation result of one generation earlier than the latest generation is displayed. On the other hand, the relocation history of one generation earlier than the latest generation shows the one executed based on the evaluation result of two generations earlier than the latest generation.

Therefore, you must consider mutual generation relations when seeing the access status chart and the relocation history.

The items displayed as relocation history are as follows.

Item	Meaning
Start Time	Time when relocation is started.

Item	Meaning
Finish Time	Time when relocation has finished.
Relocation Result	These are the execution results of relocation. One of the following is displayed: - Normal Finished - Error Finished - Normal Suspended - Error Suspended "Normal Finished" is displayed when relocation has been completed successfully. Stopping relocation results in "Normal Suspended". For action for each execution result, refer to "4.10.1 Action for Execution Result of Relocation".

P Point

Relocation history displays a maximum of five relocation results including the latest one.

The relocation result of a Tier pool can be displayed when either of the following conditions is satisfied:

- **Execution Mode** of Automated Storage Tiering is "Auto".

- **Execution Mode** of Automated Storage Tiering is "Semi-Auto" or "Manual", and relocation is executed from Web Console.

The latest and previous relocation results can be checked by Detail View. Refer to "Display Tier Pool" in the *ETERNUS SF Web Console Guide* for information on the latest relocation result and the previous relocation result.

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 volume name of the FTV.
FTV Capacity		This is the total capacity of the FTV. This is 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 is displayed: - Normal Finished - Error Finished - Normal Suspended - Error Suspended "Normal Finished" is displayed when relocation has been completed successfully. Stopping relocation results in "Normal Suspended". For action for each execution result, refer to "4.10.1 Action for Execution Result of Relocation".
	Usage Share	This is the usage share of the Tier Pool. The proportion of every layer 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.

Item		Meaning
	Relocation Results	These are the execution results of relocation. One of the following is displayed: - Normal Finished - Error Finished - Normal Suspended - Error Suspended - - (hyphen)
	Usage Share	This is the usage share of the Tier Pool. The proportion of every layer level is displayed in respect to the total physical capacity assigned to FTV being 100.

4.3 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 following items are items related to Automated QoS function. The content of each item is explained in "Chapter 5 Design of Automated QoS Function".

- Priority

- Target Response Time

- Available

- Tuning Status

- Bandwidth Limit

- Set Time

- Tier Control

The items that are displayed are as listed below.

Items Displayed under Basics Tab

Item	Meaning
Pool Number	This is the Tier pool number.
Tier Pool Name	This is the Tier pool name.
Pool Status	This is the status of the Tier pool. One of the following is displayed: - Available - Exposed - Partially Readying - Readying - Maintenance - Broken - Data Lost - No Disk Path - Unknown

Item	Meaning
Total Capacity	This is the total capacity of the Tier pool. This is displayed in units of MB, GB, or TB according to the capacity.
Used Capacity	This is the used capacity of the Tier pool. This is displayed in units of MB, GB, or TB according to the capacity.
Alarm Status	This is the alarm status of the Tier Pool. One of the following is displayed: - Normal - Warning - Caution - N/A
Usage Proportion	This is the usage proportion (%) of the Tier Pool. When the total capacity is 0, a hyphen (-) is displayed.
Operating Status	This is the operating status of Automated Storage Tiering.

Balancing:Level	This is the physical allocation balance of the Tier pool. If multiple sub-pools exist within the Tier pool, information for the sub-pool with the lowest balancing level is displayed.
	If the physical allocation capacity for the device status cannot be confirmed, or if the balancing level for the Tier pool status (*1) cannot be obtained, a hyphen (-) is displayed.
	
	- High
	  The physically allocated capacities are even between the RAID groups.
	
	- Middle
	  The physically allocated capacity has some bias.
	
	- Low
	  The physically allocated capacity has a large bias.
	
	- - (hyphen)
	  The balancing level cannot be obtained.

Balancing:Status	Displays the processing status of the Tier pool balancing.
	If a Tier pool balancing is not being performed, the physically allocated capacity for the device status cannot be confirmed, or if the balancing level for the Tier pool status cannot be obtained (*1), "Stop" is displayed.
	
	- Active
	  All FTVs within the Tier pool are in a reserved status or operating normally.
	
	- Error
	  FTVs stopped due to errors within the Tier pool exist.
	
	- Stop
	  The Tier pool balancing process is stopped.
	
	In case of an "Error", stop the Tier pool balancing process.

Balancing:Progress	Displays the progress rate for the Tier Pool balancing process. For the automatic screen refresh, the progress rate is the latest. If the Tier pool balancing process is stopped, a hyphen (-) is displayed. - Progress rate: 0 to 100% - - (hyphen)
Warning Threshold of Pool	This is the warning alarm notification threshold (%) of the Tier pool.

Item	Meaning
Caution Threshold of Pool	This is the caution alarm notification threshold (%) of the Tier pool. When the caution alarm notification threshold is configured to be "disabled", a hyphen (-) is displayed.
Encryption Status	This is the encryption status of the Tier pool. One of the following is displayed: - Yes or Yes(CM) - No
Assigned CM	This is the Assigned CM of the Tier Pool. "Auto" or the configured Assigned CM (separated with commas) is displayed.

*1: If the Tier pool **Pool Status** is not "Available", "Partially Reading", and "Exposed".

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	This is the disk categorization. One of the following is displayed: - SSD - Online - Nearline - SED-SAS - Online SED - SSD SED - Nearline SED - Unknown
Reliability	This is the reliability of the sub-pool. One of the following is displayed: - High Reliability(RAID6-FR) - High Performance(RAID1+0) - High Capacity(RAID5) - High Reliability(RAID6) - Mirroring(RAID1) - Striping(RAID0) - Unknown
FTSP Status	This is the status of the sub-pool. One of the following is displayed: - Available - Exposed - Partially Readying - Readying - Maintenance - Broken

Item	Meaning
	- Data Lost
	- No Disk Path
	- Unknown
Total Capacity of FTSP	This is the total capacity of the sub-pool. This is displayed in units of MB, GB, or TB according to the capacity.
Used Capacity	This is the used capacity of the sub-pool. This is displayed in units of MB, GB, or TB according to the capacity.

Balancing Level	This is the physical allocation balance of the sub-pool.
	 If the physical allocation capacity for the device status cannot be confirmed, or if the balancing level for the Tier Pool status (*1) cannot be obtained, a hyphen (-) is displayed.
	
	 - High
	   The physically allocated capacities are even between the RAID groups.
	
	 - Middle
	   The physically allocated capacity has some bias.
	
	 - Low
	   The physically allocated capacity has a large bias.
	
	 - - (hyphen)
	   The physically allocated capacity cannot be confirmed depending on the device status. In addition, the balancing level cannot be obtained depending on the Tier pool status.

RAID Group Number	This is the RAID group number included in the sub-pool.
Assigned CM	This is the Assigned CM of the RAID group.
RAID Group Status	This is the status of the RAID group.
Stripe Depth	This is the stripe depth. One of the following is displayed: - 64 - 128 - 256 - 512 - 1024 - - (hyphen)

*: When the Tier pool state is other than "Available", "Partially Reading" or "Exposed"

Items Displayed under Volume Tab

Item	Meaning
FTV Number	This is the volume number.
FTV Name	This is the volume name of the FTV.
Status	This is the status of the volume. A status which is the same as that of the Open volume is displayed.
Encryption Status	This is the encryption status of the volume. One of the following is displayed: - Yes or Yes(CM) - No
Total Capacity	This is the logical capacity (MB) of the volume.

Item	Meaning
Used Capacity	This is the used capacity (MB).

Alarm Status	This is the alarm status of the volume. One of the following is displayed:
	
	  - Normal
	
	  - Caution
	
	  - N/A

Caution Threshold of FTV	This is the threshold of ratio of FTV used capacity.
Priority FTSP	This is the name of the sub-pool configured as a prioritized assignment destination. "Auto" is displayed when this is not specified.
Low Quota Share	This is the configured Low quota share. When being omitted, a hyphen (-) is displayed.
Middle Quota Share	This is the configured Middle quota share. When being omitted, a hyphen (-) is displayed.
High Quota Share	This is the configured High quota share. When being omitted, a hyphen (-) is displayed.

Enable/Disable	This displays whether FTV is tuned by Automated QoS. One of the following is displayed:
	
	  - Enable
	
	  - Disable

Priority	This displays Automated QoS Priority. When this is not specified, a hyphen (-) is displayed.
	One of the following is displayed:
	
	  - Unlimited: I/O performance is not restricted.
	
	  - High: I/O performance is high.
	
	  - Middle: I/O performance is high but restrictions are possible if there are other higher priorities.
	
	  - Low: I/O performance can be low and gives way to other priorities.
	
	  - Hyphen (-): Not set

Target Response Time	This is a target response time (millisecond) of a volume used by the user.
	
	Depending on whether the items below are specified or not, the displayed contents are varied as follows:
	
	  - Automated QoS Priority is specified
	    The target response time that was calculated automatically from the performance information and by priority is displayed.
	    Depending on the conditions (such as read/write, and random/sequential) of the I/O load, the target response time for volumes that were set with a lower priority become smaller (the response becomes faster) than volumes that were set with a higher priority.
	
	  - Target Response Time is specified
	    Specified response time is displayed.
	
	  - Other than those above
	    A hyphen (-) is displayed.
	
	Even if Automated QoS Priority is specified, a hyphen (-) is displayed in the following cases:
	
	  - A period of time from when Automated QoS Priority is specified till the first performance tuning is performed (when completed, the time and value that was set in the FTV list screen is displayed).

Item	Meaning
	- The value in the Available column of the Volume tab is "No".
Available	This displays whether or not Automated QoS is available for the volume for which Automated QoS Priority or target response time is specified. When both are not specified, a hyphen (-) is displayed.
	If Automated QoS is unavailable for the volume, clicking the link of the Automated QoS Available column on the Web Console displays a popup screen. On the screen, the reason that Automated QoS is unavailable for the volume can be found.
	Any of the following messages is displayed. Their meanings and system administrator actions are as follows:
	- Automated QoS status of storage is not "Active".
	- Meaning of the message
	Automated QoS is not Active
	- System administrator action
	Start the Automated QoS function. For the startup method, refer to "Enable/Disable Automated QoS Function" in the *ETERNUS SF Web Console Guide*.
	- The volume is not subject to performance management.
	- Meaning of the message
	The volume is not monitored for performance management.
	- System administrator action
	Review the monitoring range of performance management so that the volume is monitored for performance management. If performance monitoring is stopped, start performance management. If performance monitoring is started, stop performance monitoring once and specify so that the volume is included in the list of monitored volumes and then restart performance monitoring. For the restart method, refer to "Start/Change Settings of/Stop Performance Monitoring" in the *ETERNUS SF Web Console Guide*.
	- The volume does not exist in End to End view list.
	- Meaning of the message
	Automated QoS is intended for volumes allocated to servers. If no volume is allocated, they are not displayed in the End to End view.
	- System administrator action
	Check the connection between disk storage systems and servers to allocate volumes to servers.
	- IOPS is 0 (zero).
	- Meaning of the message
	There is no I/O load on volumes. If there is no I/O load, the volume is not automatically tuned by Automated QoS.
	- System administrator action
	Execute the task using the volume.
Tuning Status	This displays currently tuned status by Automate QoS. One of the following is displayed:
	Attaining
	Tuning by Automated QoS and Automated Storage Tiering has been performed and the target is attained.

Item	Meaning
	If the volume has the highest priority in the same Tier pool or target response time of the volume is 0 (zero. when there is no bandwidth limit), and also if "Bandwidth Limit" set to the storage device by the Automated QoS function reaches 0 (zero), it represents this value. Even if the target has been attained, the load varies at all times, so tuning may be continued.
	Not Attaining
	Though tuning has been performed by Automated QoS and Automated Storage Tiering, the target is not attained. Review the configuration to improve performance.
	Working
	Tuning is being performed by Automated QoS or Automated Storage Tiering.
	Stopping
	Tuning is not being performed by Automated QoS.
	Hyphen (-)
	Not target for bandwidth tuning.
Bandwidth Limit	This displays the bandwidth limit set to the storage device by Automated QoS. One of the following is displayed: - 0: Unlimited - 1: 15,000 IOPS (800 MB/s) - 2: 12,600 IOPS (700 MB/s) - 3: 10,020 IOPS (600 MB/s) - 4: 7,500 IOPS (500 MB/s) - 5: 5,040 IOPS (400 MB/s) - 6: 3,000 IOPS (300 MB/s) - 7: 1,020 IOPS (200 MB/s) - 8: 780 IOPS (100 MB/s) - 9: 600 IOPS (70 MB/s) - 10: 420 IOPS (40 MB/s) - 11: 300 IOPS (25 MB/s) - 12: 240 IOPS (20 MB/s) - 13: 180 IOPS (15 MB/s) - 14: 120 IOPS (10 MB/s) - 15: 60 IOPS (5 MB/s)
Set Time	This displays the date and time at which the bandwidth was tuned last. If the bandwidth was never tuned in the past, a hyphen (-) is displayed.
Tier Control	This displays whether or not I/O performance is automatically tuned by the use of both Automated QoS and Automated Storage Tiering.

4.4 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 is 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

P 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.
. . . .

4.5 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.

P 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.
. . . .

4.6 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.csv
```

$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.csv
```

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

   $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.csv
   ```

4. Start the ETERRNUS 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 esfadm tier policy import command to register the placed Tiering policies.

4.7 Capacity Management of Tier Pool and FTV

By graphically displaying the total capacity and the changes in the used capacity of a Tier pool and FTV you can understand changes of the used capacity. This makes it easy to figure out the time of adding physical disks to the Tier pool and to reconfigure the threshold according to the usage. Refer to "Display Capacity Graph of Tier Pool" in the *ETERNUS SF Web Console Guide* for information on how to display Tier pool capacity graphs.

The following information can be displayed in a graph using the Dashboard. Refer to "Operations for Capacity" in the *ETERNUS SF Web Console Guide* for details.

- Tier pool capacity

- FTV capacity

Refer to "3.5.6 Expansion of Capacity of Sub-Pool" when expanding the sub-pool capacity.

Information

- The information for Tier pool total capacity and used capacity displayed in a graph is acquired at 01:30:00 every day. Information acquired time can be changed by modifying the polling service setting file. Refer to "Polling Service Setting File" in the *ETERNUS SF Storage Cruiser Operation Guide* for details.

- The total capacity and used capacity of sub-pools can be checked by displaying the Tier pool detailed information. Refer to "4.3 Confirmation of Configuration Details of Tier Pool" for display items in the Tier pool detailed information.

4.8 Tier Pool Balancing

Tier pool balancing is a function that relocates the physically allocated areas for RAID groups within each sub-pool that makes up a Tier pool so that the usage capacity of each RAID Group becomes even balanced. Therefore, I/O access to the FTV is almost evenly distributed to RAID groups within the FTSP.

Perform a Tier pool balancing when you want to equalize the volumes used by the RAID groups within the FTSP.
Tier pool balancing can be performed regardless of the balancing level. Normally, Tier pool balancing is performed to change the Tier pool balancing level from "Middle" or "Low" to "High".

The balancing level can be confirmed from **Balancing:Level** that is displayed in the Tier pool overview on the Automated Storage Tiering of the Web Console.

The Tier pool balancing processing can be stopped. The Tier pool balancing can be started/stopped for only one Tier pool within the device.

See

Refer to "Start/Stop Tier Pool Balancing" in the *ETERNUS SF Web Console Guide* for information on how to start/stop Tier pool balancing.

To perform a Tier pool balancing, the target Tier pool must satisfy all of the following requirements:

- **Pool Status** of the target Tier pool is "Available", "Partially Readying", or "Exposed".

- The Tier pool balancing process for the target Tier pool is not running.

- **Balancing:Status** of the target Tier pool is "Stop".

To stop the Tier pool balancing process, target Tier pool must satisfy the following requirement:

- **Balancing:Status** of the target Tier pool is "Active" or "Error".

Point

- Even when the business I/Os are occurring on the Tier pool, a Tier pool balancing can be performed on the Tier pool.

- The Tier pool balancing level, sub-pool balancing level and balancing progress status can be confirmed with the Web Console. Refer to "4.3 Confirmation of Configuration Details of Tier Pool" for details.

Note

- Perform a Tier pool balancing after stopping 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 information on how to stop Automated Storage Tiering of a Tier pool.

- Tier pool balancing prioritizes FTVs with a low balancing level within the Tier pool and a maximum of 32 FTVs can be balanced at a time. For this reason, if there are many FTVs, there may be times when the balancing level does not become "High" even if a Tier pool balancing is performed. To make the balancing level "High", reperform a Tier pool balancing.

- If the balancing status is "Error", stop the Tier pool balancing process for that Tier pool.

- Even if a Tier pool balancing is performed, the sub-pool that was physically allocated with the FTV is not changed.

- Tier pool balancing cannot be performed if any of the following conditions are satisfied:

    - **Operating Status** of the target Tier pool is "Start".

    - An FTV does not exist in the target Tier pool.

- A Tier pool that is performing a Tier pool balancing exists within the storage device.

- The maximum number of volumes is registered on storage device.

- The number of sessions for a Thin Provisioning Volume balancing and RAID Migration is a combined 32 processes executing at the same time in the storage device.

- The migration capacity for a Thin Provisioning Volume balancing and RAID Migration is a combined 128 TB process executing at the same time in the storage device.

- A RAID group diagnosis is being executed on the storage device.

- A disk diagnosis is being executed on the storage device.

- The capacity is being optimized for all FTVs to be balanced that exist on the target Tier pool.

- ODX is being executed for all FTVs to be balanced that exist on the target Tier pool.

- The Tier pool balancing process cannot be stopped for the following cases:

    - The Tier pool performing the Tier pool balancing does not exist.

    - The Tier pool stopping the Tier pool balancing due to an error does not exist.

    - The Tier pool balancing process for the target Tier pool is completed.

- When creating, deleting, or configuring the FTV, the balancing level is not updated. Execute a status update of Automated Storage Tiering to update the balancing level.

- FTVs that satisfy any of the following conditions are not targets for the balancing process.

    - FTVs with a total capacity of 20 GB or less

    - FTVs with a used capacity of 10 GB or less

4.9 Check of Access Status Data Synchronization Configuration Status

To check the access status data synchronization configuration status, execute the esfast heatmapsync status command.

Note

- If the synchronization target Tier pool is changed due to changing the Storage Cluster settings while synchronizing the access status data, the access status data synchronization processing is interrupted. To restart the synchronization process, re-executing Automated Storage Tiering for the synchronization target Tier pool is required.

- If the access status data currently being synchronized in the synchronization target Tier pools have a one-to-N relationship, the access status data synchronization process continues temporarily between the currently synchronized Tier pools. However, when service restarts or Automated Storage Tiering is re-executed, the access status data synchronization no longer starts. For this reason, in order to start the access status data synchronization process, reviewing the Storage Cluster environment settings so that there is a one-to-one relationship with the synchronization target Tier pools is required. Refer to "3.9.2 Starting Access Status Data Synchronization" for the conditions for starting the access status data synchronization process.

- If communication is lost with the storage device during an access status data synchronization, the access status data synchronization process is suspended. After that, if communication is restored, the access status data synchronization process is restarted.

- If the TFO group where FTVs in a Tier pool belong was created/recreated after Automated Storage Tiering was started, the access status data synchronization of that Tier pool is not performed. To perform access status data synchronization, Automated Storage Tiering on either of the synchronization target Tier pools must be restarted.

··

Refer to "Operation Method" described in "Storage Cluster Function" in the *ETERNUS SF Storage Cruiser Operation Guide* for the method to check the status of the TFO groups for the Storage Cluster function.

··

4.10 Troubleshooting

This section describes the problems in Automated Storage Tiering used environments and actions for them.

4.10.1 Action for Execution Result of Relocation

Take the following actions according to relocation results.

Relocation Result	Description of Result and Action
Normal Suspended	It is possible that Evaluation/Relocation were executed when relocation was in progress. Or it is possible that the time set in **Automated Storage Tiering Time Limit** was exceeded and the relocation processing was suspended when relocation was in progress. Check the value set in **Evaluation Period** or **Automated Storage Tiering Time Limit** in the policy to consider extending the time so that relocation can be executed.
	It is possible that the pool ran out of free space when relocation was in progress, causing the relocation processing to be suspended. After expanding Tier pool capacity or referring to "2.2 Configuration of Tier Pool" to secure the reserved area required for evaluation/relocation, execute evaluation/relocation.
Error Finished	It is possible that ETERNUS SF Manager is not properly running. After checking the ETERNUS SF Manager running status, re-execute relocation.
Error Suspended	It is possible that any fault occurred in the device. It is possible that the relocation processing did not finish normally. On completion of relocation of all the FTVs, execute the esfast relocation stop command.

If relocation does not finish normally in spite of actions taken, there may be a different issue. Collect the information required for troubleshooting and contact Fujitsu Technical Support.

Chapter 5   Design of Automated QoS Function

The Automated QoS function performs automatic tuning of QoS for the ETERNUS Disk storage system in order to achieve the I/O performance target values that were set in the volume by the operator.

The target values that can be set by the operator are Automated QoS Priority and target response time.
When setting the Automated QoS Priority, determine the priority of the operation and set an appropriate priority based on the priority of the operation.
When setting the target response time, set the target value with the average of the total read + write response time per volume unit time.

The respective target values have the following differences.

Target Value	System Process Overview	Characteristics
Automated QoS Priority	Set the Automated QoS Priority for the volume and adjust the relative performance.	When the total load for the disk storage system becomes high, priority adjustments can be made even if overall performance worsens. Configuration is simple.
Target Response Time	Sets the target response time for each volume and adjusts the performance in line with the target value.	Adjustments are possible based on the target value regardless of the total load of the disk array system. An appropriate target value must be set for each operation.

5.1   Structure of Automatic Tuning

When the Automated QoS Priority is set, the Automated QoS function calculates the targeted value (in milliseconds) at the response time. The targeted value is calculated based on the storage device that is equipped with a high performance disk, from the Automated QoS Priority that was set and the current I/O performance. In addition, if the target response time is set, the value (in milliseconds) that was set is the target value of the performance adjustment.

Automatic tuning for the Automated QoS function adjusts the bandwidth so the volume performance that was set as the target is reached. In order to adjust the bandwidth of the volume that was set with a target, the bandwidth for the volume that was not set with a target is also adjusted.

A bandwidth adjustment is performed based on the measured response time of the read + write volume. However, automatic tuning does not always guarantee the target value that was set.

Structure of Automatic Tuning

The QoS function for the ETERNUS Disk storage system sets the bandwidth restriction in 16 levels from 60 IOPS, 5 MB/s to unlimited. The Automated QoS function adjusts I/O performance by changing the bandwidth using this function.

Immediately following the target value that was initially set in the target volume, there may be cases when the effects are not immediately apparent.

By setting the Automated QoS Priority level and target response time for automatic tuning, performance information for each evaluation interval (1 minute) is obtained, and checks and adjustments are repeated as follows:

1. A common resource with the largest Busy rate (CM, Port, switch Port, and Tier pool) is found.

2. The bandwidth is adjusted between the volumes that share resources with the largest busy rate.

   a. The bandwidth of the volume with a measured performance that exceeds the target performance is narrowed by one level.

   b. The bandwidth of the volume that is controlled by the ETERNUS Disk storage system's QoS setting with a measured performance lower than the target performance is widened by one level.

   c. For bandwidth insufficiencies that arise for the results described above, adjustments are made by narrowing the bandwidth for volumes without a set target value.

Example of Automatic Tuning Using Automated QoS Priority Settings

The following example shows the adjustments that are performed with automatic tuning depending on the Automated QoS Priority setting.

1. When a business that is using three volumes (Vol#1 - Vol #3) are set to high priority, medium priority and low priority, set the volumes with Automated QoS priority.
   Here, Vol#1 is set to "High", Vol#2 is set to "Middle", and Vol#3 is set to "Low".

2. The Automated QoS function calculates the target response times for Vol#2 and Vol#3 internally based on the measured performance for Vol#1.

3. The Automated QoS function compares the calculated target response times and measured performance for Vol#2 and Vol#3. If the results of the measured performance exceed the target performance, the bandwidth is narrowed by one level. If the measured performance is lower than the target performance and the volume bandwidth is controlled by the ETERNUS Disk storage system QoS setting, the bandwidth is widened by one level.

4. Depending on the above process, the bandwidth is adjusted for the three volumes according to the Automated QoS Priority setting.

Figure 5.1 Example of Bandwidth Adjustment when Automated QoS Priority is Set
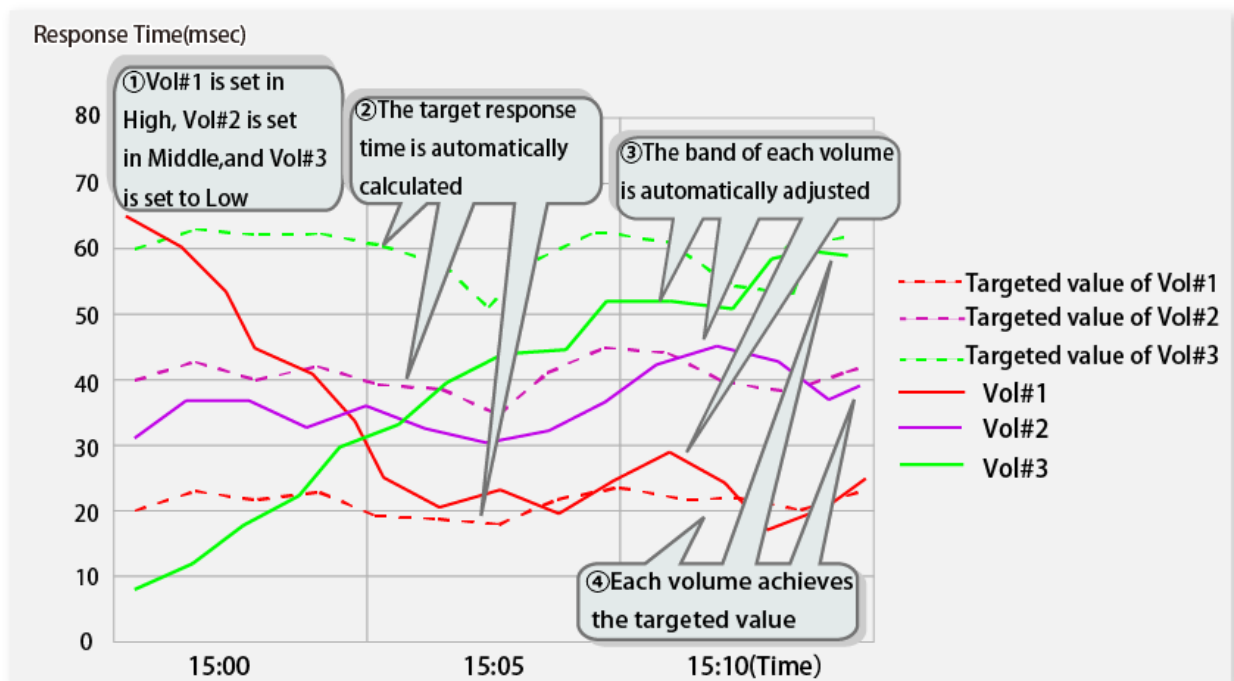
Example of Automatic Tuning Using Target Response Time Setting

The following example shows adjustments that are performed with automatic tuning depending on the target response time setting:

1. Check the I/O performance of the business application with the Web Console performance graph screen. When the measured value is 50 milliseconds for the response time of Vol#1 that is used and the I/O performance is determined to be low, reduce the response time lower than 50 milliseconds (for example, 30 milliseconds).
   At this time, it is not necessary to set the target response time for the other volumes (Vol#2, Vol#3).

2. By setting the target response time, the Automated QoS function performs adjustments by widening the bandwidth range for Vol#1 and narrowing the bandwidth for Vol#2 and Vol#3 so that the response time approaches the target value.

3. Depending on the above process, the bandwidth is adjusted for Vol#1 according to the target response time setting.

Figure 5.2 Example of Bandwidth Adjustment when Target Response Time is Set
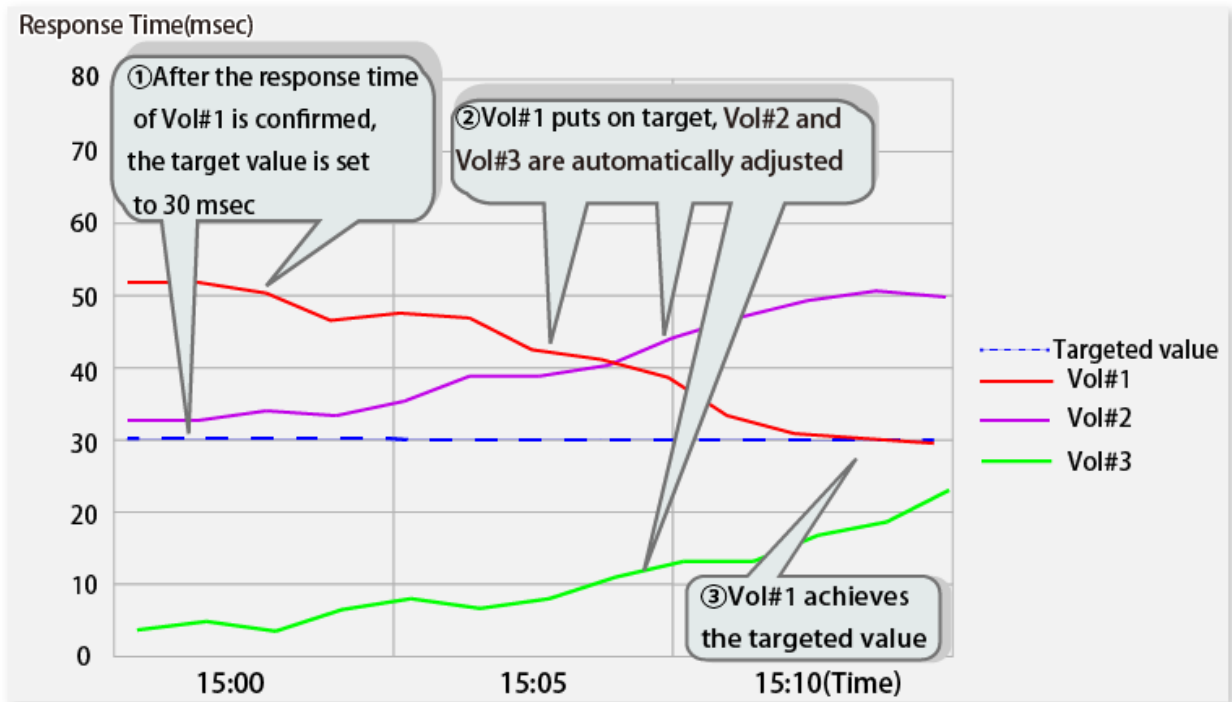
Coordination with Automated Storage Tiering

When set to link with Automated Storage Tiering, and it is not possible to achieve performance objectives with the Automated QoS function alone, Automated Storage Tiering can be used to relocate data in accordance with the capacity allocation ratio. In this way, the performance target can be achieved.

Note

The Automated QoS function refers to the performance information of the storage device that belongs to the performance adjustment target FTV, and the performance information of the switch.
The Automated QoS function can be used even when the performance function for the switch is disabled, but in this case, performance is adjusted only for shared resources related to the CMs and Tier pools.

Consideration of System in Low Load State

In general, the system load state differs according to the timeframe.

With the system in a low load state, the business application I/O performance is not affected by the operation of other business applications, and the measured response time may be shorter than the target response time. In this case, when adjusting the bandwidth to be narrower with automatic tuning, I/O access to the storage device increases suddenly and puts the system under high load and may lead to longer response times. The Automated QoS function, in order to prevent this kind of decrease in I/O performance, only narrows the bandwidth when the following conditions are satisfied.

- For volumes that are set with a target response time, the measured response time is shorter than the target response time.

- For other volumes that are set with the target response time under shared resources with a high busy rate, volumes with a longer measured response time than the target response time exist.

For this reason, automatic tuning is not performed in the following cases.

- For all volumes under the shared resources, where the measured response time is shorter than the target response time

- For volumes, when there is no load from the business application

In addition, if there is no business load but there is room in the bandwidth, the remaining bandwidth is temporarily accommodated to other volumes where the bandwidth is insufficient, and bandwidth shortage is eliminated. As a result, a higher I/O performance target response time might be obtained when there is room in the bandwidth of other volumes.

5.2 Affected Range of Automatic Tuning

The volumes that have been configured with target values are subject to automatic bandwidth adjustments in order to reach the target. For the range of shared resources, due to the effects of the bandwidth adjustments, in order to speed up the response times in the volumes that are set with the target value, the response times for volumes that are not set with the target value may be slower. Volumes that are not set with the target value refers to volumes that satisfies the following conditions:

- Volumes that are the subject of Automated QoS adjustment (set to "Enable")

- Volumes that are set to "No Set" (no priority level setting) for Automated QoS Priority and the target response time is not set

The following resource-sharing volumes are influenced by the performance adjustments of volumes that are set with a target value.

Shared Resources	Explanation of Sharing
Tier pools	Exists in the same Tier pool
CM	The same CM is used with the host affinity settings
CA/CM ports	The same CA/CM port is used with the host affinity settings
Switch port	The same switch port is used with the host affinity settings

However, the resource that is affected differs depending on the type of connection with the host.

Resource Name	Type of Connection With Host		
	FC Connection	FCoE Connection	iSCSI Connection
Tier pools	A	A	A
CM	A	A	A
CA/CM ports	A	A	N/A
Switch port	A	A	N/A

A: Affected resources
N/A: Unaffected resources

The description about the shared resources on the volume based on the configuration example in "Figure 5.3 Example of Resources Shared with Volume" is as follows:

Tier Pool Sharing

When multiple volumes within a single Tier pool are allocated in a server and different businesses use the respective volumes at the same time, the load is concentrated within that Tier pool and may affect the volumes existing in that Tier pool. "Figure 5.3 Example of Resources Shared with Volume" refers to the following volumes.

- Vol#1,Vol#2,Vol#3,and Vol#4 (a-1) sharing Tier pool#1

- Vol#5 and Vol#6 (a-2) sharing Tier pool#2

- Vol#7 and Vol#8 (a-3) sharing Tier pool#3

- Vol#9 and Vol#10 (a-4) sharing Tier pool#4

CM Sharing

The volumes in "Figure 5.3 Example of Resources Shared with Volume" that are affected by sharing the CM are as follows:

- Vol#1, Vol#2, Vol#3, Vol#4, Vol#5, and Vol#6 (b-1) sharing CM#0

CA/CM Ports Sharing

The volumes in "Figure 5.3 Example of Resources Shared with Volume" that are affected by sharing the CA/CM ports are as follows:

- Vol#7, Vol#8, Vol#9, and Vol#10 (c-1) sharing M#1-CA#0-PORT#0

Switch Port Sharing

The volumes in "Figure 5.3 Example of Resources Shared with Volume" that are affected by sharing the switch port are as follows:
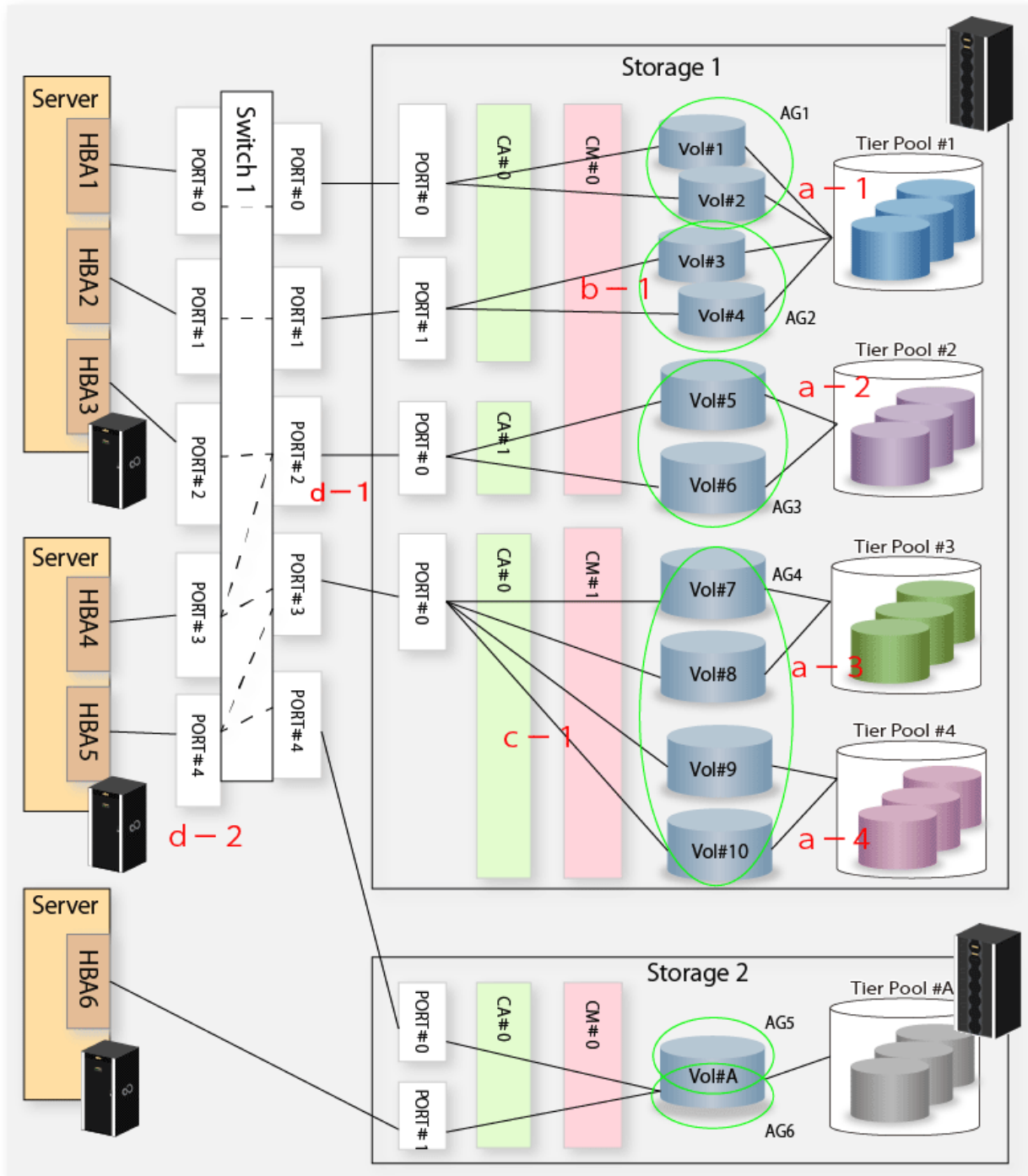
- Vol#5 and Vol#6 (d-1) sharing the storage side switch Port PORT#2 (d-1)

- Vol#7, Vol#8, Vol#9, Vol#10, and Vol#A (d-2) sharing the Server-side switch port PORT#4

Figure 5.3 Example of Resources Shared with Volume

5.3 Automated QoS Target Volume Conditions

Determines the volume from among the volumes used by the business application that performs Automated QoS in order to adjust I/O performance.

5.3.1 Automated QoS Function Target Volume

FTVs that satisfy the following conditions are target volumes for Automated QoS. Since a Virtual Volume is also a type of FTV, it is a target volume for Automated QoS. The status of whether or not each condition is satisfied, can be confirmed from the Web Console. Refer to the following sections in the *ETERNUS SF Web Console Guide* for information on the confirmation method.

Conditions	Reference Section of the Confirmation Method
The performance management function is in a started state	"Display Performance Monitoring Status" listed under "Operations for Performance Management of Storage Device"
The FTV is a volume subject to the performance management function	
ETERNUS SF Storage Cruiser Quality of Service Management optional license has been registered	"Display License"
The FTV is a volume that is displayed in Relationship Management (servers, Disk storage systems, and host affinity information that are configured between server connections have been registered)	"Display/Export End to End View"
The FTV is a volume that belongs to a storage device with which the Automated QoS is "Active"	The Main pane that is displayed by clicking the storage name from the storage list that is displayed after clicking **Storage** in the global navigation tab
This is a volume that is enabled (Enable) with the Automated QoS function	"Display FTV"

Examples of volumes to become Automated QoS targets are shown in "Figure 5.4 Automated QoS Target Volume Conditions".
In this example, among the volumes that are targets for performance management, only the two volumes (volume numbers 102 and 105) that are enabled (Enable) with Automated QoS become targets of a bandwidth adjustment by using the Automated QoS function.

Figure 5.4 Automated QoS Target Volume Conditions

Performance being Measured	Volume Number	Volume Type	Configured Target Response Time	Automated QoS Enable/Disable	Subject to Bandwidth Adjustment	
A	101	Standard		—	N/A	①Only the FTVs in the performance measurement, and Automated QoS setting is Enable are adjusted
A	102	FTV	10msec	Enable	A	
A	103	TPV		—	N/A	
A	104	Standard		—	N/A	
A	105	FTV	—	Enable	A	
A	106	TPV		—	N/A	
A	107	Standard		—	N/A	
A	108	FTV	—	Disable	N/A	
N/A	109	TPV		—	N/A	②The volumes in which the performance is not measured do not adjust bandwidth
N/A	110	Standard		—	N/A	
N/A	111	FTV	10msec	Enable	N/A	
N/A	112	FTV	—	Enable	N/A	

A : Available
N/A : Not available

If the performance management function of the switch that connects the target volume with the server has not started, among the target volumes, the Automated QoS function automatically tunes only the volumes that share CMs and Tier pools. The volumes that share the CA/CM port and switch port are not automatically tuned.

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 for switches.

5.4 Decision of Parameters Associated with Automated QoS

After determining that the volume is a target for Automated QoS, determine the values from the following items for Automated QoS:

- Target value (Automated QoS Priority or target response time)

- Link with Automated Storage Tiering

Determine the item values as follows:

1. Determine the Automated QoS Priority or target response time for volumes that are determined to be the target of Automated QoS.
   To determine the target value, refer to "5.4.1 Decision of Automated QoS Priority" and "5.4.2 Decision of Target Response Time".

2. When automatically tuning I/O performance by controlling the capacity allocation ratio of Automated Storage Tiering from the Automated QoS function, enable the parameter to link with Automated Storage Tiering (set "Tune by Quota Share" parameter to "On").

As an example, the business application model explains the item configurations related to Automated QoS.
Here, the deployment of automatic tuning that depends on the performance target value setting in relation to the following environment where the business application is operating is explained:

- During ordinary business, business applications A, B, C and D operate on "Server_1"

- The business applications use Tier pools "TrPool_1" and "TrPool_2".

- FTV#0 and FTV#1 exist in Tier pool "TrPool_1". The business application A uses FTV#0 and the business application B uses FTV#1.

- FTV#2 and FTV#3 exist in Tier pools "TrPool_2". The business application C uses FTV#2 and the business application D uses FTV#3.

Figure 5.5 Operation Model of Business Application
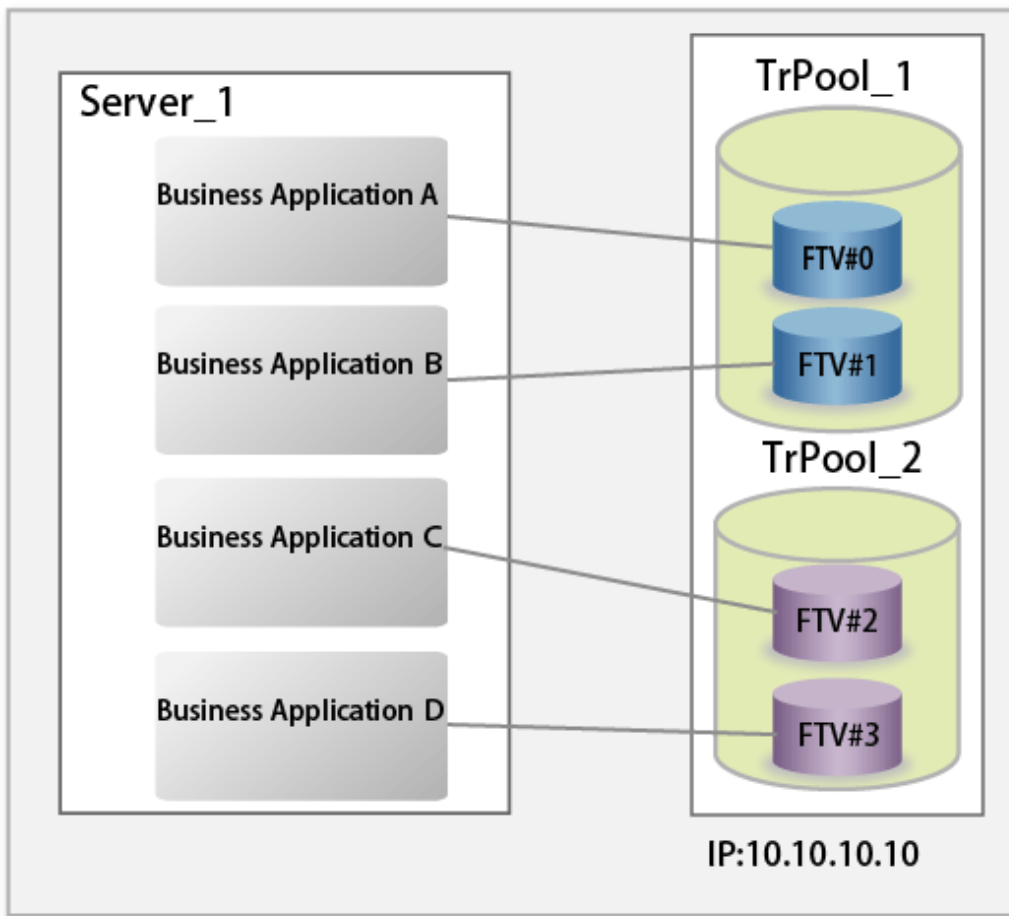
5.4.1   Decision of Automated QoS Priority

Determine the Automated QoS Priority from the following choices, according to the business conditions for the business application. The choices are described in order of highest priority.

Choices	Explanation
Unlimited	This is set for volumes that do not restrict I/O performance.
High	This is set for volumes where high I/O performance is required.
Middle	High I/O performance is necessary, but if there are other volumes that are set with a "High" priority level and compete for I/O at the same time, this volume is set with a restricted I/O performance.
Low	Other volumes are given priority and there are no problems setting this volume with a low I/O performance. If "Low" is selected, the Automated QoS function adjusts the other "High" priority volumes while considering the performance of the volumes that were selected with "Low".
No Set	The I/O performance target setting is unnecessary and is set as a volume that can have restricted I/O performance in order to adjust the performance of the other volumes that share resources. If "No Set" is selected, the Automated QoS function adjusts the performance so that the performance targets of other volumes are achieved without considering the performance of the volumes that are selected with "No Set".

> 📝 **Note**
> ....
>
> Note the following points related to the combination of volumes that are set with the Automated QoS Priority and target response time. When the conditions for the precautionary items are satisfied, performance adjustments can be made.
>
>   - When the Automated QoS Priority is set to "High", "Middle" or "Low", one or more volumes must be set with either of the following target values.
>
>   - Set "High", "Middle", or "Low" for the Automated QoS Priority that is different from the volume that was set with the Automated QoS Priority.
>
>   - Set the target response time to a number other than 0 milliseconds.
>
>   When there are two or more volumes that are set with a target value (Automated QoS Priority or target response time), I/O performance is adjusted even if the Automated QoS Priority is set with "Unlimited" or "No Set" or the target response time is set to 0 milliseconds for the other volumes.
> ....

Setting Example of Parameters Associated with Automated QoS

From the business conditions for business applications A, B, C and D, whether or not to link the Automated QoS Priority and Automated Storage Tiering for each volume is determined.

The following table settings are explained in this example.

Tier Pool Name	FTV Name	Automated QoS Priority	Coordination with Automated Storage Tiering
TrPool_1	FTV#0	High	On
	FTV#1	Middle	Off
TrPool_2	FTV#2	No Set	Off
	FTV#3	Low	Off

The I/O performance for other volumes sharing these volumes and resources (Tier pool, CM, CA.CM port, and FC switch port) is controlled in accordance with the performance adjustment of volumes that are set with the Automated QoS Priority. In this example, since FTV#0 shares the Tier pool with FTV#1, the I/O performance is also controlled for FTV#1 depending on the settings of the Automated QoS function.

> 🅿 **Point**
> ....
>
> When linking with Automated Storage Tiering is set to enable and I/O performance cannot be adjusted by the Automated QoS function alone, change the Automated Storage Tiering capacity allocation ratio, and adjust the I/O performance.
> ....

Example of Command Execution

Example of the command executed in the Windows environment is shown below.

  - FTV#0 that exists in the Tier pool "TrPool_1" is set as the target for Automated QoS adjustments, Automated QoS Priority is set to "high", and linking with Automated Storage Tiering is enabled.

```
>$INS_DIR\Common\bin\esfadm volume qosset -ipaddr 192.0.2.10 -volume 0 -qosfunc enable -
priority high -quotatune on
```

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

5.4.2 Decision of Target Response Time

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

Determine the target response time required for each volume from the performance conditions for business applications A, B, C and D.
The following table settings are explained in this example.

Tier Pool Name	FTV Name	Target Response Time	Coordination with Automated Storage Tiering
TrPool_1	FTV#0	10 msec	On
	FTV#1	20 msec	Off
TrPool_2	FTV#2	-	Off
	FTV#3	100 msec	Off

The I/O performance of other volumes sharing resources (Tier pool, CM, CA/CM port, and FC switch port) with these volumes is controlled in accordance with the performance adjustment of volumes that are set with the target response time. In this example, since FTV#3 shares the Tier pool with FTV#2, the I/O performance is also controlled for FTV#2 depending on the settings of the Automated QoS function.

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

P Point

. . . .
When linking with Automated Storage Tiering is set to enable and the target cannot be achieved with a bandwidth adjustment of the Automated QoS function, change the Automated Storage Tiering capacity allocation ratio, and adjust the I/O performance.
. . . .

Example of Command Execution

Example of the command executed in the Windows environment is shown below.

- FTV#0 that exists in the Tier pool "TrPool_1" is set as the target for Automated QoS adjustments, the target response time is set to10 milliseconds, and linking with Automated Storage Tiering is enabled.

```
>$INS_DIR\Common\bin\esfadm volume qosset -ipaddr 192.0.2.10 -volume 0 -qosfunc enable -
resptime 10 -quotatune on
```

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

Chapter 6 Setup of Automated QoS Function

This chapter explains the setup of the Automated QoS function.

The method for creating a target volume for the Automated QoS function differs depending on the type of volume. When using the Automated QoS function, create the target volume for the Automated QoS function in advance by referring to the following sections in the *ETERNUS SF Web Console Guide*.

Volume Type	Reference Section of ETERNUS SF Web Console Guide
FTV	"Operations for Automated Storage Tiering"
Virtual Volume	"Operations for VMware vSphere Virtual Volumes Function"

Figure 6.1 Setup Flow of Automated QoS Function
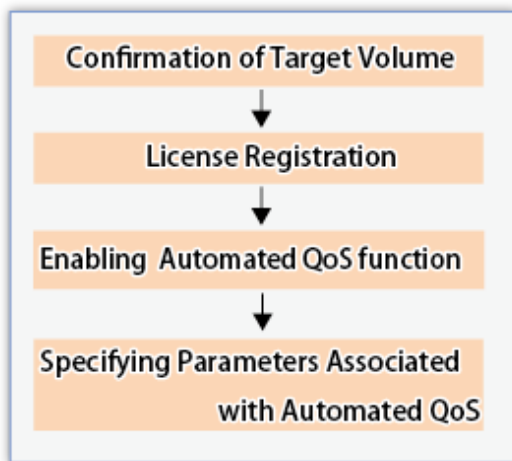
6.1 Confirmation of Target Volume

Check the volume that is to be the target of the Automated QoS function by referring to "5.3 Automated QoS Target Volume Conditions".

6.2 License Registration

The Automated QoS function can be used by registering the ETERNUS SF Storage Cruiser Quality of Service Management Option license on the server where ETERNUS SF Manager is installed. Installation of a new software is unnecessary.

Use the Web Console to register the license.

See
....
Refer to "Register License" in the *ETERNUS SF Web Console Guide* for the procedure for the license registration procedure.
....

6.3 Enabling Automated QoS Function

To use the Automated QoS function, enable the function by starting the Automated QoS function. The Automated QoS function must be in an enabled state for all ETERNUS Disk storage systems that use the Automated QoS function.

Startup the Automated QoS function from the Web Console. Refer to "Enable/Disable Automated QoS Function" in the *ETERNUS SF Web Console Guide* for information on the startup methods.

Information

There is a setting for enabling/disabling the QoS function of the ETERNUS Disk storage system. For Automated QoS to run, the QoS function of the target storage device must be enabled. Automated QoS enables the QoS function of the ETERNUS Disk storage system when either of the following is satisfied:

- If ETERNUS SF Manager is started

- If Automated QoS is run

Check whether the status of the QoS function for the ETERNUS Disk storage system is enabled/disabled with ETERNUS Web GUI or the command line.

6.4 Specifying Parameters Associated with Automated QoS

Parameters related to Automated QoS can be set to any of the following:

- Configure while creating the FTV (the creation wizard differs depending on the type of volume)

- Configure with the FTV Changing Wizard in relation to an existing FTV

- Configure with the esfadm volume qosset command for the existing FTV

6.4.1 Configuration from FTV Creating Wizard

The procedure for setting the parameters for Automated QoS when creating the FTV from the Web Console is 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 proceeds 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 Automated QoS Priority or the target response time.

7. Click **Next**.
   This proceeds to step 2 of the Creation Confirmation Wizard.

8. Click **Create**.
   Operate it as follows. Automatic tuning according to the configured Parameters associated with Automated QoS begins.

   - Newly created FTV should be assigned to a server through host affinity.

   - The performance management function should be restarted after creating a new FTV.
     However, if "All" is specified for the monitored volumes range when starting the performance management function, restarting the performance management function is not necessary.

Note

This section describes the procedure for FTV that is not Virtual Volume. Refer to "Operations for VMware vSphere Virtual Volumes Function" in the *ETERNUS SF Web Console Guide* for the operation concerning Virtual Volume.

6.4.2 Configuration from FTV Changing Wizard

The procedure for setting the parameters with the Web Console that are related to Automated QoS for the existing FTV is 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 proceeds to the FTV Changing Wizard.

6. Configure the Automated QoS Priority or the target response time.

7. Click **Modify**.
   Automatic tuning is started with the specified performance target values.

6.4.3 Operation Using Commands

When setting the parameters that are related to Automated QoS with commands, use the esfadm volume qosset command.

Chapter 7   Operation of Automated QoS Function

This chapter explains the operations that are related to the automatic adjustment of performance using the Automated QoS function.

Figure 7.1 Flow of Automatic Adjustment of Performance Using Automated QoS Function
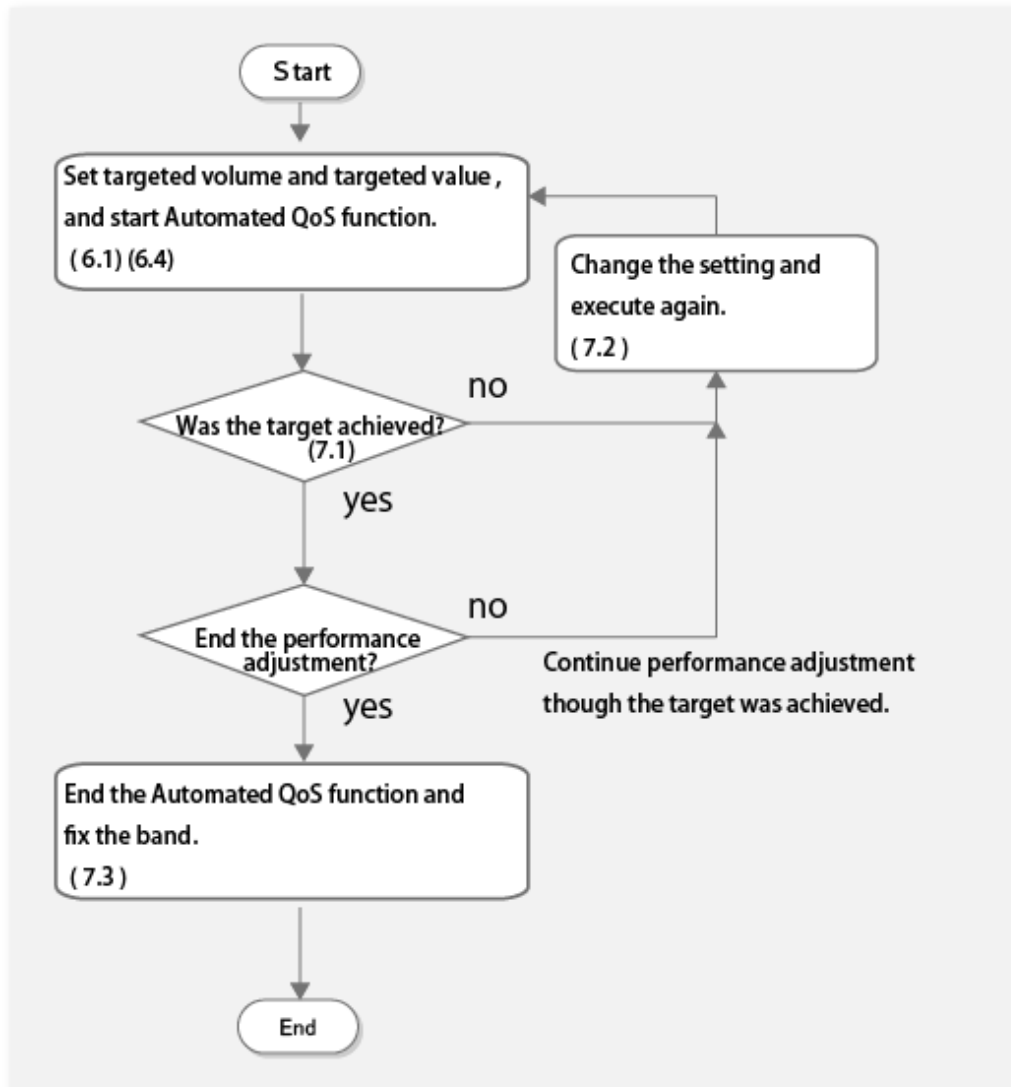
Point

The Automated QoS function is started simultaneously with ETERNUS SF Manager and continues to operate until ETERNUS SF Manager is stopped.

While ETERNUS SF Manager is stopped, even if the performance settings are changed in the storage device where the ETERNUS SF Storage Cruiser Quality of Service Management Option license is registered, once ETERNUS SF Manager is restarted, the Automated QoS function restores the performance settings to the values at the time ETERNUS SF Manager was previously stopped.

7.1   Confirming Effects of Automatic Tuning

By confirming the effects of automatic tuning of the Automated QoS function based on the following information, it is possible to judge whether the expected performance objectives have been satisfied.

Content Confirmation	Information Confirmation
Operational state of the automatic adjustment of performance, current performance settings	Information displayed on the FTV Overview screen of the Web Console
	Results of executing the esfadm volume qosinfo command
Response time results for the automatic adjustment of performance, value of the target achievement rate and fluctuations	Performance graph of the Web Console

7.1.1 Confirmation and Measures of Performance Adjustments for Automated QoS

Check whether or not the volume is the operation target for Automated QoS.

When Checking with FTV Overview Screen

Check the **Available** column for the volume. Detailed information on the cause can be checked from a pop-up menu that is displayed by clicking the link in the **Available** column.

When Checking with Commands

Execute the esfadm volume qosinfo command and check the "AVAILABLE" column in the command output.

If the value is "No" in the column, Automated QoS is unavailable for the volume. Check its detailed cause and review the configuration based on the manual so that Automated QoS becomes available for the volume.

7.1.2 Confirmation and Measures of Achievements for Performance Objectives for Automated QoS Function

Check whether or not the performance goal for the Automated QoS function is achieved.

When Checking with FTV Overview Screen

See the QoS Available Volume column on the FTV Overview screen.

When Checking with Commands

Execute the esfadm volume qosinfo command and check the "TUNING STATUS" column in the command output.

Process based on the value of the following confirmation results:

- In case of "Attaining":
  A performance target for the Automated QoS function has been attained, so that no action is required.
  On completion of performance tuning, it is also possible to stop the Automated QoS function and continue to operate. Refer to "7.3 Fixing Bandwidth after Automatic Tuning" for details.

- In case of "Working":
  Performance is being tuned toward the target, so wait for some time (if the performance monitoring interval is one minute, it takes approximately 15 minutes) and check the **Tuning Status** column again.

- In case of "Not Attaining":
  In the adjustment of Automated QoS, a performance target could not be attained. Any of the following actions is needed to attain the target:

  - If the setting of Tune by Quota Share is "Off", set it to "On".

  - Lower the priority of the volume that the resource competes.

  - If the target cannot be attained despite the lowered priority of contending volumes, review the volume configuration.An explanation of volume configuration review is in "7.2 Tuning of Performance Target".

> 🅟 **Point**
>
> ....
>
> The time for the previous automatic tuning can be confirmed from the "SET TIME" column of the esfadm volume qosinfo command or from the FTV Overview **Set Time** column. If automatic tuning has never been performed in the past, instead of a time and date, a hyphen (-) is displayed. For contending volumes, "Stopping" may be displayed. This indicates that tuning by Automated QoS is not being performed.
>
> ....

7.1.3 Confirmation and Measures for Achievement for Performance Objectives for Application

Check whether the performance objectives for the application have been achieved in the performance graph screen. If the performance objectives have been achieved for the application, the following measures are unnecessary. If the performance objectives have not been achieved for the application, raise the priority level or the target response time in order to improve the measured response time for the target FTV, and carry out automatic adjustments for a while (if the performance monitoring interval is one minute, it takes approximately 15 minutes).

For the procedure to display a performance graph, refer to "Display Performance Information Graph" or "Display FTV Performance Information Graph" in the *ETERNUS SF Web Console Guide*.

When Checking Whether or not Response Time that was Requested to Business Application is Satisfied

Check with the following procedure whether or not the response time that was requested by the business application is satisfied.

1. Check the measured response time for the Automated QoS target volume

   Display and check the measured response time performance graph with the following procedure.

   a. Click **Response Time** from a drop-down list for performance information and Click **Read+Write**.

   b. Click **Plot**.

2. Compare the measured response time with the target response time

   - When the measured response time is within the target response time
     The volume has attained the target.

   - When the measurement response time has indicated a constant value more greatly since the target response time
     Tuning by Automated QoS function may be at the edge of its capabilities. (This can be addressed by following "7.2 Tuning of Performance Target".)

> 🅟 **Point**
>
> ....
>
> Check the target achievement from the response times for each FTV. When checking multiple FTVs simultaneously, check with the QoS target achievement rate.
>
> ....

When Checking Whether or not Performance Objective that was Set has been Achieved

Check whether or not the target value (when the Automated QoS Priority is set, the target value that was calculated internally, or the target response time that was set) has been achieved with the following procedure.

1. Check the QoS achievement rate
   Check the QoS achievement rate in a performance graph. The QoS achievement rate is the ratio of the current target response time to the weighted average of Read response time and Write response time.

   a. Click **QoS achievement rate** from a drop-down list for performance information.

   b. Click **Plot**.

2. Check that the QoS achievement rate that is displayed is 100% or more

   - If QoS achievement rate is 100% or more:
     The volume performance has attained the target.

- If QoS achievement rate is less than 100% and shows a certain value:
  Tuning by Automated QoS function may be at the edge of its capabilities. (This can be addressed by following "7.2 Tuning of Performance Target".)

7.2 Tuning of Performance Target

Measures when Volume I/O Performance has not Reached Target

When the volume that is set with the Automated QoS Priority or a target response time does not reach the I/O performance target, lowering the Automated QoS Priority or making the target response time later is necessary.

If the performance target is not attained though the priority of contending volumes is lowered or the target response time is delayed, modifying the volume configuration may achieve the performance target. The following are the examples:

- If multiple volumes with high priority are sharing one and the same resource, the resource gets highly loaded and a bandwidth per volume is reduced. In this case, allocating those respective volumes to multiple resources may improve I/O performance.

- If the CM of RAID groups making up a Tier pool is different from the CM configuring host affinities, a communication between those CMs is required, so that appropriate I/O performance could not be achieved (cross access). In this case, matching the CM of RAID groups making up a Tier pool to the CM configuring host affinities may improve I/O performance.

I/O performance may increase by changing the RAID configuration within the Tier pool, such as increasing the number of disks that are configured with striping.

When linking with Automated Storage Tiering is disabled, I/O performance may be increased by enabling it. However, an increase in I/O performance can be expected by enabling this only if all of the following conditions are satisfied.

- If the Execution Mode for Automated Storage Tiering is "Auto", and Automated Storage Tiering is enabled

- If the Automated QoS Priority is not set to "Unlimited" or "No Set", or the target response time is not set to "0".

Even if the target response time is set, 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. For this reason, based on the performance information of the ETERNUS Disk storage system, set the target value according to the I/O characteristics.

Measures when I/O Performance for Business Applications has not Reached Target

When the performance target of the business application is not achieved even if you achieve the performance target of the volume, change the Automated QoS Priority or the target response time of the volume that the business application uses. If the QoS achievement rate does not reach 100% after the change, review the hardware configuration for the following items.

- When utilizing the Web Console:

  Refer to "Change Configuration of Automated QoS Function" in the *ETERNUS SF Web Console Guide*.

- When utilizing the Command Line Interface:

  Execute the esfadm volume qosset command.

After changing the Automated QoS Priority or the target response time, confirm the performance information with the performance graph. Refer to "7.1.3 Confirmation and Measures for Achievement for Performance Objectives for Application" for the confirmation methods.

Considerations Regarding Performance Limitations of Storage Device

The Automated QoS function effectively uses the I/O performance of the ETERNUS Disk storage system in order to adjust the I/O load between businesses.
Since the limit point for a performance adjustment is the maximum I/O performance value for the ETERNUS Disk storage system, even if a performance target that exceeds the capability of the ETERNUS Disk storage system is set, this target is not reached.

Considerations when Using Advanced Copy Function

When using the Advanced Copy function of the ETERNUS Disk storage system, the I/O response from the server is greater than usual while/when copying, the bandwidth of the target volume is increased more than required, and adjustments take place by narrowing

the bandwidth of other affected volumes more than necessary. Since there are possibilities that the I/O performance of the business applications that are using the affected volumes may be reduced more than necessary, stopping the Automated QoS functions, such as QuickOPC or REC, during the initial copying is recommended.

7.3 Fixing Bandwidth after Automatic Tuning

Automatic tuning constantly changes the bandwidth with the Automated QoS function because the I/O for the volume is constantly fluctuating. If you want to fix the bandwidth at the point where the the business application I/O performance target is achieved, stop the Automated QoS function.

Stopping of the Automated QoS function is performed through the Web Console or Command Line Interface. Refer to "Enable/Disable Automated QoS Function" in the *ETERNUS SF Web Console Guide* for information on how to stop the Automated QoS function when using the Web Console. When using commands, execute the esfadm storage qosset command.

Even if the measured response time does not reach the target response time, the target performance of the business application may be satisfied. In this case, if the target response time is set to the value of the measured response time at that moment, automatic tuning is performed to bring the response time of the business application closer to the target performance when the I/O load is changed.

7.4 Troubleshooting

When esgui00001 Message is Displayed

After stopping ETERNUS SF Manager, the "esgui00001 internal error occurred" message may be output when displaying the Target Response Time graph or the QoS target achievement rate graph. In this case, perform the following procedure to delete the directory for the day on which the graph stopped being displayed, and restore the environment.

In addition, when performing this procedure, you cannot display the Target Response Time graph and the QoS target achievement rate graph for the deleted date.

1. Log in to the Management Server with the following administrative permissions.

    - For Windows
      User belonging to the Administrators group

    - For Solaris/Linux
      "root" or user belonging to the root group

2. Move to the following directory.

    - For Windows
      $INS_DIR\Common\var\qos
      ($INS_DIR is the "Program Directory" when ETERNUS SF Manager has been installed.)

    - For Solaris/Linux
      /var/opt/FJSVesfcm/qos

3. Delete the directory for the date in which the graph was no longer displayed.
    A directory is created with a name in the *yyyymmdd* format.
    yyyy represents the year, *mm* the month, and *dd* the date.

Chapter 8   Operation Maintenance

This chapter explains the operation maintenance of the Optimization functions.

8.1   Collecting 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

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 are 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 occurs 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 is 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.

8.5 Check of Start of ETERNUS SF Storage Cruiser Optimization Option Service/Daemon

Windows Environment

1. Open the Service screen

   - Windows Server 2012:
     Click **Control Panel** > **System and Security** > **Administrative Tools** > **Services**.

   - Windows environments other than listed above:
     Click **Control Panel** > **Administrative Tools** > **Services**.

2. Make sure that the status of the ETERNUS SF Storage Cruiser Optimization Option service is set to "Start".

   - Check the Storage Cruiser's manager service.
     Make sure that you can log into the Web Console and on the Event Log screen of the Web Console, see that message esccs10000 is output.

Solaris/Linux Environment

- ETERNUS SF Storage Cruiser Optimization Option daemon
  Execute the following command to check whether the process exists:

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

- Check the Storage Cruiser's manager daemon.
  Make sure that you can log into the Web Console and on the Event Log screen of the Web Console, see that message esccs10000 is output.

See

Refer to "Starting and Stopping the Manager" in the *ETERNUS SF Storage Cruiser Operation Guide* for details of services/daemon start and stop.

Chapter 9   Command References

9.1   Commands of Automated Storage Tiering

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The procedure to reflect the results of executed commands into the Web Console is as follows:

1. On the Category pane, click **Automated Storage Tiering** > **Overview**.

2. On the Action pane, click **Status Update** under **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/FJSVesfcm/bin/esfadm tierpolicy import -all
```

DESCRIPTION

A request for migration of Tiering policies is 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 are migrated.

OPTIONS

Options of "import" Operand

-all

All Tiering policies of a separate environment are 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 is started, migration of Tiering policies terminates in an error.

- Refer to "8.5 Check of Start of ETERNUS SF Storage Cruiser Optimization Option Service/Daemon" to make sure that the service or daemon is started. If not, the Tiering policy cannot be migrated.

- 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 are 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 autotier start (Automated Storage Tiering Start Command)

NAME

esfast autotier start - Start Automated Storage Tiering

SYNOPSIS

```
esfast autotier start -name name
```

COMMAND PATH

Windows Environment

```
$INS_DIR\AST\Manager\opt\FJSVssast\sbin\esfast autotier start
```

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

Solaris or Linux Environment

```
/opt/FJSVssast/sbin/esfast autotier start
```

DESCRIPTION

Start Automated Storage Tiering for the Tier pool. In order to execute the command, the administrator privilege of the OS is required.

OPERAND

start

Start Automated Storage Tiering for the Tier pool.

OPTIONS

-name *name*

Specify the Tier pool name for which to start Automated Storage Tiering.
Specify a maximum of 16 characters containing one-byte alphanumeric characters, number sign (#), hyphen (-) and underscore

(_) for the name.
Non-case sensitive.
Specify the Tier pool name that has been created on the Web Console.

EXIT STATUS

=0: Completed successfully
>0: Terminated abnormally

EXAMPLES

Windows Environment

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

Solaris or Linux Environment

```
# /opt/FJSVssast/sbin/esfast autotier start -name TrPool1
INFO:esast9000:Command terminated normally.
```

NOTES

- If the Tier pool for which to start Automated Storage Tiering is a two layer or three layer Tier pool, before executing this command, register the ETERNUS SF Storage Cruiser Optimization Option license.
  If not, the command terminates abnormally.

- Refer to "8.5 Check of Start of ETERNUS SF Storage Cruiser Optimization Option Service/Daemon" to make sure that the service or daemon is started.
  If not, the command terminates abnormally.

- If this command is executed to the Tier pool for which Automated Storage Tiering has been started, it terminates abnormally.

- If the Tier pool is a two or three layers Tier pool, make sure that the Tiering policy is defined. If not, the command terminates abnormally.

- If this command is executed for Tier pools that are performing a Tier pool balancing, the command terminates abnormally.

9.1.3 esfast autotier stop (Automated Storage Tiering Stop Command)

NAME

esfast autotier stop - Stop Automated Storage Tiering.

SYNOPSIS

```
esfast autotier stop -name name
```

COMMAND PATH

Windows Environment

```
$INS_DIR\AST\Manager\opt\FJSVssast\sbin\esfast autotier stop
```

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

Solaris or Linux Environment

```
/opt/FJSVssast/sbin/esfast autotier stop
```

DESCRIPTION

Stop Automated Storage Tiering for the Tier pool.In order to execute the command, the administrator privilege of the OS is required.

OPERAND

stop

Stop Automated Storage Tiering for the Tier pool.

OPTIONS

-name *name*

Specify the Tier pool for which to stop Automated Storage Tiering.
Specify a maximum of 16 characters containing one-byte alphanumeric characters, number sign (#), hyphen (-) and underscore (_) for the name.
Non-case sensitive.
Specify the Tier pool name that has been created on the Web Console.

EXIT STATUS

=0: Completed successfully
>0: Terminated abnormally

EXAMPLES

Windows Environment

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

Solaris or Linux Environment

```
# /opt/FJSVssast/sbin/esfast autotier stop -name TrPool1
INFO:esast9000:Command terminated normally.
```

NOTES

- Refer to "8.5 Check of Start of ETERNUS SF Storage Cruiser Optimization Option Service/Daemon" to make sure that the service or daemon is started.
  If not, the command terminates abnormally.

- If this command is executed to the Tier pool for which Automated Storage Tiering is stopped, it terminates abnormally.

9.1.4 esfast evaluate start (Automated Storage Tiering Evaluation Start Command)

NAME

esfast evaluate start - Start Automated Storage Tiering evaluation

SYNOPSIS

```
esfast evaluate start -name name
```

COMMAND PATH

Windows Environment

```
$INS_DIR\AST\Manager\opt\FJSVssast\sbin\esfast evaluate start
```

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

Solaris or Linux Environment

```
/opt/FJSVssast/sbin/esfast evaluate start
```

DESCRIPTION

Start the evaluation of Automated Storage Tiering for the Tier pool.In order to execute the command, the administrator privilege of the OS is required.

OPERAND

start

Start the evaluation of Automated Storage Tiering.

OPTIONS

-name *name*

Specify the Tier pool name for which to start the evaluation of Automated Storage Tiering.
Specify a maximum of 16 characters containing one-byte alphanumeric characters, number sign (#), hyphen (-) and underscore (_) for the name.
Non-case sensitive.
Specify the Tier pool name that has been created on the Web Console.

EXIT STATUS

=0: Completed successfully
>0: Terminated abnormally

EXAMPLES

Windows Environment

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

Solaris or Linux Environment

```
# /opt/FJSVssast/sbin/esfast evaluate start -name TrPool1
INFO:esast9000:Command terminated 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 is started, migration of Tiering policies terminates in an error.

- Refer to "8.5 Check of Start of ETERNUS SF Storage Cruiser Optimization Option Service/Daemon" to make sure that the service or daemon is started.
  If not, the command terminates abnormally.

- If this command is executed to the following Tier pools, it terminates abnormally:

  - Tier pool for which Automated Storage Tiering is stopped.

  - One layer Tier pool

  - Other than Tier pool whose Execution Mode in the Tiering policy is "Manual"

9.1.5   esfast ftvshare set (Volume Quota Share Set Command)

NAME

esfast ftvshare set - Set volume quota share

SYNOPSIS

```
esfast ftvshare set -ipaddr ipAddr -name name -volume volumeNumber[,volumeNumber,..]
                    -share lowshare:middleshare:highshare [-s]
```

COMMAND PATH

Windows Environment

```
$INS_DIR\AST\Manager\opt\FJSVssast\sbin\esfast ftvshare set
```

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

Solaris or Linux Environment

```
/opt/FJSVssast/sbin/esfast ftvshare set
```

DESCRIPTION

For the specified volume, register or delete the quota share (%) of each sub-pool. In order to execute the command, the administrator privilege of the OS is required.

OPERAND

set

> For the specified volume, register or delete the quota share (%) of each sub-pool.

OPTIONS

-ipaddr *ipAddr*

> Specify the IP address of the storage device.

-name *name*

> Specify the Tier pool name.
> Specify a maximum of 16 characters containing one-byte alphanumeric characters, number sign (#), hyphen (-) and underscore (_) for the name.
> Non-case sensitive.
> Specify the Tier pool name that has been created on the Web Console.

-volume *volumeNumber* [,*volumeNumber*,..]

> Specify the FTV number for which to register or delete quota shares.
>
> - Set a decimal value.
>
> - Specify the FTV number that has been created on the Web Console.

-share *lowshare:middleshare:highshare*

> Specify the quota share (%) set to each sub-pool
>
> - Set a decimal value so that the total amount of quota shares (%) of all the sup-pools is 100.
>
> - Specify in the colon-separated form of Low sub-pool quota share (%): Middle sub-pool quota share (%): High sub-pool quota share (%).
>
> - If it is a two layer Tier pool, specify a hyphen (-) in the Middle sub-pool quota share field.
>
> - When deleting the volume quota share (%), specify a dotted line like "-:-:-".

-s

> No confirmation message is output but the processing continues.

EXIT STATUS

=0: Completed successfully
>0: Terminated abnormally

EXAMPLES

Windows Environment

```
> C:\ETERNUS_SF\AST\Manager\opt\FJSVssast\sbin\esfast ftvshare set -ipaddr 192.0.2.10 -name
Trpool1 -volume 0 -share 0:0:100 -s
INFO:esast9000:Command terminated normally.
```

Solaris or Linux Environment

```
# /opt/FJSVssast/sbin/esfast ftvshare set -ipaddr 192.0.2.10 -name Trpool1 -volume 0 -share 0:0:100
Are you sure? [y/n]: y
INFO:esast9000:Command terminated normally.
```

When setting quota shares to the volume existing in a two layer Tier pool:

```
> C:\ETERNUS_SF\AST\Manager\opt\FJSVssast\sbin\esfast ftvshare set -ipaddr 192.0.2.10 -name
Trpool1 -volume 0 -share 30:-:70 -s
INFO:esast9000:Command terminated normally.
```

When setting quota shares to the volume existing in a three layer Tier pool:

```
> C:\ETERNUS_SF\AST\Manager\opt\FJSVssast\sbin\esfast ftvshare set -ipaddr 192.0.2.10 -name
Trpool1 -volume 0 -share 20:30:50 -s
INFO:esast9000:Command terminated normally.
```

When deleting quota shares set to the volume:

```
> C:\ETERNUS_SF\AST\Manager\opt\FJSVssast\sbin\esfast ftvshare set -ipaddr 192.0.2.10 -name
Trpool1 -volume 0 -share -:-:- -s
INFO:esast9000:Command terminated 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 is started, migration of Tiering policies terminates in an error.

- Refer to "8.5 Check of Start of ETERNUS SF Storage Cruiser Optimization Option Service/Daemon" to make sure that the service or daemon is started.
  If not, the command terminates abnormally.

- If this command is executed toward a one layer Tier pool, the command terminates abnormally.

- Quota share (%) is a rough indication and may not be allocated as specified.

- If quota shares (%) are deleted, the volume is relocated based on the Tiering policy.

9.1.6   esfast heatmapsync set (Access Status Data Synchronization Function Set Command)

NAME

esfast heatmapsync set - Sets the access status data synchronization function

SYNOPSIS

```
esfast heatmapsync set -mode {enable | disable}
```

COMMAND PATH

Windows Environment

```
$INS_DIR\AST\Manager\opt\FJSVssast\sbin\esfast heatmapsync set
```

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

Solaris or Linux Environment

```
/opt/FJSVssast/sbin/esfast heatmapsync set
```

DESCRIPTION

Perform a configuration of the access status data synchronization function for Automated Storage Tiering.

If the access status data synchronization function is enabled, FTVs of all Tier pools that are registered in ETERNUS SF Manager become targets for the synchronization process.

OPERANDS

set

Perform a configuration of the access status data synchronization function.

OPTIONS

-mode {enable | disable}

Specifies whether to enable or disable access status data synchronization.

enable

Enables the access status data synchronization function.

disable

Disables the access status data synchronization function.

EXIT STATUS

=0: Completed successfully
>0: Terminated abnormally

EXAMPLES

Windows Environment

```
> C:\ETERNUS_SF\AST\Manager\opt\FJSVssast\sbin\esfast heatmapsync set -mode enable
INFO:esast9000:Command terminated normally.
```

Solaris or Linux Environment

```
# /opt/FJSVssast/sbin/esfast heatmapsync set -mode disable
INFO:esast9000:Command terminated normally.
```

When enabling the access status data synchronization:

```
> C:\ETERNUS_SF\AST\Manager\opt\FJSVssast\sbin\esfast heatmapsync set -mode enable
INFO:esast9000:Command terminated normally.
```

When disabling the access status data synchronization:

```
> C:\ETERNUS_SF\AST\Manager\opt\FJSVssast\sbin\esfast heatmapsync set -mode disable
INFO:esast9000:Command terminated normally.
```

NOTES

- Refer to "8.5 Check of Start of ETERNUS SF Storage Cruiser Optimization Option Service/Daemon" to make sure that the service or daemon is started.
  If not, the command terminates abnormally.

- The access status data synchronization function is set to enable by default.

- To perform an access status data synchronization, the Storage Cluster environment must be configured. For the Storage Cluster environment configuration procedure, refer to "Storage Cluster Function" in the *ETERNUS SF Storage Cruiser Operation Guide*.

9.1.7 esfast heatmapsync status (Access Status Data Synchronization Configuration Status Display Command)

NAME

esfast heatmapsync status - Displays the access status data synchronization configuration status

SYNOPSIS

```
esfast heatmapsync status -csv
```

COMMAND PATH

Windows Environment

```
$INS_DIR\AST\Manager\opt\FJSVssast\sbin\esfast heatmapsync status
```

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

Solaris or Linux Environment

```
/opt/FJSVssast/sbin/esfast heatmapsync status
```

DESCRIPTION

Displays the configuration status (Enabled/Disabled) of the access status data synchronization function for Automated Storage Tiering and the configuration status between Tier pools in the access status data synchronization process.

OPERANDS

status

The synchronization configuration status of the access status data is displayed in a list.

OPTIONS

-csv

Output in CSV format.

EXIT STATUS

=0: Completed successfully
>0: Terminated abnormally

OUTPUT INFORMATION

The following information is output:

Item	Explanation
HEATMAPSYNC	Displays the configuration status of the access status data synchronization function.

Item	Explanation
	enable: Enable disable: Disable
IP ADDRESS	Displays the IP address of the storage device that is to be the synchronization target for the access status data. (*1)
TIER POOL	Displays the Tier pool name of the storage device that is to be the synchronization target for the access status data. (*1)
PAIR IP ADDRESS	Displays the IP address of the other storage device that is to be the synchronization target for the access status data. (*1)
PAIR TIER POOL	Displays the Tier pool name of the other storage device that is to be the synchronization target for the access status data. (*1)
SYNC STATUS	Displays the configuration status between Tier pools in a synchronization process for the access status data. (*1, *2) NORMAL The synchronization target Tier pools are properly configured. MULTIPLE PAIR ERROR The synchronization source/destination Tier pool where the access status data synchronization is performed does not have a one-to-one relationship. PAIR CHANGE ERROR The configuration between Tier pools where the access status data synchronization is performed is changed.

*1: When the access status data synchronization is disabled, or the Tier pool of the access status data that has synchronized does not exist, it is not displayed.

*2: In this item, the status of the TFO group to where the FTV that synchronizes the access status data belongs cannot be checked. Refer to "Operation Method" in "Storage Cluster Function" in the *ETERNUS SF Storage Cruiser Operation Guide* for the method to check the status of TFO groups.

EXAMPLES

Windows Environment

- When the access status data synchronization function is enabled and Tier pools for synchronization exist:

```
> C:\ETERNUS_SF\AST\Manager\opt\FJSVssast\sbin\esfast heatmapsync status -csv
HEATMAPSYNC,IP ADDRESS,TIER POOL,PAIR IP ADDRESS,PAIR TIER POOL,SYNC STATUS
enable,192.0.2.10,TrPool1,192.0.2.11,TrPool3,NORMAL
enable,192.0.2.12,TrPool2,192.0.2.11,TrPool4,MULTIPLE PAIR ERROR
enable,192.0.2.12,TrPool2,192.0.2.11,TrPool5,MULTIPLE PAIR ERROR
enable,192.0.2.13,TrPool6,192.0.2.14,TrPool7,PAIR CHANGE ERROR
```

Solaris or Linux Environment

- When the access status data synchronization function is enabled and Tier pools for synchronization do not exist:

```
# /opt/FJSVssast/sbin/esfast heatmapsync status -csv
HEATMAPSYNC,IP ADDRESS,TIER POOL,PAIR IP ADDRESS,PAIR TIER POOL,SYNC STATUS
enable,,,,,
```

- When the access status data synchronization function is disabled:

```
# /opt/FJSVssast/sbin/esfast heatmapsync status -csv
HEATMAPSYNC,IP ADDRESS,TIER POOL,PAIR IP ADDRESS,PAIR TIER POOL,SYNC STATUS
disable,,,,,
```

- Refer to "8.5 Check of Start of ETERNUS SF Storage Cruiser Optimization Option Service/Daemon" to make sure that the service or daemon is started.
  If not, the command terminates abnormally.

9.1.8 esfast relocation history (Relocation History Information Display Command)

NAME

esfast relocation history - Display relocation history information

SYNOPSIS

```
esfast relocation history -name name -csv
```

COMMAND PATH

Windows Environment

```
$INS_DIR\AST\Manager\opt\FJSVssast\sbin\esfast relocation history
```

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

Solaris or Linux Environment

```
/opt/FJSVssast/sbin/esfast relocation history
```

DESCRIPTION

Display a list of relocation history information of Automated Storage Tiering. In order to execute the command, the administrator privilege of the OS is required.

OPERAND

history

Display a list of relocation history information.

OPTIONS

-name *name*

Specify the Tier pool name for which to display the relocation history information of Automated Storage Tiering.
Specify a maximum of 16 characters containing one-byte alphanumeric characters, number sign (#), hyphen (-) and underscore (_) for the name.
Non-case sensitive.
Specify the Tier pool name that has been created on the Web Console.

-csv

Output in CSV format.

EXIT STATUS

=0: Completed successfully
>0: Terminated abnormally

OUTPUT INFORMATION

The following information is output:

Item	Explanation
VOLNO	FTV number (decimal)

Item	Explanation
LATESTUPDATE	Latest date and time of relocation completion (yyyy/mm/dd hh:mm:ss)
LATESTSTATUS	Status of the latest relocation is displayed. - NORMAL_FINISHED: Relocation completed - ERROR_FINISHED: Relocation completed (Error occurred) - NORMAL_SUSPENDED: Relocation stopped - ERROR_SUSPENDED: Relocation stopped (Error occurred) For action for each execution result, refer to "4.10.1 Action for Execution Result of Relocation".
LATESTLOW	Quota share (%, decimal number) of Low sub-pool, of the physical capacity allocated to the target volume when the latest relocation was completed.
LATESTMIDDLE	Quota share (%, decimal number) of Middle sub-pool, of the physical capacity allocated to the target volume when the latest relocation was completed.
LATESTHIGH	Quota share (%, decimal number) of High sub-pool, of the physical capacity allocated to the target volume when the latest relocation was completed.
PREVIOUSUPDATE	Relocation date and time before last (yyyy/mm/dd hh:mm:ss)
PREVIOUSSTATUS	Status of the relocation completed before last is displayed. - NORMAL_FINISHED: Relocation completed - ERROR_FINISHED: Relocation completed (Error occurred) - NORMAL_SUSPENDED: Relocation stopped - ERROR_SUSPENDED: Relocation stopped (Error occurred)
PREVIOUSLOW	Quota share (%, decimal number) of Low sub-pool, of the physical capacity allocated to the target volume when the relocation before last was completed.
PREVIOUSMIDDLE	Quota share (%, decimal number) of Middle sub-pool, of the physical capacity allocated to the target volume when the relocation before last was completed.
PREVIOUSHIGH	Quota share (%, decimal number) of High sub-pool, of the physical capacity allocated to the target volume when the relocation before last was completed.

EXAMPLES

Windows Environment

```
> C:\ETERNUS_SF\AST\Manager\opt\FJSVssast\sbin\esfast relocation history -name TrPool -csv
VOLNO,LATESTUPDATE,LATESTSTATUS,LATESTLOW,LATESTMIDDLE,LATESTHIGH,
PREVIOUSUPDATE,PREVIOUSSTATUS,PREVIOUSLOW,PREVIOUSMIDDLE,PREVIOUSHIGH
1,2014/07/11 08:05:05, NORMAL_FINISHED,42.1,31.6,26.3,2014/07/10 00:08:00,
NORMAL_FINISHED,44.4,22.2,33.3
2,2014/07/06 04:05:10, NORMAL_SUSPENDED,20.8,62.5,16.7,-,-,-,-,-
3,2014/07/10 00:07:12,ERROR_FINISHED,40.0,60.0,0.0,2014/07/08 12:05:10,ERROR_FINISHED,
33.9,57.6,8.5
32,2014/07/10 04:02:25,ERROR_SUSPENDED,45.7,47.1,7.1,2014/07/09 20:02:15,
ERROR_FINISHED,35.3,64.7,0.0
```

Solaris or Linux Environment

```
# /opt/FJSVssast/sbin/esfast relocation history -name TrPool -csv
VOLNO,LATESTUPDATE,LATESTSTATUS,LATESTLOW,LATESTMIDDLE,LATESTHIGH,
PREVIOUSUPDATE,PREVIOUSSTATUS,PREVIOUSLOW,PREVIOUSMIDDLE,PREVIOUSHIGH
1,2014/07/11 08:05:05, NORMAL_FINISHED,42.1,31.6,26.3,2014/07/10 00:08:00,
NORMAL_FINISHED,44.4,22.2,33.3
2,2014/07/06 04:05:10, NORMAL_SUSPENDED,20.8,62.5,16.7,-,-,-,-,-
```

```
3,2014/07/10 00:07:12,ERROR_FINISHED,40.0,60.0,0.0,2014/07/08 12:05:10,ERROR_FINISHED,
33.9,57.6,8.5
32,2014/07/10 04:02:25,ERROR_SUSPENDED,45.7,47.1,7.1,2014/07/09 20:02:15,
ERROR_FINISHED,35.3,64.7,0.0
```

NOTES

- Refer to "8.5 Check of Start of ETERNUS SF Storage Cruiser Optimization Option Service/Daemon" to make sure that the service or daemon is started.
  If not, the command terminates abnormally.

9.1.9 esfast relocation status (Relocation Status Display Command)

NAME

esfast relocation status - Display relocation status

SYNOPSIS

```
esfast relocation status -ipaddr ipAddr -csv
```

COMMAND PATH

Windows Environment

```
$INS_DIR\AST\Manager\opt\FJSVssast\sbin\esfast relocation status
```

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

Solaris or Linux Environment

```
/opt/FJSVssast/sbin/esfast relocation status
```

DESCRIPTION

Display a list of volume information to be relocated by Automated Storage Tiering. In order to execute the command, the administrator privilege of the OS is required.

OPERAND

status

Display a list of volume information to be relocated.

OPTIONS

-ipaddr *ipAddr*

Specify the IP address of the storage device for which to display a list of volume information to be relocated.

-csv

Output in CSV format.

EXIT STATUS

=0: Completed successfully
>0: Terminated abnormally

OUTPUT INFORMATION

The following information is output:

Item	Explanation
DATE	Evaluation date and time (yyyy/mm/dd hh:mm:ss)
TIER POOL NAME	Tier pool name
FTV NUMBER	FTV number (decimal)
POLICY NAME	Tiering policy name set for Tier pool
HIGH UP	Rate of moving FTRPE to High sub-pool from Low sub-pool or Middle sub-pool (%, decimal. Round off the number at the second decimal place to one decimal place.)
MID UP	Rate of moving FTRPE to Middle sub-pool from Low sub-pool (%, decimal. Round off the number at the second decimal place to one decimal place.)
MID DOWN	Rate of moving FTRPE to Middle sub-pool from High sub-pool (%, decimal. Round off the number at the second decimal place to one decimal place.)
LOW DOWN	Rate of moving FTRPE to Low sub-pool from High sub-pool or Middle sub-pool (%, decimal. Round off the number at the second decimal place to one decimal place.)
KEEP HIGH	Rate of not moving FTRPE from High sub-pool (%, decimal. Round off the number at the second decimal place to one decimal place.)
KEEP MID	Rate of not moving FTRPE from Middle sub-pool (%, decimal. Round off the number at the second decimal place to one decimal place.)
KEEP LOW	Rate of not moving FTRPE from Low sub-pool (%, decimal. Round off the number at the second decimal place to one decimal place.)
STATUS	The running state of the following relocations are displayed: - EVALUATED: Evaluation finished - WAITING: Wait for relocation - REALLOCATING: Relocation in progress - SUSPENDED: Relocation stopped - ENDED: Relocation finished
TOTAL VOLUME	Total number of FTRPE to be relocated (decimal)
FINISH VOLUME	Total number of relocated FTRPE (decimal)
ERROR VOLUME	Total number of FTRPE whose relocation terminated abnormally (decimal)

EXAMPLES

Windows Environment

```
> C:\ETERNUS_SF\AST\Manager\opt\FJSVssast\sbin\esfast relocation status -ipaddr 192.0.2.10 -csv
DATE,TIER POOL NAME,FTV NUMBER,POLICY NAME,HIGH UP,MID UP,MID DOWN,LOW DOWN,KEEP HIGH,
KEEP MID,KEEP LOW,STATUS,TOTAL VOLUME,FINISH VOLUME,ERROR VOLUME
2014/07/11 19:20:30,TrPool01,1,Policy01,20.0,10.0,30.0,40.0,0.0,0.0,0.0,ENDED,1000,1000,0
2014/07/11 19:20:30,TrPool01,3,Policy01,5.0,30.0,0.0,5.0,20.0,0.0,40.0,REALLOCATING,2000,1200,40
2014/07/11 20:00:00,TrPool02,15,Policy02,0.0,40.0,10.0,5.0,5.0,30.0,10.0,WAITING,1500,0,0
2014/07/11 20:10:30,TrPool03,16,Policy03,0.0,0.0,10.0,20.0,20.0,50.0,0.0,SUSPENDED,1000,50,50
```

Solaris or Linux Environment

```
# /opt/FJSVssast/sbin/esfast relocation status -ipaddr 192.0.2.10 -csv
DATE,TIER POOL NAME,FTV NUMBER,POLICY NAME,HIGH UP,MID UP,MID DOWN,LOW DOWN,KEEP HIGH,
KEEP MID,KEEP LOW,STATUS,TOTAL VOLUME,FINISH VOLUME,ERROR VOLUME
2014/07/11 19:20:30,TrPool01,1,Policy01,20.0,10.0,30.0,40.0,0.0,0.0,0.0,ENDED,1000,1000,0
2014/07/11 19:20:30,TrPool01,3,Policy01,5.0,30.0,0.0,5.0,20.0,0.0,40.0,REALLOCATING,2000,1200,40
```

```
2014/07/11 20:00:00,TrPool02,15,Policy02,0.0,40.0,10.0,5.0,5.0,30.0,10.0,WAITING,1500,0,0
2014/07/11 20:10:30,TrPool03,16,Policy03,0.0,0.0,10.0,20.0,20.0,50.0,0.0,SUSPENDED,1000,50,50
```

NOTES

- Refer to "8.5 Check of Start of ETERNUS SF Storage Cruiser Optimization Option Service/Daemon" to make sure that the service or daemon is started.
  If not, the command terminates abnormally.

9.1.10   esfast relocation start (Automated Storage Tiering Relocation Start Command)

NAME

esfast relocation start - Start Automated Storage Tiering relocation

SYNOPSIS

```
esfast relocation start -name name -volume volumeNumber -date date [-s]
```

COMMAND PATH

Windows Environment

```
$INS_DIR\AST\Manager\opt\FJSVssast\sbin\esfast relocation start
```

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

Solaris or Linux Environment

```
/opt/FJSVssast/sbin/esfast relocation start
```

DESCRIPTION

Start the relocation of Automated Storage Tiering. In order to execute the command, the administrator privilege of the OS is required.

OPERAND

start

Start the relocation of Automated Storage Tiering.

OPTIONS

-name *name*

Specify the Tier pool name for which to start the relocation of Automated Storage Tiering.
Specify a maximum of 16 characters containing one-byte alphanumeric characters, number sign (#), hyphen (-) and underscore (_) for the name.
Non-case sensitive.
Specify the Tier pool name that has been created on the Web Console.

-volume *volumeNumber*

Specify an Automated Storage Tiering enabled FTV number.

- Set a decimal value.

- Specify the FTV number that has been created on the Web Console.

- Only the volumes whose status of evaluation is "Evaluated" can be specified.

-date *date*

Specify the date and time of having evaluated Automated Storage Tiering enabled volumes.

- Specify the date and time in the format "yyyy/mm/dd hh:mm:ss".

- Enclose the date and time with double quotes (").

-s

No confirmation message is output but the processing continues.

EXIT STATUS

=0: Completed successfully
>0: Terminated abnormally

EXAMPLES

Windows Environment

```
> C:\ETERNUS_SF\AST\Manager\opt\FJSVssast\sbin\esfast relocation start -name TrPool1 -volume 2 -
date "2013/12/19 17:05:00" -s
INFO:esast9000:Command terminated normally.
```

Solaris or Linux Environment

```
# /opt/FJSVssast/sbin/esfast relocation start -name TrPool1 -volume 2 -date "2013/12/19 17:05:00"
Are you sure? [y/n]: y
INFO:esast9000:Command terminated 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 is started, migration of Tiering policies terminates in an error.

- Refer to "8.5 Check of Start of ETERNUS SF Storage Cruiser Optimization Option Service/Daemon" to make sure that the service or daemon is started.
  If not, the command terminates abnormally.

- If this command is executed to the following Tier pools, the command terminates abnormally:

  - Tier pool for which Automated Storage Tiering is stopped.

  - One layer Tier pool

  - Tier pool for which "Execution Mode" is set to "Auto" in Tiering Policy.

9.1.11 esfast relocation stop (Automated Storage Tiering Relocation Stop Command)

NAME

esfast relocation stop - Stop Automated Storage Tiering relocation

SYNOPSIS

```
esfast relocation stop -ipaddr ipAddr [-s]
```

COMMAND PATH

Windows Environment

```
$INS_DIR\AST\Manager\opt\FJSVssast\sbin\esfast relocation stop
```

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

Solaris or Linux Environment

```
/opt/FJSVssast/sbin/esfast relocation stop
```

DESCRIPTION

Stop the relocation of Automated Storage Tiering. In order to execute the command, the administrator privilege of the OS is required.

OPERAND

stop

    Stop the relocation of Automated Storage Tiering.

OPTIONS

-ipaddr *ipAddr*

    Specify the IP address of the storage device for which to stop relocation.

-s

    No confirmation message is output but the processing continues.

EXIT STATUS

=0: Completed successfully
>0: Terminated abnormally

EXAMPLES

Windows Environment

```
> C:\ETERNUS_SF\AST\Manager\opt\FJSVssast\sbin\esfast relocation stop -ipaddr 192.0.2.10 -s
INFO:esast9000:Command terminated normally.
```

Solaris or Linux Environment

```
# /opt/FJSVssast/sbin/esfast relocation stop -ipaddr 192.0.2.10
Are you sure? [y/n]: y
INFO:esast9000:Command terminated normally.
```

NOTES

- Refer to "8.5 Check of Start of ETERNUS SF Storage Cruiser Optimization Option Service/Daemon" to make sure that the service or daemon is started.
  If not, the command terminates abnormally.

- If this command is executed, the relocation of all the volumes on the target storage device is stopped.

9.1.12   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 is 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 "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 is 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 192.0.2.10 -
newaddress 192.0.2.11
INFO:esast9000:Command terminated normally.
```

Solaris or Linux Environment

```
# /opt/FJSVssast/sbin/esfast tierpool setaddress -oldaddress 192.0.2.10 -newaddress 192.0.2.11
INFO:esast9000:Command terminated normally.
```

NOTES

- Refer to "8.5 Check of Start of ETERNUS SF Storage Cruiser Optimization Option Service/Daemon" to make sure that the service or daemon is started.
  If not, the command terminates abnormally.

- 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.

9.1.13   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 is deleted. In order to execute the command, the administrator privilege of the OS is required.

OPERANDS

delete

The Tier pool is deleted.

OPTIONS

Options of "delete" Operand

-name *name*

Specify the name of the Tier pool to delete.

Specify a maximum of 16 characters containing one-byte alphanumeric characters, number sign (#), hyphen (-) and underscore (_) for the name.
Non-case sensitive.
Specify the Tier pool name that has been created on the Web Console.

-mode *deleteMode*

The mode during deletion of the Tier pool is 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 is not deleted.

-s

The process is continued without the output of a confirmation message.

EXIT STATUS

The following end status is 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

EXIT STATUS	Meaning
255	Unexpected error

EXAMPLES

- The Tier pool [TrPool1] on the device is 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 is kept and only the data held by the Manager is 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

- Refer to "8.5 Check of Start of ETERNUS SF Storage Cruiser Optimization Option Service/Daemon" to make sure that the service or daemon is started.
  If not, the command terminates abnormally.

- 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.

- If a Virtual Volume exists in a Tier pool, the Tier pool cannot be deleted. After deleting that VM guest that has the Virtual Volume, delete the Tier pool. For Virtual Volumes with an "Unknown" VVOL type, after deleting the Virtual Volume with the storageadm volume delete command, delete the Tier pool.

- Tier pools that have configured a VVOL datastore or a Clone backup for VVOL datastores cannot be deleted. When this type of Tier pool needs to be deleted, delete the VVOL datastore or Clone backup for VVOL datatstore, or delete the Tier pool from the VVOL datastore configuration or the Clone backup for VVOL datastore configuration.

- When a Tier pool is deleted, the sub-pools configured to the Tier pool are deleted at the same time.

> See
....
A Virtual Volume is a volume that is created with the VMware vSphere Virtual Volumes function. A Virtual Volume is created from a VVOL datastore. Refer to the *ETERNUS SF Operation Guide for VMware vSphere Virtual Volumes* for details of the VMware vSphere Virtual Volumes function.
....

9.2 Commands of Automated QoS Function

9.2.1 esfadm volume qosset (Automated QoS Parameter Configuation/Change Command)

NAME

esfadm volume qosset - configuring or changing the parameters for Automated QoS function

SYNOPSIS

esfadm volume qosset -ipaddr *ipAddress* -volume *volumeNumber*
-qosfunc {enable {-resptime *targetResponseTime* | -priority *priority*} [-quotatune {on | off}] | disable}

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

For the specified FTV, configure or change Enable/Disable of Automated QoS, Automated QoS Priority, target response time and Tune by Quota Share.

OPERANDS

qosset

Configure or change Enable/Disable of Automated QoS, Automated QoS Priority, target response time and Tune by Quota Share.

OPTIONS

Options of "qosset" Operand

-ipaddr *ipAddress*

Specify the IP address of the ETERNUS Disk storage system. You cannot specify multiple addresses or use wildcards.

-volume *volumeNumber*

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

-qosfunc {enable | disable}

Specify Tuning by Automated QoS. Select either of the following:

enable

Select this when tuning by Automated QoS is enabled.

disable

Select this when tuning by QoS is not enabled.
When "disable" is selected, -priority option, -resptime option and -quotatune option cannot be specified.

-resptime *targetResponseTime*

This specifies the target response time. Specify an integer from 0 to 10000. The unit of it is millisecond.
This cannot be specified together with -priority option at the same time.
If zero (0) is specified, "on" cannot be specified for -quotatune option.

-priority *priority*

Specify Automated QoS Priority. Specify any of the following values:

unlimited

Specify this when you do not want to limit I/O performance. You can get higher I/O performance than High.

> Specify this when high I/O performance is required.

middle

> If high I/O performance is required, but other volume exists for which High is specified for priority and I/O competes at the same time, specify this when it does not matter that I/O performance is limited.

low

> Specify this when giving priority to others and it does not matter that I/O performance is low.

noset

> Specify this when a target of I/O performance need not be specified and it does not matter that I/O performance is limited for performance tuning of other volumes sharing resources.

> This cannot be specified together with -resptime option at the same time.
> If "noset" or "unlimited" is specified, "on" cannot be specified for -quotatune option.

-quotatune {on | off}

> It is specification of the cooperation between the Automated QoS Function and the Automated Storage Tiering. Specify either of the following values:

on

> Specify to enable Tune by Quota Share.

off

> Specify to disable Tune by Quota Share.

> This option can be omitted. If zero (0) is specified for -resptime option, or if "noset" or "unlimited" is specified for -priority option, "on" cannot be specified.

OUTPUT INFORMATION

Operation History of ETERNUS SF

The following execution history information is 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
!=0: Terminated abnormally

EXAMPLES

When specifying Automated QoS enabled volumes, setting Target Response Time to 10 milliseconds and setting Tune by Quota Share to "Enable" in relation to FTV#0:

Windows Environment

```
> C:\ETERNUS_SF\Common\bin\esfadm volume qosset -ipaddr 192.0.2.10 -volume 0 -qosfunc enable -
resptime 10 -quotatune on
esqos0002 The target response time has been set normally.
```

Solaris or Linux Environment

```
# /opt/FJSVesfcm/bin/esfadm volume qosset -ipaddr 192.0.2.10 -volume 0 -qosfunc enable -resptime
10 -quotatune on
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 terminates 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)

- If "disable" is specified for -qosfunc option, the existing Automated QoS Priority, target response time and Tune by Quota Share are all disabled to cause the QoS performance value set to the ETERNUS Disk storage system to be set to no limit (0).

- If a target is specified by this command while Automated QoS Priority and target response time are specified, the existing settings are disabled and the settings by this command are enabled. If a target value is specified and -quotatune option is omitted, the existing Tune by Quota Share settings are maintained.

- If "Enable" is set to an Automated QoS tuning enabled volume by this command, the command ends normally. If "Disable" is set to an Automated QoS tuning disabled volume by this command, the command ends normally.

- If Tune by Quota Share is enabled for Tune by Quota Share enabled volumes by this command, the command ends normally. If Tune by Quota Share is disabled for Tune by Quota Share disabled volumes by this command, the command ends normally. Any message that displays the result of Tune by Quota Share setting is not output.

9.2.2 esfadm volume qosclear (Automated QoS Function Parameter Clear Command)

NAME

esfadm volume qosclear - clearing Automated QoS Function Parameter

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 settings of Automated QoS Priority, target response time and Tune by Quota Share is performed. "Clear" indicates a status that "No Set" is specified for Automated QoS Priority, Target Response Time is not set and "Off" is specified for Tune by Quota Share".

OPERANDS

qosclear

Settings of Automated QoS Priority, target response time and Tune by Quota Share are cleared.
Automated QoS function configuration and Automated QoS performance value set to the ETERNUS Disk storage system are not cleared. If you want to return the set performance value to no limit, use the 9.2.4 esfadm storage qosset (Automated QoS Enable/ Disable Switching Command) to set tuning by Automated QoS to "Disable".

If this command is executed while both Automated QoS Priority and target response time are not set to the specified FTV, the command ends normally and the same message (esqos0003) as when target response time was cleared is output. Any message that displays the result of cleared Tune by Quota Share is not output.

OPTIONS

Options of "qosclear" operand

-ipaddr *ipAddress*

Specify the IP address of the ETERNUS Disk storage system. You cannot specify multiple addresses or use wildcards.

-volume *volumeNumber*

Specify the FTV Number of which settings of Automated QoS Priority, target response time and Tune by Quota Share is cleared in decimal notation. Only a single volume can be specified.

OUTPUT INFORMATION

Operation History of ETERNUS SF

The following execution history information is 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
!=0: Terminated abnormally

EXAMPLES

Clearing settings of Automated QoS Priority, target response time and Tune by Quota Share in relation to FTV#0

- When a target response time is set to FTV No.0 (priority not set):

  Windows Environment

  ```
  > C:\ETERNUS_SF\Common\bin\esfadm volume qosclear -ipaddr 192.0.2.10 -volume 0
  esqos0003 The target response time cleared normally.
  ```

  Solaris or Linux Environment

  ```
  # /opt/FJSVesfcm/bin/esfadm volume qosclear -ipaddr 192.0.2.10 -volume 0
  esqos0003 The target response time cleared normally.
  ```

- When Automated QoS Priority is set to FTV No.0:

  Windows Environment

  ```
  > C:\ETERNUS_SF\Common\bin\esfadm volume qosclear -ipaddr 192.0.2.10 -volume 0
  esqos0005 The Automated QoS priority cleared normally.
  ```

  Solaris or Linux Environment

  ```
  # /opt/FJSVesfcm/bin/esfadm volume qosclear -ipaddr 192.0.2.10 -volume 0
  esqos0005 The Automated QoS priority cleared normally.
  ```

- When Automated QoS Priority and target response time are not set to FTV No.0:

  Windows Environment

  ```
  > C:\ETERNUS_SF\Common\bin\esfadm volume qosclear -ipaddr 192.0.2.10 -volume 0
  esqos0003 The target response time cleared normally.
  ```

  Solaris or Linux Environment

  ```
  # /opt/FJSVesfcm/bin/esfadm volume qosclear -ipaddr 192.0.2.10 -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 terminates 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 (Automated QoS Operation Information Listed Display Command)

NAME

esfadm volume qosinfo - list display of Automated QoS Operation Information

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

Enable/Disable of Automated QoS, Automated QoS Priority, target response time, Automated QoS enabled volume, Automated QoS tuning status, ETERNUS Disk storage system's bandwidth limit value, last bandwidth tuning date and Tune by Quota Share are displayed.

They are output in CSV format.

A list of all the FTVs existing on the ETERNUS Disk storage that has the specified IP address is displayed.

OPERANDS

qosinfo

Automated QoS Operation Information times list is displayed.

OPTIONS

Options of "qosinfo" Operand

-ipaddr *ipAddress*

Specify the IP address of the ETERNUS Disk storage system. You cannot specify multiple addresses or use wildcards.

EXIT STATUS

=0: Completed successfully
!=0: Terminated abnormally

EXAMPLES

When displaying all of the target response times:

Windows Environment

```
> C:\ETERNUS_SF\Common\bin\esfadm volume qosinfo -ipaddr 192.0.2.10
IP ADDRESS,POOL NAME,VOLUME NUMBER,ENABLE/DISABLE,PRIORITY,RESPONSE TIME,AVAILABLE,TUNING
STATUS,BANDWIDTH LIMIT,SET TIME,TUNE BY QUOTA SHARE,VVOL TYPE
192.0.2.10,TestTier1,0,Enable ,Middle,10,Yes,Attaining,5:5040(400),2013/12/01 22:00:03,On,Data
192.0.2.10,TestTier1,1,Enable ,-,-,- ,Stopping,15:60(5),- ,Off,Config
192.0.2.10,TestTier1,2, Enable,Low,50,Yes,Working,10:60(5),2013/12/01 10:48:29,On,-
192.0.2.10,TestTier2,5, Enable,High,10,No(IOPS),Not Attaining,5:780(100),2013/12/01 20:55:10,On,-
192.0.2.10,TestTier2,10, Enable,- ,-,- ,Working,5:780(100),- ,Off,-
192.0.2.10,TestTier3,8, Disable,-,-,- ,-,Off,0:Unlimited,-,-
```

Solaris or Linux Environment

```
# /opt/FJSVesfcm/bin/esfadm volume qosinfo -ipaddr 192.0.2.10
IP ADDRESS,POOL NAME,VOLUME NUMBER,ENABLE/DISABLE,PRIORITY,RESPONSE TIME,AVAILABLE,TUNING
STATUS,BANDWIDTH LIMIT,SET TIME,TUNE BY QUOTA SHARE,VVOL TYPE
192.0.2.10,TestTier1,0,Enable ,Middle,10,Yes,Attaining,5:5040(400),2013/12/01 22:00:03,On,Data
192.0.2.10,TestTier1,1,Enable ,-,-,- ,Stopping,15:60(5),- ,Off,Config
192.0.2.10,TestTier1,2, Enable,Low,50,Yes,Working,10:60(5),2013/12/01 10:48:29,On,-
192.0.2.10,TestTier2,5, Enable,High,10,No(IOPS),Not Attaining,5:780(100),2013/12/01 20:55:10,On,-
192.0.2.10,TestTier2,10, Enable,- ,-,- ,Working,5:780(100),- ,Off,-
192.0.2.10,TestTier3,8, Disable,-,-,- ,-,Off,0:Unlimited,-,-
```

The meaning of each of the items is as follows:

Item	Explanation
IP ADDRESS	IP address of an ETERNUS Disk storage system is displayed.
POOL NAME	Name of Tier pool is displayed.
VOLUME NUMBER	Volume number is displayed.
ENABLE/DISABLE(*1)	Setting of Automated QoS Enable/Disable is displayed.
PRIORITY(*2)	Setting of Automated QoS Priority is displayed.
RESPONSE TIME	Target value of a response time of volumes used by users is displayed. Depending on whether the items below are specified or not, the displayed contents are varied as follows: - Automated QoS Priority is specified Target Response Time (millisecond) calculated by priority and performance information is displayed up to the second decimal place (round off to three decimal places). - Target Response Time is specified Specified target response time (millisecond) is displayed up to the second decimal place (round off to three decimal places). - Other than those above A hyphen (-) is displayed. Even if Automated QoS Priority is specified, a hyphen (-) is displayed in the following cases: - A period of time from when Automated QoS Priority is specified till the first performance tuning is performed. - The value in the AVAILABLE column is "No".
AVAILABLE	Automated QoS enabled volume is displayed in the following ways: Yes Automated QoS is enabled. No(c) Automated QoS is not enabled. "c" displays a highest priority reason why Automated QoS does not work on the volumes. "c" represents any of the following values. They are described from the highest priority: Act The status of Automated QoS on storage is not "Active". Perf Performance management is not applicable to the volume. EtoE The volume does not exist in End to End view. IOPS There is no I/O load on the volume. Hyphen (-) Automated QoS Priority and target response time are not specified.
TUNING STATUS(*3)	Automated QoS tuning status is displayed.

Item	Explanation
BANDWIDTH LIMIT(*4)	Bandwidth limit [0 - 15: IOPS(MB/s)] set to ETERNUS Disk storage system by Automated QoS function is displayed.
SET TIME(*5)	Date and time of last bandwidth tuning is displayed.

TUNE BY QUOTA SHARE	Cooperation between Automated QoS and Automated Storage Tiering is displayed.
	
	On
	
	    Cooperation is enabled.
	
	Off
	
	    Cooperation is disabled.

VVOL TYPE	Displays the type of Virtual Volume. The formats that are displayed are as follows:
	
	Config
	
	    A Virtual Volume for saving the configuration information of the virtual machine.
	
	Data
	
	    A Virtual Volume that stores normal data, such as the OS.
	
	Swap
	
	    A Virtual Volume for storing swapped OS memory.
	
	Memory
	
	    A Virtual Volume that is used when creating Virtual Volume snapshots when starting the OS.
	
	Other
	
	    A Virtual Volume that is used for purposes other than the above.
	
	Unknown
	
	    A Virtual Volume where management (metadata) does not exist.
	
	Hyphen (-)
	
	    An FTV. (This is not a Virtual Volume)

The following items correspond to the item names displayed on the Volume tab in "4.3 Confirmation of Configuration Details of Tier Pool":

*1: Corresponds to "Enable/Disable" displayed on Items Displayed under Volume Tab.
*2: Corresponds to "Priority" displayed on Items Displayed under Volume Tab.
*3: Corresponds to "Tuning Status" displayed on Items Displayed under Volume Tab.
*4: Corresponds to "Bandwidth Limit" displayed on Items Displayed under Volume Tab.
*5: Corresponds to "Set Time" displayed on Items Displayed under Volume Tab.

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)

9.2.4 esfadm storage qosset (Automated QoS Enable/Disable Switching Command)

NAME

esfadm storage qosset - Switching of Automated QoS Enable/Disable

SYNOPSIS

```
esfadm storage qosset -ipaddr ipAddress {-activate | -stop}
```

COMMAND PATH

Windows Environment

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

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

Solaris or Linux Environment

```
/opt/FJSVesfcm/bin/esfadm storage qosset
```

DESCRIPTION

As for a specified ETERNUS Disk storage system, switch Enable/Disable of Automated QoS.

If this command (Enable) is executed for an Automated QoS function enabled ETERNUS Disk storage system, the command ends normally and a message of normal start (message esqos0030) is output.

If this command (Disable) is executed for an Automated QoS function disabled ETERNUS Disk storage system, the command ends normally and a message of normal stop (message esqos0031) is output.

When this command (specified with the -activate option) is executed for the ETERNUS Disk storage system, and the Automated QoS function of the ETERNUS Disk storage system cannot be set to "Enable", a warning message (esqos0120) is output.

OPERANDS

qosset

Enable/Disable of Automated QoS is switched.

OPTIONS

Options of "qosset" Operand

-ipaddr ipAddress

Specify this option to specify the IP address of an ETERNUS Disk storage system. Multiple IP addresses and Wild Card cannot be specified.

-activate

Specify this option to enable Automated QoS function. This option cannot be specified together with -stop option at the same time.

-stop

Specify this option to disable Automated QoS function. This option cannot be specified together with -activate option at the same time.

OUTPUT INFORMATION

Operation History of ETERNUS SF

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

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

EXIT STATUS

=0: Completed successfully
!=0: Terminated abnormally

EXAMPLES

Example of enabling Automated QoS function for the ETERNUS Disk storage system of IP address 192.0.2.10,

Windows Environment

```
> C:\ETERNUS_SF\Common\bin\esfadm storage qosset -ipaddr 192.0.2.10 -activate
esqos0030 Automated QoS has been activated.
```

Solaris or Linux Environment

```
# /opt/FJSVesfcm/bin/esfadm storage qosset -ipaddr 192.0.2.10 -activate
esqos0030 Automated QoS has been activated.
```

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 terminates 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)

9.2.5   esfadm storage qosstat (Automaed QoS Status Display Command)

NAME

esfadm storage qosstat - Display Automaed QoS Status

SYNOPSIS

```
esfadm storage qosstat {-all | -ipaddr ipAddress}
```

COMMAND PATH

Windows Environment

```
$INS_DIR\Common\bin\esfadm storage qosstat
```

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

Solaris or Linux Environment

```
/opt/FJSVesfcm/bin/esfadm storage qosstat
```

DESCRIPTION

The status (Enabled/Disabled) of Automated Qos function is displayed. It is output in CSV format.

If -all is specified, the status of Automated QoS function of all the recognized ETERNUS Disk storage systems is displayed in a list.

If -ipaddr is specified, the status of Automated QoS function of an ETERNUS Disk storage system that has the specified IP address is displayed.

OPERANDS

qosstat

The status of Automated QoS function is displayed.

OPTIONS

Options of " qosstat " Operand

-all

This option cannot be specified together with -ipaddr option at the same time.

-ipaddr *ipAddress*

Specify this option to specify the IP address of an ETERNUS Disk storage system. Multiple IP addresses and Wild Card cannot be specified.
This option cannot be specified together with -all option at the same time.

EXIT STATUS

=0: Completed successfully
!=0: Terminated abnormally

EXAMPLES

- When specifying an IP address to display the status of Automated QoS function for the specified ETERNUS Disk storage system:

Windows Environment

```
> C:\ETERNUS_SF\Common\bin\esfadm storage qosstat -ipaddr 192.0.2.10
IP ADDRESS,AUTOMATED QOS
192.0.2.10,Active
```

Solaris or Linux Environment

```
# /opt/FJSVesfcm/bin/esfadm storage qosstat -ipaddr 192.0.2.10
IP ADDRESS,AUTOMATED QOS
192.0.2.10,Active
```

- When displaying the status of Automated QoS function of all the ETERNUS Disk storage systems:

Windows Environment

```
> C:\ETERNUS_SF\Common\bin\esfadm storage qosstat -all
IP ADDRESS,AUTOMATED QOS
192.0.2.10,Active
192.0.2.11,Stopped
```

```
    192.0.2.12,Stopped
    192.0.2.13,Active
```

Solaris or Linux Environment

```
# /opt/FJSVesfcm/bin/esfadm storage qosstat -all
IP ADDRESS,AUTOMATED QOS
192.0.2.10,Active
192.0.2.11,Stopped
192.0.2.12,Stopped
192.0.2.13,Active
```

Each item has the following meaning:

Item	Explanation
IP ADDRESS	IP address of ETERNUS Disk storage system

AUTOMATED QOS	Operating status of Automated QoS function. Either of the following statuses are displayed:
	 Active
	    Automated QoS is enabled.
	 Stopped
	    Automated QoS is disabled.

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)