

FUJITSU Storage ETERNUS SF

Express V16.9 / Storage Cruiser V16.9 / AdvancedCopy Manager V16.9

Overview

Preface

Purpose of This Manual

This manual explains an overview, functions, operating environment 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")

Intended Readers

This manual is intended for the following users:

- Users who plan the installation of Express, Storage Cruiser, or AdvancedCopy Manager
- Users who design and operate and manage the storage management system with Express, Storage Cruiser, or AdvancedCopy Manager

Structure of This Manual

The structure of this manual is as follows:

[Chapter 1 Overview of Express](#)

This chapter explains the features, main functions, product components, system configuration, and operation image of Express.

[Chapter 2 Function Overview of Express](#)

This chapter explains the functions provided by Express.

[Chapter 3 Overview of Storage Cruiser](#)

This chapter explains the features, main functions, product components, system configuration, and operation image of Storage Cruiser.

[Chapter 4 Function Overview of Storage Cruiser](#)

This chapter explains the functions provided by Storage Cruiser.

[Chapter 5 Overview of AdvancedCopy Manager](#)

This chapter explains the features, main functions, product components, system configuration, and operation image of AdvancedCopy Manager.

[Chapter 6 Function Overview of AdvancedCopy Manager](#)

This chapter explains the functions provided by AdvancedCopy Manager.

[Appendix A Overview of Advanced Copy Function](#)

This appendix explains an overview of Advanced Copy processing.

Conventions

This manual abides by the conventions listed in "Conventions" in the *FUJITSU Storage ETERNUS SF Express / Storage Cruiser / AdvancedCopy Manager Documentation Road Map*.

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Revision History

Date of Publication	Version	Document Part Number	
		PDF	HTML
February 2023	1.1	B1FW-6082-01ENZ0(01)	B1FW-6082-01ENZ2(01)
August 2021	1	B1FW-6082-01ENZ0(00)	B1FW-6082-01ENZ2(00)

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Update History

Content of Update	Updated Section	Revision
Information related to the following software has been added. <ul style="list-style-type: none"> - VMware vSphere 8 - VMware vCenter Server Appliance 8 	3.1	1.1
[Point] has been added in the description of the Management Server.	5.5	

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Chapter 1 Overview of Express

1.1 What is Express?

Express is an administrative software for small and medium-sized storage systems which allows for easy installation and easy operation of a storage device and targets those who lack installation experience of storage devices and those who are hesitant to install and operate storage devices because they feel it is "too difficult".

Point

Express cannot manage devices (various devices that compose the storage system such as servers, switches, and tape devices) other than the storage device. To manage peripheral devices in addition to the storage device, use Storage Cruiser.

The following devices can be managed with Express.

Table 1.1 Devices Can Be Managed with Express

Device Type	Device Name
Storage devices	ETERNUS DX60 S5/DX100 S5/DX200 S5
	ETERNUS DX60 S4/DX100 S4/DX200 S4
	ETERNUS DX60 S3/DX100 S3/DX200 S3
	ETERNUS DX60 S2/DX80 S2/DX90 S2
	ETERNUS AF150 S3/AF250 S3
	ETERNUS AF250 S2
	ETERNUS AF250
	ETERNUS DX200F

Information

In this chapter and "[Chapter 2 Function Overview of Express](#)", unless there is a special disclaimer, the term "storage device" indicates the devices described in the above table.

1.2 Express Features

Easy Configuration Using the Wizard

Express provides the following wizard that the storage system configuration can be completed with only a few clicks in the wizard.

- Storage configuration wizard
- Volume allocation wizard
- Advanced Copy configuration wizard

For example, the operation to allocate volumes of the storage device to a server can be completed on just three screens (**Select Server** screen, **Select HBA and Port** screen, and **Assign Volumes to Server** screen) for the Volume Allocation Wizard.

Easy Operation

What to do, how to do it: operation target and method can be selected directly on the screen in Web Console. Therefore, operation procedures are no longer difficult to understand.

Web Console can manage different storage devices from the same operation view. Therefore, there is no need to remember the different operations for each storage device.

In addition, as several storage devices can be managed, monitored and operated in the same Web Console, it is not necessary anymore to physically go to the various managed systems locations, switch between browser windows, etc.

Easy Troubleshooting

When a problem occurs, the user can determine the cause and scope of the problem before calling to report it. Easy to understand messages makes it possible to understand the cause of a problem without prior expert storage knowledge. Advice on how to handle the problem can be displayed by clicking on the message.

Performance Management

The use of Web Console makes it possible to display in a graph the 24-hour performance information of the storage device. In addition, the command line operation makes it possible to output 1-hour or 24-hour performance information of the storage device into a CSV file.

Data Copy

Express can execute snapshot copy (SnapOPC+) of the Advanced Copy function of the storage device. The maximum number of copy sessions that can be executed with the device is as follows.

Storage Device Name	Maximum Number of Copy Sessions
ETERNUS DX60 S5/DX100 S5/DX200 S5 ETERNUS DX60 S4/DX100 S4/DX200 S4 ETERNUS DX60 S3/DX100 S3/DX200 S3 ETERNUS AF150 S3 ETERNUS AF250 S3/S2 ETERNUS AF250 ETERNUS DX200F	The maximum number of copy sessions varies depending on that storage device and the firmware version. Check the manual of the storage device to be used.
ETERNUS DX60 S2/DX80 S2/DX90 S2	8

The Advanced Copy function is a function that allows high speed copy of a business volume at any time.

Operations can be performed from Web Console or the Command Line Interface (CLI). The operations through Web Console are simple. The CLI allows integration in a script, use of the OS scheduler for preset copy tasks, etc. in a customizable manner.

1.3 Component Structure of Express

Express comprises one component.

Table 1.2 Component of Express

No.	Component Name	Supported Operating Systems (A=Available, N/A=Not Available)				
		Windows	Solaris	Linux	HP-UX	AIX
1	Express's manager	A	N/A	A	N/A	N/A

Point

After installation of the ETERNUS SF Manager program, if it is set up as the Express's manager, it is possible to use Express.

See

Refer to the following section in the *Installation and Setup Guide* for details of the operating systems supported by Express's manager.

- "Operating Environment" > "Operating Environment of ETERNUS SF Manager" > "Software Requirements"

The Express's manager manages one or more storage devices and has the role of processing requests from Web Console and various events coming from the storage devices.

Information

In the Express manuals, the server where the Express's manager works is referred as "Management Server" and a server managed by the Management Server is referred as "Managed Server".

1.4 Product Structure of Express

The functions provided by Express are organized according to the license.

Basic License

Table 1.3 Basic License of Express

License Name	Explanation
ETERNUS SF Express	You can use functions of Express.

Option License

There is no license.

See

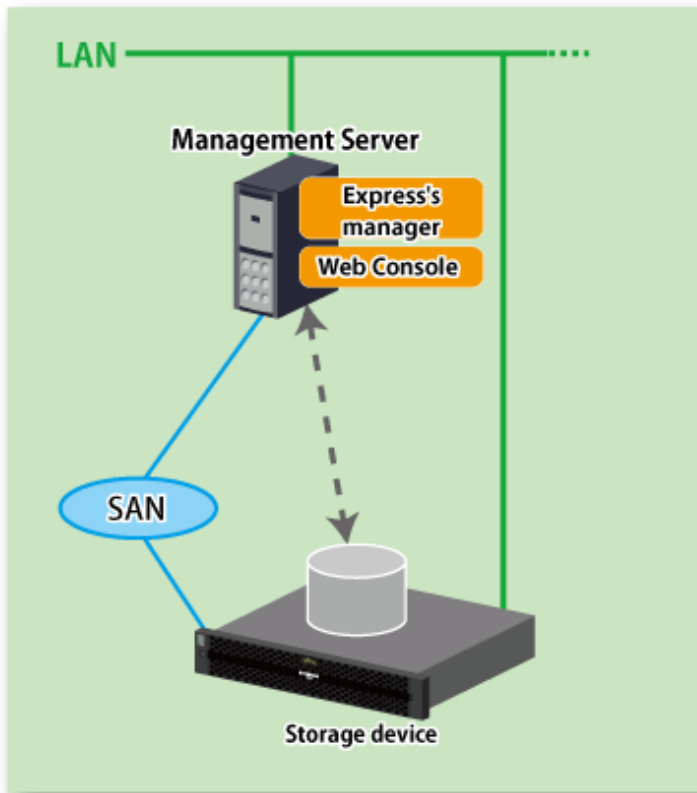
Refer to "[Chapter 2 Function Overview of Express](#)" for the overview of functions provided by Express.

1.5 System Configuration of Express

The "[Figure 1.1 Express System Configuration](#)" is a basic system configuration of Express.

Express can manage one or more storage devices. In addition to physical environments, server virtualization environments are also supported.

Figure 1.1 Express System Configuration



The Express's manager and Web Console can be operated on different servers. In this environment, Web Console accesses Express's manager over the network (HTTPS connection).

Note

- Express does not support to operate the system in the IPv6 environment. Operate the system in the IPv4 environment.
- Express does not support to work on the clustered system. If you want to increase the availability of the Management Server, use Storage Cruiser.

System Configuration When Using the Advanced Copy Function

In Express, the Management Server sends a command to a storage device to perform an Advanced Copy function. There are two available methods for sending the copy command.

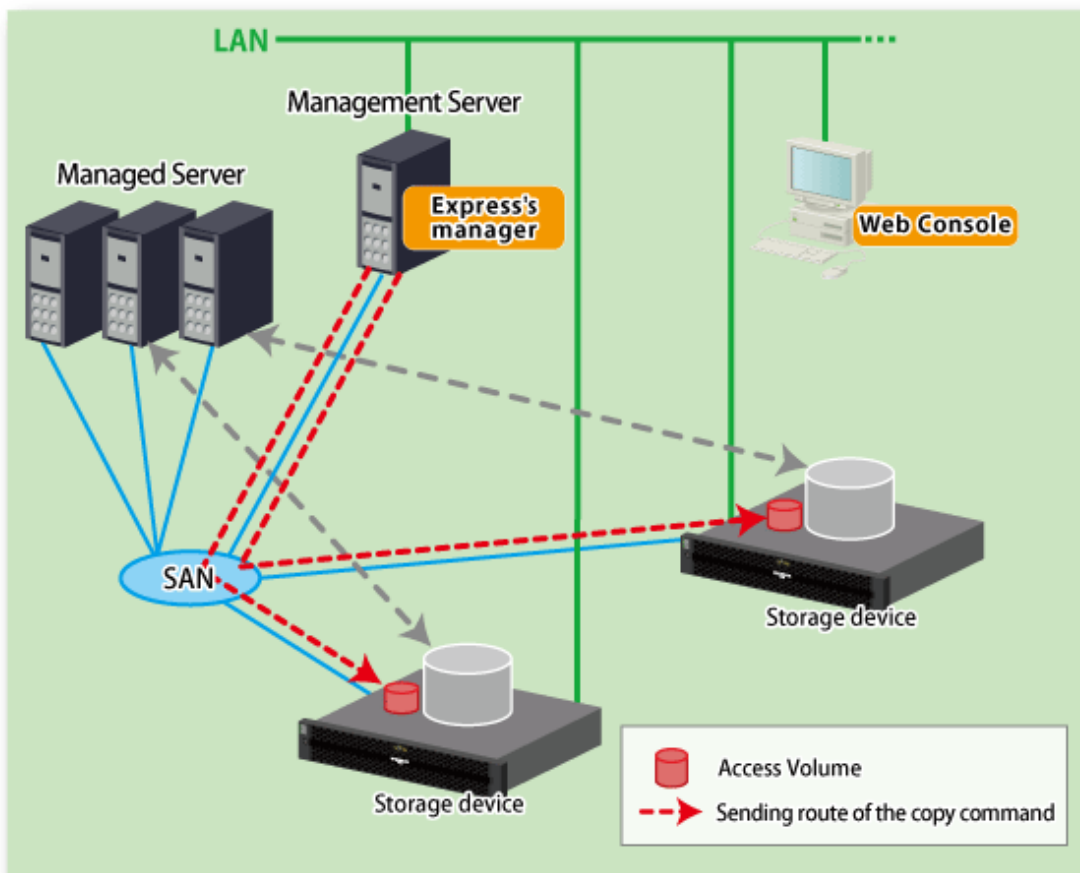
- Sending a command to a storage device to perform an Advanced Copy function from the server over the SAN (hereafter referred to as "Copy command via SAN")
- Sending a command to a storage device to perform an Advanced Copy function from the server over the LAN (hereafter referred to as "Copy command via LAN")

Note

For the ETERNUS DX60 S2, the Copy command via LAN method cannot be used. Use the Copy command via SAN method.

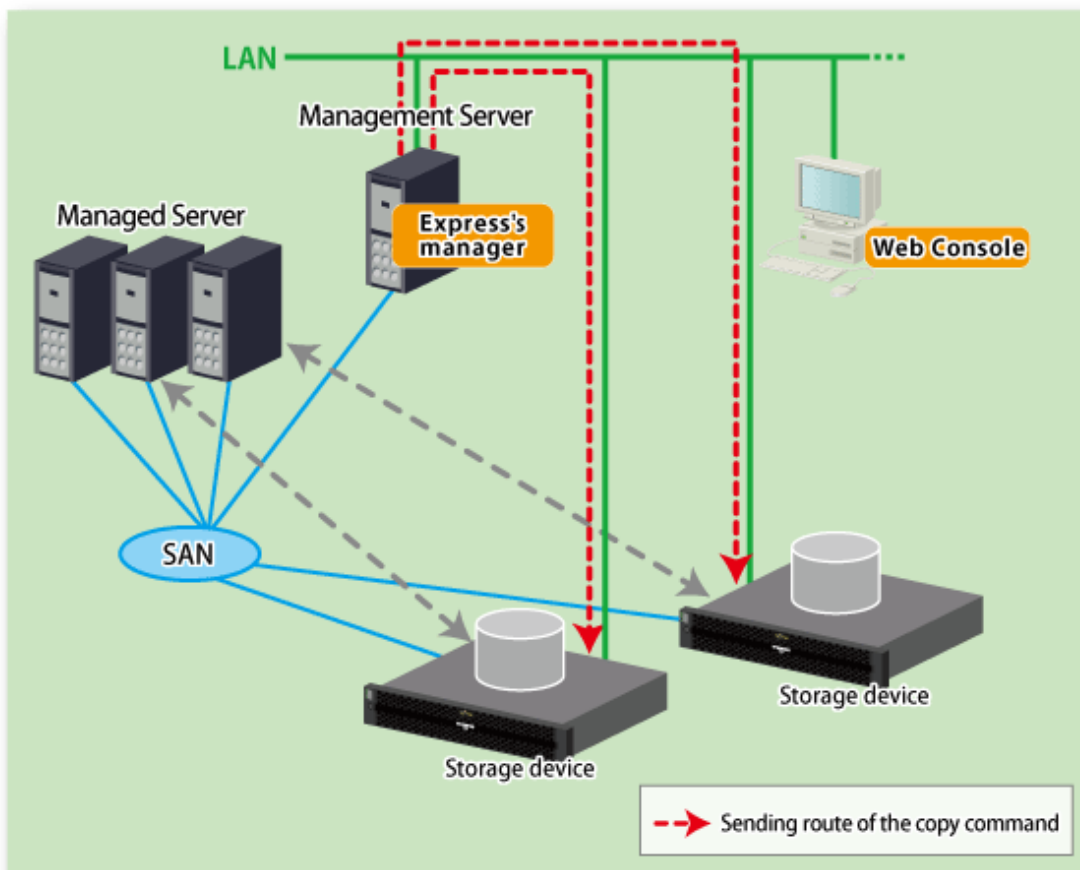
When using the Copy command via SAN method, a logical volume that can be accessed from the Management Server is needed in the storage device. In this software manuals, this logical volume is called "access volume". One logical volume of the storage device must be assigned to Management Server as the access volume.

Figure 1.2 Example of System Configuration When Using the Copy Command via SAN



When using the Copy command via LAN method, no access volume is needed.

Figure 1.3 Example of System Configuration When Using the Copy Command via LAN



Chapter 2 Function Overview of Express

2.1 Functions List

Express provides the following functions.

- [Wizard for easy configuration](#)
- [Configuration management](#)
- [Fault management](#)
- [Performance management](#)
- [Thin Provisioning management](#)
- [Energy-saving operation for storage devices](#)
- [NAS management](#)
- [Snapshot copy](#)



See

Refer to the *Express Operation Guide* for details of each function.

2.2 Wizard for Easy Configuration

Express can be easily configured with the configuration wizard.

Even without prior experience of the storage device configuration and setup, volume creation in the storage device can be done with a wizard. The storage devices and volumes can also be added later with only a few clicks in the wizard.

Express provides the following wizard.

- Storage configuration wizard
This wizard can register new server and assign volumes created in the storage device to a new server. In addition, volumes to be assigned can be created in this wizard.
- Volume allocation wizard
This wizard can assign volumes created in the storage device to a registered server.
- Advanced Copy configuration wizard
This wizard can configure the copy table size and Snap Data Pool policy required for Advanced Copy operations.

2.3 Configuration Management

The operations related to the following resources that compose the storage system can be performed from Web Console.

- Storage devices
- Volumes, RAID groups, and Thin Provisioning in the storage device
- Component information and connectivity of the storage device
- Servers

The configuration of the storage system can be managed through the operation of, for example, information display and the registration/creation/modification/deletion of a resource.

2.4 Fault Management

Since Web Console displays the status of each device with icons or messages, it is easy to identify the trouble condition.

2.5 Performance Management

The 24 hour operating state and load state of a storage device can be understood.

Use Storage Cruiser if understanding the long-term performance is required or when monitoring the performance using detailed customizations such as the collection interval is required.

Refer to "Performance Information Types" in the *Express Operation Guide* for details of the manageable performance information.

2.6 Thin Provisioning Management

In Express, the same function as the Thin Provisioning management of Storage Cruiser can be used.

Refer to "[4.5 Thin Provisioning Management](#)" for information on the overview of this function.

For the capacity graphs that can be displayed, the differences between Storage Cruiser and Express are as follows.

Capacity Graph Window Types	Product Name	
	Express	Storage Cruiser
One month graph	A	A
One year graph, 10 years graph	N/A	A

A=Available, N/A=Not Available

2.7 Energy-saving Operation for Storage Devices

The same operation as the energy-saving operation for the storage devices in Storage Cruiser can be used.

Refer to "[4.6 Energy-saving Operation for Storage Devices](#)" for information on the overview of this function.

2.8 NAS Management

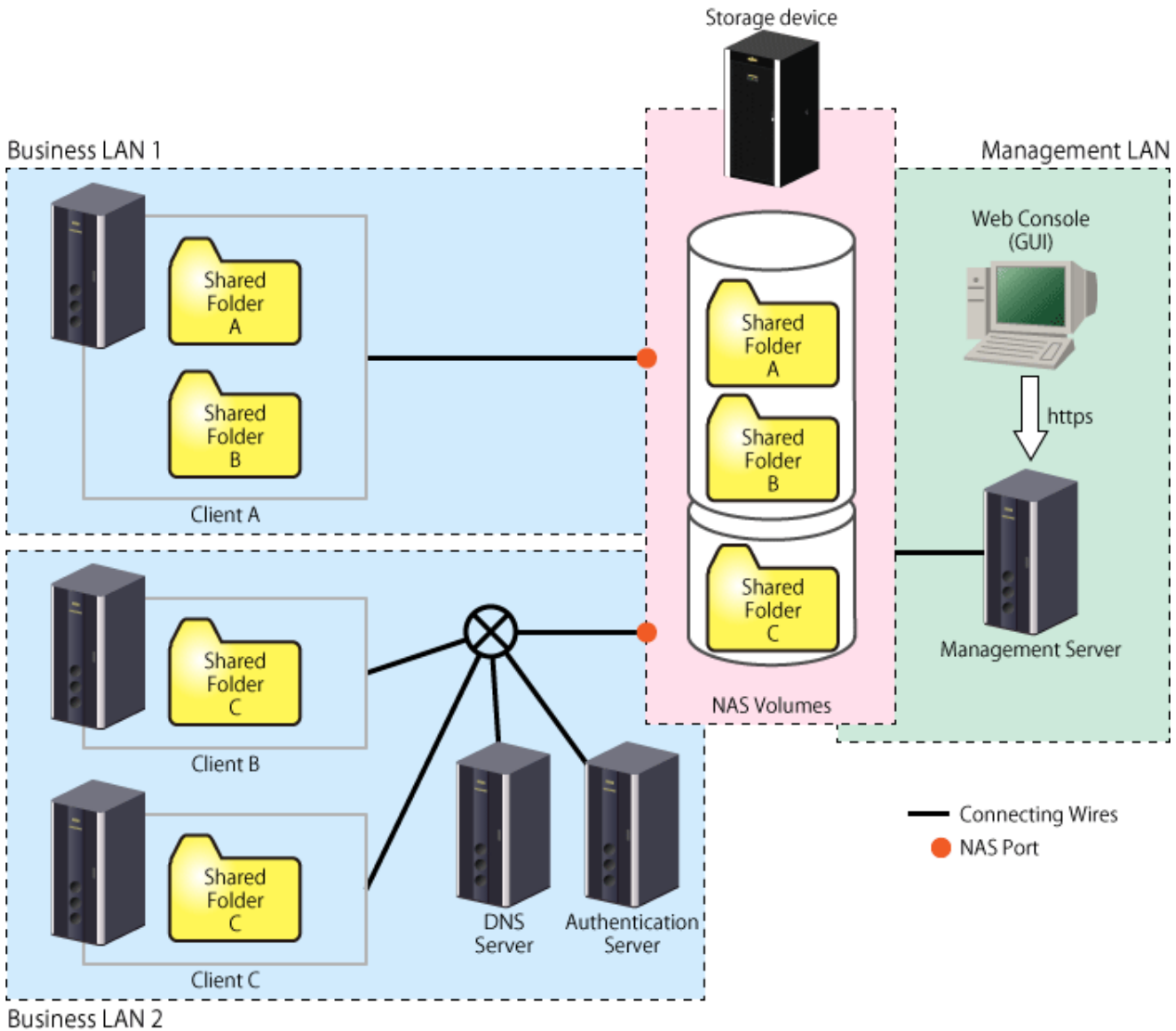
Express manages the following storage devices that are multi-protocol storage with a block access interface (SAN) and a file access interface (NAS).

- ETERNUS DX100 S5/DX200 S5
- ETERNUS DX100 S4/DX200 S4
- ETERNUS DX100 S3/DX200 S3

With Web Console, various features for operating the NAS file system of above storage devices where NAS function is installed file system can be utilized.

The basic system configuration of NAS operation is as follows.

Figure 2.1 Basic System Configuration of NAS Operation



It is necessary to perform a NAS Configuration on the Management Server.

Connect the Management Server and the storage device with a management LAN. Access to the Management Server can be performed from either the Management Server or Web Console of a terminal within a network capable of HTTPS communication with the Management Server.

The NAS feature of the storage device can be accessed by a client through one or more business LANs.

It is recommended that a business LAN include a DNS Server for name resolution and an authentication server for authenticating NAS accesses into the NAS file system.

Point

- When an authentication system is not used for the NAS file system, it is unnecessary to set up an authentication server in the storage management system.
If an authentication system is not implemented then the NAS file system can be accessed from any clients connected to the business LAN. It is strongly recommended that an authentication server is properly configured and implemented.
- When the firmware version of the storage device to be used is V10L53 or later, creating a local user/local group on the storage device for connecting to NAS can implement an authentication system without setting up an authentication server.

2.9 Snapshot Copy

The snapshot copy (SnapOPC+) uses the Copy-on-Write method and create a pre-update copy source volume. The pre-update data on the copy source volume can be saved on a per snap generation (unit of volume replication) basis.

The snapshot copy (SnapOPC+) is designed in view of its mechanism and features to be used as backups for recovery from software failures such as an operational error or a software error. If a copy source volume becomes inaccessible due to any hardware failure, SnapOPC+ session(s) fail making it impossible to read the data on the copy destination volume.

The snapshot copy (SnapOPC+) can be effectively used for the following situations.

- Backups of temporary files used for cascade copy to alternate media such as tape
- Backups of file servers and other data less frequently updated

Refer to "[Figure A.4 Processing Flow of SnapOPC+](#)" for information on the processing flow of SnapOPC+.

Chapter 3 Overview of Storage Cruiser

3.1 What is Storage Cruiser?

Storage Cruiser is an administrative software that integrates the management of the storage system with the storage device as the core and provides stable operation of the storage system.

In addition to SAN storage devices and NAS storage devices, by managing various devices that compose the storage system, such as servers, switches, and tape devices, the storage system state which changes daily can be centrally managed.

Storage Cruiser not only supports physical environments, but server virtualization environments as well.

The following devices can be managed with Storage Cruiser.

Table 3.1 Devices Can Be Managed with Storage Cruiser

Device Type	Device Name
Storage devices	ETERNUS DX series ETERNUS AF All-Flash Arrays ETERNUS DX200F ETERNUS AX/HX series ETERNUS AB/HB series ETERNUS VS850 S3 ETERNUS CS800 M1/CS800 S7/CS800 S6 NetApp FAS Series NetApp FAS Series (with clustered Data ONTAP) NetApp AFF series
Tape libraries	ETERNUS LT series ETERNUS CS2000
Fibre Channel switches	PRIMERGY BX600 Fibre Channel Switch Blade Brocade series
Converged Switches	VDX series PRIMERGY BX Ethernet Fabric Switch
Others	Windows, Linux, Solaris, HP-UX, and AIX server nodes VMware vSphere 8 VMware vCenter Server Appliance 8 VMware vSphere 7 VMware vCenter Server Appliance 7 VMware vSphere 6 VMware vCenter Server 6

Information

In this chapter and "[Chapter 4 Function Overview of Storage Cruiser](#)", unless there is a special disclaimer, the term "storage device" indicates the storage devices described in the above table.

Additionally, Storage Cruiser can manage the following middleware.

- File system
- Multipath driver



See

Depending on the OS and version of the server managed by Storage Cruiser, the type of middleware and their contents that can be managed vary. Refer to "Server Node Middleware for Which Management Is Possible" in the *Storage Cruiser Operation Guide* for details.

3.2 Storage Cruiser Features

In Storage Cruiser, information such as the configuration information, performance information, and the failure occurrence state of the entire storage system that is comprised of various devices can be centrally managed with a GUI. This GUI is called "Web Console".

Web Console unifies the operation interface for all models of the ETERNUS DX series, ETERNUS AF All-Flash Arrays, ETERNUS DX200F, ETERNUS AX/HX series, and ETERNUS AB/HB series. Because there is no need to remember the operations of each model, the burden of operation management and the costs can be reduced.

Configuration Management Realizing the Total Management of Devices in Entire Storage System

This function displays the status of each device in a current entire storage system and the status of physical connection between devices graphically on Web Console. Because of this, the details of the connection destination for each part of the device (such as the Fibre Channel switch port) can be understood.

Correlation Management Realizing the Total Management of Small-sized Resources of All Devices

This function not only manages detailed configurations within the storage devices but also automatically obtains the physical paths from disks and related server node configuration information, and then displays information correlating to this data on a single window.

In Storage Cruiser, the correlation of entities can be displayed in a common display format on a single window, and consequently the entire configuration can simply be grasped and an error can be detected if any configuration error should exist.

Fault Management Function for Facilitating to Locate of Failed Parts and Affected Areas

Failures that occur on devices are properly displayed in an understandable way.

Error information can be automatically reported to FUJITSU Software Systemwalker, integrated administrative software, and other vendors' management software. For this reason, centralized management of the storage system becomes available.

Optimal Environment Delivery via the Performance Information Management

Performance information of managed devices can be managed and displayed. Performance information of devices are stored on the Management Server, past performance information can be accessed as well as real-time performance information. Additionally, because performance information can be viewed in a graphic format, you can simply see the picture of the performance statuses and load statuses of devices.

In addition, threshold values can be set on devices so that alarms are reported when those threshold values are exceeded. The bottleneck causes and locations can be identified, and as a result, the configuration of devices is improved and the operation in the optimal environment is delivered.

Reporting Function

This function collects capacity and usage time information for volumes connected to servers. This provides the required information for you to charge fees based on volume utilization.

Support for the VMware vSphere Virtual Volumes Function

The VMware vSphere Virtual Volumes function is a function to perform the VM disk (VMDK) operations that were performed on the Virtual Machine File System (VMFS) on the storage device. This function simplifies the performance design and performance analysis for the storage device. Further, a backup can be taken for each VM guest. If it is within the same device, the Advanced Copy function of the ETERNUS DX series, ETERNUS AF All-Flash Arrays, and ETERNUS DX200F can be used to achieve VMware standard snapshot and clone, and Storage vMotion processing at high speed.

Automated Storage Tiering

Automated Storage Tiering is a function for optimizing the performance and costs in environments configured with mixed drives of different types. The access frequency of the data is detected and an optimal data relocation is automatically performed according to the access frequency.

By setting the data relocation policy, arrangements according to the work requirement and priority are available, so resource sharing and efficient use of resources are possible while complying with the various work requirements.

Automated QoS Function

Just by setting the target performance for the business volume, the balance of the I/O performance between the volumes that share the storage device is automatically adjusted based on the performance information of the switch and storage device.

Because high priority business I/Os can be prioritized, even for businesses that emphasize performance such as databases, stable operation is possible without receiving the effects of load fluctuations from other business I/Os.

Storage Cluster Function

If one storage device is down between two storage devices connected to a server, this function fails over to the other storage device transparently. This function enables business to continue.

3.3 Component Structure of Storage Cruiser

Storage Cruiser comprises two components.

Table 3.2 Components of Storage Cruiser

No.	Component Name	Supported Operating Systems (A=Available, N/A=Not Available)				
		Windows	Solaris	Linux	HP-UX	AIX
1	Storage Cruiser's manager	A	A	A	N/A	N/A
2	Storage Cruiser's agent	A	A	A	A	A

Point

After installation of the ETERNUS SF Manager program, if it is set up as the Storage Cruiser's manager, it is possible to use Storage Cruiser.

See

Refer to the following sections in the *Installation and Setup Guide* for details of the operating systems supported by above components.

- "Operating Environment" > "Operating Environment of ETERNUS SF Manager" > "Software Requirements"
- "Operating Environment" > "Operating Environment of Storage Cruiser's Agent" > "Software Requirements"

The Storage Cruiser's manager manages the entire storage system and has the role of processing requests from Web Console and events from various devices that compose the storage system.

The Storage Cruiser's agent monitors the status of the server in which this component is installed. In addition, for Windows environments, Solaris environments, or Linux environments, if the Storage Cruiser's agent is set as the Storage Cluster Controller, the health of the storage device is monitored in the Storage Cluster environment and when the storage device fails, the storage device is automatically switched.

Information

In the Storage Cruiser manuals, the server where the Storage Cruiser's manager works is referred as "Management Server" and a server managed by the Management Server is referred as "Managed Server".

3.4 Product Structure of Storage Cruiser

The functions provided by Storage Cruiser are organized according to the license.

Basic Licenses

Table 3.3 Basic Licenses of Storage Cruiser

License Name	Explanation
ETERNUS SF Storage Cruiser Basic	You can use basic functions of Storage Cruiser. This is a license for managing the ETERNUS DX series, ETERNUS AF All-Flash Arrays, and ETERNUS DX200F.
ETERNUS SF Storage Cruiser Standard	You can use basic functions of Storage Cruiser. This is a license for totally managing the SAN environment including the ETERNUS DX series, ETERNUS AF All-Flash Arrays, ETERNUS DX200F, switches, and servers. In addition, the ETERNUS AX/HX series, ETERNUS AB/HB series, NetApp FAS Series, NetApp FAS Series (with clustered Data ONTAP), and NetApp AFF series can be managed by this license.

Option Licenses

Depending on the operation purpose of the storage system, multiple option licenses can be combined. There is no exclusive relationship for option licenses.

Table 3.4 Option Licenses of Storage Cruiser

License Name	Explanation
ETERNUS SF Storage Cruiser Optimization Option	You can use Automated Storage Tiering with multiple tiers. (*1)
ETERNUS SF Storage Cruiser Quality of Service Management Option	You can use the Automated QoS function.
ETERNUS SF Storage Cruiser Storage Cluster Option	You can use the Storage Cluster function.

*1: Automated Storage Tiering can be used for a single tier with a basic license.

See

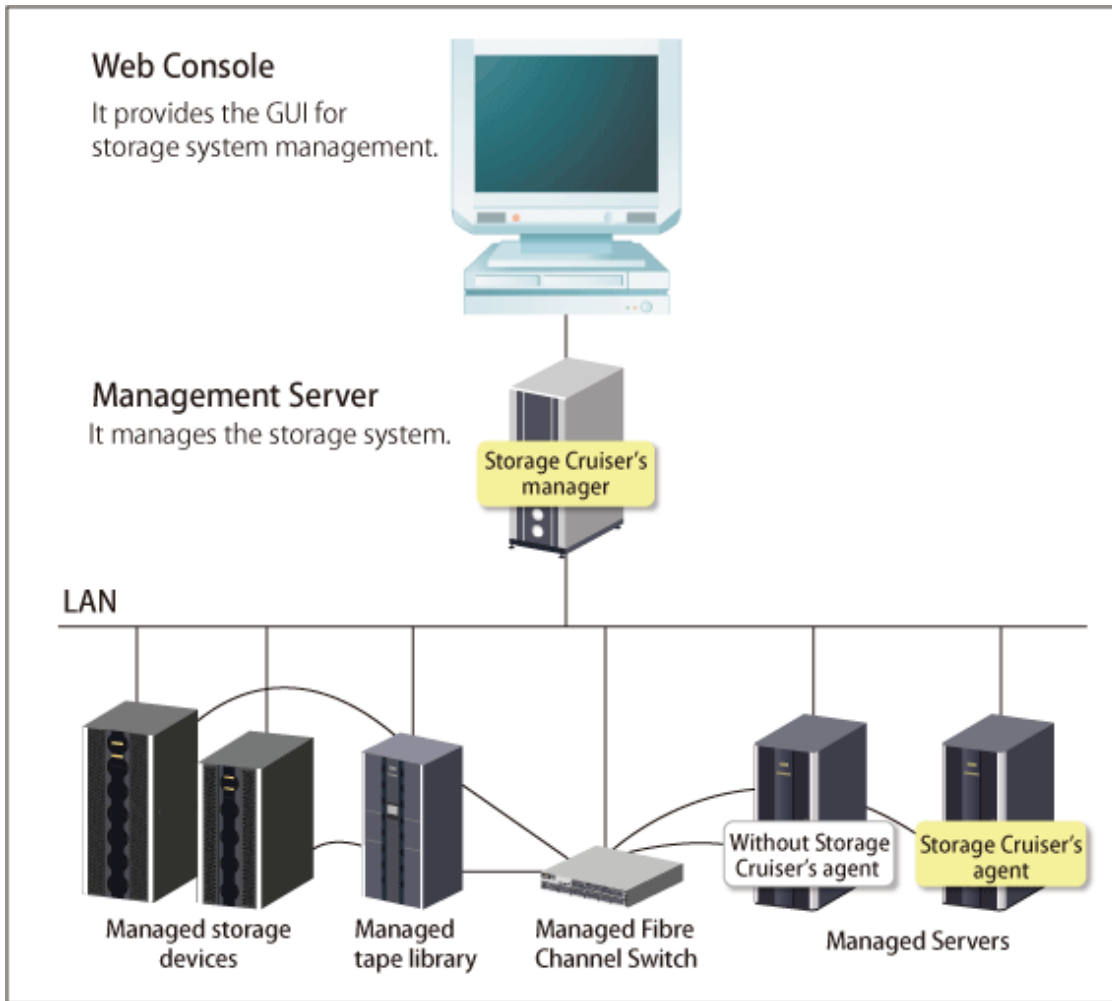
Refer to "[Chapter 4 Function Overview of Storage Cruiser](#)" for the overview of functions provided by Storage Cruiser.

3.5 System Configuration of Storage Cruiser

The "[Figure 3.1 Storage Cruiser System Configuration](#)" is a basic system configuration of Storage Cruiser.

Storage Cruiser can manage multiple storage devices, tape libraries, switches, and servers. In addition to physical environments, server virtualization environments are also supported.

Figure 3.1 Storage Cruiser System Configuration



Servers can be managed regardless of whether the Storage Cruiser's agent is installed or not. However, the functional level for server management differs depending on whether it is installed or not. Refer to "Support Levels" in the *Storage Cruiser Operator's Guide* for details.

Installation to Clustered Systems

- Installation of the Storage Cruiser's manager

To increase the availability of the Storage Cruiser's manager, make the system redundant by installing the Storage Cruiser's manager to the clustered system.

Also, note that this product does not support configurations of managing a single operating system with multiple Storage Cruiser's managers (multiple Management Servers environment).



Refer to the *Cluster Environment Setup Guide* for information on how to install and set up the Storage Cruiser's manager in a clustered system.

- Installation of the Storage Cruiser's agent

Storage Cruiser monitors the status of all nodes comprising the clustered system. If installing the Storage Cruiser's agent to a clustered system, install to all nodes comprising the clustered system.

Chapter 4 Function Overview of Storage Cruiser

4.1 Function List

Storage Cruiser provides the following functions.

- [Configuration management](#)
- [Fault management](#)
- [Performance management](#)
- [Thin Provisioning management](#)
- [Energy-saving operation for storage devices](#)
- [NAS Management](#)
- [Reporting function](#)
- [VMware vSphere Virtual Volumes function](#)
- [Automated Storage Tiering](#)
- [Automated QoS function](#)
- [Storage Cluster function](#)



See

-
- Refer to the following manuals for details of each function.
 - *Storage Cruiser Operation Guide*
 - *Storage Cruiser Operation Guide for Optimization Function*
 - *Storage Cruiser / AdvancedCopy Manager Operation Guide for VMware vSphere Virtual Volumes*
 - There may be conditions in the firmware version of the storage device to use each function. Refer to "Supported Devices" in "Operating Environment" of the *Installation and Setup Guide* for information on the required firmware version.
-

4.2 Configuration Management

Connection Status Management

This function displays on Web Console the status of physical connections between devices. This makes it possible to get a grasp of the access points for the parts of each device (for example, the Fibre Channel switch ports). In addition, since this function displays on Web Console information correlating with the connections within the storage device and with the servers, it is possible to get a grasp of the entire configuration by looking at one screen.

Access Path Management

This function manages and sets access paths automatically by performing integrated management of security functions provided from server nodes, Fibre Channel switches, and storage devices.

An access path can be automatically recognized and displayed from the binding/zoning information that has already been set in a device. Access paths are managed based on the security information from all registered devices. Even if a physical Fibre Channel cable or a SAN route that forms an access path is disconnected, the access path is displayed with Error status.

For access paths managed by Storage Cruiser, the configuration definition of a device can be changed manually as well as automatically from Storage Cruiser. In such cases, it can check whether the manual configuration changes were performed correctly.

Point

Devices subject to storage management must be registered with Storage Cruiser. To register a device, the IP address of the device is required. In addition, a user ID and password for management are required for some of storage devices and Fibre Channel switches.

4.3 Fault Management

The fault management of this software has the three features described below.

- [Asynchronous Fault Event Monitoring Using Event Notification from Devices](#)
- [Fault Monitoring Using Device Polling](#)
- [Fault Monitoring by Checking Current Status of Devices](#)

The fault management starts monitoring through the registration of the target device to the Storage Cruiser's manager and continues monitoring processing while the Storage Cruiser's manager is running.

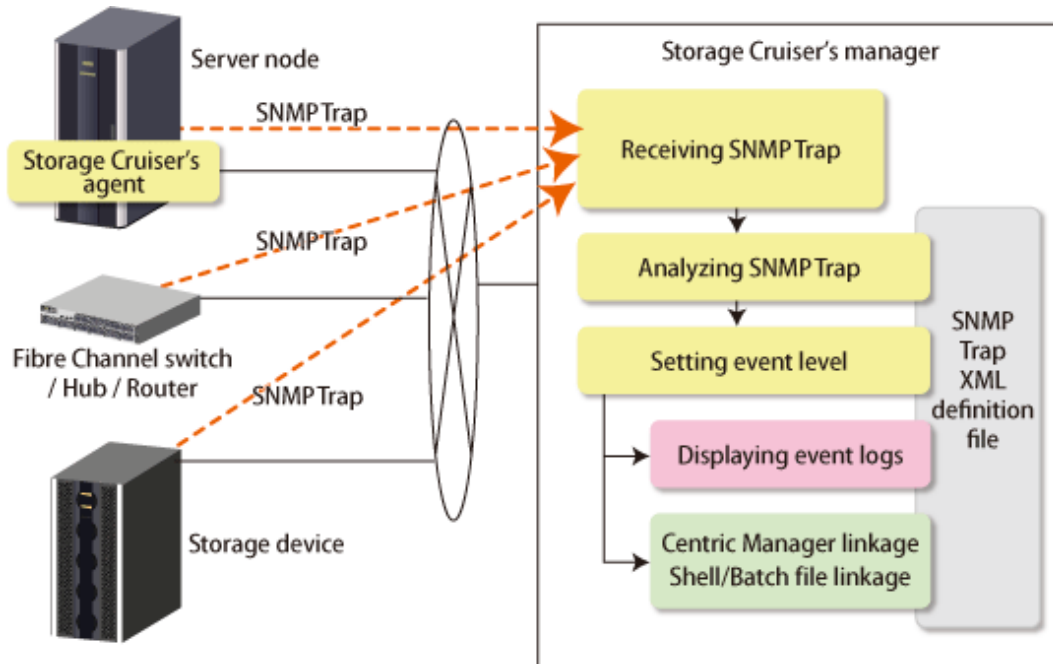
Point

- Storage Cruiser monitors the devices with LAN. Therefore, it is not possible to monitor the devices which are not connected with LAN.
- In the Storage Cruiser manuals, "Device status" indicates the total status of the device.

Asynchronous Fault Event Monitoring Using Event Notification from Devices

Storage Cruiser processes an SNMP Trap from a device and monitoring information from the Storage Cruiser's agent, properly decodes them, and displays them as an asynchronous event. Since the displayed contents of the event are more detailed and easier to understand than decodes generated by a normal SNMP MIB compiler, they support smooth operation.

Figure 4.1 Image of Fault Monitoring Using Event Notification



The display for events can be customized in detail by using an SNMP Trap XML definition file. Therefore, operation can be made suitable for the environment to be used. In addition, the fault management of devices not supported by Storage Cruiser is dynamically enabled by adding and editing the SNMP Trap XML definition file.

Since events can be linked to the Systemwalker Centric Manager and shell / batch files that can be edited as desired by users, operation can be made suitable for the environment to be used.

Fault Monitoring Using Device Polling

The device polling is a function for Storage Cruiser's manager to observe regularly the state of all devices connected with LAN by using SNMP, ping, or unique protocol.

When the SNMP Trap from the device cannot be received, the change in the state of the device can be detected and the network error between each device and the Management Server of this software can be detected by this function.

This function is effective to the manually embedded device.

Fault Monitoring by Checking Current Status of Devices

For the following devices that support automatic updates of the device component status, the Storage Cruiser's manager acquires the device status and device component status automatically from the device. For this reason, no operation is required to acquire the latest status information of the device.

Table 4.1 Storage Devices Supporting Automatic Acquisition of Device Component Status

Storage Devices Supporting Automatic Acquisition of Device Component Status	Required Firmware Version
ETERNUS DX S5/S4 series	None (All versions are available)
ETERNUS DX S3 series	V10L60 or later
ETERNUS AF All-Flash Arrays	None (All versions are available)
ETERNUS DX200F	V10L60 or later

For devices that do not support automatic updates of the device component status, the Storage Cruiser's manager acquires the device status automatically from the device, but does not acquire the device component status automatically. To check the latest device component status, operation is required to acquire the latest status information of the device. Performing operation to acquire the latest status information changes the device component status from the current status.

If a problem occurs, a device status changes the display corresponding to its status.

4.4 Performance Management

When the performance information acquisition is issued for devices which the performance is managed by Storage Cruiser, Storage Cruiser obtains the performance information from the devices and saves the obtained information on the Management Server. The performance information can be displayed and managed in Web Console.

Storage Cruiser supports this function for the following devices.

- Fibre Channel switches
- ETERNUS DX series
- ETERNUS AF All-Flash Arrays
- ETERNUS DX200F
- NetApp FAS Series (data collection only)

This function can be used to obtain the detailed operational status and load status of a device. Additionally, by knowing the number of active disks, it is possible to verify the Eco-mode status of the ETERNUS DX series, ETERNUS AF All-Flash Arrays, and ETERNUS DX200F.

A threshold can be set for particular information. The function can detect a potential bottleneck and be used to address the problem.

Point

The performance information can be referenced using Systemwalker Service Quality Coordinator. For details, refer to the Systemwalker Service Quality Coordinator manuals.

4.5 Thin Provisioning Management

The ETERNUS DX series (excluding the ETERNUS DX60 S2), ETERNUS AF All-Flash Arrays, and ETERNUS DX200F are equipped with a storage capacity virtualization function that uses Thin Provisioning technology.

Thin Provisioning technology virtualizes and allocates storage resources, thus enabling the physical capacity of the storage to be reduced. Environments where Thin Provisioning technology have been installed manage physical disks as a common disk pool, and allocations to servers are treated as allocations to a virtual volume. When writing to a virtual volume, physical disks are allocated from the disk pool in accordance with the size of the data being written. Physical disks can be extended in accordance with the disk pool busy rate without affecting the servers. This enables users to start operation using only a small physical disk capacity to make large capacity virtual disk allocations to servers, thus keeping the initial investment low (small start).

Storage Cruiser provides the following functions for the above storage devices where Thin Provisioning technology have been installed.

- Configuration management

This function makes the associations between virtual volumes and physical disks visible. Web Console displays the associations between the configuration that is virtualized by means of thin provisioning (disk pool and virtual volumes) and the physical configuration (RAID groups and physical disks). This function makes it easy to check the affected location when a physical disk fault or other problem occurs.

- Threshold monitoring

This function monitors the disk pool threshold values and performs capacity management. Threshold values are established for the physical disk pool and these values are monitored so that consumption of the physical capacity does not cause disk pool shortages. When the disk busy rate reaches the threshold value, this function notifies using SNMP Traps.

- Capacity management

This function displays the Thin Provisioning Pool Capacity and its changes in the capacity used graphically to grasp the changes in the capacity used for the Thin Provisioning Pool. This enables users to grasp the period to expand the size of the physical disk for the Thin Provisioning Pool, or to review the threshold setting according to the situation.

4.6 Energy-saving Operation for Storage Devices

Eco-mode based on Massive Arrays of Idle Disks (MAID) can be configured for storage devices. Performing either of the following controls during a period of time of not accessing disk drives can reduce power consumption, leading to the reduction of loads on environments:

- a. Spindle rotation control of disk drives
- b. Power control of disk drives

The above "b" is recommended. It can reduce power consumption more effectively than the above "a". The devices that support "b" are shown below.

Table 4.2 Devices That Support Power Control of Disk Drives

Storage Device Name	Required Firmware Version
ETERNUS DX S5/S4 series	None (All versions are available)
ETERNUS DX60 S3	None (All versions are available)
ETERNUS DX100 S3/DX200 S3 ETERNUS DX500 S3/DX600 S3	V10L20 or later
ETERNUS DX8000 S3 series	None (All versions are available)



Note

Eco-mode operation cannot be performed on the ETERNUS AF All-Flash Arrays and ETERNUS DX200F. Performance information such as the number of active disks, power consumption and temperature can be displayed.

Storage Cruiser provides the following functions.

- Controlling Eco-mode

Eco-mode of the ETERNUS DX series can be controlled with Web Console or the command.

- Displaying performance information for number of active disks

For the ETERNUS DX series, of the disk drives mounted on the storage devices, the following disk drive count is displayed as the number of active disks.

Table 4.3 Number of Active Disks

Eco Mode Set to RAID Group to Which Disk Drives Belong	Number of Active Disks
Spindle rotation control of disk drives	Number of disk drives whose spindle is rotating
Power control of disk drives	Number of powered disk drives
Eco-mode unset	Number of powered disk drives

The following storage devices display the number of disk drives whose spindle is rotating as the "number of active disks".

Storage Device Name	Firmware Version
ETERNUS DX100 S3/DX200 S3 ETERNUS DX500 S3/DX600 S3	Less than V10L20
ETERNUS DX S2 series	All versions

For the ETERNUS AF All-Flash Arrays and ETERNUS DX200F, all the disk drives are displayed as the number of active disks.

- Displaying power consumption and temperature performance information

The amount of power used by the ETERNUS DX series, ETERNUS AF All-Flash Arrays, and ETERNUS DX200F as a whole is displayed as "Power consumption".

The peripheral temperature (fan intake temperature) of a storage device is displayed as "Temperature".

By using the performance information for power consumption, the effects of energy-saving operations can be easily verified.

By using the performance information for temperature, the air-conditioning effects at the device periphery can be easily verified.

4.7 NAS Management

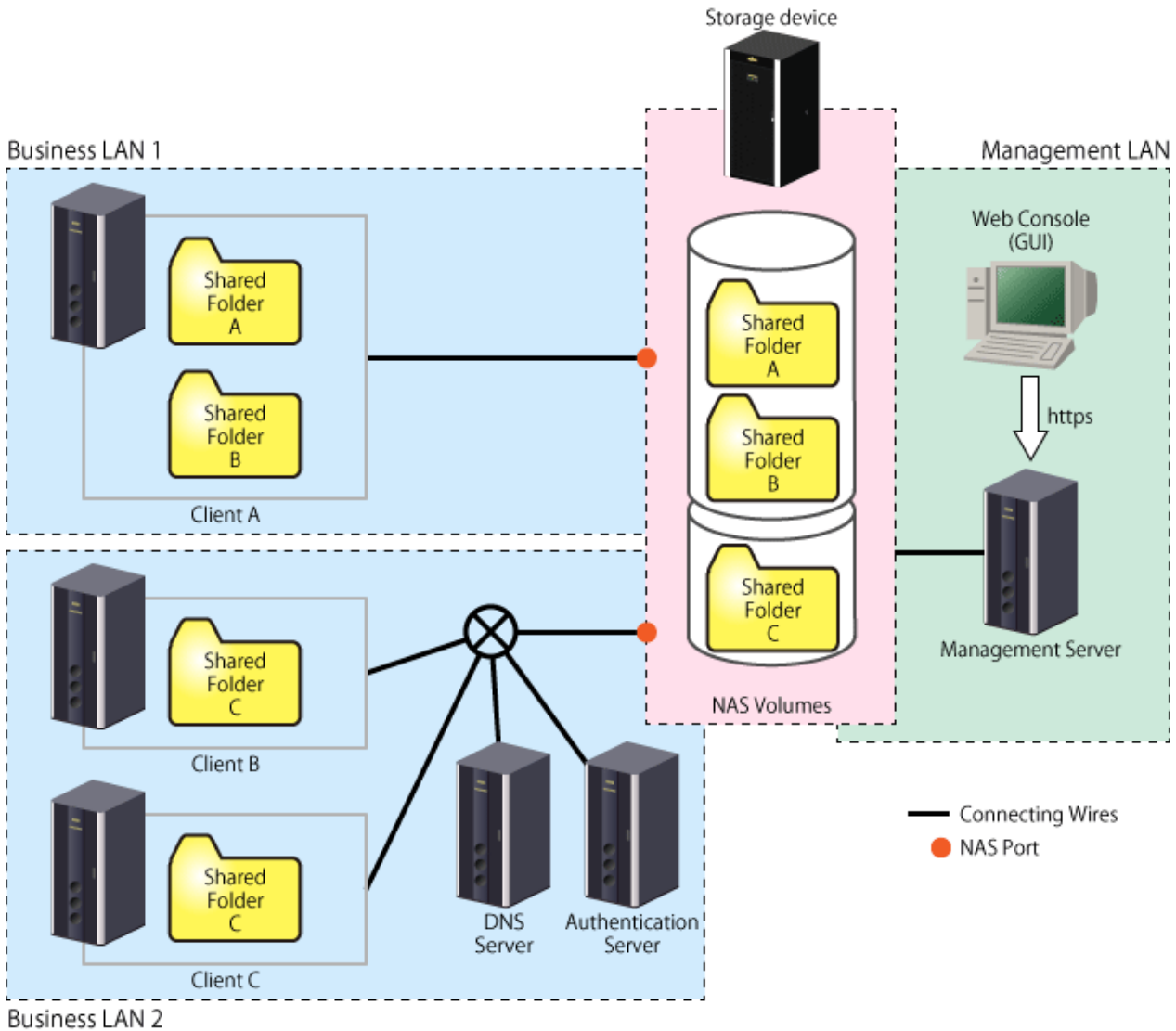
Storage Cruiser manages the following storage devices that are multi-protocol storage with a block access interface (SAN) and a file access interface (NAS).

- ETERNUS DX100 S5/DX200 S5, DX500 S5/DX600 S5
- ETERNUS DX100 S4/DX200 S4, DX500 S4/DX600 S4
- ETERNUS DX100 S3/DX200 S3, DX500 S3/DX600 S3

With Web Console, various features for operating the NAS file system of above storage devices where NAS function is installed file system can be utilized.

The basic system configuration of NAS operation is as follows.

Figure 4.2 Basic System Configuration of NAS Operation



It is necessary to perform a NAS Configuration on the Management Server.

Connect the Management Server and the storage device with a management LAN. Access to the Management Server can be performed from either the Management Server or Web Console of a terminal within a network capable of HTTPS communication with the Management Server.

The NAS feature of the storage device can be accessed by a client through one or more business LANs.

It is recommended that a business LAN include a DNS Server for name resolution and an authentication server for authenticating NAS accesses into the NAS file system.

Point

- When an authentication system is not used for the NAS file system, it is unnecessary to set up an authentication server in the storage management system.
If an authentication system is not implemented then the NAS file system can be accessed from any clients connected to the business LAN. It is strongly recommended that an authentication server is properly configured and implemented.
- When the firmware version of the storage device to be used is V10L53 or later, creating a local user/local group on the storage device for connecting to NAS can implement an authentication system without setting up an authentication server.

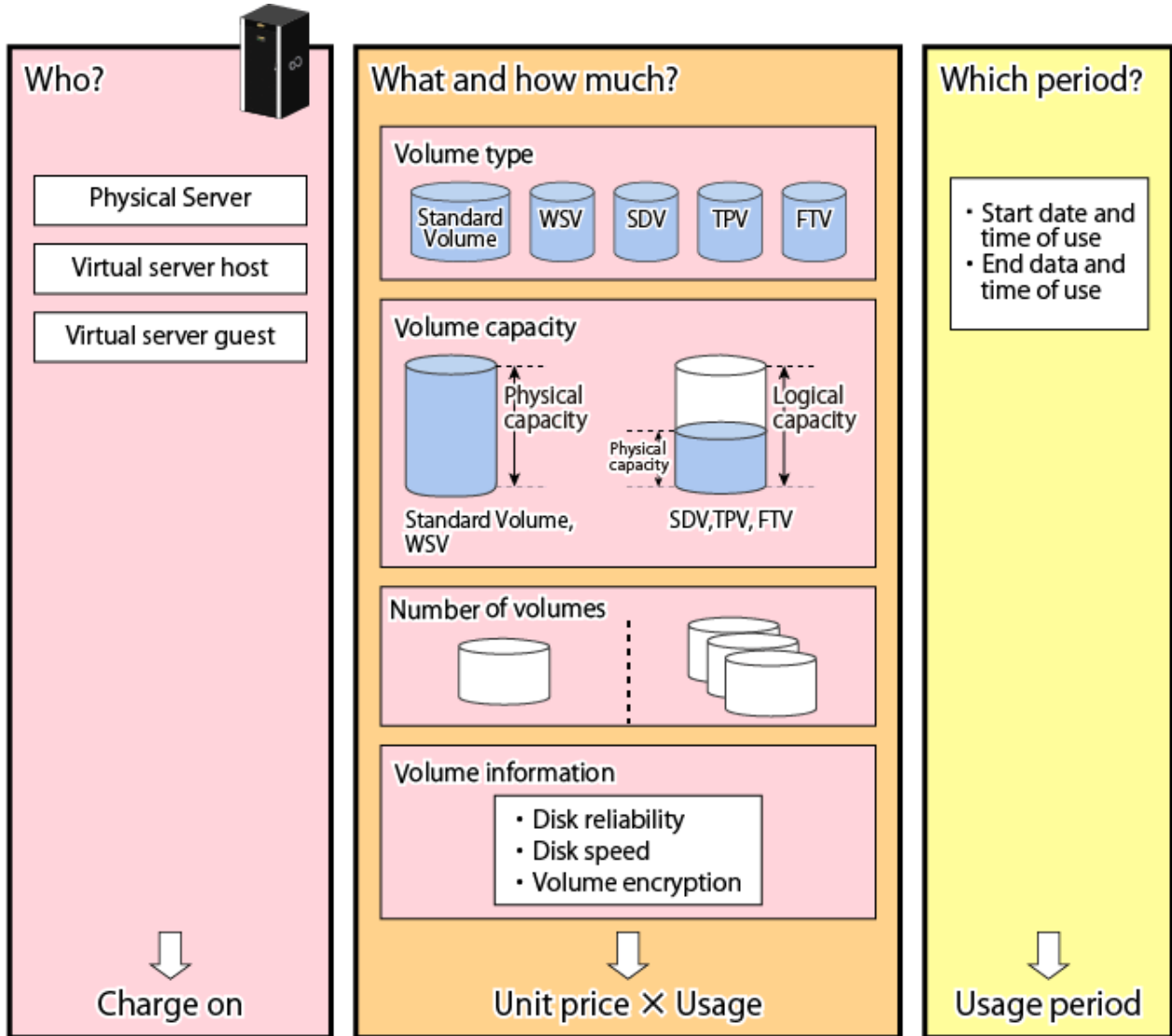
4.8 Reporting Function

The Reporting function collects the information associated with volumes connected to servers and outputs the information required for charging such as capacity information and usage time.

To collect information required for charging, the following points should be made clear.

- Who used it?
- What and how much was used?
- In which period was it used?

Figure 4.3 Required Information for Charging



Information Collectable by Reporting Function

The information collectable by the Reporting function is as follows.

Table 4.4 Information Collectable by Reporting Function

Information Collectable by Reporting Function	
Unit of counting servers	Physical server
	Virtual server host

Information Collectable by Reporting Function	
Volume type and capacity	Physical capacity of Standard Volume
	Physical capacity of Wide Striping Volume (WSV)
	Logical capacity of Snap Data Volume (SDV)
	Logical capacity of Thin Provisioning Volume (TPV)
	Logical capacity of Flexible Tier Volume (FTV)
Usage period	Start date and time of use
	End date and time of use
Volume information	RAID level
	Disk type: SAS, SSD, SED-SAS
	Volume encryption

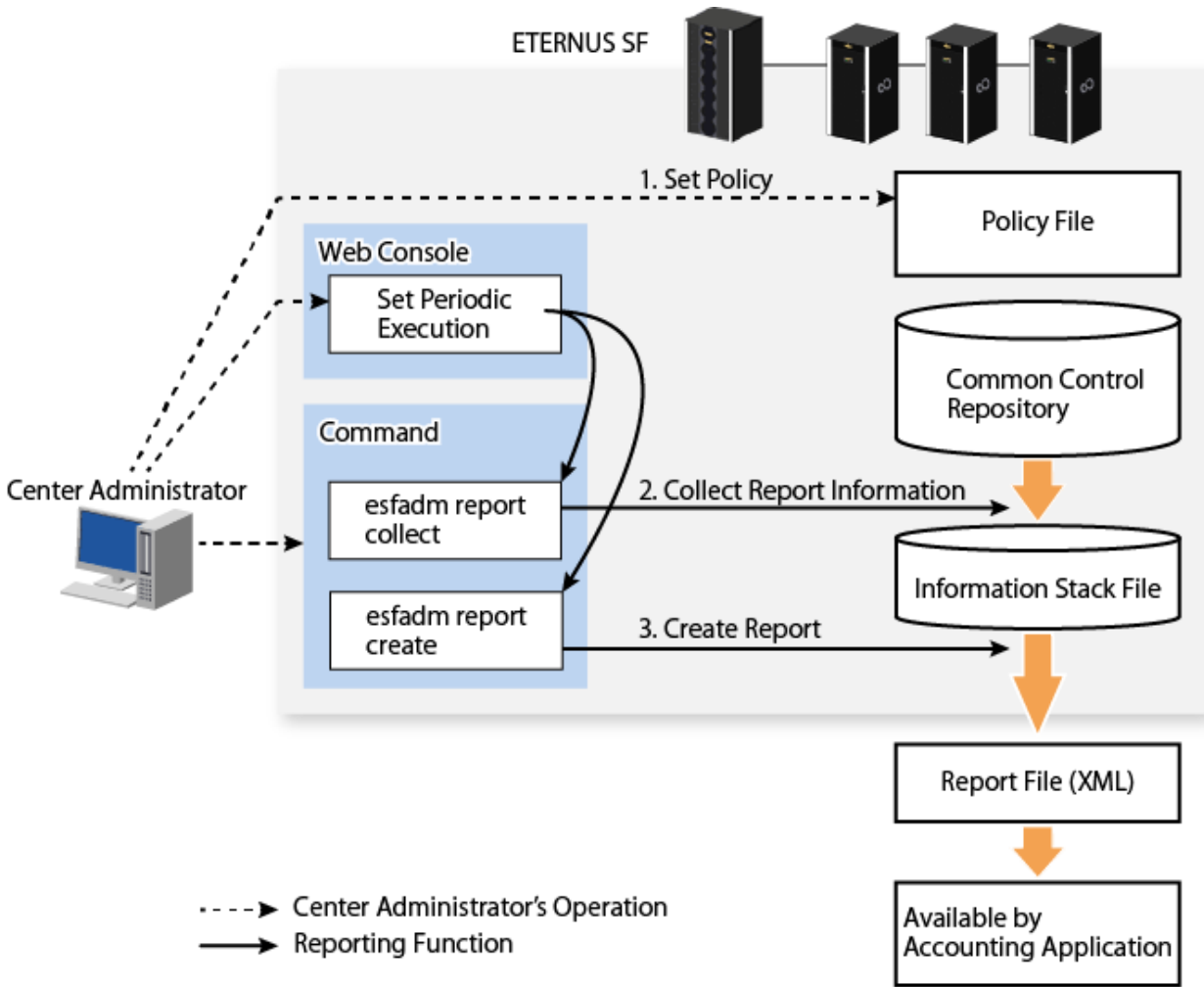
 **Information**

The following information cannot be collected by the Reporting function.

- Virtual server guest
- Physical capacity of SDV, TPV, and FTV

In the Reporting function, the procedure flow that creates a report containing information required for charging is as follows.

Figure 4.4 Report Creation Flow



Item	Description
Common Control repository	Database that stores configuration information of the devices to be managed
Report information	Required information for charging (configuration information related to volumes)
Information stack file	File that accumulates report information
Policy file	Configuration file for activities of the Reporting function
Report file	File that has output report information
Accounting application	Application to make an invoice from a report file (made by the center administrator)

1. Set policy

Set up a policy file for activities of the Reporting function.

2. Collect report information

Use the "esfadm report collect" command to store report information in the information stack file from the common control repository.

3. Create report

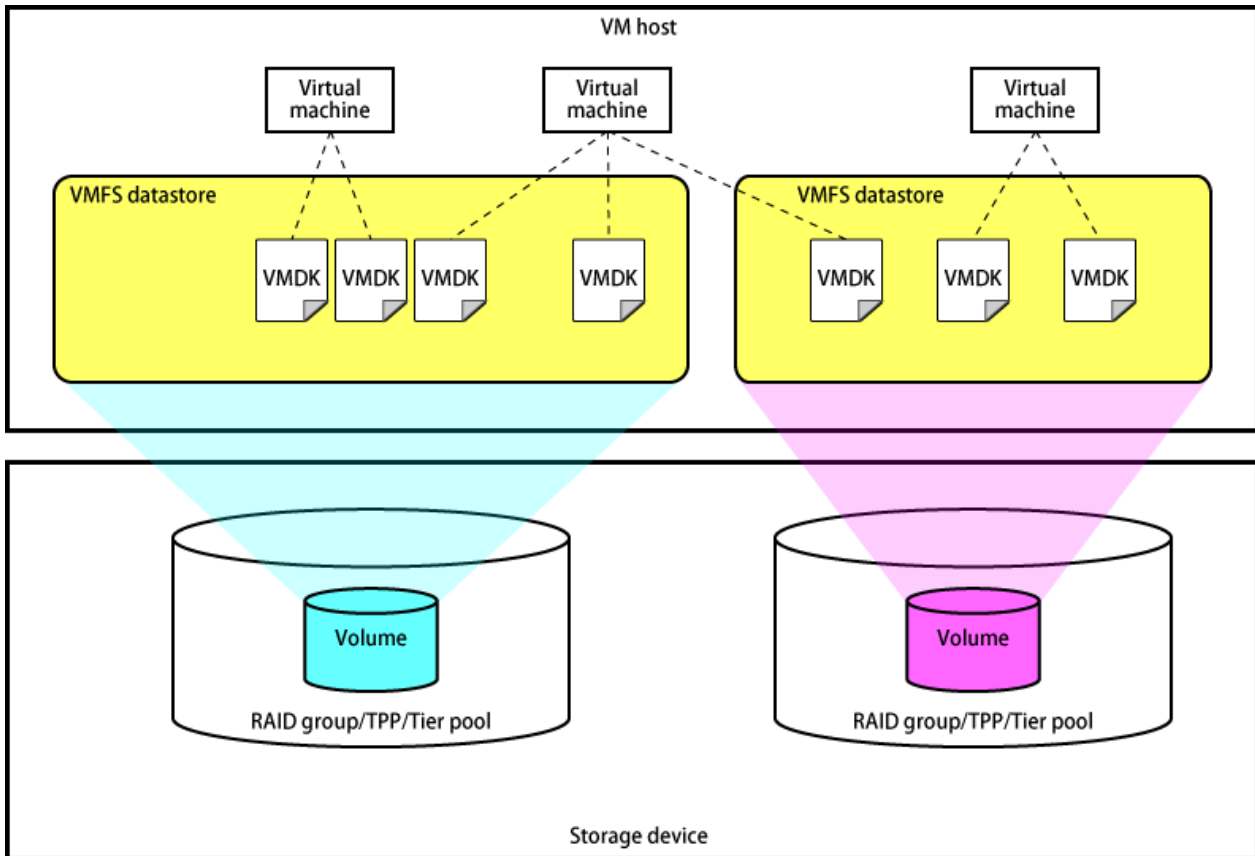
Use the "esfadm report create" command to tally up report information in the information stack file based on the policy file and create a report file.

4.9 VMware vSphere Virtual Volumes Function

VMware vSphere Virtual Volumes is a technology that offloads VMDK file operations that was previously performed on VMFS to the volume operation of the storage device.

In VMFS, one formatted volume was counted as a VMFS datastore, and multiple VMDK files created on the VMFS datastore constituted one virtual machine. For this reason, virtual machine operation was realized by operating the files in the VMFS, and the advanced functions of the storage device were not fully utilized.

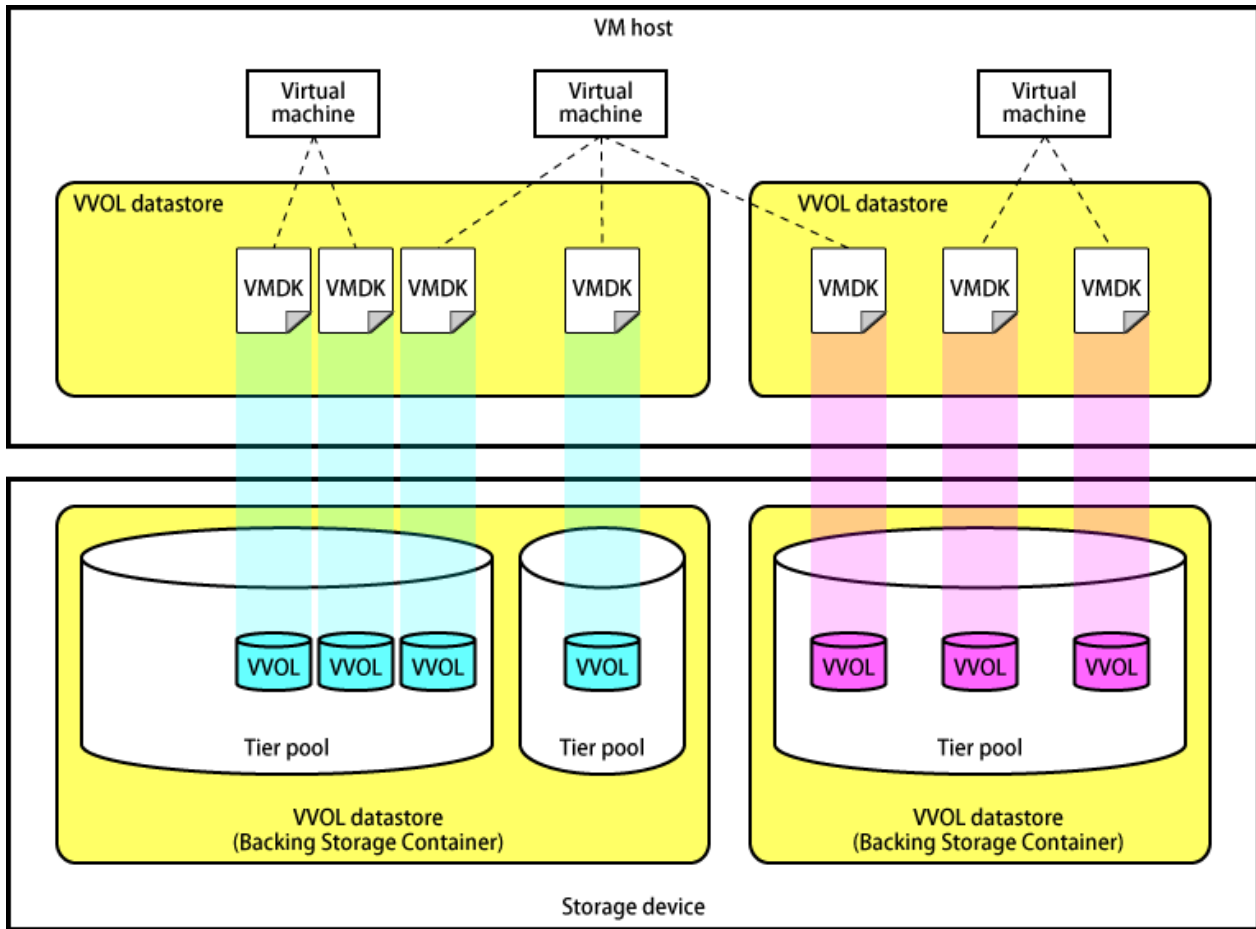
Figure 4.5 VMFS Environment



In VMware vSphere Virtual Volumes, the logical area configured in a storage device as a datastore and individual volumes created in that area as VMDK, makes up the virtual machine. This makes it possible to utilize the various functions of the storage device for each virtual machine. A datastore for Virtual Volumes is called "VVOL datastore".

The VMware vSphere Virtual Volumes function can simplify performance design and performance analysis for the storage devices. In addition, backups for each virtual machine can be obtained. By using the Advanced Copy function of the storage device within the same device, VMware standard snapshots and clones can be created, and high-speed Storage vMotion process can be realized.

Figure 4.6 VMware vSphere Virtual Volumes Environment



Information

In the VMware vSphere Virtual Volumes function, a datastore configured on the storage device side is referred to as "Backing Storage Container".

An overview of the major functions of Storage Cruiser for VMware vSphere Virtual Volumes is as follows.

- WVOL access path management

In VMware environments with VMFS, recognizing volumes in VM hosts in order to configure the VMFS datastore, setting access paths (FC switch zoning and host affinity for the storage device) between the VM host and the storage device was required.

Even in VMware vSphere Virtual Volumes environments, access path settings are required. However, since a WVOL datastore is not a volume, unlike the previous host affinity setting, the host affinity setting is required so the WVOL datastore can be recognized.

Storage Cruiser offers the function to manage access paths between VM host and WVOL datastore as well as the function to manage access paths between the storage device and the VM host.

From now on, access paths other than WVOL access path are referred to as "access path" in the Storage Cruiser manuals.

- WVOL datastore configuration management

WVOL datastore is a logical area for locating Virtual Volumes created for the control of a virtual machine. In Storage Cruiser, one WVOL datastore is comprised of one Tier pool or multiple Tier pools. Where Tier pools in the WVOL datastore Virtual Volumes are located is automatically determined by a policy specified for the virtual machine.

- Correlation management

In the End to End view (VMware), the relationship from virtual machines to Virtual Volumes is displayed, and detailed information of the components of each related device can be displayed.

- Performance management

Performance information for each Virtual Volume is collected from the storage device, displayed in a graph, and the load status and performance analysis of each virtual machine is supported.

- VM storage policies

The structure of VM storage policies is a standard function of VMware vSphere Virtual Volumes. By preparing for the requirements of the virtual machine and storage device as a policy in advance, a VVOL datastore that meets the policy in accordance with various operations of the virtual machine (new virtual machine creation, snapshot, clone, Storage vMotion) can be selected.

In Storage Cruiser, by defining various settings for Automated Storage Tiering, Automated QoS, and virtual machine backup functions as a policy, VVOL datastores and Tier pools that satisfy the policy can be selected, and collective control can be enforced for created Virtual Volumes and virtual machines.



See

Refer to "Operating Environment" in the *Storage Cruiser / AdvancedCopy Manager Operation Guide for VMware vSphere Virtual Volumes* for details of the conditions required for using this function.



Note

The following functions do not support VMware vSphere Virtual Volumes.

- Reporting function
- Storage Cluster function



Point

By adding the ETERNUS SF AdvancedCopy Manager Local Copy License and using the virtual machine backup function, a backup can be taken for each VM guest. If it is within the same storage device, the Advanced Copy function of the storage device can be used to achieve VMware standard snapshot and clone, and Storage vMotion processing at high speed.

Refer to "[6.6.1 Virtual Machine Backup Operation on VMware vSphere Virtual Volumes Environment](#)" for the overview of the virtual machine backup function.

4.10 Automated Storage Tiering



Point

To use this function, the ETERNUS SF Storage Cruiser Optimization Option license is required.

Automated Storage Tiering optimizes the performance and cost by managing disk drives in pools and by automatically relocating data in the storage device to the appropriate disk in block units smaller than the volume capacity according to the access state.

For storage devices with mixed disks of different types, because frequently accessed data can be arranged in high-speed disks such as SSDs and infrequently accessed data can be arranged in low cost, high capacity Nearline disks, optimal performance can be attained to match the cost. The settings for the server connected to the storage device do not need to be changed even if a data relocation is performed.

In Automated Storage Tiering, the managed pool is called "Tier pool" or "Flexible Tier Pool (FTRP)" and 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)".

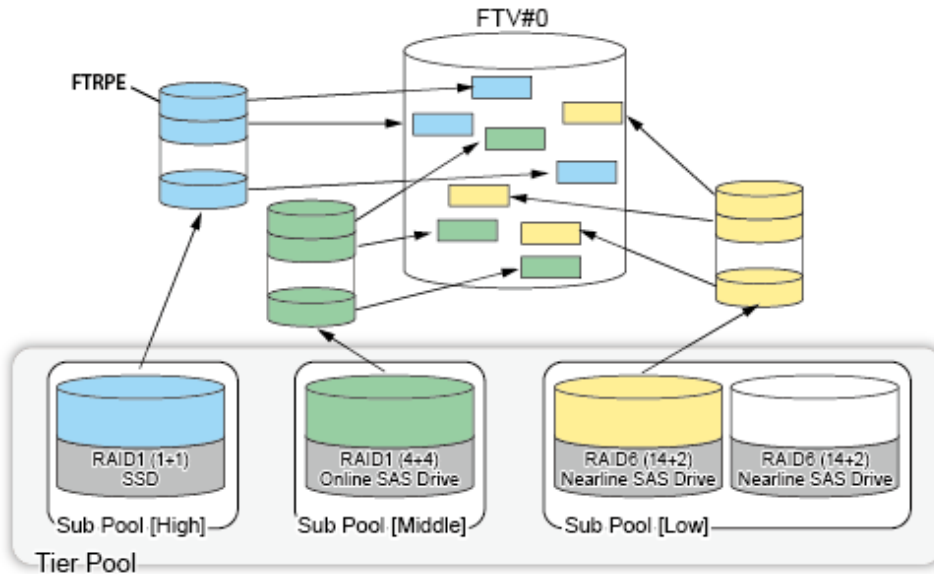
The sub-pool is configured of assignment units referred to as "Flexible Tier Pool Element (FTRPE)", and the evaluation of access status in order to perform Automated Storage Tiering is conducted with every FTRPE.

P Point

- There is an upper limit for the number and total capacity of Tier pools that can be managed by Automated Storage Tiering. Refer to "Upper Limit of Automated Storage Tiering" in the *Installation and Setup Guide* for details.
- There is an upper limit for the total number of Tier pools used that can simultaneously evaluate the Automated Storage Tiering access status data. The value 2 PB is set by default, but can be customized. Refer to "Customizing Automated Storage Tiering Configuration File" in the *Installation and Setup Guide* for information on how to customize the value.

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

Figure 4.7 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.

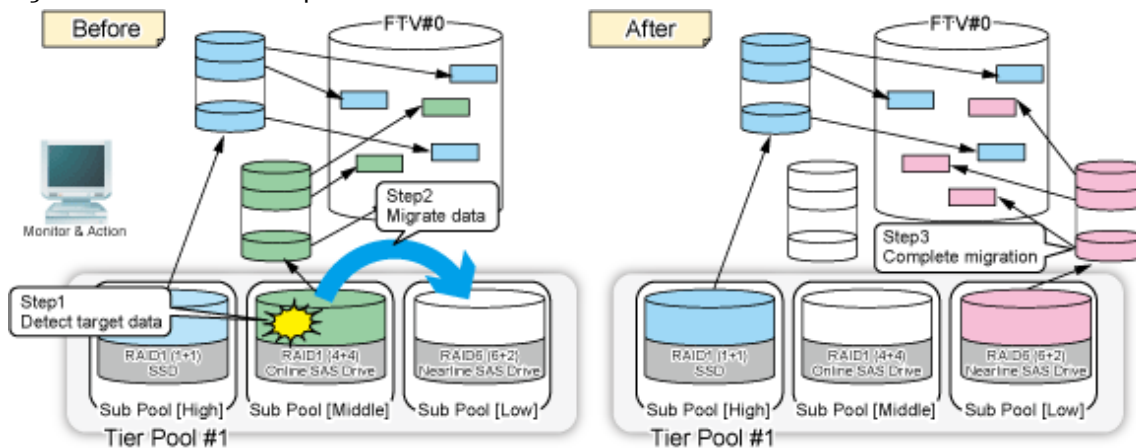
Relocation according to the access status is performed in the following manner.

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 4.8 Execution Example of Relocation



With Storage Cruiser, the evaluation time, Evaluation Period, evaluation standard, and Execution Mode can be selected as "Tiering policies".

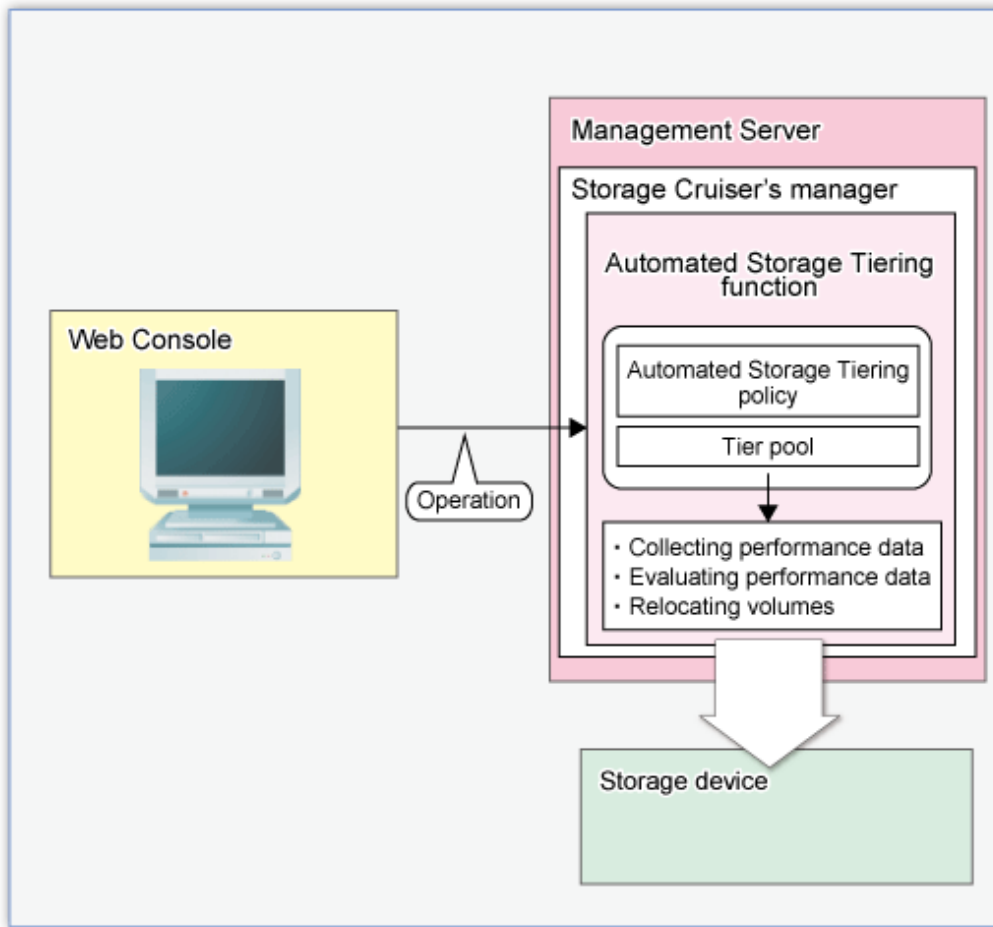
By collecting and evaluating access status data from the server, based on Tiering policies, and automatically relocating configuration units of the volume (FTRPE) to the appropriate sub-pool, Storage Cruiser realizes optimized utilization of storage resources.

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. It is recommended 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 before starting operation of Automated Storage Tiering.

With Web Console, all operations of Automated Storage Tiering can be performed.

Figure 4.9 System Configuration



4.11 Automated QoS Function

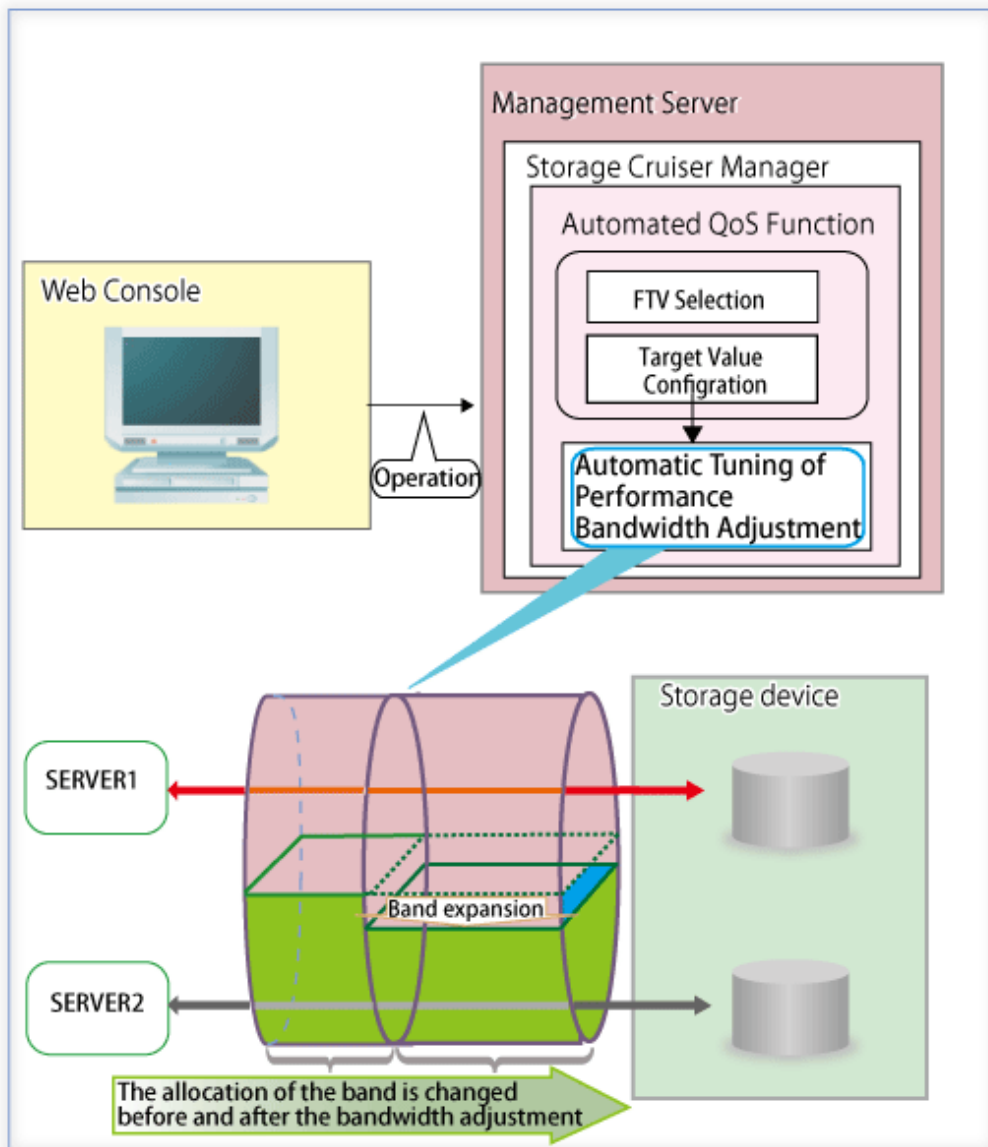
Point

To use this function, the ETERNUS SF Storage Cruiser Quality of Service Management Option license is required.

For environments that share the storage device with multiple operations, the desired I/O performance for the operation may not be guaranteed depending on resource conflicts. With the Automated QoS function, to achieve the target value of the I/O performance that is set for the volume by the user, the balance of the I/O performance between the volumes that share the storage device is automatically adjusted based on the performance information of the switch and the storage device.

The target value for "Automated QoS Priority" (volume priority) or "Target Response Time" (objective 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.

Figure 4.10 Overview of Automated QoS Function



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.

4.12 Storage Cluster Function

Point

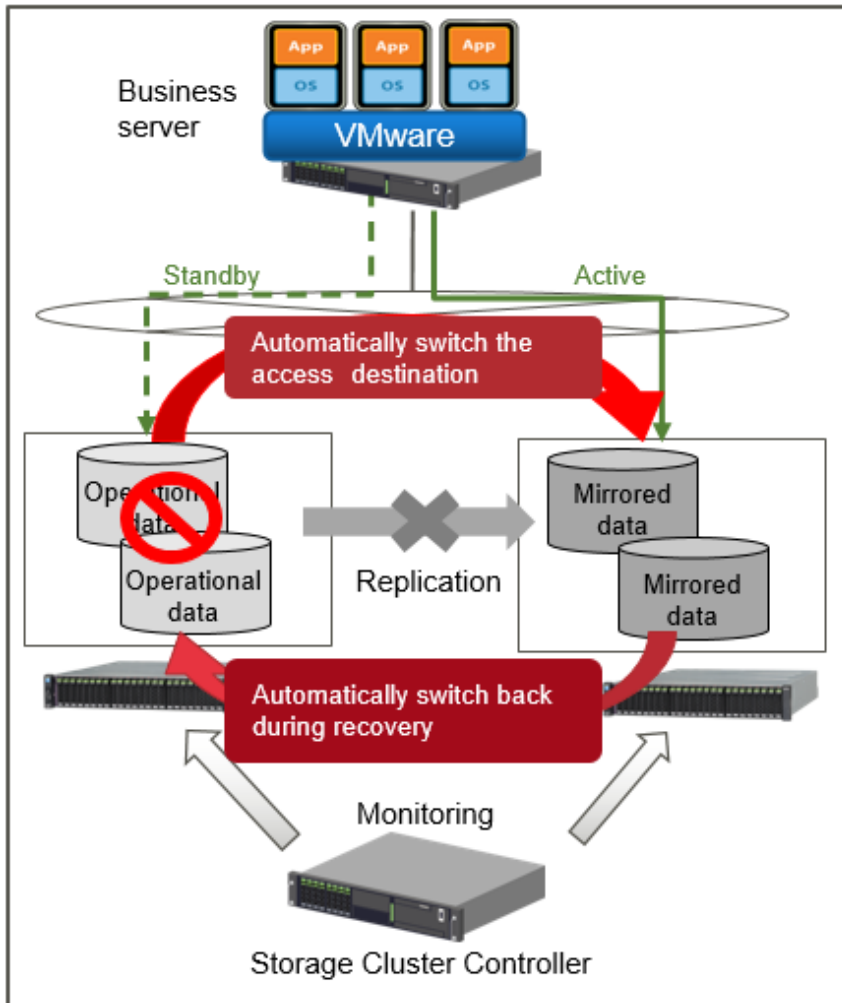
To use this function, the following licenses is required.

- ETERNUS SF Storage Cruiser Storage Cluster Option license
- ETERNUS SF AdvancedCopy Manager Remote Copy License

If one storage device is down between two storage devices, the Storage Cluster function fails over transparently to the other storage device. A high availability system can be realized with storage devices. Failures that occur in the storage system are automatically

detected and because the access destination storage device is automatically switched without affecting the business server, business can continue.

Figure 4.11 Image of Storage Device Being Automatically Switched with Storage Cluster Function



Usage scene examples of the Storage Cluster function are as follows.

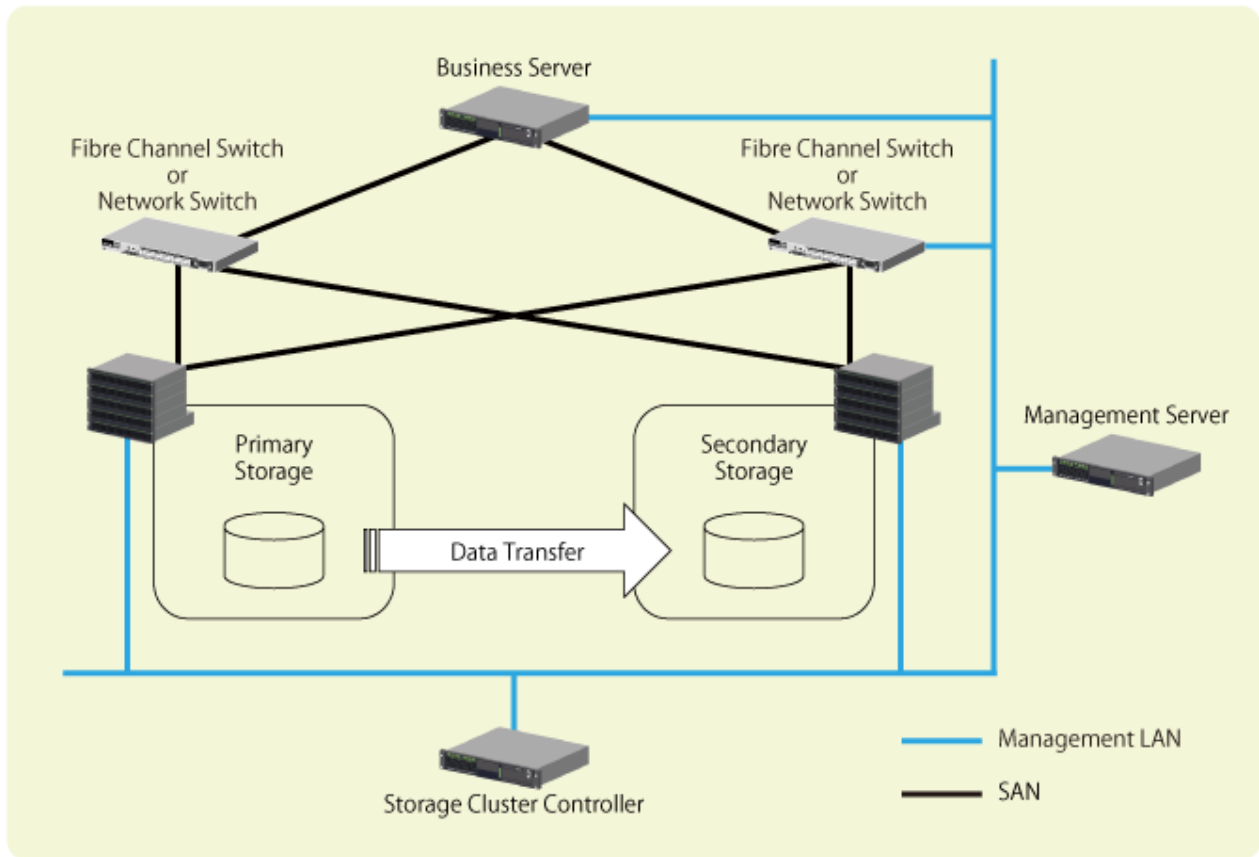
- Business continuity during planned power outages of the building and during maintenance of the storage device
- Improving availability in the event of disasters in the building such as a fire
- Improving availability by combining a redundancy mechanism (VMware vSphere High Availability) for the server virtualization environment

There are two ways of failover to storage device as follows.

Failover Method	Explanation
Automatic failover	The Storage Cluster function monitors the life of storage devices. If any failure in one storage device, switchover to the other storage device is automatically done. To use this method, Storage Cluster Controller must be required.
Manual failover	Failover is directed and performed through Web Console.

The following is a description of basic system configuration required to use the Storage Cluster function.

Figure 4.12 System Configuration Example When Using the Storage Cluster Function



The "Primary Storage" is a storage device used as an active system.

The "Secondary Storage" is a storage device used as a standby system.

The "Storage Cluster Controller" is a server that monitors the Primary Storage and the Secondary Storage.

Chapter 5 Overview of AdvancedCopy Manager

5.1 What is AdvancedCopy Manager?

AdvancedCopy Manager is a storage management software that achieves high speed backup/restore and replication by utilizing the Advanced Copy function of storage devices.

AdvancedCopy Manager also responds to backup of virtual volumes in a server virtualization environment, online backup in cooperation with applications, and green IT features to support the continuity of diverse business systems.

The following devices can be managed with AdvancedCopy Manager.

Table 5.1 Devices Can Be Managed with AdvancedCopy Manager

Device Type	Device Name
Storage devices	ETERNUS DX series ETERNUS AF All-Flash Arrays ETERNUS DX200F

Information

In this chapter and "[Chapter 6 Function Overview of AdvancedCopy Manager](#)", unless there is a special disclaimer, the term "storage device" indicates the devices described in the above table.

5.2 AdvancedCopy Manager Features

High speed Backup and Replication without Loading Business Systems

AdvancedCopy Manager uses the Advanced Copy function of the storage devices to copy data. Even as the amount of data to be processed increases, the high speed data copy keeps the backup windows to a minimum. The downtime required for backups and replication is drastically reduced. In addition, since data copy processing is performed within the storage devices, backup and replication are achievable without loading business systems.

Non-downtime Application Backup

Suspension of operation for backups can be avoided by coordinating with major databases, including Exchange Server, SQL Server, Oracle, DB2, and FUJITSU Software Symfaware. 24-hour and 365-day continuous operation is feasible.

Simplification of Exchange Server and SQL Server Operations

AdvancedCopy Manager provides wizards to simplify Exchange Server and SQL Server operations.

- Wizard to create backup environments

The risk of human error is reduced, and backup environments can be created quickly.

Registering the backup script generated by a wizard in the scheduler of this product enables regular backup operations.

- Wizard to perform a restore

Operation downtimes can be reduced as a restore can be performed safely and securely based on information provided during backup.

Information

To use the wizard that performs a restore, the option license described in "[5.4 Product Structure of AdvancedCopy Manager](#)" is required.

Energy-saving Operation for Storage Devices

To reduce power consumption of storage devices, backup destination disks can be scheduled to spin-up for backup windows and power down when unused. Storage Cruiser's visualization of power consumption and temperatures, allows for easy verification of power-savings.

Provision for Disaster Recovery Solutions

The Remote Advanced Copy function of the storage device can copy and store data to the storage devices at remote sites, minimizing the risk of data loss from a disaster. Business can be quickly resumed after a disaster by either accessing data at the remote site or recovering the data to the primary site.

Backup Operation for TFOVs Managed by the Storage Cluster Function

AdvancedCopy Manager Copy Control Module provides a function to back up from a TFOV (that is a volume managed by the Storage Cluster function) to a non-TFOV (that is not a volume managed by the Storage Cluster function).

Replication Operation Using the Storage Cluster Continuous Copy Function

In a Storage Cluster environment, if a failover occurs in the primary storage device while executing Advanced Copy, the secondary storage device can continue the copy operation by automatically taking over the Advanced Copy process.

Backup Operation for NAS Volumes in NAS Environments

For the NAS file system in a storage device, high-speed backup and restore of NAS volumes can be performed using the Advanced Copy function of the storage device.

The use of the NAS backup volume provides protection against loss or corruption of the active NAS volume. In addition, the NAS backup volume can be accessed Read-Only for file level recovery.

Snapshot and Backup on a per Virtual Machine Basis in VMware vSphere Virtual Volumes Environments

In a VMware vSphere Virtual Volumes environment, high-speed snapshot, backup, and restore on a per virtual machine basis can be performed using the Advanced Copy function of the storage device.

Operation for AdvancedCopy Manager Operating Environment with Web Console

For the operation environments using the backup management function or the replication management function, the operations can be performed from web browsers. In addition, the operations can also be performed at the command line as well as Web Console.

5.3 Component Structure of AdvancedCopy Manager

AdvancedCopy Manager comprises three components.

Table 5.2 Components of AdvancedCopy Manager

No.	Component Name	Supported Operating Systems (A=Available, N/A=Not Available)				
		Windows	Solaris	Linux	HP-UX	AIX
1	AdvancedCopy Manager's manager	A	A	A	N/A	N/A
2	AdvancedCopy Manager's agent	A	A	A	A	A
3	AdvancedCopy Manager Copy Control Module	A	A	A	N/A	N/A

Point

After installation of the ETERNUS SF Manager program, if it is set up as the AdvancedCopy Manager's manager, it is possible to use AdvancedCopy Manager.



See

Refer to the following sections in the *Installation and Setup Guide* for details of the operating systems supported by above components.

- "Operating Environment" > "Operating Environment of ETERNUS SF Manager" > "Software Requirements"
- "Operating Environment" > "Operating Environment of AdvancedCopy Manager's Agent" > "Software Requirements"
- "Operating Environment" > "Operating Environment of AdvancedCopy Manager CCM" > "Software Requirements"

The AdvancedCopy Manager's manager manages the data in the storage device which composes the storage system and has the role of processing requests from Web Console.

The AdvancedCopy Manager's agent performs a backup and replication.

AdvancedCopy Manager Copy Control Module backs up and restores the business server data that exists in the storage device by using the Advanced Copy function of the storage device without coordinating with the business server.



Information

In the AdvancedCopy Manager manuals, the server where the AdvancedCopy Manager's manager works is referred as "Management Server" and the server where AdvancedCopy Manager Copy Control Module is installed is referred as "CCM Server". In addition, a server managed by the Management Server or the CCM Server is referred as "Managed Server".

5.4 Product Structure of AdvancedCopy Manager

The functions provided by AdvancedCopy Manager are organized according to the license.

Basic Licenses

Table 5.3 Basic Licenses of AdvancedCopy Manager

License Name	Explanation
ETERNUS SF AdvancedCopy Manager Local Copy License	You can use basic functions of AdvancedCopy Manager. Advanced Copy can be done inside a storage device only.
ETERNUS SF AdvancedCopy Manager Remote Copy License	You can use basic functions of AdvancedCopy Manager. Advanced Copy can be done between storage devices.

Option Licenses

Depending on the operation purpose of the storage system, multiple option licenses can be combined. There is no exclusive relationship for option licenses.

Table 5.4 Option Licenses of AdvancedCopy Manager

License Name	Explanation
ETERNUS SF AdvancedCopy Manager for Exchange Server	The Exchange Server mailbox database can be restored using the Restore Wizard.
ETERNUS SF AdvancedCopy Manager for Microsoft SQL Server	The SQL Server database can be restored using the Restore Wizard.



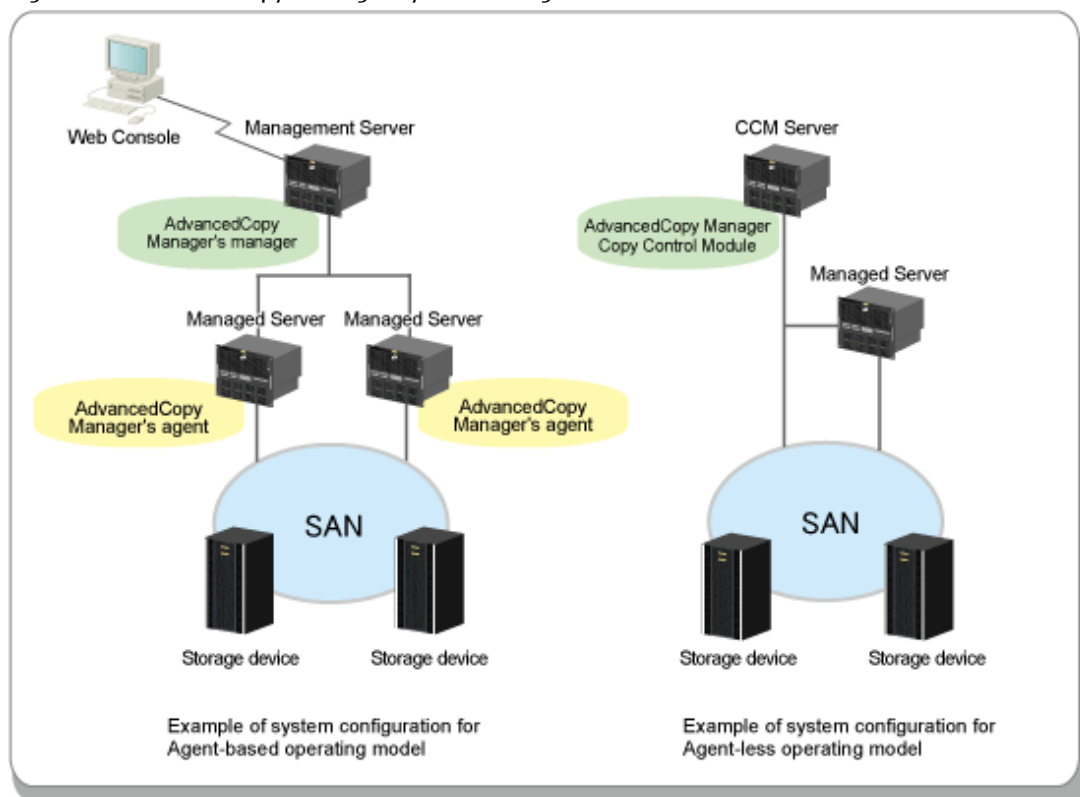
See

Refer to "[Chapter 6 Function Overview of AdvancedCopy Manager](#)" for the overview of functions provided by AdvancedCopy Manager.

5.5 System Configuration of AdvancedCopy Manager

The "Figure 5.1 AdvancedCopy Manager System Configuration" is a basic system configuration of AdvancedCopy Manager.

Figure 5.1 AdvancedCopy Manager System Configuration



The servers of which the operating environment of AdvancedCopy Manager consists may include the items described below.

- Management Server

The configuration of the operating environment for AdvancedCopy Manager requires a single Management Server. The Management Server's primary roles are as follows:

- Serve as centralized control center
- Maintain a database of Managed Servers and associated devices such as transaction volumes, backup volumes and replication pairs
- Accept requests from Web Console and execute the AdvancedCopy Manager functions

A single Management Server can manage multiple Managed Servers.

The Manager is equipped with agent functions. If the Management Server is connected to a storage device, the Management Server can additionally take up the role of a Managed Server.

Point

Only one Management Server can be placed in a single AdvancedCopy Manager operation environment. The relationship between a Management Server and Managed Server is only 1:n. A single Managed Server cannot be managed by multiple Management Servers.

- Managed Server

This server is a business server (where business applications are running), that is connected to a storage device and controlled by the Management Server or the CCM Server. A single operating environment of AdvancedCopy Manager can be set up with multiple Managed Servers.

To execute commands of the backup management function and replication management function on this server, the AdvancedCopy Manager's agent must be installed.

To back up resources for the storage device connected to a server without any AdvancedCopy Manager's agent installed on it, use AdvancedCopy Manager Copy Control Module.

- CCM Server

This server is a server that backs up the resources in the storage device in that server without the need to install the AdvancedCopy Manager's agent on the business servers that are connected to the storage device.

Setting up this type of server is not necessary if you do not use AdvancedCopy Manager Copy Control Module for backup.



Information

AdvancedCopy Manager Copy Control Module is included in the ETERNUS SF Manager program. Consequently, if you already have the ETERNUS SF Manager program installed, you have the AdvancedCopy Manager Copy Control Module available for use without any need to install it separately.

For using AdvancedCopy Manager Copy Control Module as included in the ETERNUS SF Manager program, the Management Server must be assigned as a CCM Server.

- Web Console

Web Console monitors and manages the AdvancedCopy Manager operating environment by connecting to the Management Server.

Refer to the *Web Console Guide* for information on the Web Console operating environment and its screens.

Installation to a Clustered System

- Installation of the AdvancedCopy Manager's manager

To increase the availability of the AdvancedCopy Manager's manager, make the system redundant by installing the AdvancedCopy Manager's manager to the clustered system.

Also, note that this product does not support configurations of managing a single operating system with multiple AdvancedCopy Manager's managers (multiple Management Servers environment).

- Installation of the AdvancedCopy Manager's agent

To increase the availability of the AdvancedCopy Manager's agent, make the system redundant by installing the AdvancedCopy Manager's agent to the clustered system.

- Installation of AdvancedCopy Manager Copy Control Module

To increase the availability of AdvancedCopy Manager Copy Control Module, make the system redundant by installing AdvancedCopy Manager Copy Control Module to the clustered system.

Also, note that this product does not support configurations of managing a single operating system with multiple AdvancedCopy Manager Copy Control Modules (multiple CCM Servers environment).



See

Refer to the *Cluster Environment Setup Guide* for information on how to install and set up AdvancedCopy Manager in a clustered system.

5.6 Operating Environment Models of AdvancedCopy Manager

With AdvancedCopy Manager, the following two operating modes are available:

- Agent-based operating model

This operating model requires the installation of the ETERNUS SF Manager program and the AdvancedCopy Manager's agent.

Use of this operating model requires that the installed ETERNUS SF Manager program is set up as the AdvancedCopy Manager's manager.

Application data copy is possible on a server where a business application is installed (hereafter "business server"). As a function to trigger scripts before and after the copy operation is provided, scripts can be customized to conform to the administration policies and allow flexible and optimized operations.

- Agent-less operating model

This operating model requires the installation of AdvancedCopy Manager Copy Control Module.

There is no need to install either the ETERNUS SF Manager program or the AdvancedCopy Manager's agent, therefore the time to get ready to start is shorter compared to Agent-based operating model. Moreover, as all the operations can be done directly on the server where AdvancedCopy Manager Copy Control Module has been installed, there are no requirements about the OS environment of the business server.

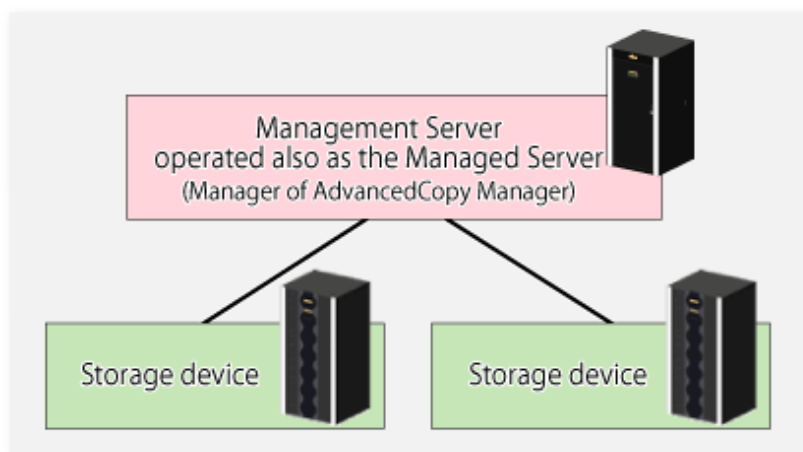
Unlike the copy operation with an agent, the copy is done per disk rather than per partition or slice. For this reason, the copy destination resource must be larger. Also, as copy is done without relation to the application running on the business server, the operator must ensure the integrity of the copied data. (for example, by performing the copy when the data is inactive).

5.6.1 Agent-based Operating Model

5.6.1.1 Single Business Server Configuration

If there is only one business server connected to the storage device, set up the AdvancedCopy Manager's manager on that server. Since the AdvancedCopy Manager's manager also provides AdvancedCopy Manager's agent functions, the Management Server role and the Managed Server role can be performed on one server.

Figure 5.2 Single Business Server Configuration



5.6.1.2 Multiple Business Servers Configuration

If two or more business servers are connected to storage devices, the following two configurations are possible.

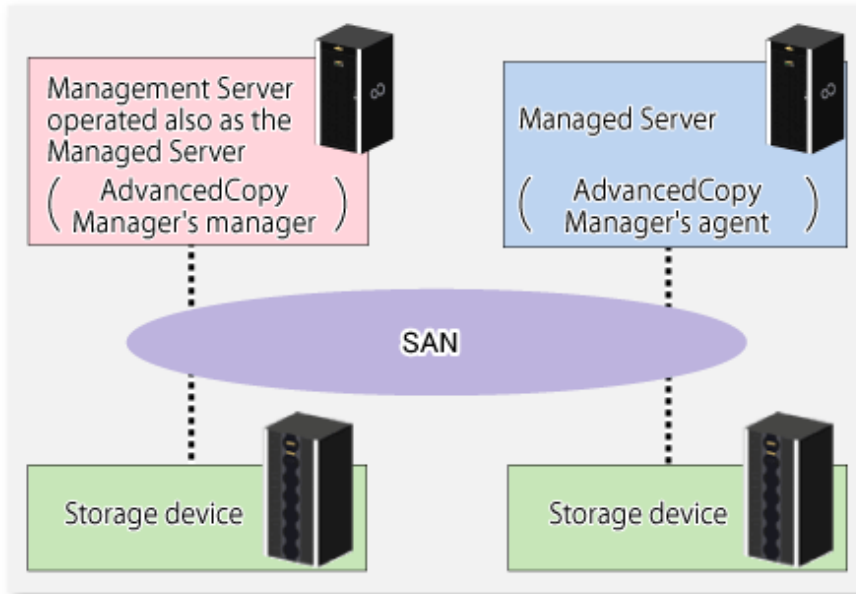
- A Managed Server is operated as a Management Server

One of the business servers functions as a Management Server. The Management Server has a repository where the information on operating and management of all Managed Servers is stored.

When many Managed Servers exist, they all compete for access to the repository. To ensure overall performance and other

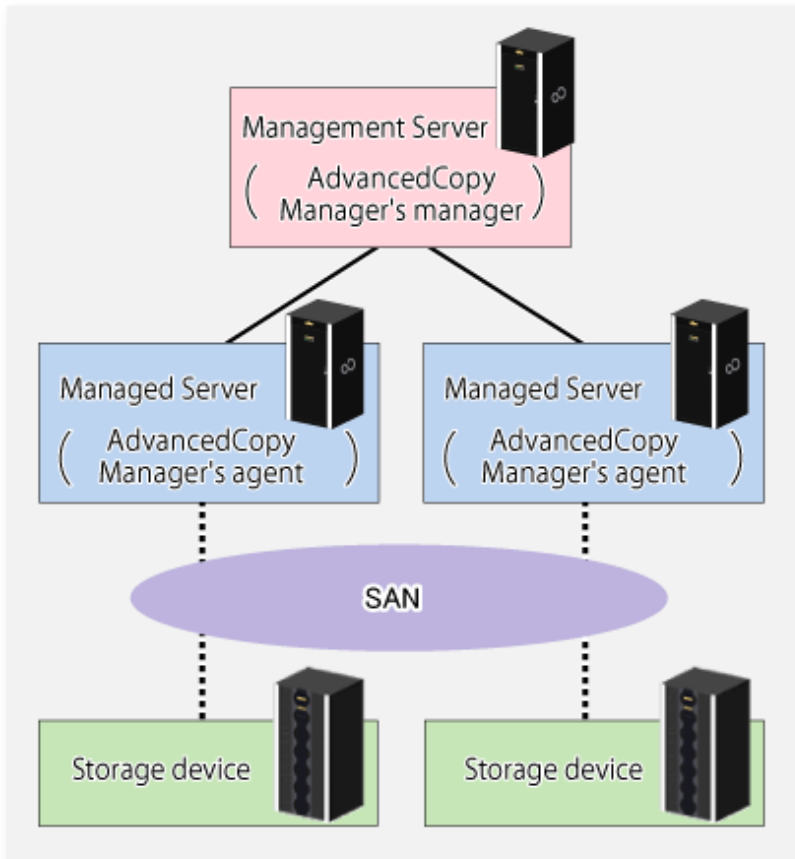
applications running on the same server are not adversely affected, the Management Server functionality should be installed on a dedicated server, or on a server on which the load of other applications is relatively low.

Figure 5.3 When Managed Server Is Also Operated as Management Server



- Dedicated Management Server manages Managed Servers

Figure 5.4 When Dedicated Management Server Manages Managed Servers



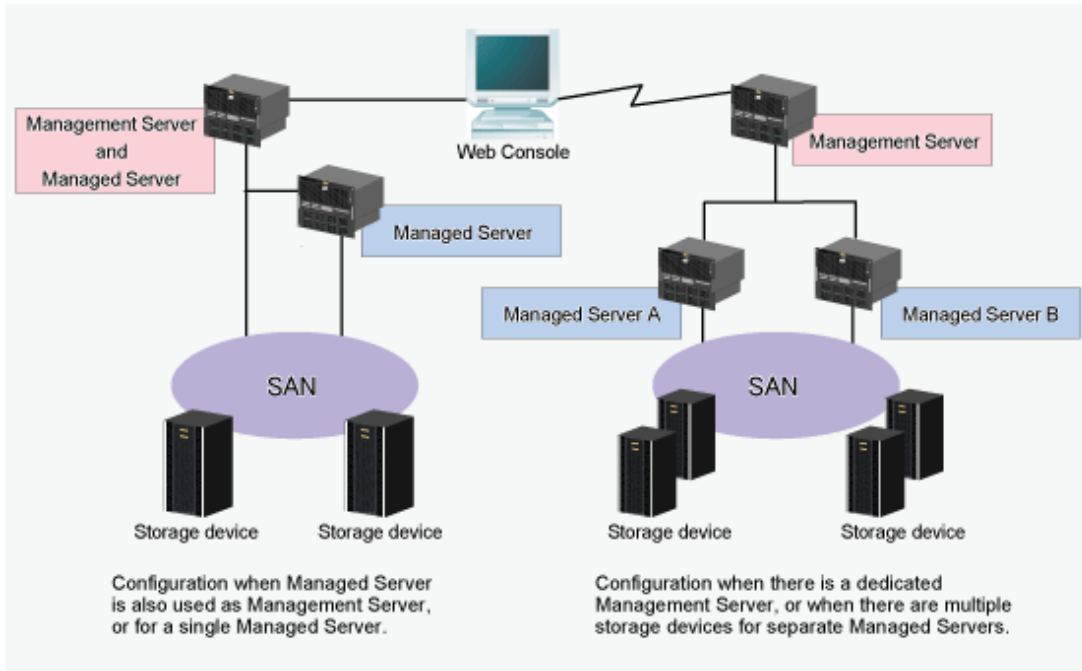
P Point

The AdvancedCopy Manager's manager uses some server resources, so the operational performance of the AdvancedCopy Manager's agents and other applications installed on these servers may be adversely affected. For this reason, it is recommended that you set up the AdvancedCopy Manager's manager on a dedicated server.

Backup can only function within a single storage device connected to a single Managed Server, while replication can be performed across multiple Managed Servers or the storage devices.

Web Console can manage one or more AdvancedCopy Manager operating configurations.

Figure 5.5 When Single Web Console Manages Multiple AdvancedCopy Manager Operating Configurations



5.6.1.3 Available Advanced Copy Types

The following table shows the available copy types. Refer to "[Appendix A Overview of Advanced Copy Function](#)" for details of the copy types.

Table 5.5 Available Copy Types

		Intra-box Copy	Inter-box Copy
Intra-server (Single Managed Server)	Available Functions	Backup management function and replication management function	Replication management function
	Available Copy Types	OPC, EC, QuickOPC, SnapOPC, and SnapOPC+ (*1)	REC (*1)
	Diagram		
Inter-server (Multiple)	Available Functions	Replication management function	Replication management function

		Intra-box Copy	Inter-box Copy
Managed Servers)	Available Copy Types	OPC, EC, QuickOPC, SnapOPC, and SnapOPC+ (*1)	REC (*1)
	Diagram		

*1: The SnapOPC, SnapOPC+, and REC cannot be used in a Storage Cluster environment.

5.6.2 Agent-less Operating Model

The following two methods are available for sending the Advanced Copy command from a CCM Server to a storage device.

- Sending a command to a storage device to perform an Advanced Copy function from the server over the SAN (hereafter referred to as "Copy command via SAN")
- Sending a command to a storage device to perform an Advanced Copy function from the server over the LAN (hereafter referred to as "Copy command via LAN")



Note

For the ETERNUS DX60 S2, the Copy command via LAN method cannot be used. Use the Copy command via SAN method.

5.6.2.1 Using Copy Command via SAN

This operating model serves to give Advanced Copy instructions from the CCM Server to a storage device via SAN.

With the Copy command via SAN, a logical volume that connects the CCM Server and the storage device is required. This logical volume is called "access volume". A logical volume that belongs to the storage device must be assigned to the CCM Server as an access volume.

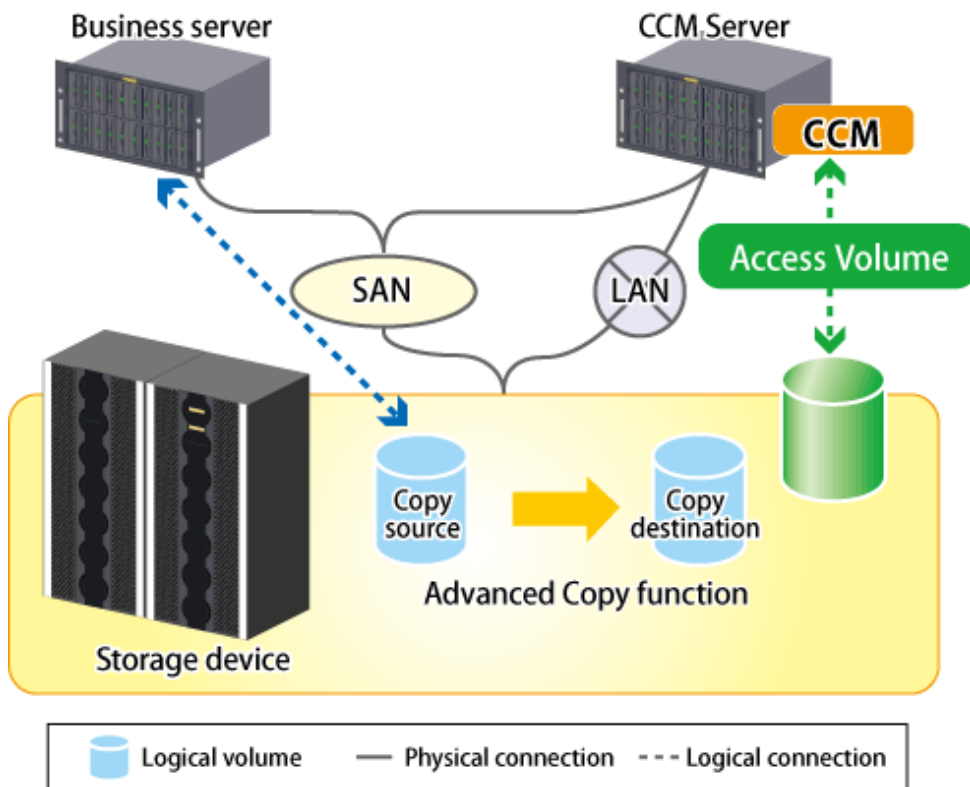
Intra-box Copy

To operate the intra-box copy via SAN, the system configuration must meet the following requirements:

- The CCM Server and the storage device have a LAN connection.
- An access volume exists in the storage device.

The system configuration for the intra-box copy is as follows.

Figure 5.6 System Configuration for Intra-box Copy



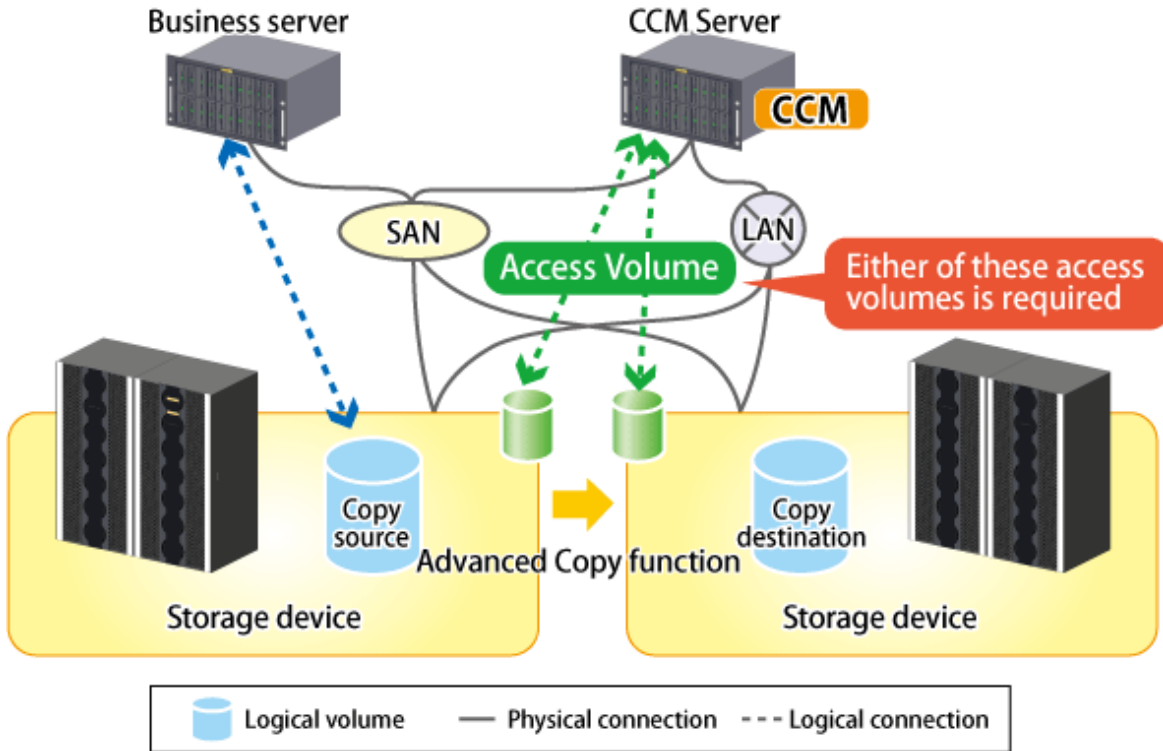
Inter-box Copy

To operate the inter-box copy via SAN, the system configuration must meet the following requirements:

- The CCM Server and either the copy source or copy destination storage device have a LAN connection.
- An access volume exists in either the copy source or copy destination storage device.

The system configuration for the inter-box copy is as follows.

Figure 5.7 System Configuration for Inter-box Copy



5.6.2.2 Using Copy Command via LAN

This operating model serves to give Advanced Copy instructions from the CCM Server to a storage device via LAN. With the Copy command via LAN, the Advanced Copy command is sent via LAN from a CCM Server to a storage device. Therefore, in this operating model, an access volume is not required.

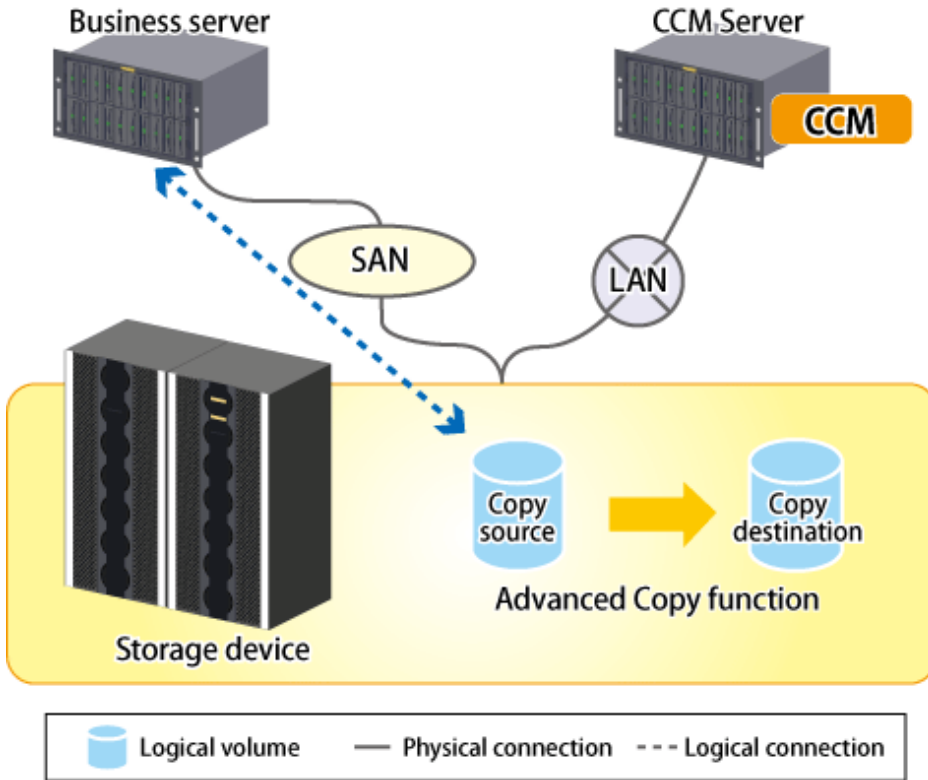
Intra-box Copy

To operate the intra-box copy via LAN, the system configuration must meet the following requirement:

- The CCM Server and the storage device have a LAN connection.

The system configuration for the intra-box copy is as follows.

Figure 5.8 System Configuration for Intra-box Copy



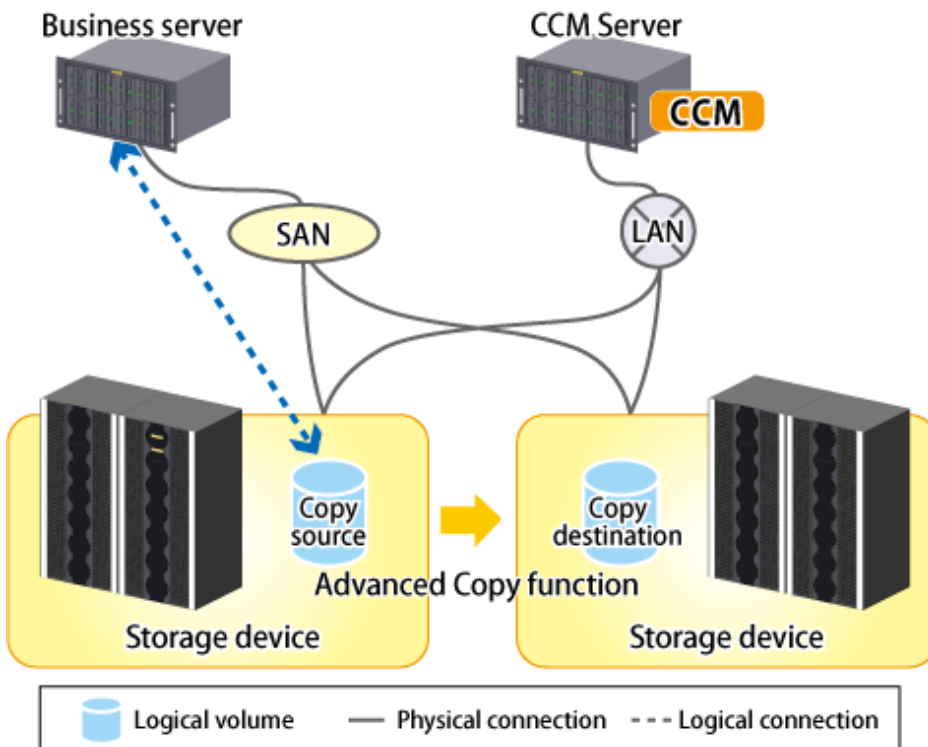
Inter-box Copy

To operate the inter-box copy via LAN, the system configuration must meet the following requirement:

- The CCM Server and either the copy source or copy destination storage device have a LAN connection.

The system configuration for the inter-box copy is as follows.

Figure 5.9 System Configuration for Inter-box Copy



5.7 Linkable Applications with AdvancedCopy Manager

AdvancedCopy Manager can be linked up with the applications listed below. Refer to "5.6 Operating Environment Models of AdvancedCopy Manager" for information on the Agent-based operating model and the Agent-less operating model.

Table 5.6 Linkable Applications

Application Name	Linkable Function (A=Available, N/A=Not Available)		
	Agent-Based Operating Model		Agent-Less Operating Model
	Backup Management Function (*1)	Replication Management Function	
Oracle	A	A	N/A
SQL Server	A	A	N/A
Exchange Server	N/A	A	N/A
Symfoware	A	A (*2)	N/A
DB2	A	A	N/A
Hyper-V	N/A	A	N/A
VMware	N/A	N/A	A

*1: This function cannot be used in Storage Cluster environments.

*2: This application can be linked in Windows environments only.

Chapter 6 Function Overview of AdvancedCopy Manager

6.1 Functions List

AdvancedCopy Manager provides the following functions:

- Backup management function
- Replication management function
- Agent-less backup using AdvancedCopy Manager Copy Control Module
- Storage Cluster Continuous Copy function
- Backup operation on server virtualization environments



See

Refer to the following manuals for details of each function.

- *AdvancedCopy Manager Operation Guide*
- *AdvancedCopy Manager Operation Guide for Copy Control Module*
- *Storage Cruiser / AdvancedCopy Manager Operation Guide for VMware vSphere Virtual Volumes*

Below chart shows whether the backup management function, the replication management function, and the backup/restore function using AdvancedCopy Manager Copy Control Module are available.

Table 6.1 Availability of Backup, Replication, and Backup Using AdvancedCopy Manager Copy Control Module for Each Function of AdvancedCopy Manager

AdvancedCopy Manager Function	Backup Management Function	Replication Management Function	Backup/restore Function Using AdvancedCopy Manager Copy Control Module
Policy management	A	N/A	N/A
Storage configuration management	A	A	A
Backup history management	A	N/A	A
Selection of copy destination volume	Auto/Manual	Manual	Manual
Control by Command Line Interface	A	A	A
Use of Web Console	A	A	A (*1)
Storage Cluster Continuous Copy function (*2)	N/A	A	A
Backup/restore for NAS volumes in a NAS environment	N/A	N/A	A
Backup/restore for each virtual machine in a VMware vSphere Virtual Volumes environment	N/A	N/A	A (*3)

(A=Available, N/A=Not Available)

*1: Available only in AdvancedCopy Manager Copy Control Module bundled with the ETERNUS SF Manager program.

*2: This function can be used only in a Storage Cluster environment.

*3: AdvancedCopy Manager Copy Control Module is used as the data copy engine when creating a snapshot and performing a restore.

6.2 Backup Management Function

The backup management function of AdvancedCopy Manager provides operation management for high-speed backup by using the Advanced Copy function of the storage device.

The backup management function has the following features:

- High-speed backup and restore can be performed between volumes regardless of volume capacities.
- Online backup is supported in mainstream database environments.
- Faster backups can be made by performing updates of differential copies.
- AdvancedCopy Manager automatically selects backup volumes. Alternatively, you can define explicit relationships between transaction volumes and backup volumes manually.
- The backup history information stored in AdvancedCopy Manager allows data to be restored from the most suitable backup volume to a transaction volume. By default, data is restored to the transaction volume that was the backup source; however, it is possible to change the restore destination.

The following functions allow you to manage the backup operation.

- Policy management

The policy management function manages the number of preservation generations of backup and the number of interval days in which backup should be performed (displays the delay when displaying information for a volume to be backed up).

- Storage configuration management

The storage configuration management function manages the configurations of volumes to be backed up and volumes to which a backup should be saved.

On AdvancedCopy Manager, a volume to be backed up is called "transaction volume"; a volume to which a backup should be saved is called "backup volume".

- Performing a backup and restore

The backup and restore functions backup and restore a specified volume.

- History information management

The history information management function manages, out of the information that has been backed up in the past, the information in preservation generations as backup history.



Note

In the backup management function, the Advanced Copy function for Storage Cluster-enabled volumes (hereinafter referred to as "TFOV") is not available. When using a TFOV with the Advanced Copy function, use the replication management function or AdvancedCopy Manager Copy Control Module.

In an environment using the backup management function, the following backup operations become possible.

High-speed Backup Operation

The Advanced Copy function of the storage device is used to perform high-speed backup between volumes regardless of volume capacities. This function greatly reduces the impact of a backup operation.

Faster backups can be made by performing update differential copies using the Advanced Copy function.

Backup Operation Associated with SQL Server or Symfoware

A linkage with SQL Server or Symfoware, you can perform fast backups without stopping your transactions.

Backup Operation Associated with Oracle or DB2 (Sample Shell Scripts)

The sample shell scripts provide AdvancedCopy Manager commands and Oracle / DB2 operations combined together.

6.3 Replication Management Function

The replication management function of AdvancedCopy Manager provides operation management of replications by using the Advanced Copy function of the storage device.

The replication management function is defined as copying that is intended for concurrent use by other applications. A replication destination volume remains accessible, unlike a backup destination volume which is typically unmounted.

The replication management function is not limited to within a single Managed Server or a single storage device. Using the inter-box copy, replication can also be performed across different storage devices regardless of geographical locations.

The replication management function has the following features:

- One of the following directional modes can be configured.
 - Uni-directional: copying can only be performed from the source volume to the destination volume.
 - Bi-directional: copying can be performed in either direction between volumes.
- If the copy source and copy destination volumes are both in the same storage device and hosted by the same Managed Server, data can be copied in real-time.

In an environment using the replication management function, the following replication operations become possible.

High-speed Replication Operation

The Advanced Copy function of the storage device is used to perform high-speed replication between volumes regardless of volume capacities. This function greatly reduces the impact of a replication operation.

Faster replications can be made by using update differential copy of the Advanced Copy function.

The replication management function is suitable for temporary backups because it does not have history information management found in the backup management function.

Replication Operation Associated with Exchange Server, SQL Server, Symfoware, or Hyper-V

A linkage with Exchange Server, SQL Server, Symfoware or Hyper-V, you can perform fast replication without stopping your transactions.

Replication Operation Associated with Oracle or DB2 (Sample Shell Scripts)

The sample shell scripts provide AdvancedCopy Manager commands and Oracle / DB2 operations combined together.

Storage Cluster Continuous Copy Function

In a Storage Cluster environment, if a failover occurs in the Primary Storage while executing Advanced Copy, this function can continue the copy operation with the Secondary Storage by automatically taking over the Advanced Copy process.

Backup Operation for System Volume

In a SAN boot environment where the system volume is located in the storage device, the system volume can be backed up and restored using the replication management function.

6.4 Agent-less Backup Using AdvancedCopy Manager Copy Control Module

AdvancedCopy Manager Copy Control Module is a function to support the backup operation by using the Advanced Copy function of the storage device without installing an AdvancedCopy Manager's agent on the business server.

Since the AdvancedCopy Manager's agent installation on the business server is unnecessary, there is the following advantages when AdvancedCopy Manager Copy Control Module is used.

- Data of the business server can be backed up independently of the operating system of the business server.
- Operational work becomes more efficient, because there is no need to spend time installing the AdvancedCopy Manager's agents on each of the business servers.

6.5 Storage Cluster Continuous Copy Function

In a Storage Cluster environment, even if a failover occurs in the Primary Storage while executing the Advanced Copy, the storage management system using this function can continue the copy operation with the Secondary Storage by automatically taking over the Advanced Copy process.

This function can only be used when the copy source and copy destination volumes are TFOV. The copy types that can be used are OPC, QuickOPC, and EC.

Traditionally with Storage Cluster operations, copy settings were required on both the Primary Storage and Secondary Storage, so if the Primary Storage stopped, re-executing the copy on the Secondary Storage was required. However, this function can continue the copy operation by sharing the copy settings on both the Primary Storage and Secondary Storage without needing to perform a copy setting and re-execution of the copy in the Secondary Storage.

6.6 Backup Operation on Server Virtualization Environments

AdvancedCopy Manager provides the following backup operations on server virtualization environments.

- [Virtual machine backup operation on VMware vSphere Virtual Volumes environment](#)
- [Backup operation on Hyper-V environment](#)
- [Backup operation on KVM environment](#)
- [Backup operation on Oracle Solaris Zones environment](#)
- [Backup operation on Oracle VM Server for SPARC environment](#)
- [Automatic backup operation of VMware virtual machine using script](#)

6.6.1 Virtual Machine Backup Operation on VMware vSphere Virtual Volumes Environment

In an environment using VMware vSphere Virtual Volumes, by using the Advanced Copy function of the storage device, the function to perform a high speed backup/restore for each virtual machine is provided.

The features of this function are as follows:

- High speed copy that does not put load on the business systems.

By using the Advanced Copy function of the storage device, backups that do not put load on virtual machines and business servers are possible.

- Policy-based backup operation

By configuring a policy with VMware, backup operations are performed based on the policy.

The initial setting of the backup policy is performed by selecting a policy when creating a virtual machine on VMware. This helps reduce configuration mistakes.

- Acquisition of a Snapshot backup and a Clone backup

The following two backups are acquired with data consistency ensured:

- Snapshot backup using VMware Snapshot
- Clone backup with a physical disk failure

In addition, Clone backup makes copies of the minimum amount of data using a differential copy (QuickOPC), thereby reducing the time spent on the physical copy.

- Generation management of Snapshot backups

Snapshot generations are managed according to a set policy. Because unnecessary resources are automatically removed, efficient operation of storage resources is possible.

- Auto execution of backups

Backups are executed according to the schedule set for the policy.

- Purpose dependent restoration

Multiple restore methods are provided depending on the purpose.

Restore Methods	Example of Usage
Restore from a snapshot backup	Recovery from logical data fault
Restore from a clone backup	Recovery from physical fault
Single item restore	Recovery on a per file basis



See

Refer to "Operating Environment" in the *Storage Cruiser / AdvancedCopy Manager Operation Guide for VMware vSphere Virtual Volumes* for details of the conditions required for using this function.



Note

The following functions do not support VMware vSphere Virtual Volumes.

- Backup management function
- Replication management function

6.6.2 Backup operation on Hyper-V environment

For Hyper-V guest OSs configured in the Cluster Shared Volume (CSV), AdvancedCopy Manager coordinates with Volume Shadow Copy Service (VSS) and Hyper-V VSS writer to perform high-speed backups using the Advanced Copy function.



See

Refer to "Backup and Restore of Hyper-V" in the *AdvancedCopy Manager Operation Guide (for Windows)* for details.

6.6.3 Backup operation on KVM environment

In a Linux KVM environment, AdvancedCopy Manager provides a function that performs Advanced Copy via the AdvancedCopy Manager's agent of the KVM host from the AdvancedCopy Manager's agent of the KVM guest. With this function, high-speed backups/restores and replications can be performed for the storage device resources that are used by the business server of the KVM guest.

The following AdvancedCopy Manager functions can be used.

- Backup management function
- Replication management function



See

Refer to "Operation on KVM Guests" in the *AdvancedCopy Manager Operation Guide (for Windows or Linux)* for details.

6.6.4 Backup operation on Oracle Solaris Zones environment

In an Oracle Solaris Zones environment, AdvancedCopy Manager provides a function that performs Advanced Copy via the AdvancedCopy Manager's agent of the global zone from the AdvancedCopy Manager's agent of the non-global zone. With this function, high-speed backups/restores and replications can be performed for the storage device resources that are used by the business server of the non-global zone.

The following AdvancedCopy Manager functions can be used.

- Backup management function
- Replication management function



See

Refer to "Operation in Oracle Solaris Zones" in the *AdvancedCopy Manager Operation Guide (for Solaris)* for details.

6.6.5 Backup operation on Oracle VM Server for SPARC environment

In an Oracle VM Server for SPARC environment, high-speed backups/restores and replications that use the Advanced Copy function of the storage device can be performed for the storage device resources that are used from the control domain, I/O root domain, and guest domain.

The following AdvancedCopy Manager functions can be used.

- Backup management function
- Replication management function
- Agent-less backup using AdvancedCopy Manager Copy Control Module



See

Refer to "Operation in Oracle VM Server for SPARC" in the *AdvancedCopy Manager Operation Guide (for Solaris)* for details.

6.6.6 Automatic backup operation of VMware virtual machine using script

In a VMware environment, scripts are provided to automatically backup/restore system areas and data areas by using the virtual machine snapshot function and AdvancedCopy Manager Copy Control Module. By using this script, virtual machine environments configured on a VMware VMFS datastore can be backed up/restored at high speed.



See

Refer to "VMware Virtual Machine Automatic Backup/Restore (Script)" in the *AdvancedCopy Manager Operation Guide for Copy Control Module* for details of the script.

Appendix A Overview of Advanced Copy Function

AdvancedCopy Manager supports two distinct copy functions:

- Snapshot high-speed copy function

This creates a snapshot of data. The Advanced Copy types available with this function are:

- OPC
- QuickOPC
- SnapOPC
- SnapOPC+

- Synchronous high-speed copy function

This maintains the equivalent state for a transaction volume and backup volume. The Advanced Copy types available with this function are:

- EC
- REC

With these copy functions (except the OPC), once an initial copy has been made, it is possible to perform differential copying, which copies only the modified portions.

With the REC, it is possible to perform synchronous high-speed copy from a storage device to other storage device at remote locations.

Advanced Copy is executed by the storage device. For details about Advanced Copy, refer to the manuals of the storage device to be used.

A.1 Snapshot High-Speed Copy

AdvancedCopy Manager supports both Snapshot backup and differential copying. Point in Time recovery for high transaction database environments where roll-forward has been enabled is also available. These features are particularly effective in minimizing system downtime and server I/O load.

OPC

OPC executes a copy of the entire volume.

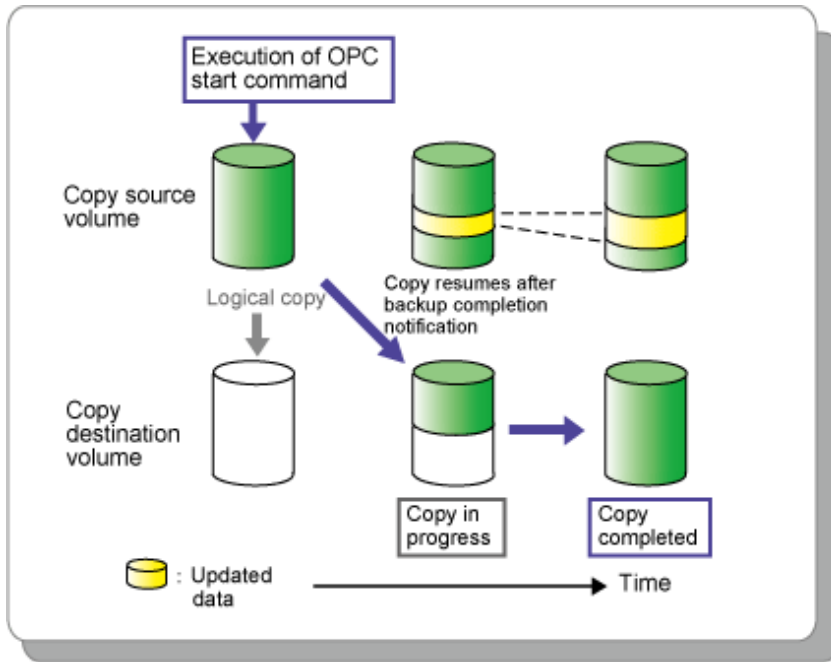
When OPC is executed, the storage device creates a point in time snapshot of the source volume and then immediately returns a notification to the operator that the copy is complete, before any physical copying has even occurred. This allows for access to be returned to the transaction or source volume with little or no interruption while the copy is performed as a background process at the hardware level in the storage device.

OPC can be used for the following situations:

- Generation backups where continuous transactions are critical, such as in Internet business applications
- Data restoration from a backup volume
- Maintenance of data for archival purposes

The following diagram represents the processing flow of OPC.

Figure A.1 Processing Flow of OPC



QuickOPC

Differential copying using QuickOPC requires that an initial copy exists.

When QuickOPC is executed, it determines if an initial copy exists, then copies only updated blocks of data that have been tracked since the initial copy was created to the backup volume for that specific QuickOPC session.

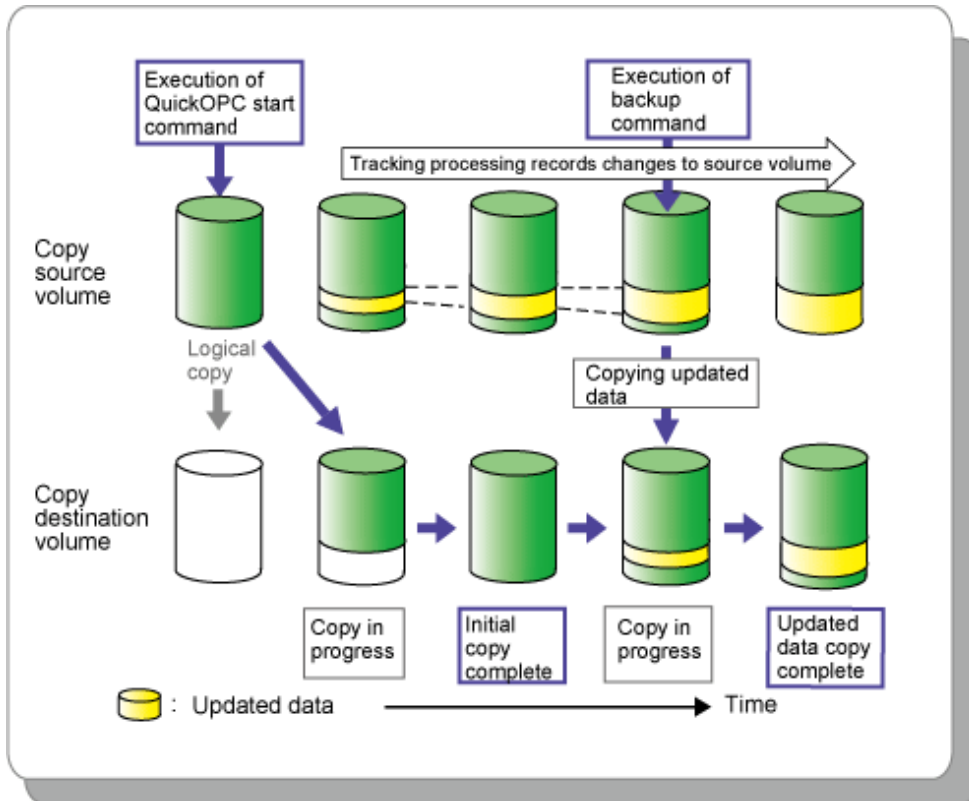
If QuickOPC detects that an initial copy does not exist, it creates the initial copy using OPC. The differential copy method used in QuickOPC significantly reduces the time required for physical data copying in order to create a Point in Time snapshot while minimizing the I/O load on the storage system host server.

QuickOPC can be effectively used for the following situations:

- Backup to disk where uptime is critical
- Frequent creation of restore points or generation backups

The following diagram represents the processing flow of QuickOPC.

Figure A.2 Processing Flow of QuickOPC



SnapOPC

SnapOPC uses the Copy-on-Write method to create a copy of the source volume as it was before any updates are made. Only the replication function can use SnapOPC.

When an update is required to be made to the copy source volume, the original data in the copy source volume is first copied to the copy destination volume. The change is then applied to the source volume. This method of backup copy is called "Copy-on-Write".

The copy destination volume stores only original data that has been modified or updated on the copy source volume.

The size of the copy destination volume is relative to the rate of modification on the copy source volume and a utility is used to provide an accurate estimate of the size. If the copy source volume is relatively stable, only a relatively small copy destination volume is required.

Although the physical size of the copy destination volume maybe smaller, the logical size (that is, the size presented to the operating system) of the copy destination volume is in effect the same as the copy source volume. AdvancedCopy Manager achieves this by combining the original data copied to the copy destination volume with the unmodified data on the copy source volume to form a logical view of the copy destination volume.

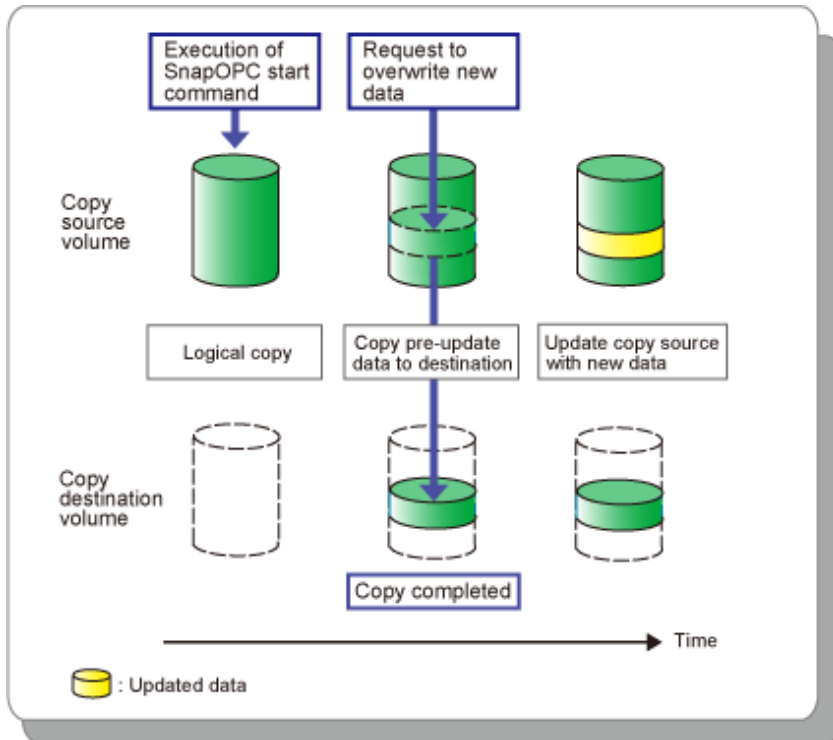
However, it should be understood that SnapOPC may be unsuitable for some purposes as the copy method can reduce access performance in the copy source volume, and any loss of data on the copy source volume would render the copied data unusable.

SnapOPC can be used for the following situations:

- Temporary file to use when performing a cascade copy to alternate media such as tape
- Backup of file servers and "other data" with low modification rates

The following diagram represents the processing flow of SnapOPC.

Figure A.3 Processing Flow of SnapOPC



SnapOPC+

Like SnapOPC, SnapOPC+ uses the Copy-on-Write method to create a copy of the source volume as it was before any updates. The replication management function and AdvancedCopy Manager Copy Control Module can use SnapOPC+.

SnapOPC+ can save the copy source volume data as it was before any updates are made in snap generation units (units in which replication volumes were created). Since copy is performed only to the new copy destination volume, the access load on the copy source volume and the physical size used on the copy destination volume can be smaller than with SnapOPC.

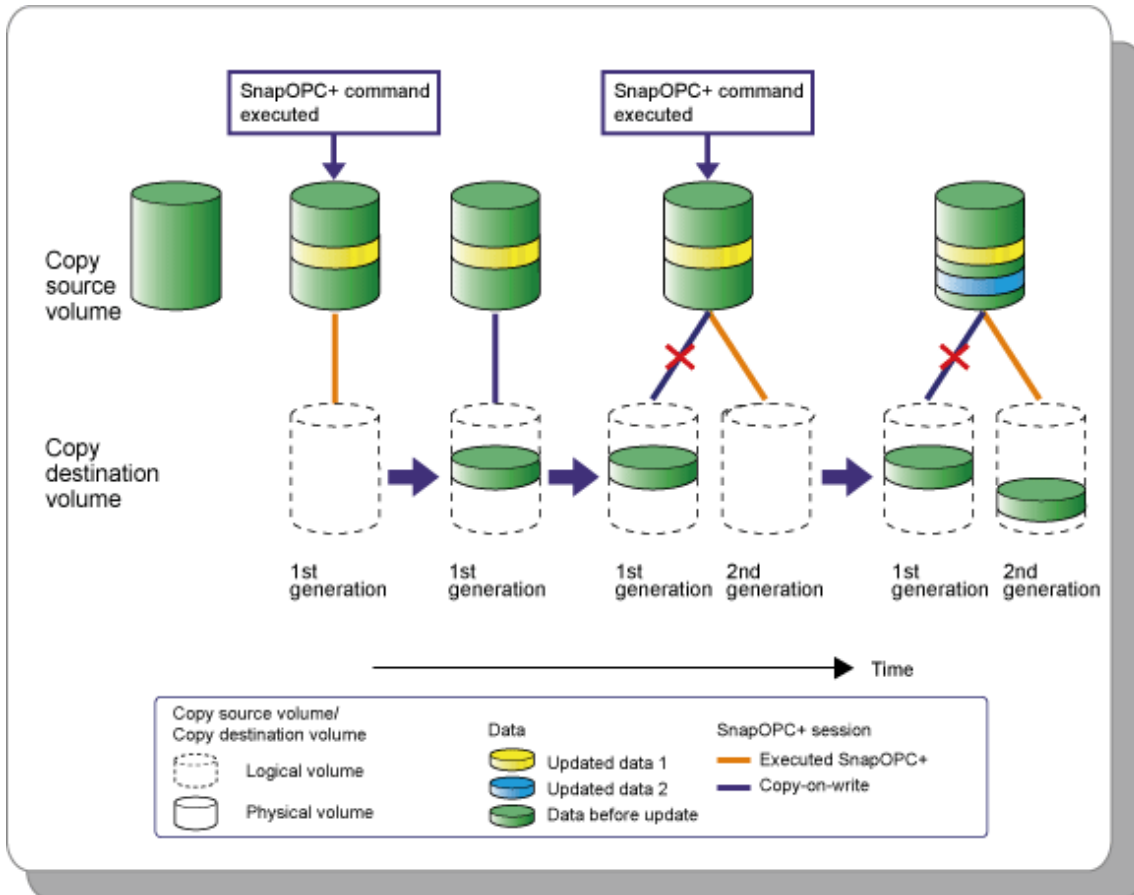
Due to the mechanism and features of SnapOPC+, it is assumed that it is used as a backup to enable recovery in case of soft faults (such as operator mistakes and software errors). If a copy source volume becomes inaccessible due to a hardware fault, then the relevant copy session also becomes inaccessible. As a result, the data on the copy destination volume cannot be read. In order to be prepared for such fatal hardware faults, it is recommended that OPC, QuickOPC, EC, or REC is used to make a complete copy of data in conjunction with SnapOPC+.

SnapOPC+ can be used for the following situations:

- Temporary file to use when performing a cascade copy to alternate media such as tape
- Backup of file servers and "other data" with low modification rates

The following diagram represents the processing flow of SnapOPC+.

Figure A.4 Processing Flow of SnapOPC+



A.2 Synchronous High-Speed Copy

EC

The EC feature of AdvancedCopy Manager invokes a process of synchronization between source and destination volumes to create a synchronized copy of the source volume. The purpose of the synchronization is to reach and maintain a state of equivalence with the source volume in order to create a temporary copy or archival backup.

The source volume remains available and accessible as there is no need to stop or suspend access to the source volume while the copy is built using the synchronization process.

When a state of equivalence with the source volume has been attained, the destination volume continues to be maintained as an image of the source volume.

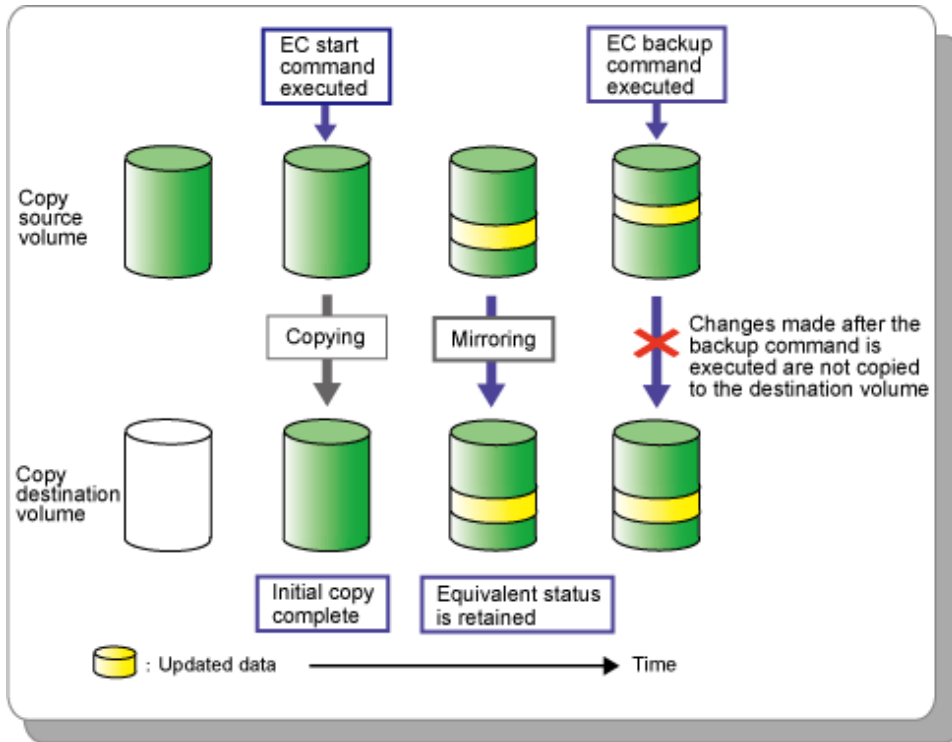
At any subsequent point while the copy source volume and destination volume are in this state of equivalence, the destination volume can be split from the source, thus creating a backup with history or a replica copy as at that point in time.

EC can be effectively used for the following situations:

- Collection of backup data in parallel with ordinary transactions
- Distributed processing using copy data

The following diagram represents the processing flow of EC.

Figure A.5 Processing Flow of EC



Suspend/Resume Function Provided by EC

The Suspend/Resume function of EC is used to create a backup after an initial copy has been built using the EC synchronization process. At this point, the copy source and copy destination volumes (Volume Pair) have attained a state of equivalence.

The EC session is then suspended using the Suspend option, detaching the destination volume from the EC session to create a copy which can be used as a backup with history or as a source volume for a subsequent copy to an archive device. This copy could also be mounted and become available for use by other applications.

While the session is suspended all updates to the copy source volume continue to be tracked so that they can be applied to the destination volume should that EC session be subsequently resumed.

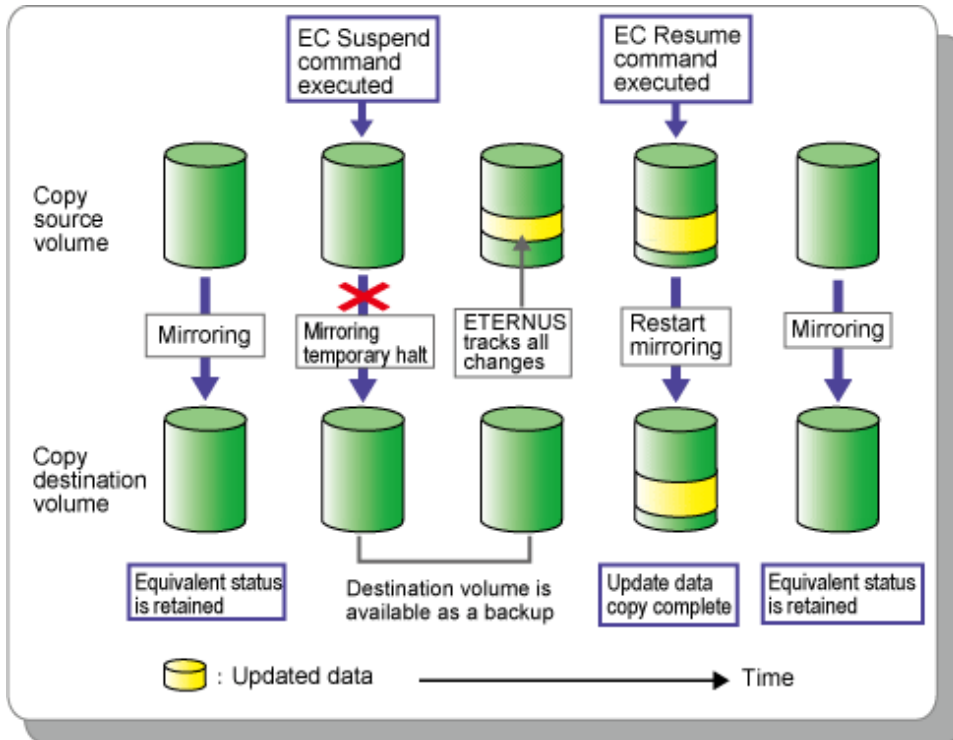
This allows the same destination volume to be reused as the base for a continuing backup, thus reducing the time required for backup.

The Resume option invokes a re-synchronization process of the same source and destination volume pair where all of the tracked changes to the source volume are applied to the destination volume to attain a state of equivalence again.

A suspend and resume process can be performed on the same volume pair as many times as required.

The following diagram represents the processing flow of the Suspend/Resume function of EC.

Figure A.6 Processing Flow of Suspend/Resume Function of EC



REC

REC is a method for copying data between different storage devices. The replication management function and AdvancedCopy Manager Copy Control Module can use REC.

REC has two transfer methods; synchronous and asynchronous.

Synchronous transfer method guarantees that the copy destination always matches the copy source.

Asynchronous transfer method is typically used in the following circumstances:

- Where there may be a significant communications lag between the devices
- Used to avoid adversely affecting server performance and write performance on the copy source

Asynchronous transfer method has three transfer modes (Stack mode, Consistency mode, and Through mode) which provide control over data transmission according to transaction intensity and or data volume, or available bandwidth between copy source and copy destination.

REC can be effectively used for the following situation:

- Remote backup of a disaster countermeasure system or similar

The following diagram represents the processing flow of REC.

Figure A.7 Processing Flow of REC

