

FUJITSU Storage ETERNUS DX60 S3 Disk storage system

Overview

This page is intentionally left blank.

Fujitsu would like to thank you for purchasing our FUJITSU Storage ETERNUS DX60 S3 Disk storage system (hereinafter referred to as ETERNUS DX).

The ETERNUS DX is designed to be connected to Fujitsu servers (Fujitsu M10, PRIMEQUEST, PRIMERGY, and other servers) or non-Fujitsu servers.

This manual provides the basic information that is required to use the ETERNUS DX.

This manual is intended for use of the ETERNUS DX in regions other than Japan.

Please carefully review the information outlined in this manual.

Sixth Edition

April 2016

About This Manual

Organization

This manual is composed of the following five chapters:

- "Chapter 1 Overview" (page 12)

This chapter provides an overview and describes the features of the ETERNUS DX.

- "Chapter 2 Specifications" (page 16)

This chapter describes the specifications, the function specifications, and the operating environment of the ETERNUS DX.

- "Chapter 3 Functions" (page 25)

This chapter explains the available functions for the ETERNUS DX.

- "Chapter 4 Hardware Configurations" (page 49)

This chapter explains hardware configurations for the ETERNUS DX.

- "Chapter 5 Release Information" (page 64)

This chapter provides firmware modification information of the ETERNUS DX, such as information on functions that have been added or modified.

Registered Trademarks and Trademarks

- All SPARC trademarks are used under license from SPARC International, Inc. and are trademarks or registered trademarks of that company in the United States and other countries.
- UNIX is a registered trademark of The Open Group in the United States and other countries.
- Microsoft, Windows, Windows Server, and Internet Explorer are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
- Oracle and Java are registered trademarks of Oracle and/or its affiliates.
- HP-UX is a trademark of Hewlett-Packard Company in the U.S. and other countries.
- Mozilla, Firefox, and the Mozilla and Firefox logos are trademarks or registered trademarks of the Mozilla Foundation in the United States and other countries.
- Red Hat and Red Hat Enterprise Linux are trademarks of Red Hat, Inc., registered in the U.S. and other countries.
- Linux® is the registered trademark of Linus Torvalds in the U.S. and other countries.
- SUSE is a registered trademark of Novell, Inc. in the United States and other countries.
- IBM, AIX, and Tivoli are trademarks of International Business Machines Corporation, registered in many jurisdictions worldwide.
- VMware, VMware logos, Virtual SMP, and vMotion are either registered trademarks or trademarks of VMware, Inc. in the U.S. and/or other countries.
- Arcserve is a registered trademark or trademark of Arcserve (USA), LLC.
- NetVault is a registered trademark of Dell Inc. in the United States and other countries.
- EMC and NetWorker are either registered trademarks or trademarks of EMC Corporation in the United States and/or other countries.
- The company names, product names and service names mentioned in this document are registered trademarks or trademarks of their respective companies.
- Microsoft product screen shot(s) reprinted with permission from Microsoft Corporation.

Naming Conventions

■ Product Names

- The following abbreviations are used for Microsoft® Windows Server®.

Product name	Abbreviation
Microsoft® Windows Server® 2008 Datacenter	Windows Server 2008
Microsoft® Windows Server® 2008 R2 Datacenter	
Microsoft® Windows Server® 2008 Enterprise	
Microsoft® Windows Server® 2008 R2 Enterprise	
Microsoft® Windows Server® 2008 Standard	
Microsoft® Windows Server® 2008 R2 Standard	
Microsoft® Windows Server® 2008 for Itanium-Based Systems	
Microsoft® Windows Server® 2008 R2 for Itanium-Based Systems	
Microsoft® Windows Server® 2008 HPC Edition	
Microsoft® Windows Server® 2008 R2 HPC Edition	

Product name	Abbreviation
Microsoft® Windows Server® 2012 Datacenter	Windows Server 2012
Microsoft® Windows Server® 2012 R2 Datacenter	
Microsoft® Windows Server® 2012 Standard	
Microsoft® Windows Server® 2012 R2 Standard	
Microsoft® Windows Server® 2012 Essentials	
Microsoft® Windows Server® 2012 R2 Essentials	

- The following abbreviations are used for Red Hat Linux.

Product name	Abbreviation
Red Hat Enterprise Linux 5 (for x86)	Red Hat Enterprise Linux 5
Red Hat Enterprise Linux 5 (for Intel64)	
Red Hat Enterprise Linux 6 (for x86)	Red Hat Enterprise Linux 6
Red Hat Enterprise Linux 6 (for Intel64)	
Red Hat Enterprise Linux 7 (for Intel 64)	Red Hat Enterprise Linux 7

■ Symbols Used in This Manual

The following symbols are used throughout this manual:



This indicates information for the user to note when using the ETERNUS DX. Please be sure to read this information.



This indicates supplementary and reference information.

■ Abbreviations Used in This Manual

- "ETERNUS DX" refers to the FUJITSU Storage ETERNUS DX60 S3 Disk storage system.
- "CA" refers to a host interface module that is used in an ETERNUS DX to connect to a server.
- "Host Bus Adapter (HBA)" refers to an interface module that is normally used in a server to connect to ETERNUS DX storage systems.
- Trademark symbols such as ™ and ® are omitted in this document.

Warning Signs

Warning signs are shown throughout this manual in order to prevent injury to the user and/or material damage. These signs are composed of a symbol and a message describing the recommended level of caution. The following explains the symbol, its level of caution, and its meaning as used in this manual.



This symbol indicates the possibility of serious or fatal injury if the ETERNUS DX is not used properly.



This symbol indicates the possibility of minor or moderate personal injury, as well as damage to the ETERNUS DX and/or to other users and their property, if the ETERNUS DX is not used properly.

IMPORTANT This symbol indicates IMPORTANT information for the user to note when using the ETERNUS DX.

The following symbols are used to indicate the type of warnings or cautions being described.

Electric Shock



△ The triangle emphasizes the urgency of the WARNING and CAUTION contents. Inside the triangle and above it are details concerning the symbol (e.g. Electrical Shock).

No Disassembly



⊘ The barred "Do Not..." circle warns against certain actions. The action which must be avoided is both illustrated inside the barred circle and written above it (e.g. No Disassembly).

Unplug



● The black "Must Do..." circle indicates actions that must be taken. The required action is both illustrated inside the black disk and written above it (e.g. Unplug).

How Warnings are Presented in This Manual

A message is written beside the symbol indicating the caution level. This message is marked with a vertical ribbon in the left margin, to distinguish this warning from ordinary descriptions.

A display example is shown here.

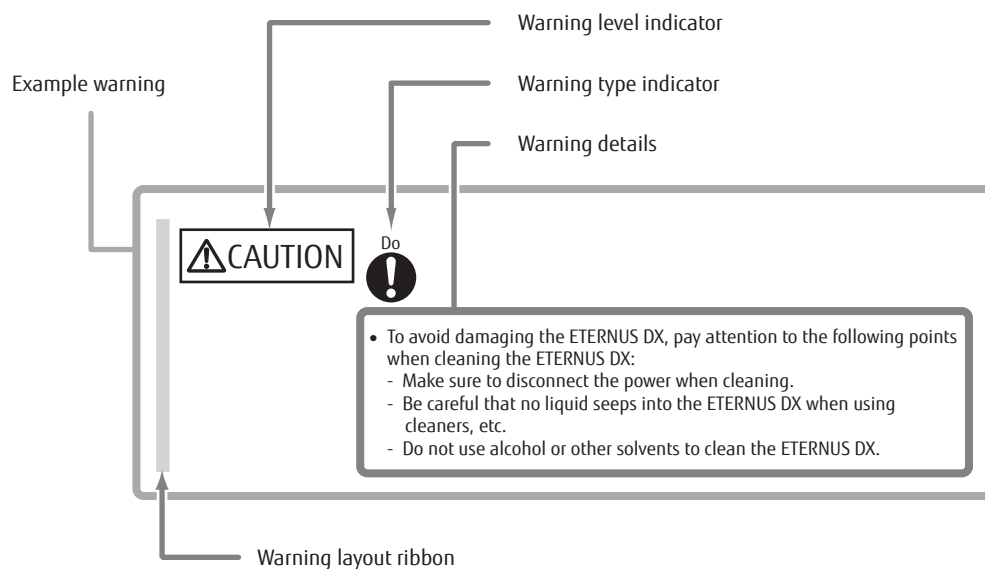


Table of Contents

Chapter 1 Overview	12
Chapter 2 Specifications	16
2.1 Specifications	17
2.2 Function Specifications.....	18
2.3 Operating Environment.....	18
2.3.1 Supported OSs.....	18
2.3.2 ETERNUS Web GUI/ETERNUS CLI Operating Environment	24
Chapter 3 Functions	25
3.1 Data Protection	25
3.1.1 Data Block Guard	25
3.1.2 Disk Drive Patrol	26
3.1.3 Redundant Copy	26
3.1.4 Rebuild/Copyback	27
3.1.5 Fast Recovery.....	28
3.1.6 Protection (Shield).....	28
3.2 Operations Optimization (Virtualization)	29
3.2.1 Thin Provisioning.....	29
3.3 Optimization of Volume Configurations.....	30
3.4 Security	31
3.4.1 Account Management.....	31
3.4.2 User Authentication	32
3.4.3 Audit Log	32
3.4.4 Host Affinity.....	33
3.4.5 iSCSI Security.....	34
3.5 Environmental Burden Reduction.....	34
3.5.1 Eco-mode.....	34
3.5.2 Power Consumption Visualization.....	35
3.6 Operation Management.....	36
3.6.1 Operation Management Interface.....	36
3.6.2 Event Notification	37
3.6.3 Performance Information Management.....	38

3.6.4 Device Time Synchronization	38
3.6.5 Power Control	39
3.7 Backup (Advanced Copy)	41
3.8 Stable Operation	42
3.8.1 Host Response	42
3.9 Data Migration	43
3.9.1 Storage Migration	43
3.10 Server Linkage Functions	44
3.10.1 Oracle VM Linkage	44
3.10.2 VMware Linkage	45
3.10.3 Microsoft Linkage	47
3.10.4 OpenStack Linkage	48
3.10.5 Logical Volume Manager (LVM)	48
Chapter 4 Hardware Configurations	49
4.1 Controller Enclosure	49
4.1.1 Controllers	52
4.1.2 Power Supply Units	54
4.1.3 Drives	55
4.2 Drive Enclosure	56
4.2.1 I/O Modules	59
4.2.2 Power Supply Units	59
4.2.3 Drives	60
4.3 Power Distribution Units (Only for Regions other than the EMEIA, North American, Central American, and Caribbean Regions)	61
4.4 Power Synchronized Unit	63
Chapter 5 Release Information	64
5.1 Firmware Release Information	64

List of Figures

Figure 1.1	External View (2.5" Type Controller Enclosure)	12
Figure 1.2	External View (3.5" Type Controller Enclosure)	12
Figure 1.3	External View (2.5" Type Drive Enclosure)	12
Figure 1.4	External View (3.5" Type Drive Enclosure)	12
Figure 3.1	Data Block Guard.....	25
Figure 3.2	Drive Check	26
Figure 3.3	Redundant Copy Function	26
Figure 3.4	Rebuild/Copyback Function	27
Figure 3.5	Fast Recovery	28
Figure 3.6	Example of Thin Provisioning	29
Figure 3.7	Account Management	31
Figure 3.8	Audit Log.....	32
Figure 3.9	Host Affinity	33
Figure 3.10	Eco-mode Overview.....	34
Figure 3.11	Power Consumption Visualization	35
Figure 3.12	Event Notification	37
Figure 3.13	Device Time Synchronization.....	38
Figure 3.14	Power Synchronized Unit Diagram	39
Figure 3.15	Power Supply Control Using Wake On LAN	40
Figure 3.16	Example of Advanced Copy	41
Figure 3.17	Host Response (Connection Operation Mode)	42
Figure 3.18	Storage Migration	43
Figure 3.19	Oracle VM Linkage	44
Figure 3.20	VMware Linkage.....	45
Figure 3.21	Microsoft Linkage.....	47
Figure 4.1	Front View of a 2.5" Type Controller Enclosure.....	49
Figure 4.2	Rear View of a 2.5" Type Controller Enclosure (with One Controller Installed)	50
Figure 4.3	Rear View of a 2.5" Type Controller Enclosure (with Two Controllers Installed)	50
Figure 4.4	Front View of a 3.5" Type Controller Enclosure.....	51
Figure 4.5	Rear View of a 3.5" Type Controller Enclosure (with One Controller Installed)	51
Figure 4.6	Rear View of a 3.5" Type Controller Enclosure (with Two Controllers Installed)	52
Figure 4.7	Front View of a 2.5" Type Drive Enclosure	56
Figure 4.8	Rear View of a Drive Enclosure With a Single I/O Module	56
Figure 4.9	Rear View of a Drive Enclosure With Two I/O Modules	57
Figure 4.10	Front View of a 3.5" Type Drive Enclosure.....	57
Figure 4.11	Rear View of a Drive Enclosure (Single-IOM Type)	58
Figure 4.12	Rear View of a Drive Enclosure (Dual-IOM Type)	58
Figure 4.13	Power Distribution Unit (AC200-240V, 1U, 4 Outlets)	61
Figure 4.14	Power Distribution Unit (AC200-240V, 2U, 12 Outlets)	62
Figure 4.15	Power Distribution Unit (AC200-240V, 2U, 16 Outlets)	63

List of Tables

Table 2.1	Specifications (ETERNUS DX60 S3)	17
Table 2.2	Function Specifications (ETERNUS DX60 S3)	18
Table 2.3	Supported Servers and OSs (FC Interface)	19
Table 2.4	Supported Servers and OSs (iSCSI Interface)	21
Table 2.5	Supported Servers and OSs (SAS Interface)	23
Table 2.6	ETERNUS Web GUI Operating Environment	24
Table 4.1	Host Interface Specifications	53
Table 4.2	Drive Interface Port Specifications for Controllers	54
Table 4.3	MNT Port/RMT Port Specifications	54
Table 4.4	PWC Port Specifications	54
Table 4.5	2.5" Drive Specifications (2.5" Type Controller Enclosure)	55
Table 4.6	3.5" Drive Specifications (3.5" Type Controller Enclosure)	55
Table 4.7	Drive Interface Port Specification (I/O Module)	59
Table 4.8	2.5" Drive Specifications (2.5" Type Controller Enclosure)	60
Table 4.9	3.5" Drive Specifications (3.5" Type Controller Enclosure)	60
Table 4.10	Power Distribution Unit (AC200-240V, 1U, 4 Outlets) and Provided AC Cable Specifications	61
Table 4.11	Power Distribution Unit (AC200-240V, 2U, 12 Outlets) and Provided AC Cable Specifications	62
Table 4.12	Power Distribution Unit (AC200-240V, 2U, 16 Outlets) and Provided AC Cable Specifications	63
Table 5.1	Release Information List	64

Chapter 1

Overview

This chapter provides an overview and describes the features of the ETERNUS DX.

Figure 1.1 External View (2.5" Type Controller Enclosure)

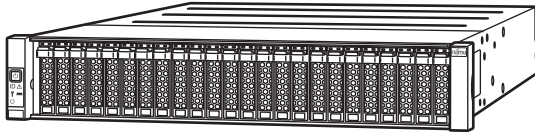


Figure 1.2 External View (3.5" Type Controller Enclosure)

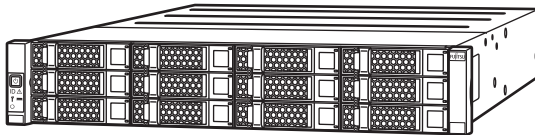


Figure 1.3 External View (2.5" Type Drive Enclosure)

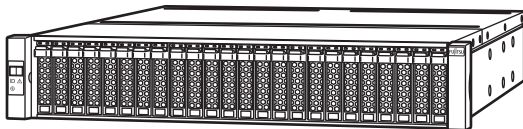
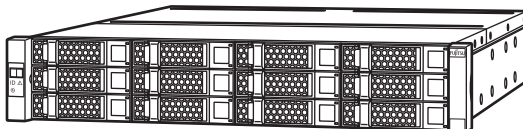


Figure 1.4 External View (3.5" Type Drive Enclosure)



■ Scalability

The ETERNUS DX series offers a broad assortment of host interfaces and drive types that can be mixed and combined without restriction.

Therefore, the system can be freely adapted to fit all user and application needs, such as capacity and performance, even if those needs change during the system's lifetime.

● Unit

The base unit (controller enclosure) size is 2U (*1). Two types are available; the 2.5" type (24 drives for each enclosure) and the 3.5" type (12 drives for each enclosure).

For expansion units (drive enclosure), two types are available; the 2U size 2.5" type (24 drives for each enclosure) and the 2U size 3.5" type (12 drives for each enclosure).

***1:** 1U is the height for a device that can be installed in one 19-inch rack unit (1U = 44.45mm).

● Drives

The ETERNUS DX supports SAS disks, cost-efficient and high-capacity Nearline SAS disks, and very high performance Solid State Drives (SSDs).

Up to 96 drives can be installed.
Up to eight SSDs can be installed.
2.5" and 3.5" drives can be mixed in the same ETERNUS DX.

- Controller

One or two controllers can be installed. When an ETERNUS DX has one controller, another controller can be added.

- Host Interfaces

Host interfaces can be selected from FC 8Gbit/s, iSCSI 10Gbit/s, iSCSI 1Gbit/s and SAS 6Gbit/s. Up to four ports can be installed in a single ETERNUS DX.

- Cache Capacity

The cache memory capacity for each controller is 2GB.

- Model Upgrade

As a support for system scalability after installation, an ETERNUS DX can be upgraded to a higher-end model. The ETERNUS DX60 S3 can be upgraded to the ETERNUS DX100 S3.

■ High Reliability

The high reliability of the ETERNUS DX enables operations to continue even when hardware fails. The ETERNUS DX also protects data and provides high speed data access.

- Data Integrity

The ETERNUS DX adds check codes to all data that is saved. The data is verified at multiple checkpoints on transmission paths to ensure data integrity.

In addition, the T10-DIF function (*2) is supported. The generated check codes and the data integrity are checked in the transmission path to the servers in order to verify data. By linking the Data Integrity Extensions (DIX) function of Oracle DB, data integrity can be ensured in the entire system including the server.

***2:** T10-Data Integrity Field. SCSI specifications related to the data protection mechanism set by T10, a Technical Committee that manages SCSI standards.

- Pro-Active Monitoring

When a sign of potential drive failure is detected, the data from the suspected drive is restored to the hot spare. When the restore is complete, the hot spare is switched for the drive with a possible sign of drive failure.

- Improved Connection Path Availability

Availability for data transfer paths between controllers and drives is now better than older models. Even if an error occurs in a drive enclosure on a path, reverse cabling ensures continued access by using normal paths to minimize the effect of the affected areas.

- Fast Recovery

A RAID level (RAID6-FR) that reduces data recovery times by supporting high speed recovery.

■ Security

Security and compliance are essential for the globalization of business activities and for the company's responsibility in society.

Support of Secure Socket Layer (SSL) and Secure Shell (SSH), which enable encryption of the network data that is transferred between the ETERNUS DX and the operation terminals, prevents any fraudulent access, alteration, and information leakage from occurring.

■ Cloud Platform

Optimal storage virtualization that supports cloud computing can provide a flexible ICT environment.

The system administrator can assign virtual resources flexibly on an on-demand basis according to operation load regardless of the physical devices by virtualizing all of the servers and storage systems and setting up a virtual resource pool.

● Disk Volume Virtualization

"Thin Provisioning", which is storage capacity virtualization technology, can reduce unused physical disks by allocating only the required capacity as logical disks. This reduces the operational burden and the initial cost that is required for upgrading the storage capacity (small start).

The ETERNUS DX has a function that balances writing areas on a volume basis to prevent concentrated access to a specific RAID group in multiple RAID groups that configure a disk pool.

● Virtualization Integration

Various functions that are provided by Oracle VM, VMware, and Microsoft are supported to configure and operate virtualized environments.

Linkage with software allows the backup of virtual environments (VMware/Hyper-V) without stopping the virtual machines. A more effective use of resources and the integrated management of virtualized environments can be achieved by offloading the server load to the ETERNUS DX.

■ Operability

Operation management for the ETERNUS DX can be performed easily.

● Easy Operation Management

Operation management can be easily performed with ETERNUS Web GUI by using a Web browser or with ETERNUS CLI by using commands and command scripts.

● Power Control

The ETERNUS DX power can be controlled when the servers are powered on and off. Scheduled operations can be performed according to the server operation.

● ETERNUS SF Express

ETERNUS SF Express is a storage system introduction and operation support software for the user who had put off the introduction of the storage system up to now because of "Difficulty" and "Introduction and operation cost increase". ETERNUS SF Express is an easy-to-use software that facilitates management of the ETERNUS DX storage systems. ETERNUS SF Express can be used free of charge with the purchase of an ETERNUS DX.

■ Business Continuity

The ETERNUS DX supports business continuity from the two perspectives of "data protection" and "backup".

● Data Protection

The ETERNUS DX can continue to operate even if failures occur because the main components of the ETERNUS DX are redundant.

If a power failure occurs, power is supplied from the electric double layer capacitors and the data in the cache memory is backed up to non-volatile memory. This protects the data in the cache memory without there being any restrictions on the number of days that data is retained.

The components in the storage system are periodically diagnosed and monitored for signs of failure, which enables error components to be dealt with at an early stage.

● Backup

High speed data replication can be performed at any point in time using the Advanced Copy functions in conjunction with software such as ETERNUS SF AdvancedCopy Manager.

■ Environmental Friendliness

The ETERNUS DX is a green-certified product that satisfies Fujitsu's original strict environmental standards as part of its global efforts to reduce the environmental burden.

The environmental burden is reduced by using an energy saving design that reduces power consumption.

● Energy Efficiency

The disk drives used in the ETERNUS DX have Eco-mode support by using the Massive Array of Idle Disks (MAID) technology. Based on the scheduled use of specific disks, Eco-mode reduces the power consumption of those disks by spinning down or by completely powering off the disks during periods of inactivity.

● RoHS Compliance

The ETERNUS DX complies with RoHS, as mandated by the European Parliament and Council. RoHS limits the use in electric and electronic equipment of six specific chemicals: lead, hexavalent chromium, mercury, cadmium, polybrominated biphenyl (PBB), and polybrominated diphenyl ether (PBDE). In addition, lead-free soldering is used for all printed-wiring boards.

Chapter 2

Specifications



This chapter describes the specifications, the function specifications, and the operating environment of the ETERNUS DX.

2.1 Specifications

Table 2.1 Specifications (ETERNUS DX60 S3)

Item		ETERNUS DX60 S3
Physical capacity (max.) (*1)	SAS disks	172.8TB
	Nearline SAS disks	384.0TB
	SSDs	12.8TB
Number of controllers		1 / 2
Cache capacity		2GB / 4GB
Host interface (maximum transfer rate)		FC (8Gbit/s) iSCSI (10Gbit/s, 10GBASE-T) iSCSI (1Gbit/s, 1000BASE-T) SAS (6Gbit/s)
Number of host interface ports	FC	2 / 4
	iSCSI	2 / 4
	SAS	2 / 4
Number of drives		2 – 96 (*2)
Drive capacity (rotational speed) (*3)	2.5" SAS disks	300GB, 600GB, 900GB, 1.2TB, 1.8TB (10,000rpm)
		300GB, 600GB (15,000rpm)
	2.5" Nearline SAS disks	1TB, 2TB (7,200rpm)
	2.5" SSDs	400GB, 800GB, 1.6TB
	3.5" SAS disks	900GB, 1.2TB, 1.8TB (10,000rpm)
	3.5" Nearline SAS disks	2TB, 4TB, 6TB, 8TB (7,200rpm)
Drive interface (maximum transfer rate)		SAS (6Gbit/s)

***1:** Physical capacity is calculated based on the assumption that 1TB=1,000GB and 1GB=1,000MB.

***2:** These are the values when three 2.5" type drive enclosures are installed in a 2.5" type controller enclosure.

***3:** The following disks are Advanced Format (512e) disks.

- 2.5"/3.5" SAS disks (1.8TB)
- 2.5" Nearline SAS disks (2TB)
- 3.5" Nearline SAS disks (6TB)
- 3.5" Nearline SAS disks (8TB)

2.2 Function Specifications

This section contains the specifications of the functions for the ETERNUS DX.

Table 2.2 Function Specifications (ETERNUS DX60 S3)

Item		ETERNUS DX60 S3
Supported RAID levels		0 (*1), 1, 1+0, 5, 5+0, 6, 6-FR (*2)
RAID groups	Number of RAID groups (max.) (*3)	48
	Number of volumes per RAID group	128
Volumes	Number of volumes (max.)	1,024
	Volume capacity (max.)	128TB
Number of connectable SAN hosts (HBAs) (max.)	Per storage system	128
	Per port	32

***1:** Use of RAID0 is not recommended because it is not redundant. For RAID0 configurations, data may be lost due to the failure of a drive.

***2:** Fujitsu original RAID level that provides the high speed rebuild function, and striping with double distributed parity.

***3:** The maximum number of RAID groups that can be registered (for the RAID1 configuration).

2.3 Operating Environment

This section explains the operating environment that is required for the ETERNUS DX operation.

2.3.1 Supported OSs

Servers and OSs that are supported by the ETERNUS DX as a SAN host are shown below.

For details on servers, Host Bus Adapters (HBAs), and driver software combined, refer to "Configuration Guide -Server Connection-".

■ FC Interface

Table 2.3 Supported Servers and OSs (FC Interface)

Server		OS
Manufacturer	Product name	
Fujitsu	Mission critical IA servers PRIMEQUEST	Windows Server 2008
		Windows Server 2012
		Red Hat Enterprise Linux 5
		Red Hat Enterprise Linux 6
		Red Hat Enterprise Linux 7
		VMware vSphere 5
		VMware vSphere 5.1
		VMware vSphere 5.5
		VMware vSphere 6
	UNIX servers SPARC Enterprise Fujitsu M10	Solaris 10
		Solaris 11
	Industry standard servers PRIMERGY	Windows Server 2008
		Windows Server 2012
		Red Hat Enterprise Linux 4
		Red Hat Enterprise Linux 5
		Red Hat Enterprise Linux 6
		Red Hat Enterprise Linux 7
		Oracle Linux 5
		Oracle Linux 6
		Oracle Linux 7
		VMware vSphere 5
		VMware vSphere 5.1
		VMware vSphere 5.5
		VMware vSphere 6
		SUSE Linux Enterprise Server 10
		SUSE Linux Enterprise Server 11
		SUSE Linux Enterprise Server 12
		Oracle VM 3
		XenServer 6
Oracle	SPARC Enterprise Fujitsu M10 Servers	Solaris 10
		Solaris 11
IBM	RS/6000 P series System p Power Systems	AIX 5.3
		AIX 6
		AIX 7
		VIOS 2.2

Server		OS
Manufacturer	Product name	
HP	HP 9000 server	HP-UX 11i v2
	HP Integrity server	HP-UX 11i v3
Others	Other industry standard servers	Solaris 10
		Solaris 11
		Windows Server 2008
		Windows Server 2012
		Red Hat Enterprise Linux 4
		Red Hat Enterprise Linux 5
		Red Hat Enterprise Linux 6
		Red Hat Enterprise Linux 7
		SUSE Linux Enterprise Server 10
		SUSE Linux Enterprise Server 11
		SUSE Linux Enterprise Server 12
		Oracle Linux 5
		Oracle Linux 6
		Oracle Linux 7
		Oracle VM 3
		VMware vSphere 5
		VMware vSphere 5.1
		VMware vSphere 5.5
		VMware vSphere 6
		XenServer 6

■ iSCSI Interface

Table 2.4 Supported Servers and OSs (iSCSI Interface)

Server		OS
Manufacturer	Product name	
Fujitsu	Mission critical IA servers PRIMEQUEST	Windows Server 2008
		Windows Server 2012
		Red Hat Enterprise Linux 5
		Red Hat Enterprise Linux 6
		Red Hat Enterprise Linux 7
		VMware vSphere 5
		VMware vSphere 5.1
		VMware vSphere 5.5
		VMware vSphere 6
	UNIX servers SPARC Enterprise Fujitsu M10	Solaris 10
		Solaris 11
	Industry standard servers PRIMERGY	Windows Server 2008
		Windows Server 2012
		Red Hat Enterprise Linux 5
		Red Hat Enterprise Linux 6
		Red Hat Enterprise Linux 7
		SUSE Linux Enterprise Server 10
		SUSE Linux Enterprise Server 11
		SUSE Linux Enterprise Server 12
		Oracle Linux 5
		Oracle Linux 6
		Oracle Linux 7
		VMware vSphere 5
		VMware vSphere 5.1
		VMware vSphere 5.5
		VMware vSphere 6
		Oracle VM 3
		XenServer 6
Oracle	SPARC Enterprise Fujitsu M10 Servers	Solaris 10
		Solaris 11
HP	HP 9000 server HP Integrity server	HP-UX 11i v2
		HP-UX 11i v3

Server		OS
Manufacturer	Product name	
Others	Other industry standard servers	Solaris 10
		Solaris 11
		Windows Server 2008
		Windows Server 2012
		Red Hat Enterprise Linux 5
		Red Hat Enterprise Linux 6
		Red Hat Enterprise Linux 7
		SUSE Linux Enterprise Server 10
		SUSE Linux Enterprise Server 11
		SUSE Linux Enterprise Server 12
		Oracle Linux 5
		Oracle Linux 6
		Oracle Linux 7
		VMware vSphere 5
		VMware vSphere 5.1
		VMware vSphere 5.5
		VMware vSphere 6
		Oracle VM 3
		XenServer 6

■ SAS Interface

Table 2.5 Supported Servers and OSs (SAS Interface)

Server		OS
Manufacturer	Product name	
Fujitsu	Mission critical IA servers PRIMEQUEST	Windows Server 2008
		Windows Server 2012
		Red Hat Enterprise Linux 5
		Red Hat Enterprise Linux 6
		Red Hat Enterprise Linux 7
		VMware vSphere 5
		VMware vSphere 5.1
		VMware vSphere 5.5
	UNIX servers SPARC Enterprise Fujitsu M10	Solaris 10
		Solaris 11
	Industry standard servers PRIMERGY	Windows Server 2008
		Windows Server 2012
		Red Hat Enterprise Linux 5
		Red Hat Enterprise Linux 6
		Red Hat Enterprise Linux 7
		SUSE Linux Enterprise Server 10
		SUSE Linux Enterprise Server 11
		SUSE Linux Enterprise Server 12
		VMware vSphere 5
		VMware vSphere 5.1
		VMware vSphere 5.5
		VMware vSphere 6
Oracle	SPARC Enterprise Fujitsu M10 Servers	Solaris 10
		Solaris 11

Server		OS
Manufacturer	Product name	
Others	Other industry standard servers	Solaris 10
		Solaris 11
		Windows Server 2008
		Windows Server 2012
		Red Hat Enterprise Linux 5
		Red Hat Enterprise Linux 6
		Red Hat Enterprise Linux 7
		SUSE Linux Enterprise Server 10
		SUSE Linux Enterprise Server 11
		SUSE Linux Enterprise Server 12
		VMware vSphere 5
		VMware vSphere 5.1
		VMware vSphere 5.5
		VMware vSphere 6

2.3.2 ETERNUS Web GUI/ETERNUS CLI Operating Environment

The ETERNUS DX can be managed via ETERNUS Web GUI or ETERNUS CLI.

ETERNUS Web GUI or ETERNUS CLI can be started by accessing the ETERNUS DX from the administration terminal via the LAN. They can be used to configure, monitor, and manage the storage system.

- ETERNUS Web GUI

When using ETERNUS Web GUI to manage operations, prepare a Web browser in the administration terminal. The following table shows the supported Web browsers.

Table 2.6 ETERNUS Web GUI Operating Environment

Software	Guaranteed operating environment
Web browser	Microsoft Internet Explorer 7.0, 8.0, 9.0, 10.0 (desktop version), 11.0 (desktop version)
	Mozilla Firefox 3.6.x, ESR 10.0.x, ESR 17.0.x, ESR 24.0.x

- ETERNUS CLI

When using ETERNUS CLI for operation management, prepare the telnet application, the SSH application, or the terminal emulator in the administration terminal.

Chapter 3

Functions

This chapter explains the available functions for the ETERNUS DX.

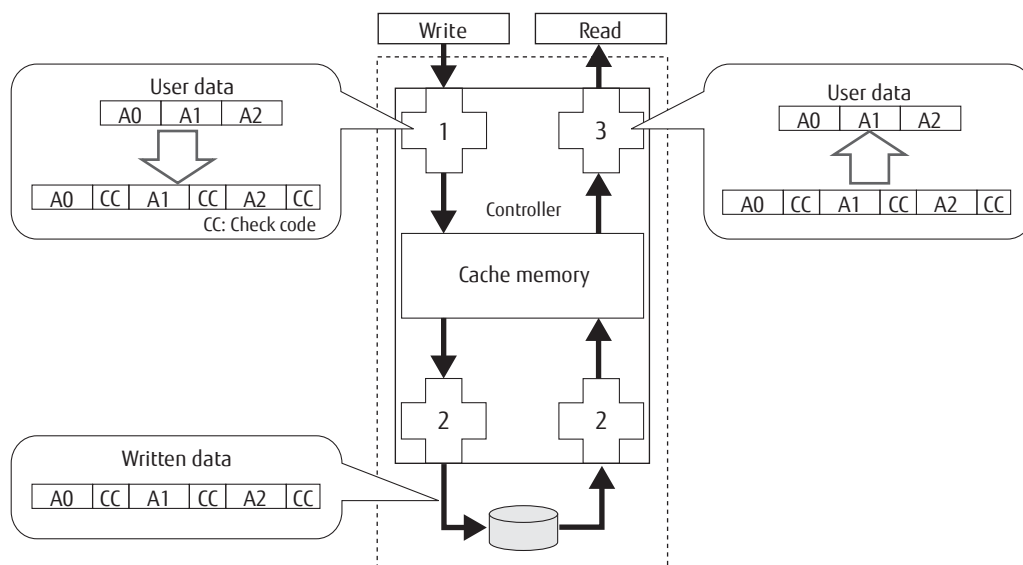
3.1 Data Protection

The ETERNUS DX has functions to securely protect user data.

3.1.1 Data Block Guard

When data is written from the server, the Data Block Guard function adds eight bytes check codes to each block (every 512 bytes) of the data and verifies the data at multiple checkpoints to ensure data consistency. This function can detect a data error when data is destroyed or data corruption occurs. When data is read from the server, the check codes are confirmed and then removed, ensuring that data consistency is verified in the whole storage system.

Figure 3.1 Data Block Guard



1. The check codes are added
2. The check codes are confirmed
3. The check codes are confirmed and removed

In addition, the T10-DIF function is supported. T10-DIF is a function that adds a check code to data that is to be transferred between the Oracle Linux server and the ETERNUS DX, and ensures data integrity at the SCSI level.

The server generates a check code for the user data in the host bus adapter (HBA), and verifies the check code when reading data in order to ensure data integrity.

The ETERNUS DX double-checks data by using the data block guard function and by using the supported T10-DIF to improve reliability.

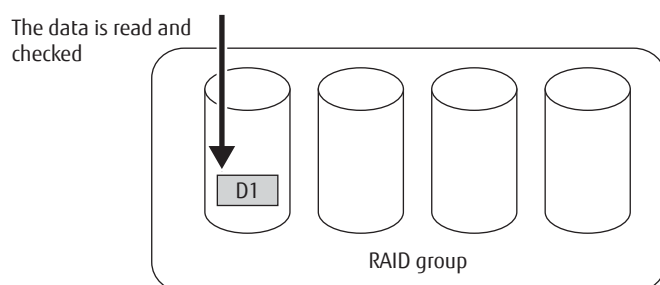
Data is protected at the SCSI level on the path to the server. Therefore, data integrity can be ensured even if data is corrupted during a check code reassignment.

By linking the Data Integrity Extensions (DIX) function of Oracle DB, data integrity can be ensured in the entire system including the server.

3.1.2 Disk Drive Patrol

The Disk Drive Patrol function regularly diagnoses and monitors the operational status of all drives that are installed in the ETERNUS DX. Drives are checked (read check) regularly as a background process.

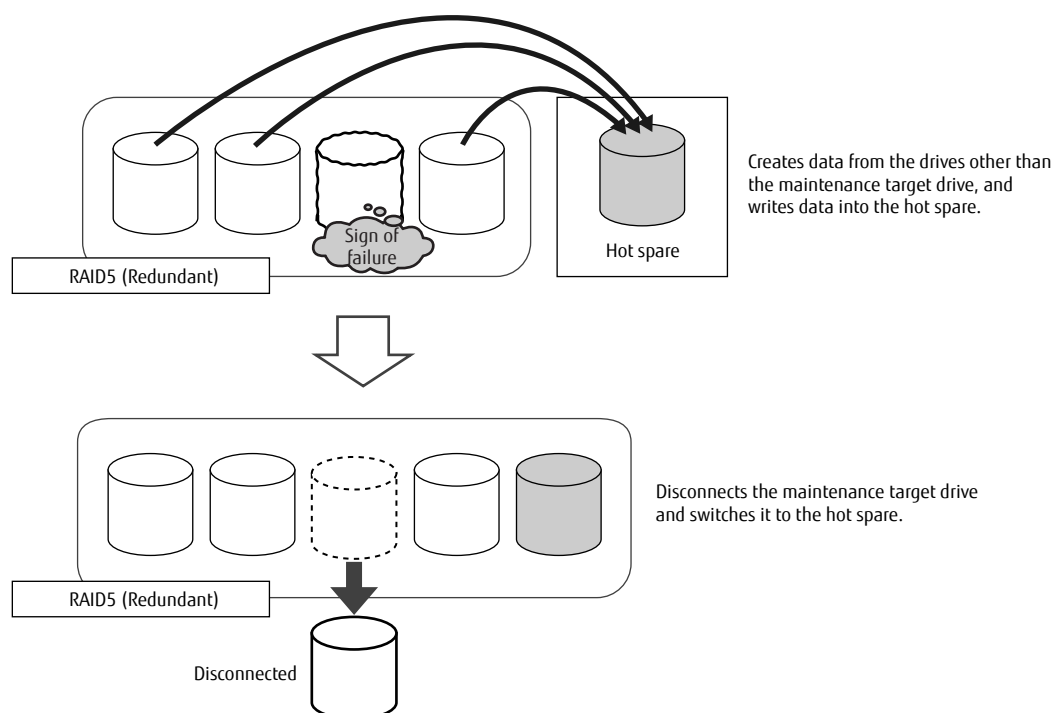
Figure 3.2 Drive Check



3.1.3 Redundant Copy

When the Disk Patrol function decides that preventative maintenance is required for a drive, the Redundant Copy function uses the remaining drives to re-create the data of the maintenance target drive and writes the data to the hot spare. The Redundant Copy function enables data to be restored while maintaining data redundancy.

Figure 3.3 Redundant Copy Function

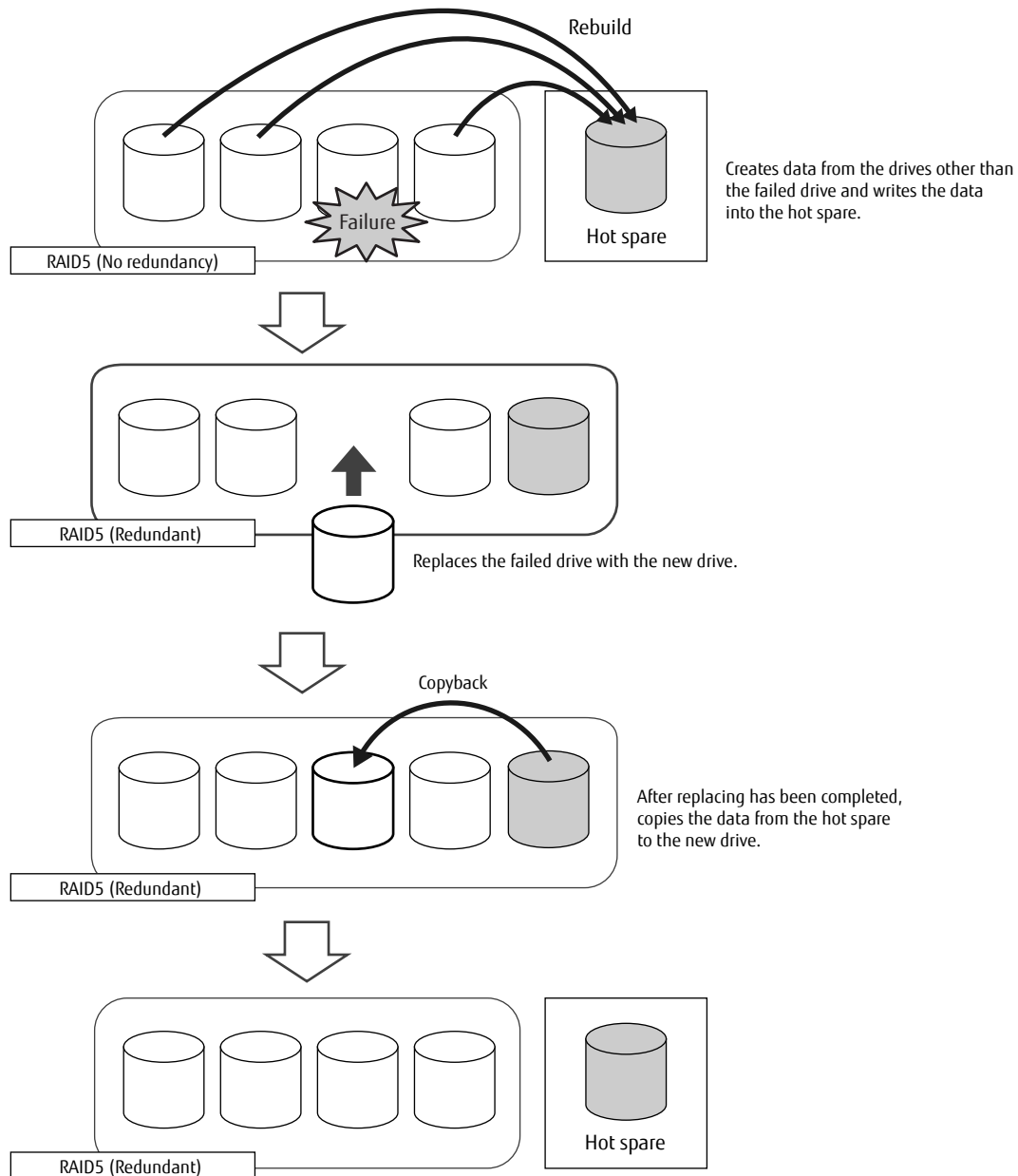


3.1.4 Rebuild/Copyback

When a drive fails and RAID group redundancy is broken, Rebuild/Copyback restores the drive status back to normal status as a background process. If a free hot spare is available when one of the RAID group drives has a problem, data of this drive is automatically replicated in the hot spare. This ensures data redundancy.

Copyback can be performed automatically by changing the copyback setting. Copyback is not automatically performed by default when a failed drive is replaced and the replacement drive is used as a hot spare (Copybackless).

Figure 3.4 Rebuild/Copyback Function

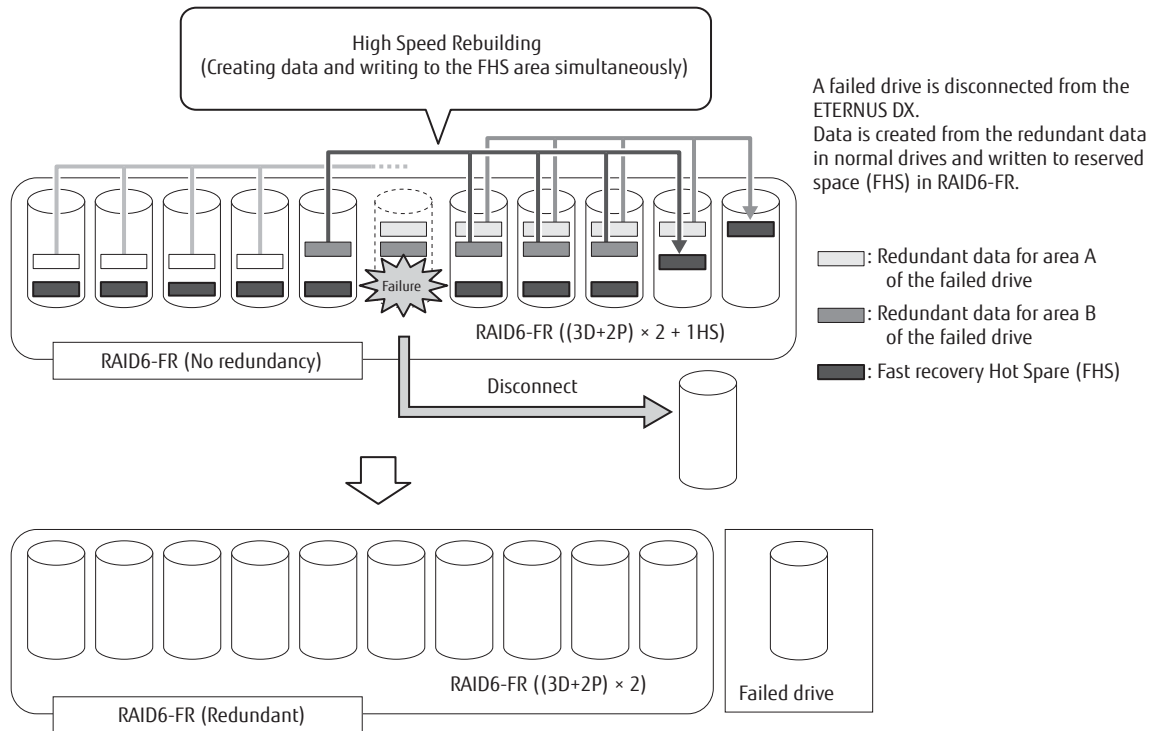


3.1.5 Fast Recovery

This function recovers data quickly by relocating data in the failed drive to the other remaining drives when a drive error is detected.

A RAID level (RAID6-FR) that preserves reserved areas equivalent to hot spares in a RAID group is used.

Figure 3.5 Fast Recovery



3.1.6 Protection (Shield)

The Protection (Shield) function diagnoses temporary drive errors. A drive can continue to be used if it is determined to be normal. The target drive temporarily changes to diagnosis status when drive errors are detected by the Disk Drive Patrol function or error notifications.

For a drive that configures a RAID group, data is moved to a hot spare by a rebuild or redundant copy before the drive is diagnosed.

For a drive that is disconnected from a RAID group, whether the drive has a permanent error or a temporary error is determined. The drive can be used again if it is determined that the drive has only a temporary error.

The target drives for the Protection (Shield) function are SAS disks and Nearline SAS disks that are registered in RAID groups or as hot spares. Note that the Protection (Shield) function is not available for SSDs and unused drives.

3.2 Operations Optimization (Virtualization)

The Thin Provisioning function can be used for disk virtualization. This function reduces the initial cost by optimizing the usability of physical capacity. The power consumption requirements can also be reduced because a fewer number of drives are installed.

IMPORTANT

A single controller configuration differs from a dual controller configuration in the following ways:

- The Thin Provisioning function cannot be used.

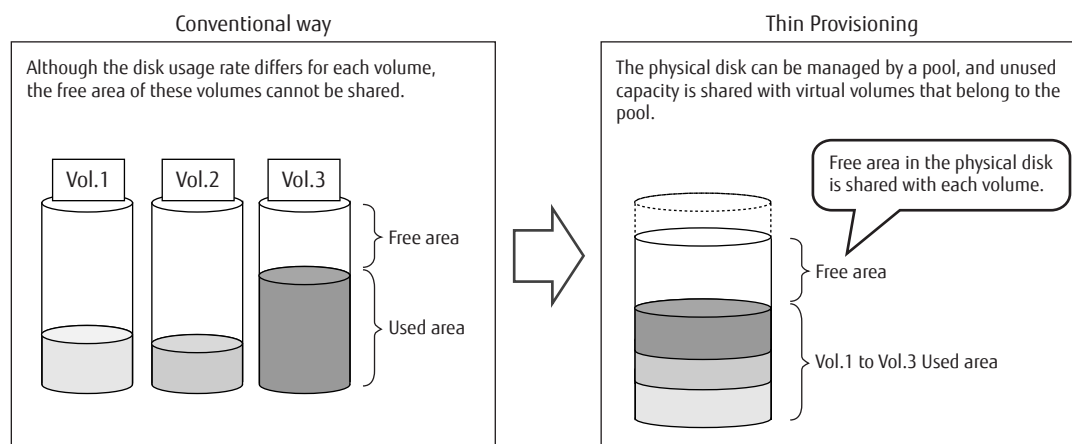
3.2.1 Thin Provisioning

The Thin Provisioning function sets virtually-available capacity regardless of the actual physical capacity that is registered.

In an environment where the Thin Provisioning function is used, the capacity is allocated to virtual volumes instead of physical disks to meet user's requests. Physical disks are managed as a shared disk pool. Physical disks are allocated a capacity that is in proportion to the amount of data that is written to the virtual volume. This enables efficient usage of physical disks by making sure that there are no unused physical disks.

A threshold for a physical disk pool to prevent any capacity shortage and a function that automatically notifies the administrator when the threshold is reached enable drives to be added when needed.

Figure 3.6 Example of Thin Provisioning



3.3 Optimization of Volume Configurations

This section explains the functions that optimize volume configurations according to the customer's environment.

The ETERNUS DX allows for the expansion of volumes and RAID group capacities, migration among RAID groups, and changing of RAID levels according to changes in the operation load and performance conditions without interruption to data.

■ Expansion of Volume Capacity

Volume capacity expansion is possible by using RAID Migration to move a volume to a RAID group that has enough free space.

Volume capacity expansion is also possible by using LUN Concatenation to add areas of free space to an existing volume.

■ Expansion of RAID Group Capacity

The existing RAID group capacity can be expanded by adding drives to the RAID group with Logical Device Expansion.

■ Migration among RAID Groups

Migration of a volume to another RAID group is possible by using RAID Migration.

■ Changing the RAID Level

Changing of the RAID level is possible by using RAID Migration to migrate to a RAID group with a different RAID level.

Logical Device Expansion can also be used to change the RAID level. Drives can be added while the RAID level is being changed.

■ Striping for Multiple RAID Groups

Server I/O access performance can be improved by distributing the allocation of a volume across multiple RAID groups with Wide Striping.

3.4 Security

The ETERNUS DX provides various enhanced security functions.

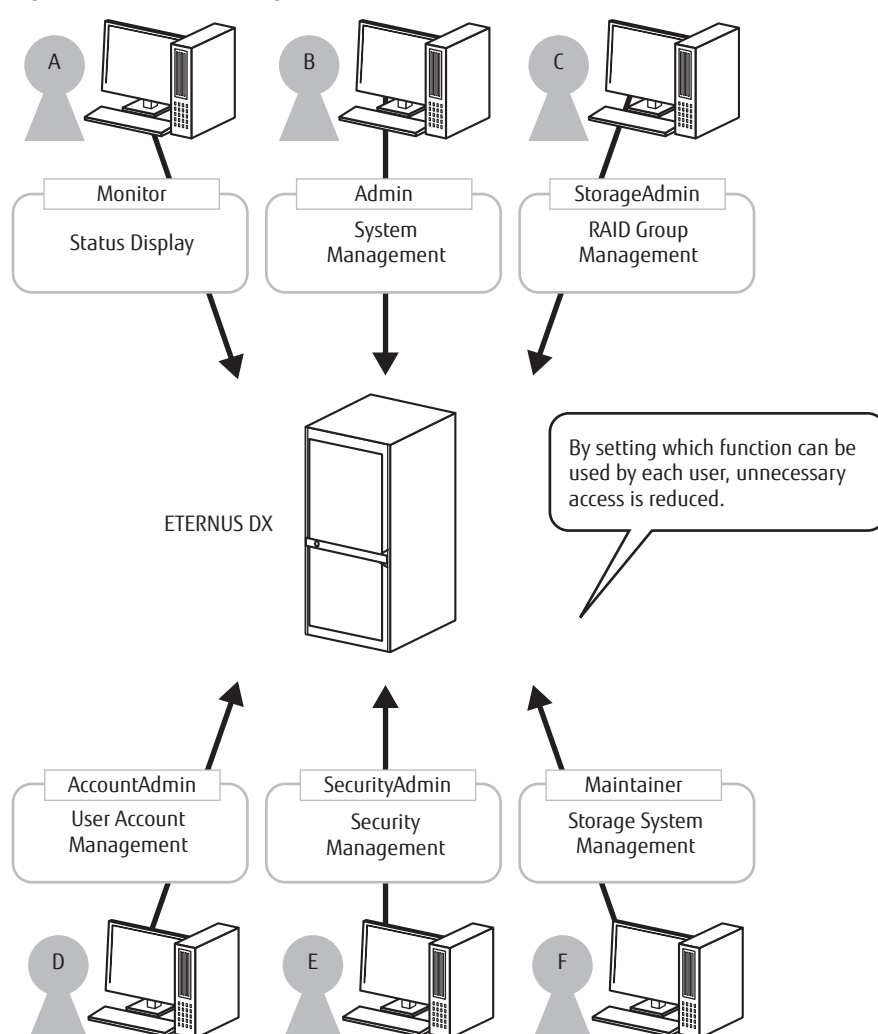
3.4.1 Account Management

Proper user account management is very important to configure a system where security is paramount.

The ETERNUS DX allocates roles and access authority when a user account is created, and sets which functions can be used depending on the user privileges.

Since the authorized functions of the storage administrator are classified according to the usage and only minimum privileges are given to the administrator, security is improved and operational mistakes and management hours can be reduced.

Figure 3.7 Account Management



3.4.2 User Authentication

Internal Authentication and External Authentication are available as logon authentication methods.

Internal Authentication uses the user account information that is registered in the ETERNUS DX to perform logon authentication.

External Authentication uses the user account information that is registered on the RADIUS server.

An authentication with a server certificate is performed when an https connection is used with SSL/TLS to connect to ETERNUS Web GUI. Password authentication and client public key authentication are available when SSH is used to connect to ETERNUS CLI.

3.4.3 Audit Log

The ETERNUS DX can send information such as access records by the administrator and setting changes as audit logs to the Syslog servers.

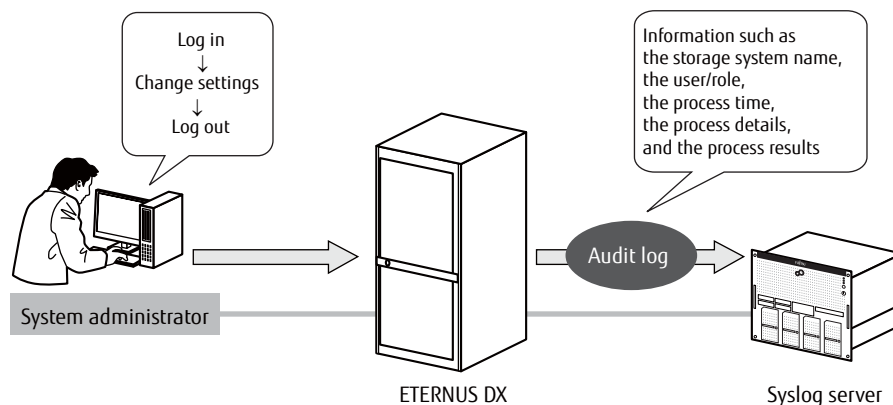
Audit logs are audit trail information that record operations that are executed for the ETERNUS DX and the response from the system. This information is required for auditing.

The audit log function enables monitoring of all operations and any unauthorized access that may affect the system.

Syslog protocols (RFC3164 and RFC5424) are supported for audit logs.

Information that is to be sent is not saved in the ETERNUS DX and the Syslog protocols are used to send out the information. Two Syslog servers can be set as the destination servers in addition to the Syslog server that is used for event notification.

Figure 3.8 Audit Log



3.4.4 Host Affinity

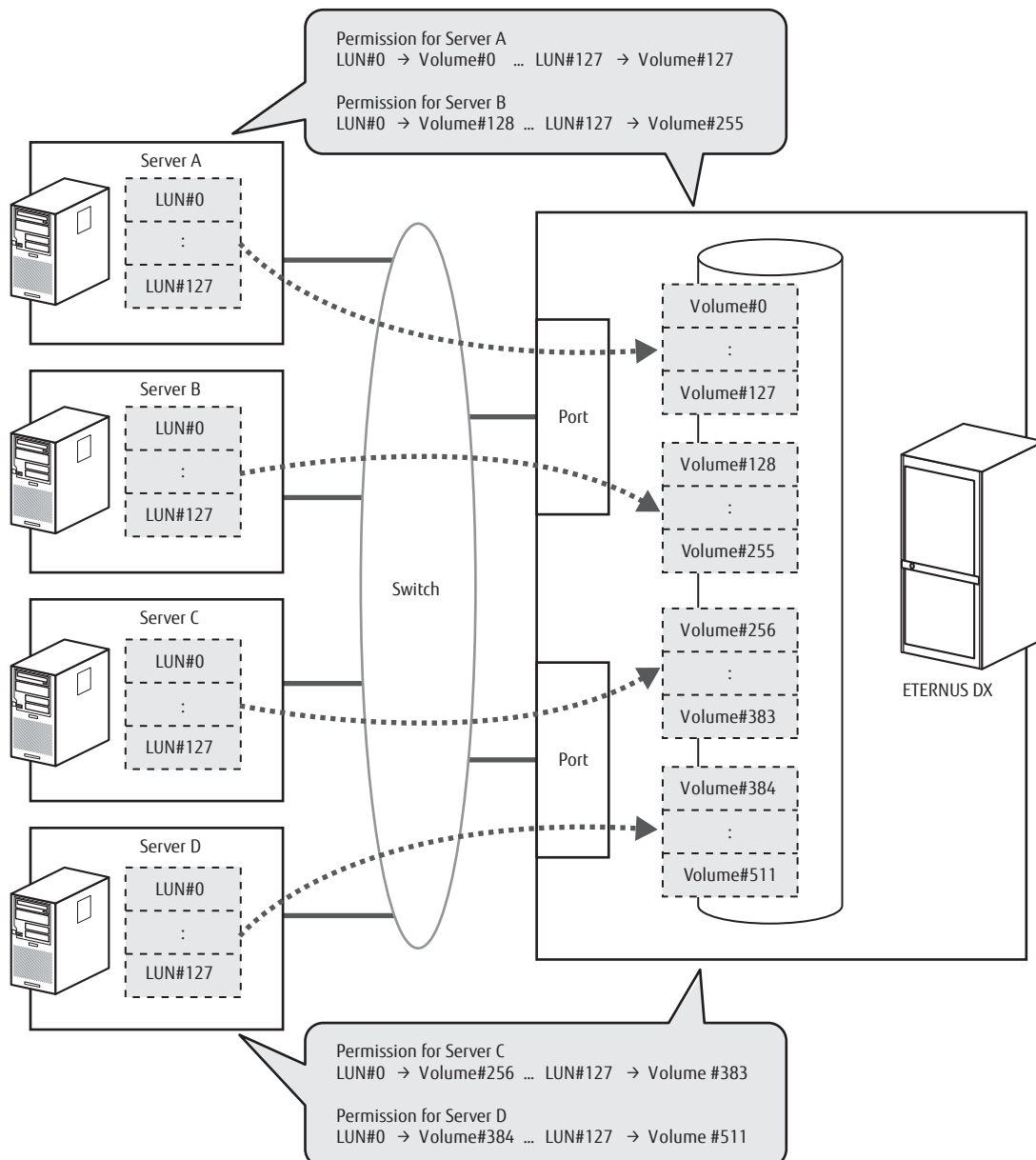
The host affinity function prevents data from being damaged due to inadvertent storage access.

By defining a server that can access the volume, security can be ensured when multiple servers are connected.

A server can access the volume by associating the server that is allowed to access the volume with the volume.

Volumes that are accessed can be set for each host interface port.

Figure 3.9 Host Affinity



By using the host affinity function, a host interface port can be shared by multiple servers with different OSs in a system or by multiple servers in a cluster system.

3.4.5 iSCSI Security

For an iSCSI interface, the iSCSI authentication function can be used when the initiator accesses the target. The iSCSI authentication function is available for host connections and remote copying.

The Challenge Handshake Authentication Protocol (CHAP) is supported for iSCSI authentication. For CHAP Authentication, unidirectional CHAP or bidirectional CHAP can be selected. When unidirectional CHAP is used, the target authenticates the initiator to prevent fraudulent access. When bidirectional CHAP is used, the target authenticates the initiator to prevent fraudulent access and the initiator authenticates the target to prevent impersonation.

3.5 Environmental Burden Reduction

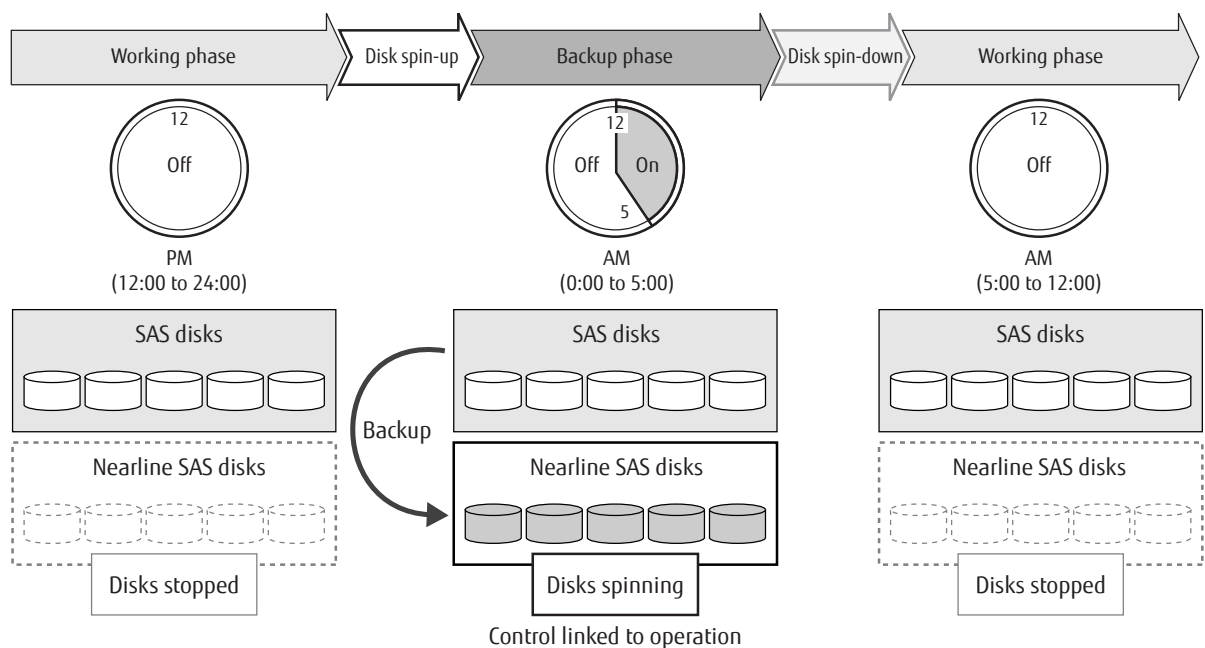
The ETERNUS DX has energy and power savings that reduce CO2 emissions and lessen the burden on the environment.

3.5.1 Eco-mode

Eco-mode is a function that reduces power consumption for limited access disks by stopping the disks rotation during specified periods or by powering off the disks.

An overview of the Eco-mode is shown below.

Figure 3.10 Eco-mode Overview

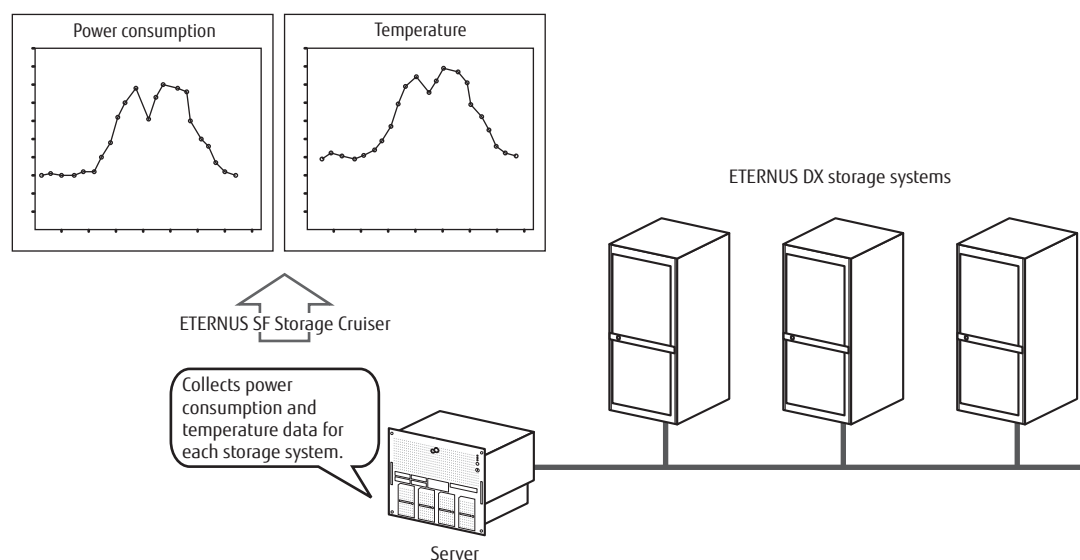


3.5.2 Power Consumption Visualization

The power consumption and the temperature of the ETERNUS DX can be visualized with a graph by using the ETERNUS SF Storage Cruiser integrated management software in a storage system environment. Cooling efficiency can be improved by understanding local temperature rises in the data center and reviewing the location of air-conditioning.

Understanding the drives that have a specific time to be used from the access frequency to RAID groups enables the Eco-mode schedule to be adjusted accordingly.

Figure 3.11 Power Consumption Visualization



3.6 Operation Management

This section explains the functions related to operation management and device monitoring for the ETERNUS DX.

A failed part can be promptly detected and diagnosed by operation management software. This enables the problem to be appropriately dealt with. Collecting and analyzing detailed performance data improves the performance of the system.

3.6.1 Operation Management Interface

Operation management software can be selected in the ETERNUS DX according to environment of the user. ETERNUS Web GUI (Graphical User Interface) and ETERNUS CLI (Command Line Interface) are embedded in the ETERNUS DX controllers.

■ ETERNUS Web GUI

ETERNUS Web GUI is a program for settings and operation management that is embedded in the ETERNUS DX and accessed by using a web browser via http or https.

ETERNUS Web GUI has an easy-to-use design that makes intuitive operation possible.

The settings that are required for the ETERNUS DX initial installation can be easily performed by following the wizard and inputting the parameters for the displayed setting items.

■ ETERNUS CLI

ETERNUS CLI supports Telnet or SSH connections. The ETERNUS DX can be configured and monitored using commands and command scripts.

ETERNUS CLI has most of the functions that are available in ETERNUS Web GUI.

■ ETERNUS SF

ETERNUS SF can manage a Fujitsu storage products centered storage environment. An easy-to-use interface enables complicated storage environment design and setting operations, which allows easy installation of a storage system without needing to have high level skills.

ETERNUS SF ensures stable operation by managing the entire storage environment.

■ SMI-S

Storage systems can be managed collectively using the general storage management application that supports Version 1.6 of Storage Management Initiative Specification (SMI-S). SMI-S is a storage management interface standard of the Storage Network Industry Association (SNIA).

3.6.2 Event Notification

When an error occurs in the ETERNUS DX, the event notification function notifies the event information to the administrator. The administrator can be informed that an error occurred without monitoring the screen all the time.

The methods to notify an event are e-mail, SNMP Trap, Syslog, remote support, and host sense.

The notification methods and levels can be set as required.

- E-mail

When an event occurs, an e-mail is sent to the specified e-mail address.

- SNMP Trap

Using the SNMP agent function, management information is sent to the SNMP manager (monitoring server).

- Syslog

By registering the Syslog destination server in the ETERNUS DX, various events that are detected by the ETERNUS DX are sent to the Syslog server as event logs.

- Remote support

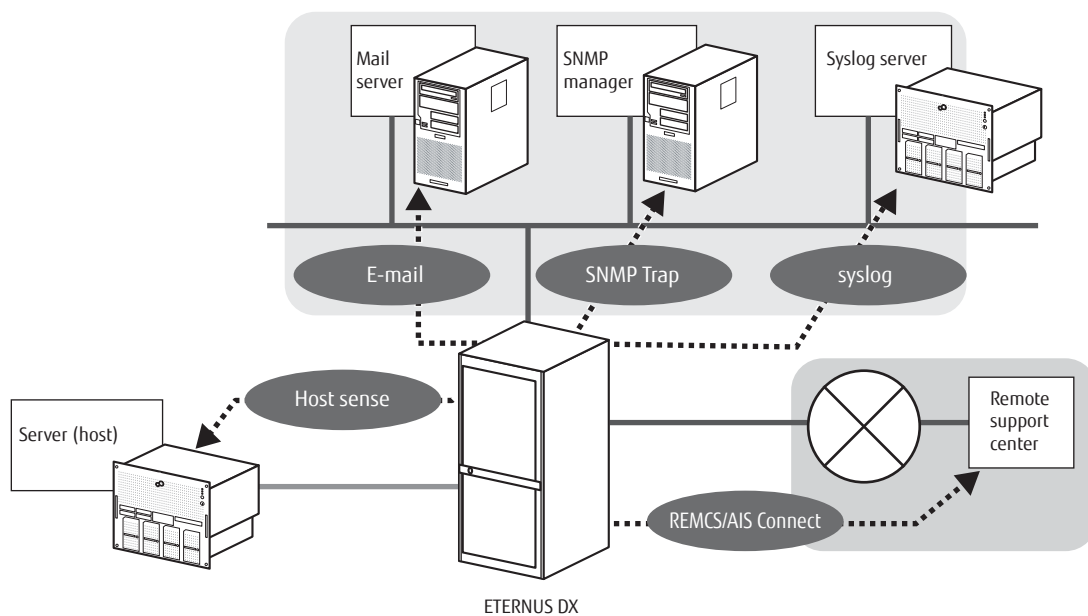
The errors that occur in the ETERNUS DX are notified to the remote support center. Additional information (logs and system configuration information) for checking the error is also sent. This shortens the time to collect information.

- Host sense

The ETERNUS DX returns host senses (sense codes) to notify specific status to the server. Detailed information such as error contents can be obtained from the sense code.

Using the ETERNUS Multipath Driver to monitor the storage system by host senses is recommended. Sense codes that cannot be detected in a single configuration can also be reported.

Figure 3.12 Event Notification



3.6.3 Performance Information Management

The ETERNUS DX supports a function that collects and displays the performance data of the storage system via ETERNUS Web GUI or ETERNUS CLI. The collected performance information shows the operation status and load status of the ETERNUS DX and can be used to optimize the system configuration.

Performance information that can be collected includes host I/O information (IOPS values, throughput values, response time, cache hit rate) and the usage information of CMs (CPUs) and drives.

ETERNUS SF Storage Cruiser or ETERNUS SF Express can be used to easily understand the operation status and load status of the ETERNUS DX by graphically displaying the collected information on the GUI. An administrator can also use ETERNUS SF Storage Cruiser to monitor the performance threshold and specify how long performance information is retained.

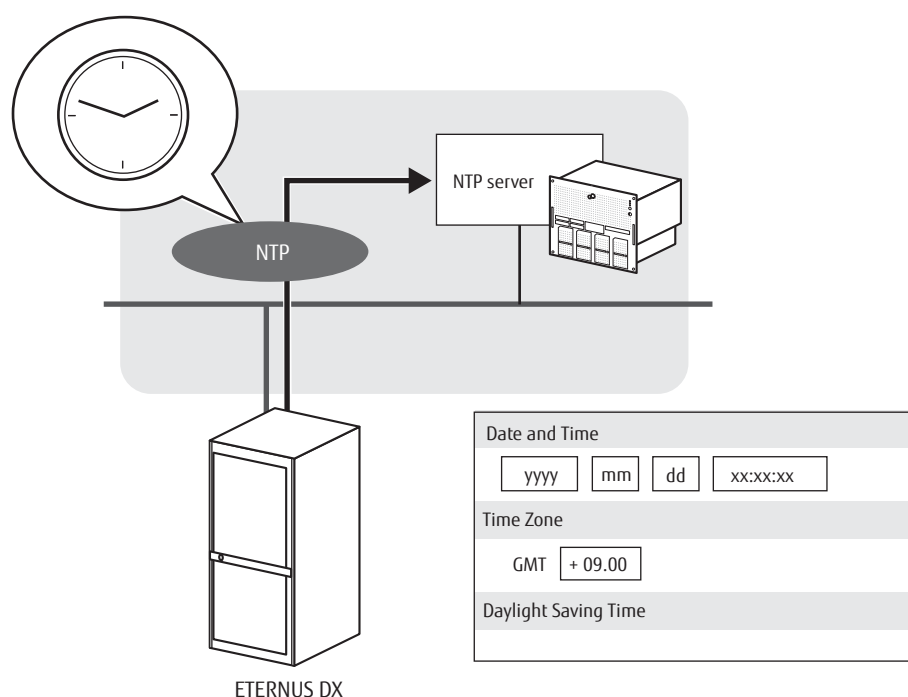
3.6.4 Device Time Synchronization

The ETERNUS DX has a clock function and manages time information of date/time and the time zone (the region in which the ETERNUS DX is installed). This time information is used for internal logs and for functions such as Eco-mode and remote support.

The automatic time correction by the Network Time Protocol (NTP) is recommended to synchronize time in the whole system.

When using the NTP, specify the NTP server or the SNTP server. The time correction mode is Step mode (immediate correction). The time is regularly corrected every three hours once the NTP is set.

Figure 3.13 Device Time Synchronization



3.6.5 Power Control

Power control methods for the ETERNUS DX are described below.

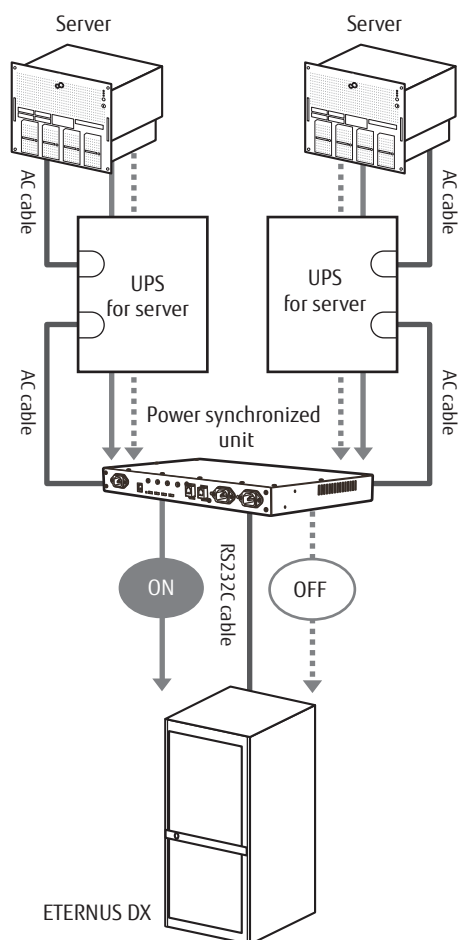
- Power synchronized unit
- Wake On LAN

■ Power Synchronized Unit

A power synchronized unit detects changes in the AC power output of the Uninterruptible Power Supply (UPS) unit that is connected to the server and automatically turns on and off the ETERNUS DX.

For more details about power synchronized units, refer to "Configuration Guide (Power Synchronized Unit)".

Figure 3.14 Power Synchronized Unit Diagram



■ Remote Power Operation (Wake On LAN)

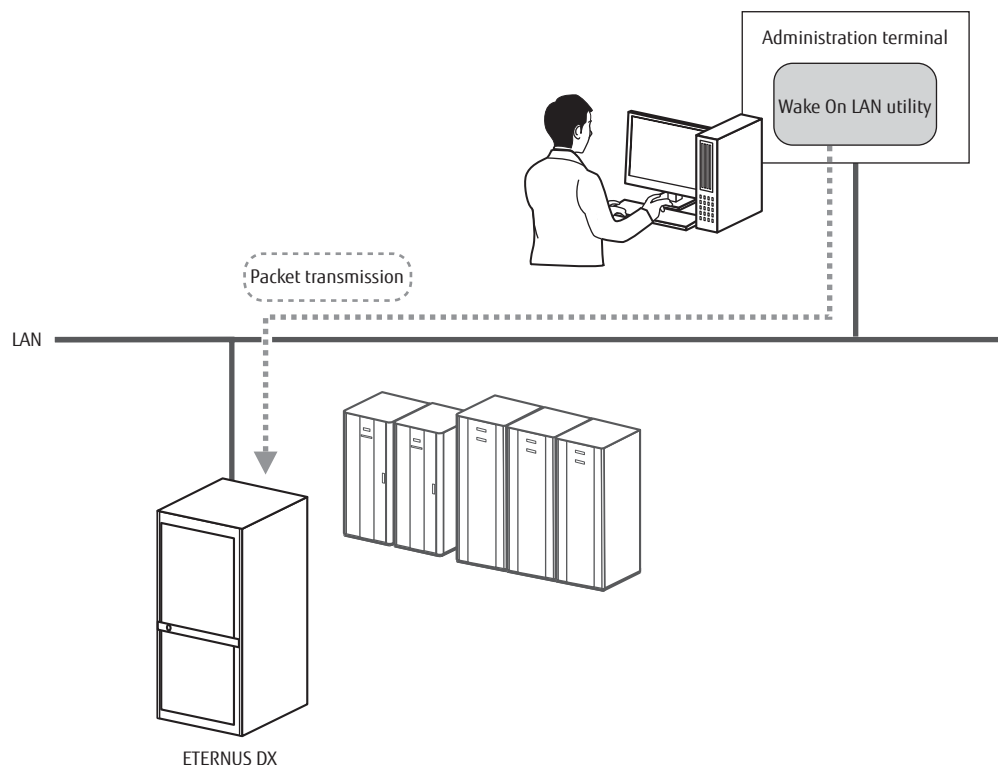
Wake On LAN is a function that turns on the ETERNUS DX via a network.

When "magic packet" data is sent from an administration terminal, the ETERNUS DX detects the packet and the power is turned on.

To perform Wake On LAN, utility software for Wake On LAN is required and settings for Wake On LAN must be performed.

The MAC address for the ETERNUS DX can be checked on ETERNUS CLI.

Figure 3.15 Power Supply Control Using Wake On LAN



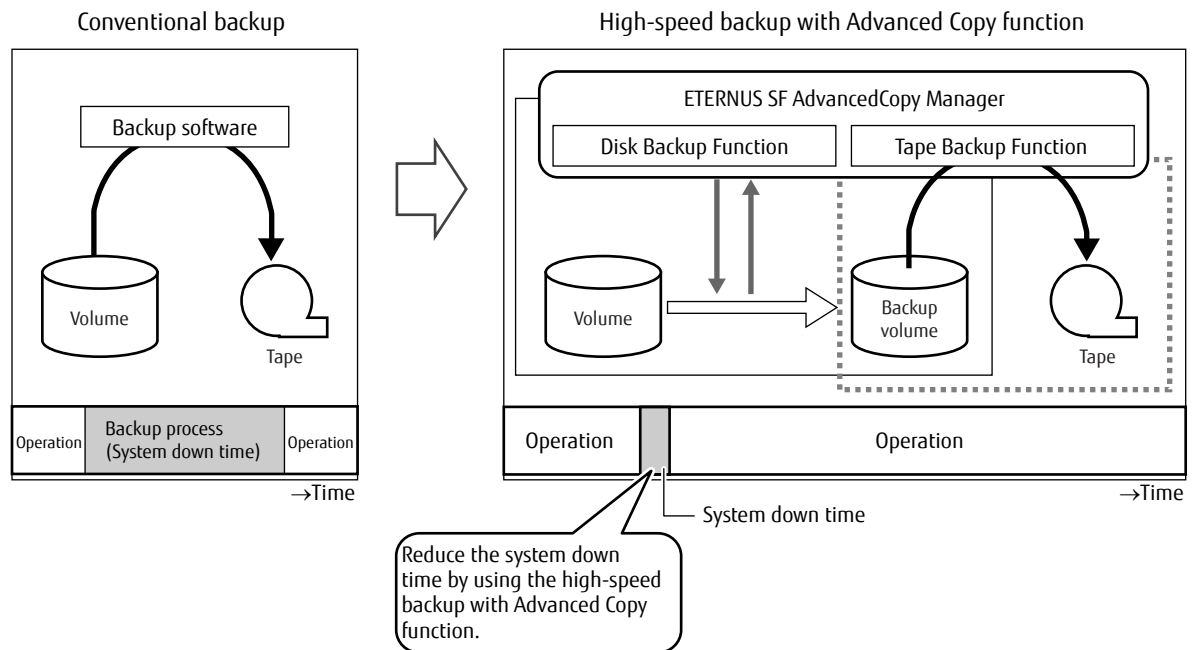
3.7 Backup (Advanced Copy)

The Advanced Copy function (high-speed copying function) enables data backup (data replication) at any point without stopping the operations of the ETERNUS DX.

For an ETERNUS DX backup operation, data can be replicated without placing a load on the business server. The replication process for large amounts of data can be performed by controlling the timing and business access so that data protection can be considered separate from operation processes.

An example of an Advanced Copy operation using ETERNUS SF AdvancedCopy Manager is shown below.

Figure 3.16 Example of Advanced Copy



There is one type of Advanced Copy: a local copy that is performed within a single ETERNUS DX.

The following copy methods are available:

- One Point Copy (OPC)
- QuickOPC
- SnapOPC
- SnapOPC+
- Equivalent Copy (EC)

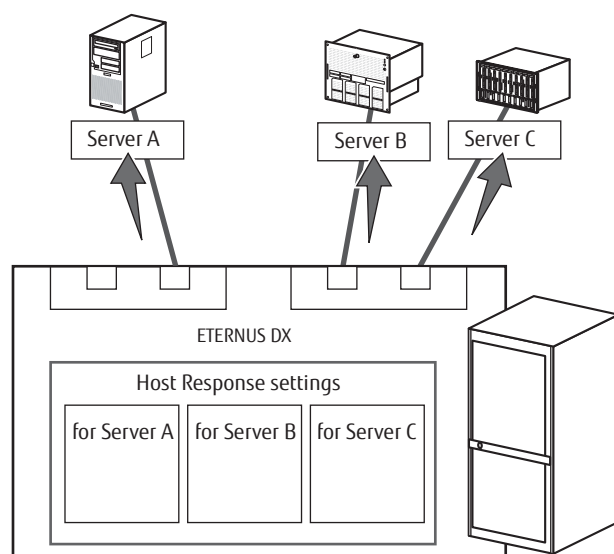
3.8 Stable Operation

This section explains a function that sets the operation mode according to the connection environment of the ETERNUS DX in order to enable stable operation.

3.8.1 Host Response

The server requirements of the supported functions, LUN addressing, and the method for command responses vary depending on the connection environments such as the server OS and the driver that will be used. Responses from the ETERNUS DX can be changed to the optimal one by specifying the appropriate operation mode for the connection environments.

Figure 3.17 Host Response (Connection Operation Mode)



3.9 Data Migration

This section explains the function that migrates data from an old storage system to the ETERNUS DX.

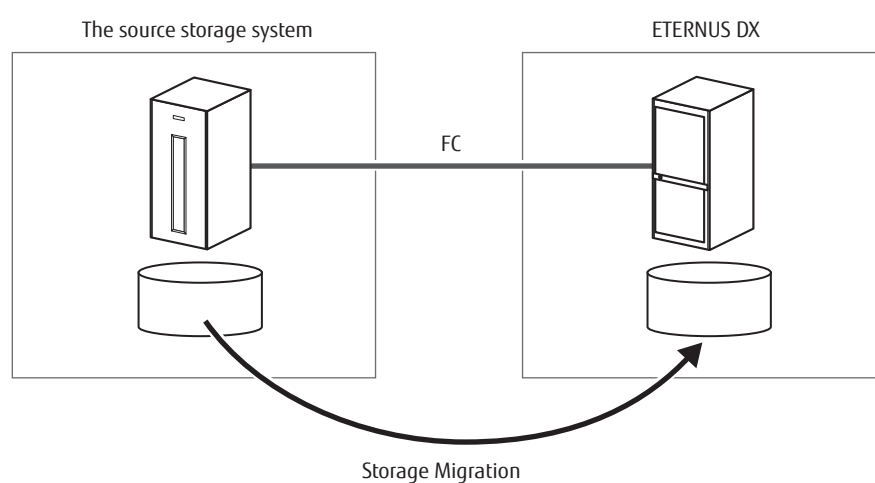
3.9.1 Storage Migration

Storage Migration is a function that migrates the volume data from an old storage system to volumes in a new storage system without using a host in cases such as when replacing a storage system.

The migration source storage system and migration destination ETERNUS DX are connected using FC cables. Data read from the target volume in the migration source is written to the migration destination volume in the ETERNUS DX.

Since Storage Migration is controlled by ETERNUS DX controllers, no additional software is required.

Figure 3.18 Storage Migration



3.10 Server Linkage Functions

The ETERNUS DX supports various functions that are provided by linking with servers.

Examples of linkage functions include a backup function that does not place a load on the server and a function that can obtain information from the ETERNUS DX and visualize this information without using ETERNUS Web GUI. These functions enable integrated infrastructure management in a virtual environment.

Note that some of these functions may require installation of plug-ins. Refer to the following site for more details:

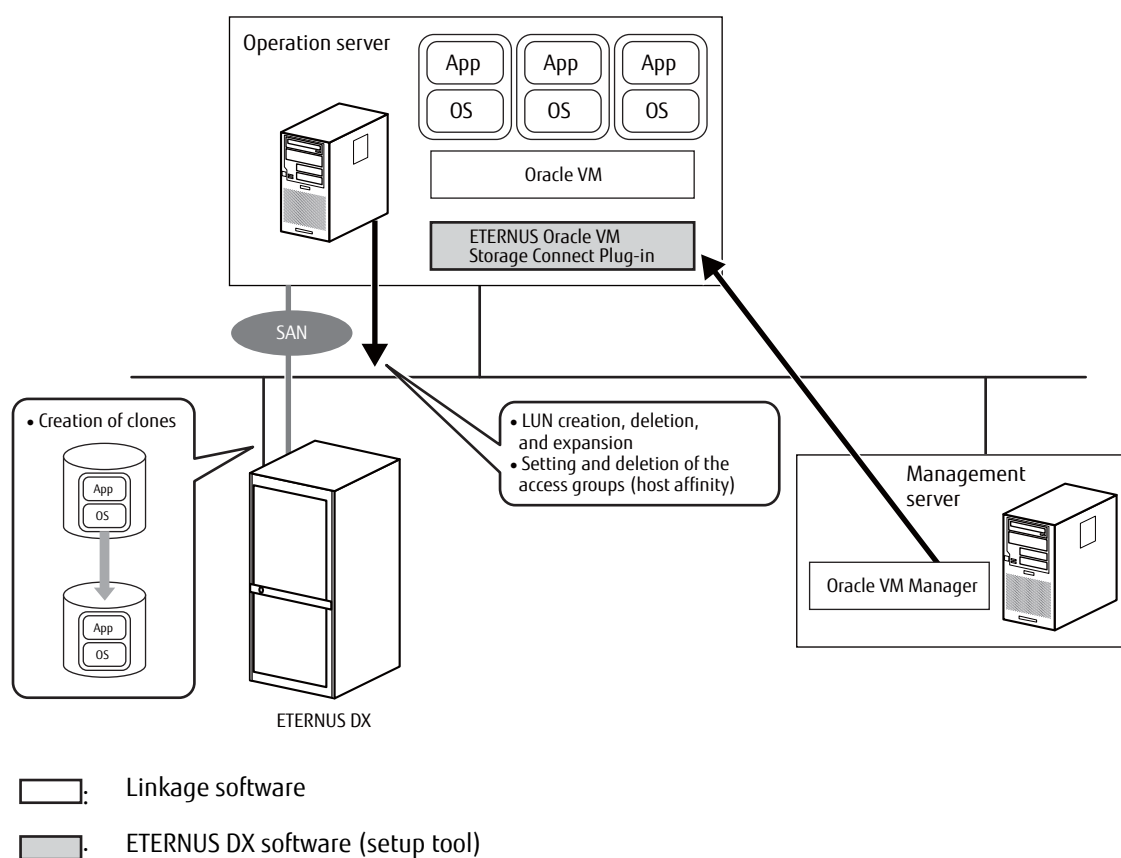
<http://www.fujitsu.com/global/support/products/computing/storage/download/>

3.10.1 Oracle VM Linkage

"Oracle VM Manager", which is the user interface of the "Oracle VM" server environment virtualization software, can manage the ETERNUS DX.

The Oracle VM Storage Connect framework enables Oracle VM Manager to directly use the resources and functions of the ETERNUS DX in an Oracle VM environment. Native storage services such as Logical Unit Number (LUN) creation, deletion, expansion, and snapshots are supported.

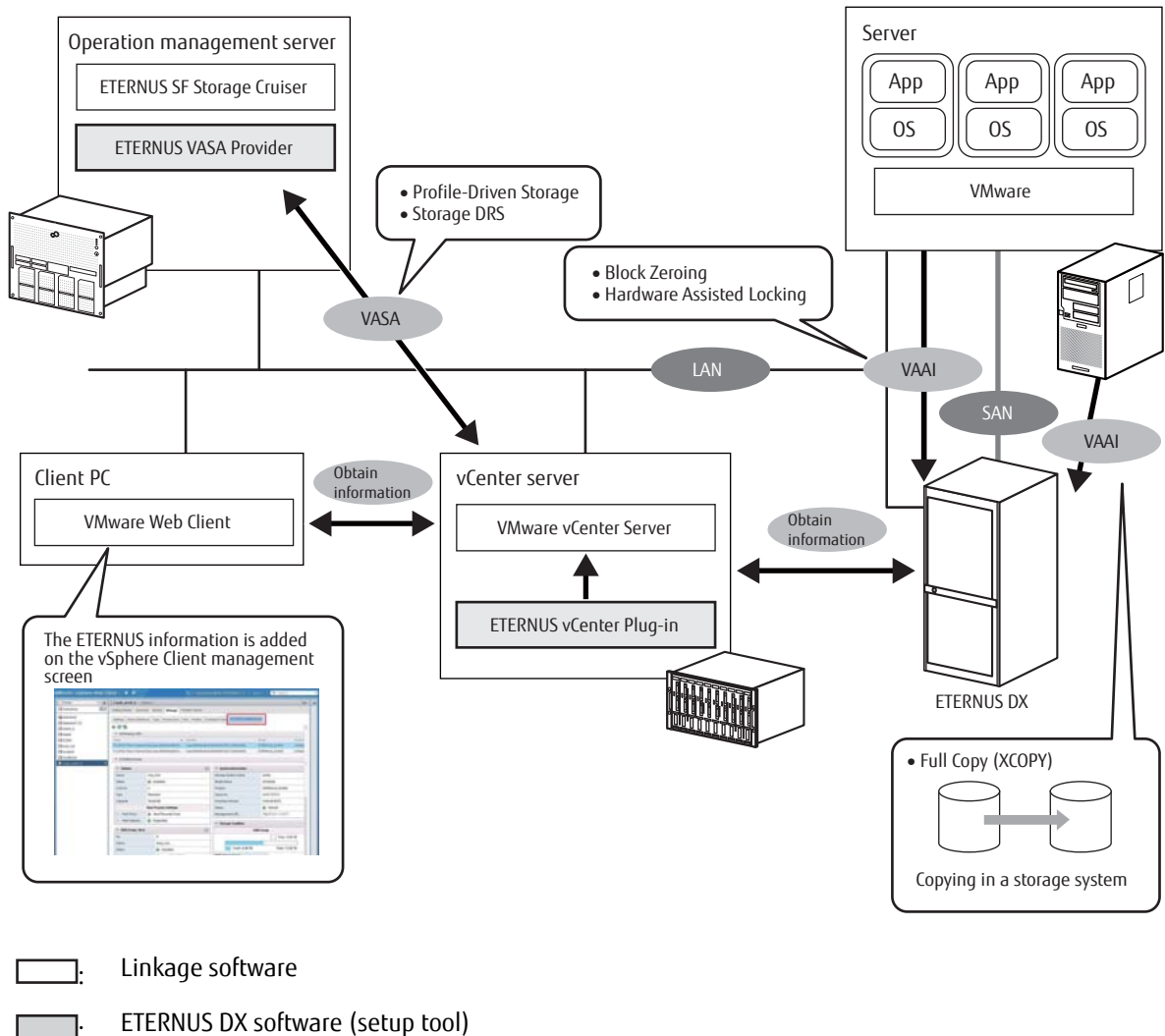
Figure 3.19 Oracle VM Linkage



3.10.2 VMware Linkage

By linking with "VMware vSphere" (which virtualizes platforms) and "VMware vCenter Server" (which supports integrated management of VMware vSphere), the resources of the ETERNUS DX can be effectively used and system performance can be improved.

Figure 3.20 VMware Linkage



■ VMware VASA

vStorage API for Storage Awareness (VASA) is an API that enables vCenter Server to link with the storage system and obtain storage system information. With VMware, VASA integrates the virtual infrastructure of the storage, and enhances the Distributed Resource Scheduling (DRS) function and the troubleshooting efficiency.

- Profile-Driven Storage

The Profile-Driven Storage function classifies volumes according to the service level in order to allocate virtual machines with the most suitable volumes.

- Distributed Resource Scheduler (Storage DRS)

The Storage DRS function moves original data in virtual machines to the most suitable storage area according to the access volume. Storage DRS balances the loads on multiple physical servers in order to eliminate the need for performance management on each virtual machine.

■ VMware VAAI

vStorage APIs for Array Integration (VAAI) are APIs that improve system performance and scalability by using the storage system resources more effectively.

The ETERNUS DX supports the following features.

- Full Copy (XCOPY)

Data copying processes can be performed in the ETERNUS DX without the use of a server such as when replicating or migrating the virtual machine. With Full Copy (XCOPY), the load on the servers is reduced and the system performance is improved.

- Block Zeroing

When allocating storage areas to create new virtual machines, it is necessary to zero out these storage areas for the initialization process. This process was previously performed on the server side. By performing this process on the ETERNUS DX side instead, the load on the servers is reduced and the dynamic capacity allocation (provisioning) of the virtual machines is accelerated.

- Hardware Assisted Locking

This control function enables the use of smaller blocks that are stored in the ETERNUS DX for exclusive control of specific storage areas.

Compared to LUN (logical volume) level control that is implemented in "VMware vSphere", enabling access control in block units minimizes the storage areas that have limited access using exclusive control and improves the operational efficiency of virtual machines.

■ VMware vCenter Server

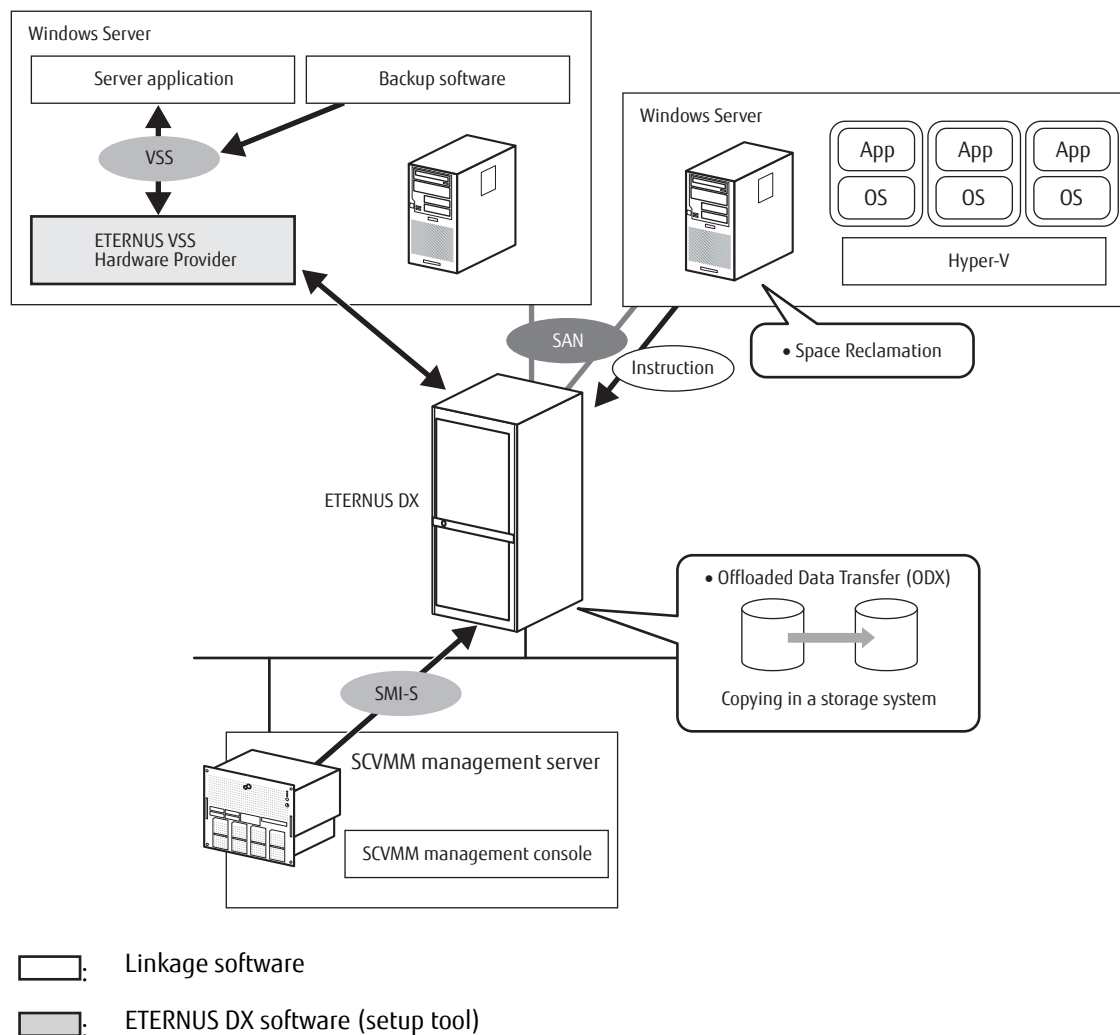
- vCenter linkage

Various information of the ETERNUS DX can be displayed on vSphere Web Client by expanding the user interface of VMware Web Client. Because storage side information is more visualized, integrated management of the infrastructure under a virtual environment can be realized and usability can be improved.

3.10.3 Microsoft Linkage

The ETERNUS DX supports integrated management of virtualized platforms and cloud linkage by using functions in Windows Server and System Center.

Figure 3.21 Microsoft Linkage



■ Windows Server

The ETERNUS DX supports the following functions in Windows Server.

- Offloaded Data Transfer (ODX)

The ODX function of Windows Server 2012 offloads the processing load for copying and transferring files from the CPU of the server to the storage system.

- Thin Provisioning Space Reclamation

The Thin Provisioning Space Reclamation function of Windows Server 2012 automatically releases areas in the storage system that are no longer used by the OS or applications. A notification function for the host is provided when the amount of allocated blocks of the TPV reaches the threshold.

- Hyper-V

Hyper-V is virtualization software for Windows Server.

By using the Hyper-V virtualized Fibre Channel, direct access to the SAN environment from a guest OS can be performed. The volumes in the ETERNUS DX can be directly recognized and mounted from the guest OS.

- Volume Shadow Copy Service (VSS)

VSS is performed in combination with the backup software and the server applications that are compatible with Windows Server VSS while online backups are performed via the Advanced Copy function for the ETERNUS DX.

■ System Center Virtual Machine Manager (SCVMM)

System Center is a platform to manage operations of data centers and clouds. This platform also provides an integrated tool set for the management of applications and services.

SCVMM is a component of System Center 2012 that performs integrated management of virtualized environments. The ETERNUS DX can be managed from SCVMM by using the SMI-S functions of the ETERNUS DX.

3.10.4 OpenStack Linkage

ETERNUS OpenStack VolumeDriver is a program that supports linkage between the ETERNUS DX and OpenStack.

By using the VolumeDriver for the ETERNUS DX, the ETERNUS DX can be used as a BlockStorage for cinder. Creating volumes in the ETERNUS DX and assigning created volumes to VM instances can be performed via an OpenStack standard interface (Horizon).

3.10.5 Logical Volume Manager (LVM)

The Logical Volume Manager is a management function that groups the save areas in multiple drives and partitions and manages these areas as one logical drive. Adding drives and expanding logical volumes can be performed without stopping the system. This function can be used on UNIX OSs (includes Linux).

LVM has a snapshot function. This function obtains any logical volume data as a snapshot and saves the snapshot as a different logical volume.

Chapter 4

Hardware Configurations

This chapter explains hardware configurations for the ETERNUS DX.

4.1 Controller Enclosure

This section explains the main components in the controller enclosure.

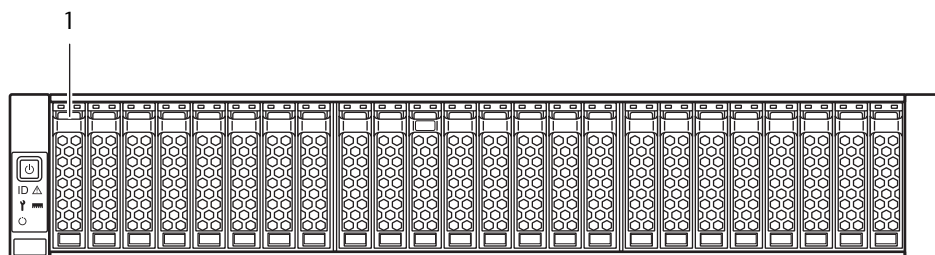
The controller enclosure contains drives installed in the front, and controllers and power supply units in the rear.

Two types of controller enclosures are available; a 2.5" type and a 3.5" type.

■ External Views of a 2.5" Type Controller Enclosure

● Front View

Figure 4.1 Front View of a 2.5" Type Controller Enclosure

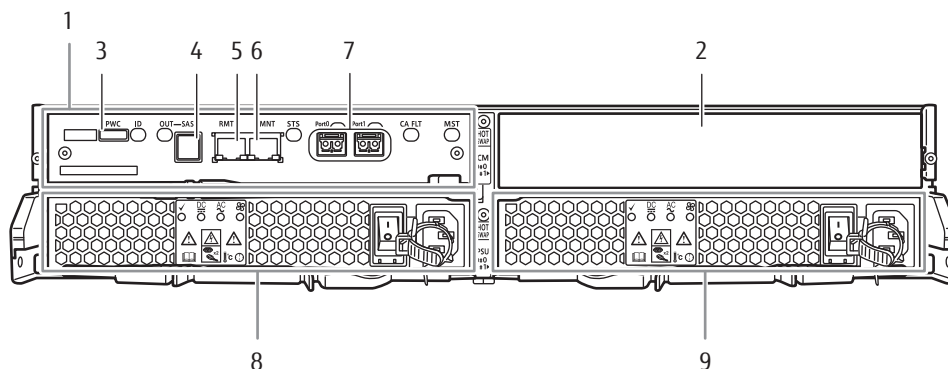


1. 2.5" disk

● Rear View

- When only one controller is installed

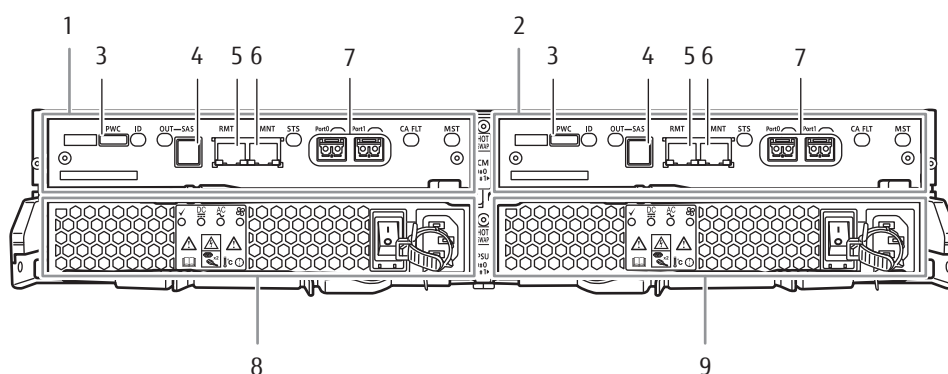
Figure 4.2 Rear View of a 2.5" Type Controller Enclosure (with One Controller Installed)



1. Controller (CM#0)
2. Cover
3. PWC port
4. Drive interface (OUT) port
5. LAN (RMT) port
6. LAN (MNT) port
7. Host interface (CA#0)
8. Power supply unit (PSU#0)
9. Power supply unit (PSU#1)

- When two controllers are installed

Figure 4.3 Rear View of a 2.5" Type Controller Enclosure (with Two Controllers Installed)



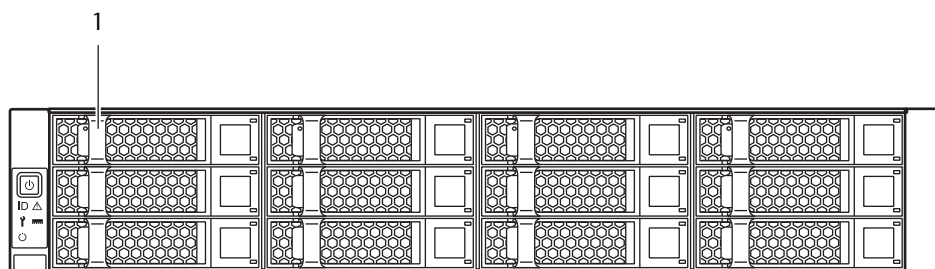
1. Controller (CM#0)
2. Controller (CM#1)
3. PWC port
4. Drive interface (OUT) port
5. LAN (RMT) port
6. LAN (MNT) port
7. Host interface (CA#0)

8. Power supply unit (PSU#0)
9. Power supply unit (PSU#1)

■ External Views of a 3.5" Type Controller Enclosure

● Front View

Figure 4.4 Front View of a 3.5" Type Controller Enclosure

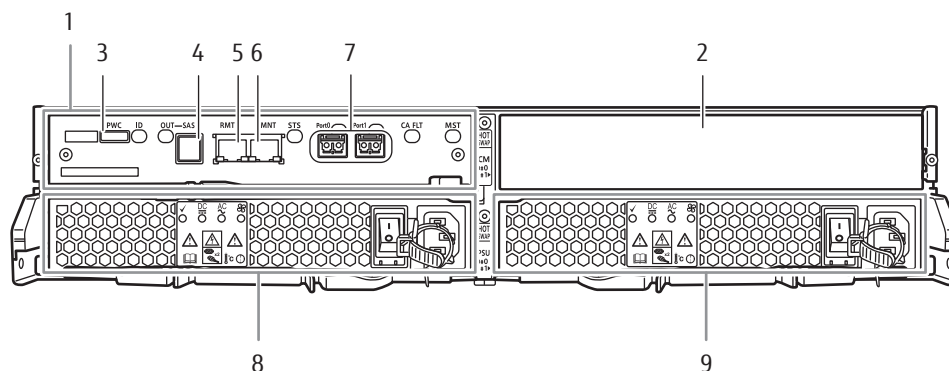


1. 3.5" SAS disks

● Rear View

- When only one controller is installed

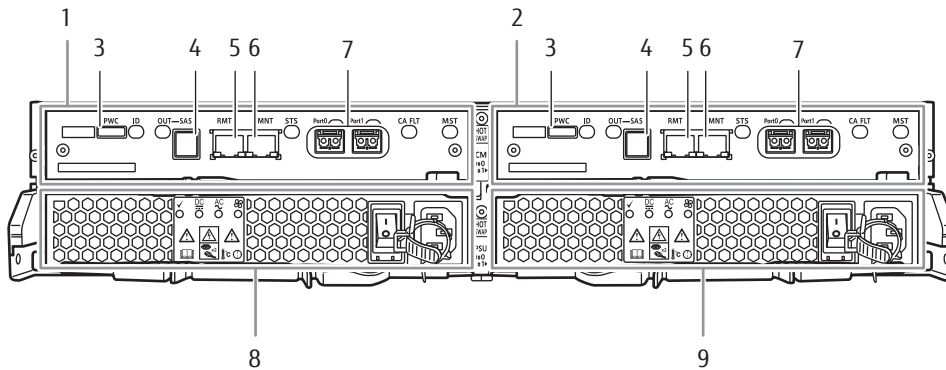
Figure 4.5 Rear View of a 3.5" Type Controller Enclosure (with One Controller Installed)



1. Controller (CM#0)
2. Cover
3. PWC port
4. Drive interface (OUT) port
5. LAN (RMT) port
6. LAN (MNT) port
7. Host interface (CA#0)
8. Power supply unit (PSU#0)
9. Power supply unit (PSU#1)

- When two controllers are installed

Figure 4.6 Rear View of a 3.5" Type Controller Enclosure (with Two Controllers Installed)



1. Controller (CM#0)
2. Controller (CM#1)
3. PWC port
4. Drive interface (OUT) port
5. LAN (RMT) port
6. LAN (MNT) port
7. Host interface (CA#0)
8. Power supply unit (PSU#0)
9. Power supply unit (PSU#1)

4.1.1 Controllers

The controller contains a CPU, cache memory, System Capacitor Unit (SCU), Bootup and Utility Device (BUD), host interfaces, and drive interface ports. The controller controls all operations in the ETERNUS DX.

An ETERNUS DX has one or two controllers.

When an ETERNUS DX has one controller, another controller can be added during system operation. If one of the controllers fails in an ETERNUS DX with two controllers, the failed controller can be replaced while the system is running.

IMPORTANT

- The single-controller type differs from the dual-controller type by the following features:
 - The controller and I/O module are not duplicated.
 - Hot maintenance or swapping of the controller and I/O module is not possible.
 - Concurrent firmware loading or update of the controller firmware and I/O module firmware is not possible.
 - Multipath connection to a single server is not available.
 - The Thin Provisioning function cannot be used.
- Fujitsu recommends that the dual-controller types, in which the controller and I/O module are duplicated, be used in a system where a high level of reliability is required.

■ CPU

Each controller has one CPU.

■ Cache Memory

Cache memory enables high speed processing by storing frequently used data.

The cache memory capacity for each controller is 2GB.

If an ETERNUS DX is equipped with two controllers, when the cache memory fails, the failed cache memory can be replaced while the system is running.

■ BUD

A BUD is non-volatile memory in which the firmware of an ETERNUS DX is registered. A BUD is used as an area to back up data in the cache memory if a power failure occurs.

Each controller has one BUD.

If an ETERNUS DX is equipped with two controllers, when the BUD fails, the failed BUD can be replaced while the system is running.

■ Host Interface

A host interface (CA) is an interface that connects a controller to a server.

The available types are FC, iSCSI, and SAS.

The host interface specifications are shown below.

Table 4.1 Host Interface Specifications

Interface	Transfer rate (max.)	Connector type	Number of ports for each controller
FC	8Gbit/s	LC	2
iSCSI	10Gbit/s	RJ-45	2
	1Gbit/s	RJ-45	2
SAS	6Gbit/s	miniSAS (SFF-8088)	2

■ Drive Interface Ports

This port is used to connect drive enclosures.

The drive interface port specifications are shown below.

Table 4.2 Drive Interface Port Specifications for Controllers

Interface	Transfer rate (max.)	Connector type	Number of ports for each controller
SAS	6Gbit/s	SFF-8644	1

■ MNT Port/RMT Port

The MNT port is used for operation management and the RMT port is used for the remote support function.

The specifications for the MNT port and the RMT port are provided below.

Table 4.3 MNT Port/RMT Port Specifications

Interface	Transfer rate (max.)	Connector type	Number of ports for each controller
Ethernet (1000Base-T/ 100Base-TX/10Base-T)	1Gbit/s	RJ-45	1 (MNT) 1 (RMT)

■ SCU

A System Capacitor Unit (SCU) is installed in a controller as a backup power source in case of power outage.

The SCU is charged from an external power source while the ETERNUS DX is running normally. If a power failure is detected, the data in the cache memory is saved to the BUD in the controller by using SCU. There is no limit to the post-failure data retention time.

■ PWC Ports

The PWC port is used to connect a power synchronized unit to perform power synchronization.

The PWC port specifications are shown below.

Table 4.4 PWC Port Specifications

Interface	Connector type	Number of ports for each controller
RS232C	PWC	1

4.1.2 Power Supply Units

The power supply unit transforms input AC power from a power socket to DC power and supplies power to each component. A controller enclosure has two power supply units. Each power supply unit contains fans. If one of the power supply units fails, the failed unit can be replaced while the system is running.

4.1.3 Drives

2.5" drives and 3.5" drives are available.

Up to twenty-four 2.5" drives can be installed in a single 2.5" type controller enclosure.

Up to twelve 3.5" drives can be installed in a single 3.5" type controller enclosure.

Drives can be added during system operation. When an error occurs, replacement operations can be performed while the system is running.

● 2.5" Drives

The 2.5" drive specifications are shown below.

Table 4.5 2.5" Drive Specifications (2.5" Type Controller Enclosure)

Product name	Drive interface	Storage media	Storage capacity	Rotational speed
SAS disks	Serial Attached SCSI	Hard disk	300GB, 600GB, 900GB, 1.2TB, 1.8TB (*1)	10,000rpm
			300GB, 600GB	15,000rpm
Nearline SAS disks			1TB, 2TB (*1)	7,200rpm
SSDs	Serial Attached SCSI	Flash memory	400GB, 800GB, 1.6TB	—

***1:** The following disks are Advanced Format (512e) disks.

- 1.8TB SAS disks
- 2TB Nearline SAS disks

● 3.5" Drives

The 3.5" drive specifications are shown below.

Table 4.6 3.5" Drive Specifications (3.5" Type Controller Enclosure)

Product name	Drive interface	Storage media	Storage capacity	Rotational speed
SAS disks	Serial Attached SCSI	Hard disk	900GB, 1.2TB, 1.8TB (*1)	10,000rpm
Nearline SAS disks			2TB, 4TB, 6TB, 8TB (*1)	7,200rpm
SSDs	Serial Attached SCSI	Flash memory	400GB, 800GB, 1.6TB	—

***1:** The following disks are Advanced Format (512e) disks.

- 1.8TB SAS disks
- 6TB Nearline SAS disks
- 8TB Nearline SAS disks

4.2 Drive Enclosure

This section explains the main components in the drive enclosure.

The drive enclosure contains drives installed in the front, and I/O modules and power supply units in the rear.

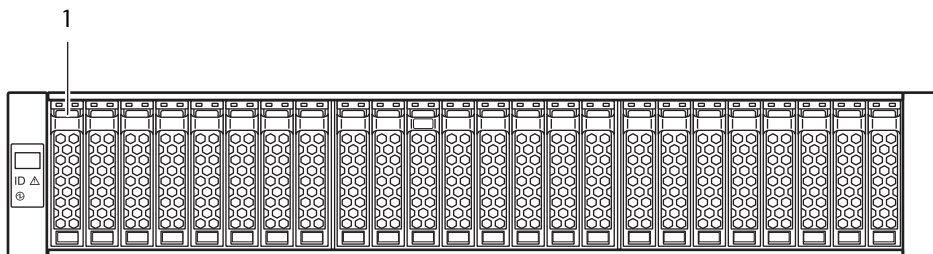
Two types of drive enclosures are available; a 2.5" type and a 3.5" type.

Drive enclosures can be added during system operation. When an error occurs, replacement operations can be performed while the system is running.

■ External Views of a 2.5" Type Drive Enclosure

● Front View

Figure 4.7 Front View of a 2.5" Type Drive Enclosure

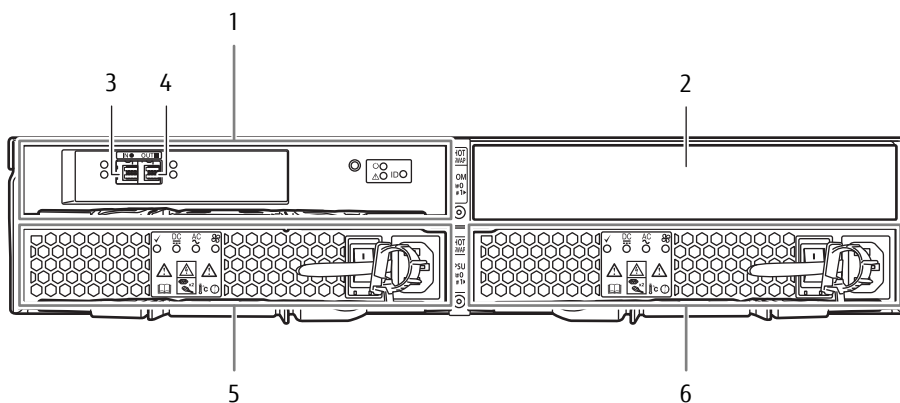


1. 2.5" disk or 2.5" SSD

● Rear View

- When a single I/O module is installed

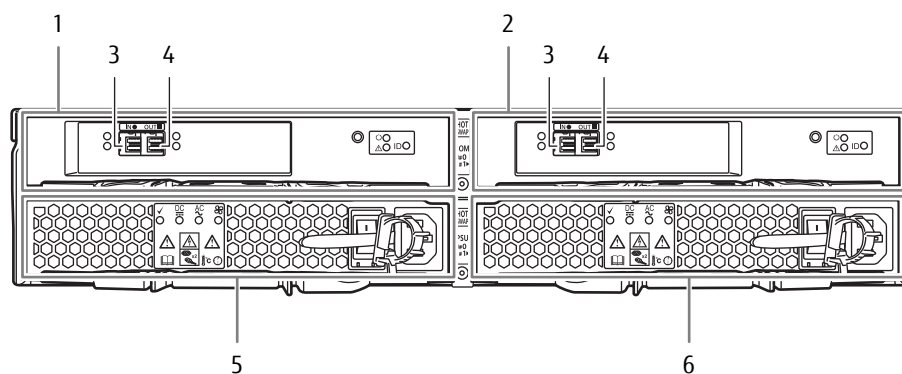
Figure 4.8 Rear View of a Drive Enclosure With a Single I/O Module



1. I/O module (IOM#0)
2. Cover
3. Drive interface (IN) port
4. Drive interface (OUT) port
5. Power supply unit (PSU#0)
6. Power supply unit (PSU#1)

- When two I/O modules are installed

Figure 4.9 Rear View of a Drive Enclosure With Two I/O Modules

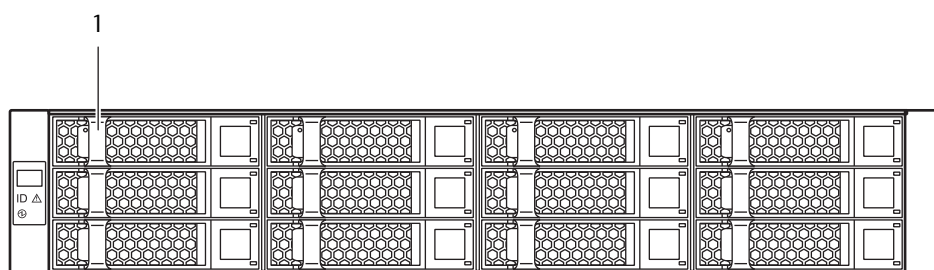


1. I/O module (IOM#0)
2. I/O module (IOM#1)
3. Drive interface (IN) port
4. Drive interface (OUT) port
5. Power supply unit (PSU#0)
6. Power supply unit (PSU#1)

■ External Views of a 3.5" Type Drive Enclosure

- Front View

Figure 4.10 Front View of a 3.5" Type Drive Enclosure

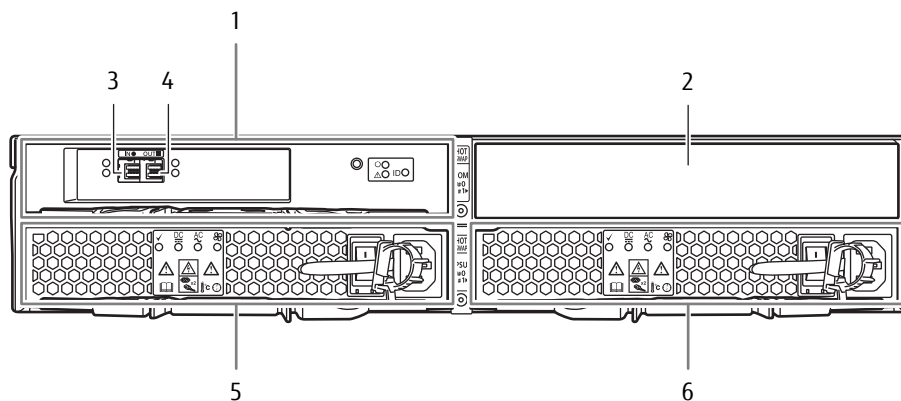


1. 3.5" disk or 3.5" SSD

- Rear View

- Single-IOM type

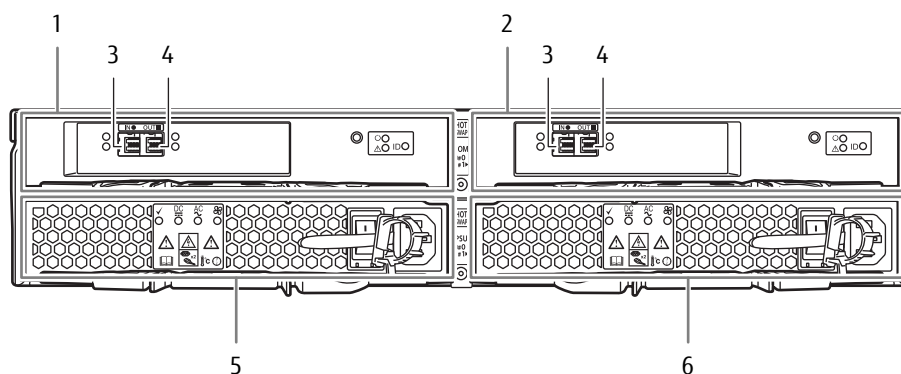
Figure 4.11 Rear View of a Drive Enclosure (Single-IOM Type)



1. I/O module (IOM#0)
2. Cover
3. Drive interface (IN) port
4. Drive interface (OUT) port
5. Power supply unit (PSU#0)
6. Power supply unit (PSU#1)

- Dual-IOM type

Figure 4.12 Rear View of a Drive Enclosure (Dual-IOM Type)



1. I/O module (IOM#0)
2. I/O module (IOM#1)
3. Drive interface (IN) port
4. Drive interface (OUT) port
5. Power supply unit (PSU#0)
6. Power supply unit (PSU#1)

4.2.1 I/O Modules

The I/O module is a component that controls how the controller and the drives interact.

The I/O module is connected to the controller or an I/O module on another drive enclosure.

A drive enclosure has one or two I/O modules.

When a drive enclosure has one I/O module, another module can be added during system operation. If one of the I/O modules fails in a drive enclosure with two I/O modules, the failed I/O module can be replaced while the system is running.

■ Drive Interface Ports

This port is for connecting controller enclosures or drive enclosures.

The drive interface port has an IN port and an OUT port.

The drive interface port specifications are shown below.

Table 4.7 Drive Interface Port Specification (I/O Module)

Interface	Transfer rate (max.)	Connector type	Number of ports for each I/O module
SAS	6Gbit/s	SFF-8644	1 (IN) 1 (OUT)

4.2.2 Power Supply Units

The power supply unit transforms input AC power from a power socket to DC power and supplies power to each component. Each power supply unit contains fans.

A drive enclosure has two power supply units, which makes it possible for a failed unit to be replaced while the system is running.

4.2.3 Drives

Two types of drives are available; a 2.5" type and a 3.5" type.

Up to twenty-four 2.5" drives can be installed in a single 2.5" type drive enclosure.

Up to twelve 3.5" drives can be installed in a single 3.5" type drive enclosure.

Drives can be added during system operation. When an error occurs, replacement operations can be performed while the system is running.

● 2.5" Drives

The 2.5" drive specifications are shown below.

Table 4.8 2.5" Drive Specifications (2.5" Type Controller Enclosure)

Product name	Drive interface	Storage media	Storage capacity	Rotational speed
SAS disks	Serial Attached SCSI	Hard disk	300GB, 600GB, 900GB, 1.2TB, 1.8TB (*1)	10,000rpm
			300GB, 600GB	15,000rpm
Nearline SAS disks			1TB, 2TB (*1)	7,200rpm
SSDs	Serial Attached SCSI	Flash memory	400GB, 800GB, 1.6TB	—

***1:** The following disks are Advanced Format (512e) disks.

- 1.8TB SAS disks
- 2TB Nearline SAS disks

● 3.5" Drives

The 3.5" drive specifications are shown below.

Table 4.9 3.5" Drive Specifications (3.5" Type Controller Enclosure)

Product name	Drive interface	Storage media	Storage capacity	Rotational speed
SAS disks	Serial Attached SCSI	Hard disk	900GB, 1.2TB, 1.8TB (*1)	10,000rpm
Nearline SAS disks			2TB, 4TB, 6TB, 8TB (*1)	7,200rpm
SSDs	Serial Attached SCSI	Flash memory	400GB, 800GB, 1.6TB	—

***1:** The following disks are Advanced Format (512e) disks.

- 1.8TB SAS disks
- 6TB Nearline SAS disks
- 8TB Nearline SAS disks

4.3 Power Distribution Units (Only for Regions other than the EMEA, North American, Central American, and Caribbean Regions)

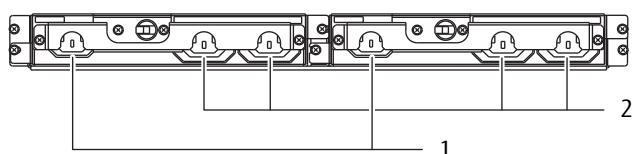
There are two sizes for power distribution units: 1U and 2U.

A power distribution unit is an option to connect power supply units to power outlets when power sockets are limited.

■ Power Distribution Unit (AC200-240V, 1U, 4 Outlets)

There are four outlets and two inlets.

Figure 4.13 Power Distribution Unit (AC200-240V, 1U, 4 Outlets)



1. Inlet (INPUT)
2. Outlet (OUTPUT)

The specifications of a power distribution unit and the AC cables that are provided are shown below.

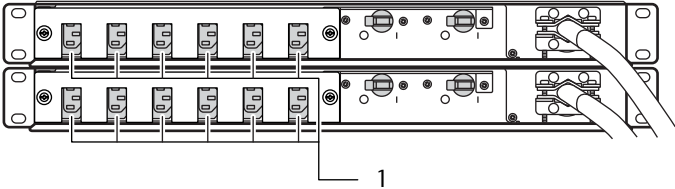
Table 4.10 Power Distribution Unit (AC200-240V, 1U, 4 Outlets) and Provided AC Cable Specifications

Item		Specifications
Power	Voltage	AC 200 – 240V
	Phase	Single
	Frequency	50Hz/60Hz
Input cable	Connection type	IEC60320 C13 ↔ NEMA L6-15P
	Length	4m
	Quantity	2

■ Power Distribution Unit (AC200-240V, 2U, 12 Outlets)

There are 12 outlets.

Figure 4.14 Power Distribution Unit (AC200-240V, 2U, 12 Outlets)



1. Outlet (OUTPUT)

The specifications of a power distribution unit and the AC cables that are provided are shown below.

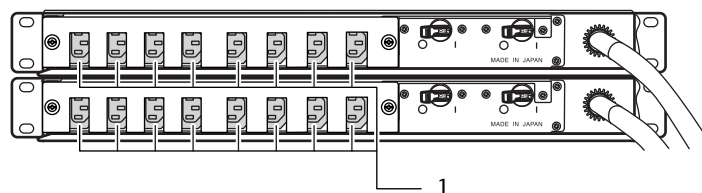
Table 4.11 Power Distribution Unit (AC200-240V, 2U, 12 Outlets) and Provided AC Cable Specifications

Item		Specifications
Power	Voltage	AC 200 – 240V
	Phase	Single
	Frequency	50Hz/60Hz
Input cable	Connection type	Straight-through ↔ NEMA L6-20P
	Length	4m
	Quantity	2

■ Power Distribution Unit (AC200-240V, 2U, 16 Outlets)

There are 16 outlets.

Figure 4.15 Power Distribution Unit (AC200-240V, 2U, 16 Outlets)



1. Outlet (OUTPUT)

The specifications of a power distribution unit and the AC cables that are provided are shown below.

Table 4.12 Power Distribution Unit (AC200-240V, 2U, 16 Outlets) and Provided AC Cable Specifications

Item		Specifications
Power	Voltage	AC 200 – 240V
	Phase	Single
	Frequency	50Hz/60Hz
Input cable	Connection type	Straight-through ↔ NEMA L6-30P
	Length	4m
	Quantity	2

4.4 Power Synchronized Unit

A power synchronized unit detects changes in the AC power output of the Uninterruptible Power Supply (UPS) unit that is connected to the server and automatically turns on and off the ETERNUS DX.

For more details about power synchronized units, refer to "Configuration Guide (Power Synchronized Unit)".

Chapter 5

Release Information

This chapter provides firmware modification information, such as information on functions that have been added or modified.

5.1 Firmware Release Information

The firmware version of the ETERNUS DX may need to be upgraded to add optional products or to use updated functions.

The firmware version that is currently in use can be checked via ETERNUS Web GUI or ETERNUS CLI.

The firmware versions in parentheses are firmware versions for China.

Table 5.1 Release Information List

Firmware version	Release date	Detail of functional modification
V10L25	December 2014	New version
V10L50 (V10L50-9000)	November 2015	• The following functions are supported. - Host interface (iSCSI 10Gbit/s) - T10-DIF - Selection of the physical area Allocation method (TPV) - SSD - 2.5" Type Drive Enclosure - The following functions are added to the FUNCTION button. - Initialization of the user settings (user account, role, and RADIUS settings)

FUJITSU Storage ETERNUS DX60 S3 Disk storage system Overview

P3AM-8972-06ENZ0

Date of issuance: April 2016
Issuance responsibility: FUJITSU LIMITED

- The content of this manual is subject to change without notice.
- This manual was prepared with the utmost attention to detail.
However, Fujitsu shall assume no responsibility for any operational problems as the result of errors, omissions, or the use of information in this manual.
- Fujitsu assumes no liability for damages to third party copyrights or other rights arising from the use of any information in this manual.
- The content of this manual may not be reproduced or distributed in part or in its entirety without prior permission from Fujitsu.

FUJITSU