

Fujitsu Storage ETERNUS DX100 S4/DX200 S4 Hybrid Storage Systems

Overview



Functions/features

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Preface

Fujitsu would like to thank you for purchasing the Fujitsu Storage ETERNUS DX100 S4/DX200 S4 (hereinafter referred to as ETERNUS DX).

The ETERNUS DX is designed to be connected to Fujitsu servers (Fujitsu SPARC Servers, PRIME-QUEST, 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.

Fifteenth Edition

August 2023

Trademarks

Third-party trademark information related to this product is available at:

<https://www.fujitsu.com/global/products/computing/storage/eternus/trademarks.html>

About This Manual

Intended Audience

This manual is intended for system administrators who design the ETERNUS DX system or use the ETERNUS DX.

Related Information and Documents

The latest version of this manual and the latest information for your model are available at:

<https://www.fujitsu.com/global/support/products/computing/storage/manuals-list.html>

Refer to the following manuals of your model as necessary:

"Configuration Guide -Server Connection-"

"Configuration Guide (Power Synchronized Unit)"

"Configuration Guide (Web GUI)"

"ETERNUS Web GUI User's Guide"

Document Conventions

■ Third-Party Product Names

- Oracle Solaris may be referred to as "Solaris", "Solaris Operating System", or "Solaris OS".
- Microsoft® Windows Server® may be referred to as "Windows Server".
- Red Hat Linux may be referred to as "Red Hat Enterprise Linux".

■ Notice Symbols

The following notice symbols are used in this manual:



Indicates information that you need to observe when using the ETERNUS storage system. Make sure to read the information.



Indicates information and suggestions that supplement the descriptions included in this manual.

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



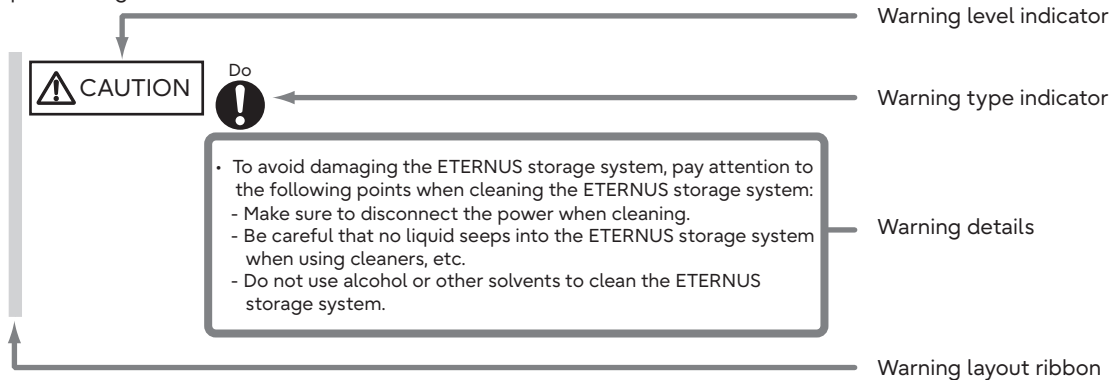
The black "Must Do..." circle indicates actions that must be taken. The required action is both illustrated inside the black disk and written above it (e.g. Unplug).

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.

Example warning



1. Overview

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

Figure 1 External View (2.5" Type Controller Enclosure)

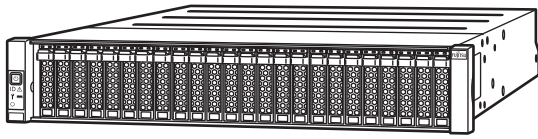


Figure 2 External View (3.5" Type Controller Enclosure)

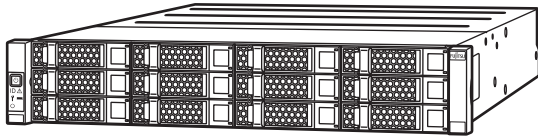


Figure 3 External View (2.5" Type Drive Enclosure)

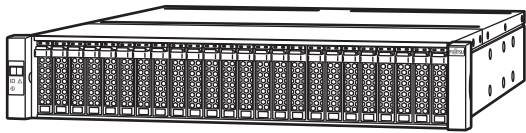


Figure 4 External View (3.5" Type Drive Enclosure)

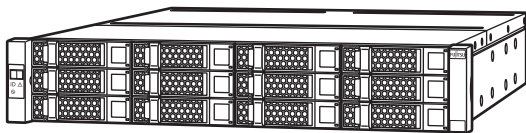
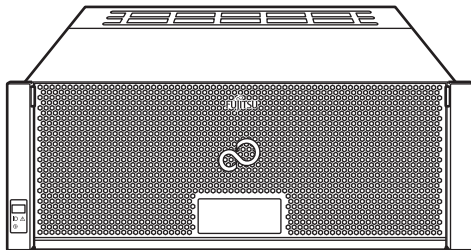


Figure 5 External View (High-Density Drive Enclosure)



■ 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 Size

The size of the base unit (or controller enclosure) 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 (or drive enclosures), three types are available; the 2U size 2.5" type (24 drives for each enclosure), the 2U size 3.5" type (12 drives for each enclosure), and the 4U size 3.5" high-density type (60 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 144 drives can be installed in the ETERNUS DX100 S4 and up to 264 drives can be installed in the ETERNUS DX200 S4.

2.5" and 3.5" drives can be mixed in the same ETERNUS DX.

● Host Interfaces

SAN host interfaces can be selected from FC 32Gbit/s, FC 16Gbit/s, FC 8Gbit/s, iSCSI 10Gbit/s, iSCSI 1Gbit/s, and SAS 12Gbit/s. Up to eight ports can be installed in a single ETERNUS DX.

NAS host interface can be selected from Ethernet 10Gbit/s and Ethernet 1Gbit/s. Up to eight Ethernet 10Gbit/s ports or up to 16 Ethernet 1Gbit/s ports can be installed in a single ETERNUS DX.

Different types of host interfaces can exist together in the same ETERNUS DX.

● System Memory Capacity

The maximum system memory capacity that can be installed in a storage system is 32GB for the ETERNUS DX100 S4 and 64GB for the ETERNUS DX200 S4.

● Model Upgrade

As a support for system scalability after installation, an ETERNUS DX can be upgraded to a higher-end model. The ETERNUS DX100 S4 can be upgraded to the ETERNUS DX200 S4.

The ETERNUS DX200 S4 can be upgraded to the ETERNUS DX500 S4.

■ 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 check codes are generated 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

High availability is provided for data transfer paths between controllers and drives. 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.

An ETERNUS DX protects against external attacks and internal data leakage, ensures the reliability of information, and manages information over long periods of time. A strong emphasis is placed upon encryption as a measure against information leakage.

● Data Encryption

In order to ensure full data security, the ETERNUS DX supports Self Encrypting Drives (SEDs).

Fraudulent decoding can be prevented by encrypting the drive data. Even if a drive is removed or a drive that is removed for maintenance is stolen by malicious third parties during transportation, data cannot be decoded.

The SED encryption method is AES-256 (*3).

***3:** Advanced Encryption Standard: Federal Information Processing Standards encryption method

- **Key Management Server Linkage**

By managing the authentication keys in an external server that is connected with the network, the authentication keys can be managed more securely, thereby reducing management costs and minimizing the risk of information leakage. The Key Management Interoperability Protocol (KMIP), which is a standard protocol for key management, is used for key management server linkage.

- **Encrypted Network Transfer**

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.

- **Deduplication/Compression**

To reduce the amount of saved data, the Deduplication/Compression function eliminates data that is a duplicate of the saved data, and compresses the deduplicated data. This allows a reduction in the number of drives and drive capacity than before, and efficiently saves the increasing amount of data.

- **Virtualization Integration**

Various functions that are provided by Oracle VM, VMware, Veeam Software, 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.

VMware vSphere's Virtual Volumes (VVOLs) that manage volumes for each virtual machine are also supported. Finely tuned backup operations and resource management can be achieved according to the operational requirements for each virtual machine.

■ Operability

By using a virtual environment, the ETERNUS DX is able to utilize its resources more efficiently. In addition, various connectivity options are provided and integrated storage management is available.

● Unified Storage

The ETERNUS DX provides SAN and NAS functions and enables a SAN/NAS storage integrated environment.

In a SAN environment, block data transfer is performed via FC, iSCSI, and SAS.

In a NAS environment, the ETERNUS DX can be used as a file server to transfer file data by using the NFS protocol and the CIFS protocol via Ethernet.

In addition, by installing ETERNUS SF Storage Cruiser (storage management software), integrated monitoring of SAN and NAS environments is available.

● Automated Storage Tiering

The ETERNUS DX supports Automated Storage Tiering. This function detects data access frequency and redistributes data between drives with various drive types according to the policy that is set. The most suitable cost effective performance can be realized by moving frequently accessed data to high performance SSDs and less frequently accessed data to cost effective Nearline SAS disks in collaboration with ETERNUS SF Storage Cruiser. Server settings do not need to be changed after redistribution.

● 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.

● Stabilization of Processing Performance

When loads from one application are high in a storage integrated environment and sufficient resources to process other operations cannot be secured, performance may be reduced remarkably.

The Quality of Service (QoS) function can be used to stabilize performance by setting the load upper limit for each application to secure the processing performance of the server that needs to be processed preferentially so that workload fluctuations do not affect other applications.

● Extreme Cache Pool

By using SSDs as the secondary cache, the read cache capacity can be significantly increased and the read access performance can be improved.

● 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 "disaster control".

- **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 battery, and cache data in the system memory is backed up to non-volatile memory. This protects the cache data without there being any restrictions on the number of days that cache 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.

Copies of the file system (snapshots) can be acquired and saved periodically in NAS environments. Depending on the set schedule, differential data is automatically copied from the previous acquisition to that point in time. A file restore can be performed easily from the client.

- **Disaster Control**

Set up the same configuration as the business site and back up the data to the remote site in order to continue operation by switching to the remote site even when the business site fails. Backup operations can be performed without interrupting business operations because backing up is performed between the storage systems while the systems are running.

The ETERNUS DX deals with various business characteristics by allowing the selection of either the Asynchronous mode, which emphasizes the I/O response time, or the Synchronous mode, which backs up all of the data up until the point when a disaster occurs.

- **Storage Cluster Configuration**

Regarding connections with a SAN host, a cluster configuration between two ETERNUS DX/AF storage systems is possible. Even if some trouble occurs and I/O becomes inaccessible, operations can continue by automatically switching the access destination to the standby ETERNUS DX/AF.

- **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 of specific chemicals in electrical and electronic equipment.

2. Specifications

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

ETERNUS DX Specifications

This section describes ETERNUS DX specifications.

ETERNUS DX100 S4 Specifications

Table 1 Specifications (ETERNUS DX100 S4)

Item		ETERNUS DX100 S4	
Physical capacity (max.) (*1)	SAS disks	346TB	
	Nearline SAS disks	2,016TB	
	SSDs	4,424TB	
Number of controllers		1 / 2	
System memory capacity (max.)		32GB	
Extreme Cache Pool capacity (max.)		1.6TB	
Host interfaces	SAN connection	FC (32Gbit/s) FC (16Gbit/s) FC (8Gbit/s) iSCSI (10Gbit/s, 10GBASE-SR/10GBASE-CR) iSCSI (10Gbit/s, 10GBASE-T) iSCSI (1Gbit/s, 1000BASE-T) SAS (12Gbit/s)	
	NAS connection (Unified)	Ethernet (10Gbit/s) Ethernet (1Gbit/s)	
Number of host interface ports	SAN connection	FC	2 / 4 / 8
		iSCSI	2 / 4 / 8
		SAS	2 / 4 / 8
	NAS connection (Unified)	Ethernet (10Gbit/s)	2 / 4 / 8
Ethernet (1Gbit/s)		4 / 8 / 16	
Number of drive enclosures (max.) (*2)	2.5" type drive enclosure		5
	3.5" type drive enclosure		10
	High-density drive enclosure		2
Number of drives (*3)		2 - 144	

Item			ETERNUS DX100 S4
Drive capacity (rotational speed) (*4)	2.5" SAS disks	Non-self-encrypting	300GB, 600GB, 900GB, 1.2TB, 1.8TB, 2.4TB (10,000rpm)
		Self-encrypting	300GB, 600GB, 900GB (15,000rpm)
	2.5" Nearline SAS disks		1.2TB, 2.4TB (10,000rpm)
	2.5" SSDs	Non-self-encrypting	1TB, 2TB (7,200rpm)
		Self-encrypting	400GB, 960GB, 1.92TB, 3.84TB, 7.68TB, 15.36TB, 30.72TB
	3.5" SAS disks		400GB, 1.92TB, 3.84TB, 7.68TB
	3.5" Nearline SAS disks	Non-self-encrypting	1.2TB (10,000rpm)
		Self-encrypting	2TB, 4TB, 6TB, 8TB, 10TB, 12TB, 14TB (7,200rpm)
	3.5" SSDs	Non-self-encrypting	4TB, 8TB, 12TB (7,200rpm)
		Self-encrypting	400GB, 960GB, 1.92TB, 3.84TB
Drive interface (maximum transfer rate)			SAS (12Gbit/s)

- *1: Physical capacity is calculated based on the assumption that 1TB=1,000GB and 1GB=1,000MB.
- *2: Different types of drive enclosures can be installed together in an ETERNUS DX. When different types of drive enclosures are installed together, the maximum number of installable drive enclosures depends on which drive enclosure type combinations are used.
- *3: These values are only for when all of the installed drives are the same type and the number of these drives is the maximum.
- *4: The following disks are Advanced Format (512e) disks.
 - 2.5" SAS disks (1.8TB)
 - 2.5" SAS disks (2.4TB)
 - 2.5" SAS self encrypting disks (2.4TB)
 - 2.5" Nearline SAS disks (2TB)
 - 3.5" Nearline SAS disks (6TB)
 - 3.5" Nearline SAS disks (8TB)
 - 3.5" Nearline SAS disks (10TB)
 - 3.5" Nearline SAS disks (12TB)
 - 3.5" Nearline SAS disks (14TB)
 - 3.5" Nearline SAS self encrypting disks (8TB)
 - 3.5" Nearline SAS self encrypting disks (12TB)

ETERNUS DX200 S4 Specifications

Table 2 Specifications (ETERNUS DX200 S4)

Item		ETERNUS DX200 S4		
Physical capacity (max.) (*1)	SAS disks		634TB	
	Nearline SAS disks		3,696TB	
	SSDs		8,110TB	
Number of controllers			1 / 2	
System memory capacity (max.)			64GB	
Extreme Cache Pool capacity (max.)			1.6TB	
Host interfaces	SAN connection		FC (32Gbit/s) FC (16Gbit/s) FC (8Gbit/s) iSCSI (10Gbit/s, 10GBASE-SR/10GBASE-CR) iSCSI (10Gbit/s, 10GBASE-T) iSCSI (1Gbit/s, 1000BASE-T) SAS (12Gbit/s)	
	NAS connection (Unified)		Ethernet (10Gbit/s) Ethernet (1Gbit/s)	
Number of host interface ports	SAN connection	FC	2 / 4 / 8	
		iSCSI	2 / 4 / 8	
		SAS	2 / 4 / 8	
	NAS connection (Unified)	Ethernet (10Gbit/s)	2 / 4 / 8	
		Ethernet (1Gbit/s)	4 / 8 / 16	
Number of drive enclosures (max.) (*2)	2.5" type drive enclosure		10	
	3.5" type drive enclosure		10	
	High-density drive enclosure		4	
Number of drives (*3)			2 – 264	
Drive capacity (rotational speed) (*4)	2.5" SAS disks	Non-self-encrypting	300GB, 600GB, 900GB, 1.2TB, 1.8TB, 2.4TB (10,000rpm)	
		Self-encrypting	300GB, 600GB, 900GB (15,000rpm) 1.2TB, 2.4TB (10,000rpm)	
	2.5" Nearline SAS disks		1TB, 2TB (7,200rpm)	
	2.5" SSDs	Non-self-encrypting	400GB, 960GB, 1.92TB, 3.84TB, 7.68TB, 15.36TB, 30.72TB	
		Self-encrypting	400GB, 1.92TB, 3.84TB, 7.68TB	
	3.5" SAS disks		1.2TB (10,000rpm)	
	3.5" Nearline SAS disks	Non-self-encrypting	2TB, 4TB, 6TB, 8TB, 10TB, 12TB, 14TB (7,200rpm)	
		Self-encrypting	4TB, 8TB, 12TB (7,200rpm)	
	3.5" SSDs	Non-self-encrypting	400GB, 960GB, 1.92TB, 3.84TB	
		Self-encrypting	400GB, 1.92TB, 3.84TB	
	Drive interface (maximum transfer rate)			SAS (12Gbit/s)

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

- *2:** Different types of drive enclosures can be installed together in an ETERNUS DX. When different types of drive enclosures are installed together, the maximum number of installable drive enclosures depends on which drive enclosure type combinations are used.
- *3:** These values are only for when all of the installed drives are the same type and the number of these drives is the maximum.
- *4:** The following disks are Advanced Format (512e) disks.
 - 2.5" SAS disks (1.8TB)
 - 2.5" SAS disks (2.4TB)
 - 2.5" SAS self encrypting disks (2.4TB)
 - 2.5" Nearline SAS disks (2TB)
 - 3.5" Nearline SAS disks (6TB)
 - 3.5" Nearline SAS disks (8TB)
 - 3.5" Nearline SAS disks (10TB)
 - 3.5" Nearline SAS disks (12TB)
 - 3.5" Nearline SAS disks (14TB)
 - 3.5" Nearline SAS self encrypting disks (8TB)
 - 3.5" Nearline SAS self encrypting disks (12TB)

Function Specifications

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

Table 3 Function Specifications (ETERNUS DX100 S4/DX200 S4)

Item		ETERNUS DX100 S4	ETERNUS DX200 S4
Supported RAID levels		0 (*1), 1, 1+0, 5, 5+0, 6, 6-FR (*2)	
RAID groups	Number of RAID groups (max.) (*3)	72	132
	Number of volumes per RAID group (max.)	128	
Thin Provisioning Pool (TPP)/ Flexible Tier Sub Pool (FTSP)	Number of pools (max.) (*4)	72	132
	Number of volumes per pool (max.) (*5)	2,047 (*6) 4,095 (*7)	4,095 (*6) 8,191 (*7)
Volumes	Number of volumes (max.)	2,048 (*6) 4,096 (*7)	4,096 (*6) 8,192 (*7)
	Volume capacity (max.)	128TB	
File system (NAS)	File system capacity per ETERNUS DX (max.)	256TB	512TB
Number of connectable SAN hosts (HBAs) (max.)	Per storage system	1,024	
	Per port	256	

- *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 single 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).
- *4: The maximum total number of TPPs and FTSPs.
- *5: The maximum number of volumes that can be created in a TPP or an FTSP is calculated by subtracting the number of RAID groups that configure the relevant TPP or FTSP from the maximum number of volumes that can be created in the ETERNUS DX.
- *6: The values if the "Expand Volume Mode" is disabled.
- *7: The values if the "Expand Volume Mode" is enabled.

Operating Environment

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

Supported OSs (in SAN Environments)

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 4 Supported Servers and OSs (FC Interface)

Server		OS
Manufacturer	Product name	
Fujitsu	Mission critical IA servers PRIMEQUEST	Windows Server 2012
		Windows Server 2016
		Red Hat Enterprise Linux 6
		Red Hat Enterprise Linux 7 (for Intel64)
		Oracle Linux 7
		VMware vSphere 6
		VMware vSphere 6.5
		VMware vSphere 6.7
		Oracle VM 3
	UNIX servers SPARC Enterprise Fujitsu SPARC Servers	Solaris 10
	Solaris 11	

Server		OS
Manufacturer	Product name	
Fujitsu	Industry standard servers PRIMERGY	Windows Server 2012
		Windows Server 2016
		Windows Server 2019
		Red Hat Enterprise Linux 6
		Red Hat Enterprise Linux 7 (for Intel64)
		SUSE Linux Enterprise Server 11
		SUSE Linux Enterprise Server 12
		SUSE Linux Enterprise Server 15
		Oracle Linux 5
		Oracle Linux 6
		Oracle Linux 7
		VMware vSphere 6
		VMware vSphere 6.5
		VMware vSphere 6.7
		Oracle VM 3
XenServer 6		
XenServer 7		
FalconStor NSS		
Oracle	SPARC Enterprise Fujitsu M10 Servers Fujitsu SPARC M12	Solaris 10
		Solaris 11
IBM	System p Power Systems	AIX 7
HP	HP 9000 server HP Integrity server	HP-UX 11i v3

Server		OS
Manufacturer	Product name	
Others	Other industry standard servers	Windows Server 2012
		Windows Server 2016
		Windows Server 2019
		Red Hat Enterprise Linux 6
		Red Hat Enterprise Linux 7 (for Intel64)
		SUSE Linux Enterprise Server 11
		SUSE Linux Enterprise Server 12
		SUSE Linux Enterprise Server 15
		Oracle Linux 5
		Oracle Linux 6
		Oracle Linux 7
		VMware vSphere 6
		VMware vSphere 6.5
		VMware vSphere 6.7
		Oracle VM 3
		XenServer 6
XenServer 7		
FalconStor NSS		

■ iSCSI Interface

Table 5 Supported Servers and OSs (iSCSI Interface)

Server		OS
Manufacturer	Product name	
Fujitsu	Mission critical IA servers PRIMEQUEST	Windows Server 2012
		Windows Server 2016
		Red Hat Enterprise Linux 6
		Red Hat Enterprise Linux 7 (for Intel64)
		VMware vSphere 6
		VMware vSphere 6.5
		VMware vSphere 6.7
	UNIX servers SPARC Enterprise Fujitsu SPARC Servers	Solaris 10
		Solaris 11

Server		OS
Manufacturer	Product name	
Fujitsu	Industry standard servers PRIMERGY	Windows Server 2012
		Windows Server 2016
		Windows Server 2019
		Red Hat Enterprise Linux 6
		Red Hat Enterprise Linux 7 (for Intel64)
		SUSE Linux Enterprise Server 11
		SUSE Linux Enterprise Server 12
		SUSE Linux Enterprise Server 15
		Oracle Linux 5
		Oracle Linux 6
		Oracle Linux 7
		VMware vSphere 6
		VMware vSphere 6.5
		VMware vSphere 6.7
		Oracle VM 3
		XenServer 6
XenServer 7		
FalconStor NSS		
Oracle	SPARC Enterprise Fujitsu M10 Servers Fujitsu SPARC M12	Solaris 10
		Solaris 11
HP	HP 9000 server HP Integrity server	HP-UX 11i v3

Server		OS
Manufacturer	Product name	
Others	Other industry standard servers	Windows Server 2012
		Windows Server 2016
		Windows Server 2019
		Red Hat Enterprise Linux 6
		Red Hat Enterprise Linux 7 (for Intel64)
		SUSE Linux Enterprise Server 11
		SUSE Linux Enterprise Server 12
		SUSE Linux Enterprise Server 15
		Oracle Linux 5
		Oracle Linux 6
		Oracle Linux 7
		VMware vSphere 6
		VMware vSphere 6.5
		VMware vSphere 6.7
		Oracle VM 3
		XenServer 6
XenServer 7		
FalconStor NSS		

■ SAS Interface

Table 6 Supported Servers and OSs (SAS Interface)

Server		OS
Manufacturer	Product name	
Fujitsu	UNIX servers SPARC Enterprise Fujitsu SPARC Servers	Solaris 10
		Solaris 11
	Industry standard servers PRIMERGY	Windows Server 2012
		Windows Server 2016
		Windows Server 2019
		Red Hat Enterprise Linux 6
		Red Hat Enterprise Linux 7 (for Intel64)
		SUSE Linux Enterprise Server 11
		SUSE Linux Enterprise Server 12
		SUSE Linux Enterprise Server 15
		VMware vSphere 6
		VMware vSphere 6.5
		VMware vSphere 6.7

Server		OS
Manufacturer	Product name	
Oracle	SPARC Enterprise	Solaris 10
	Fujitsu M10 Servers Fujitsu SPARC M12	Solaris 11
Others	Other industry standard servers	Windows Server 2012
		Windows Server 2016
		Windows Server 2019
		Red Hat Enterprise Linux 6
		Red Hat Enterprise Linux 7 (for Intel64)
		SUSE Linux Enterprise Server 11
		SUSE Linux Enterprise Server 12
		SUSE Linux Enterprise Server 15
		VMware vSphere 6
		VMware vSphere 6.5
VMware vSphere 6.7		

Supported OSs (in NAS Environments)

The ETERNUS DX can be connected to OSs that support available protocols for the ETERNUS DX.

The confirmed OS for NFSv4.0 can be connected to the ETERNUS DX.

The following OSs are confirmed to connect to the ETERNUS DX as a NAS client.

- The confirmed OSs with the CIFS protocol
 - Windows Server 2012
 - Windows Server 2012 R2
 - Windows Server 2016
 - Windows 8.1
 - Windows 10
- The confirmed OSs with the NFSv3 protocol
 - Red Hat Enterprise Linux 6
 - Red Hat Enterprise Linux 7.0
 - Red Hat Enterprise Linux 7.1
 - Red Hat Enterprise Linux 7.2
 - Red Hat Enterprise Linux 7.3
 - Solaris 10 1/13 (Update 11)
 - Solaris 11.2
 - Solaris 11.3
 - VMware vSphere 6.0 Update 1b
 - Oracle VM 3
 - AIX 7.1
 - HP-UX 11i v3

- The confirmed OSs with the NFSv4.0 protocol
The confirmed OSs for the NFSv4.0 protocol are used as supported OSs.
 - Red Hat Enterprise Linux 6.7
 - Red Hat Enterprise Linux 6.8
 - Red Hat Enterprise Linux 7.0
 - Red Hat Enterprise Linux 7.1
 - Red Hat Enterprise Linux 7.2
 - Red Hat Enterprise Linux 7.3
 - Red Hat Enterprise Linux 7.4
 - Solaris 10 1/13 (Update 11)
 - Solaris 11.2
 - Solaris 11.3
- The confirmed OSs with FTP / FXP
Regardless of the OS type, access is possible as long as an FTP client is used.

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 operations are managed using ETERNUS Web GUI, a Web browser must be prepared in the administration terminal.

For details on the operating environment of ETERNUS Web GUI, refer to "ETERNUS Web GUI User's Guide" or "Configuration Guide (Web GUI)".

● ETERNUS CLI

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

3. Basic Functions

The ETERNUS DX integrates block data (SAN area) and file data (NAS area).

The ETERNUS DX has functions such as the SAN function (supports block data access), the NAS function (supports file data access), and basic functions that can be used without needing to recognize the SAN or the NAS.

This chapter explains the basic functions of the ETERNUS DX.

For more details about the functions that are used for a SAN connection, refer to "4. SAN Functions" (page 51). For more details about the functions that are used for a NAS connection, refer to "5. NAS Functions" (page 65).

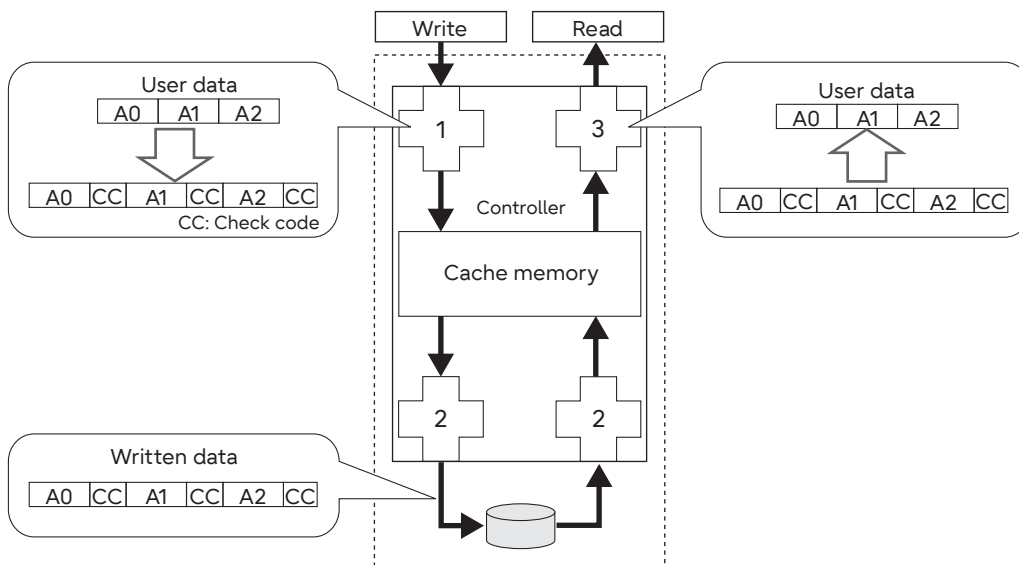
Data Protection

The ETERNUS DX has functions to securely protect user data.

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 6 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.

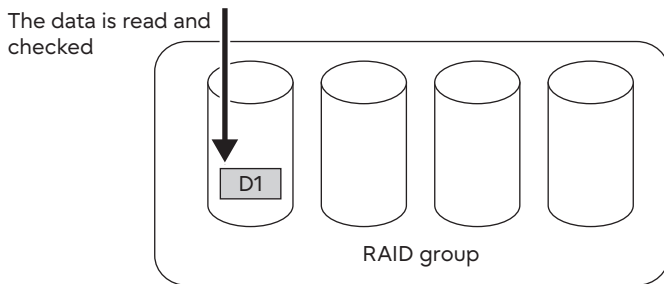
Data is protected at the SCSI level on the path to the server. Therefore, data integrity can be ensured even if data is corrupted during a check code reassignment.

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

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.

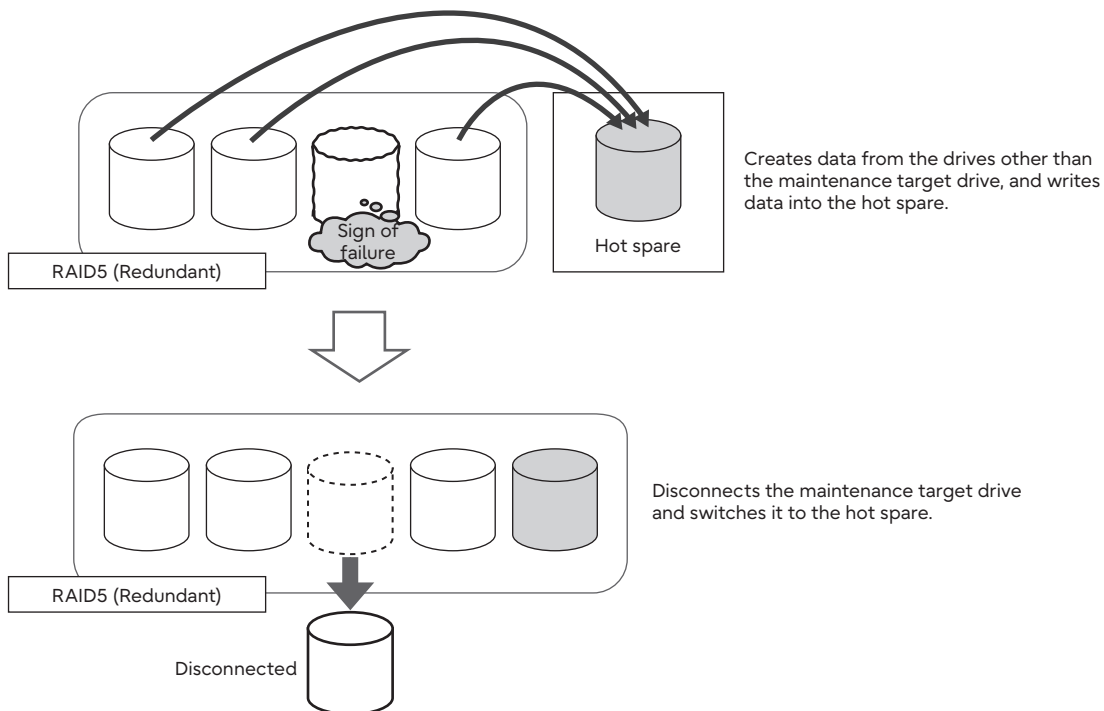
Figure 7 Drive Check



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 8 Redundant Copy Function

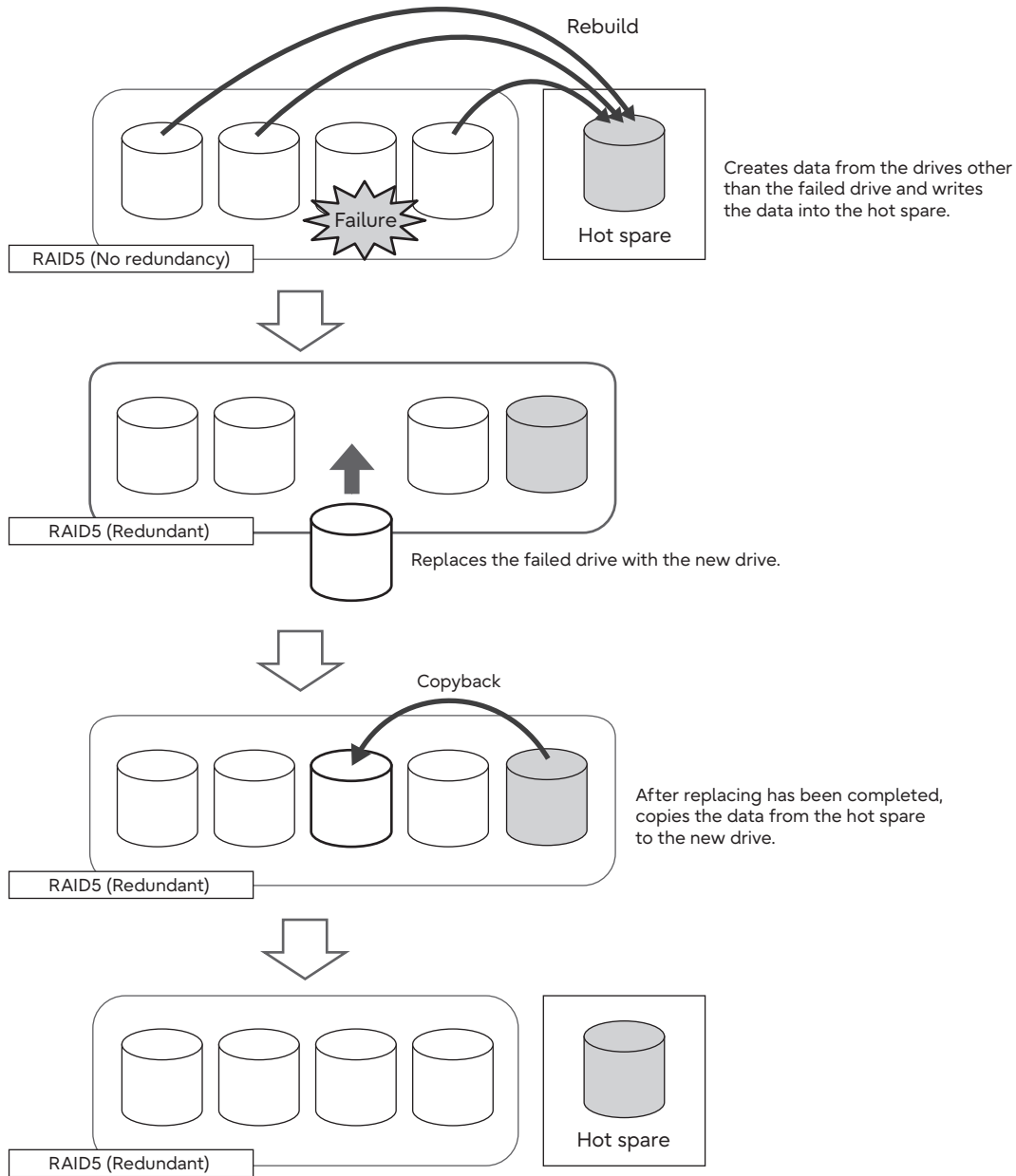


Rebuild/Copyback

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 9 Rebuild/Copyback Function

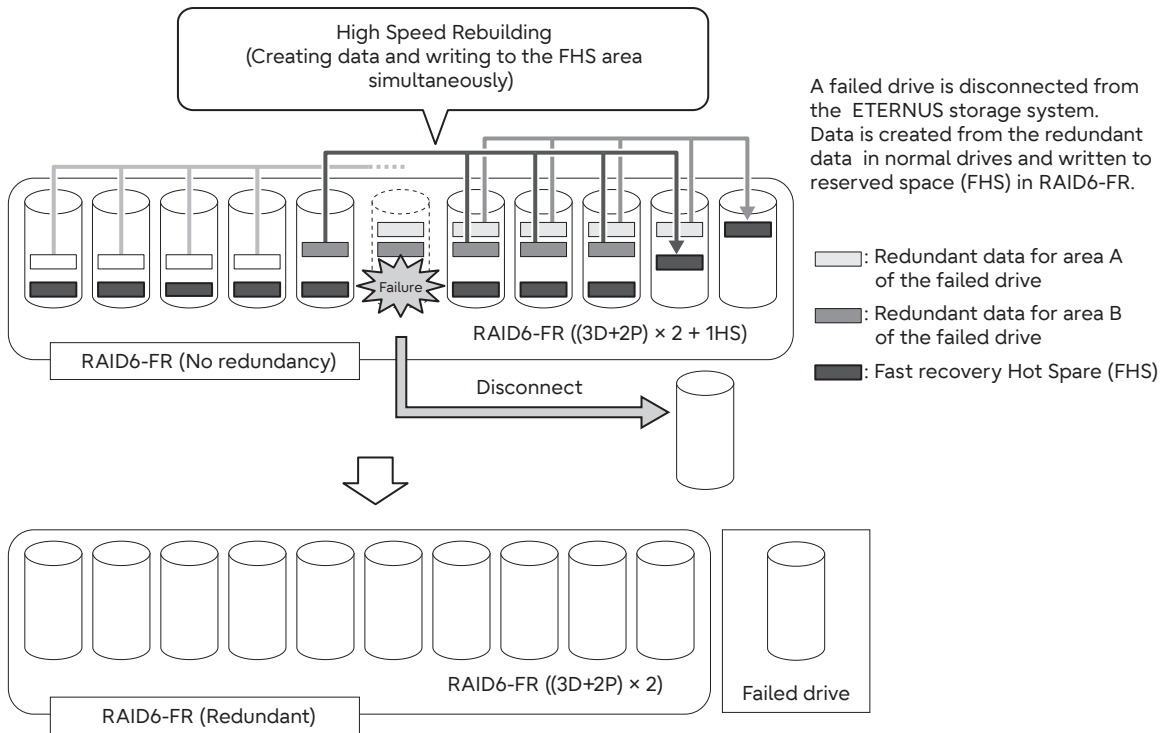


Fast Recovery

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 10 Fast Recovery



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 of the Protection (Shield) function are all the drives that are registered in RAID groups or registered as hot spares. Note that the Protection (Shield) function is not available for unused drives.

Operations Optimization (Virtualization/Automated Storage Tiering)

The Thin Provisioning function and the Flexible Tier function can be used for disk virtualization. These functions reduce 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 as follows:

- The Thin Provisioning function cannot be used.
- The Flexible Tier function cannot be used.

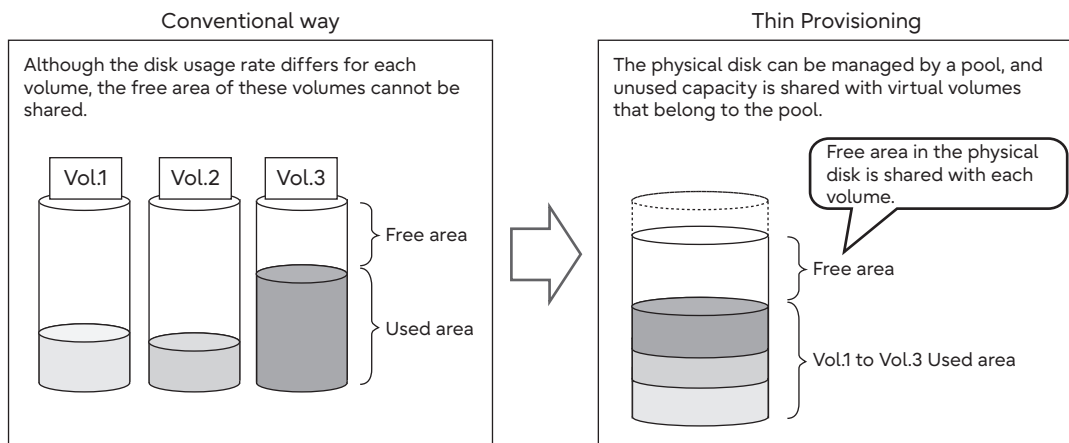
Thin Provisioning

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 11 Example of Thin Provisioning

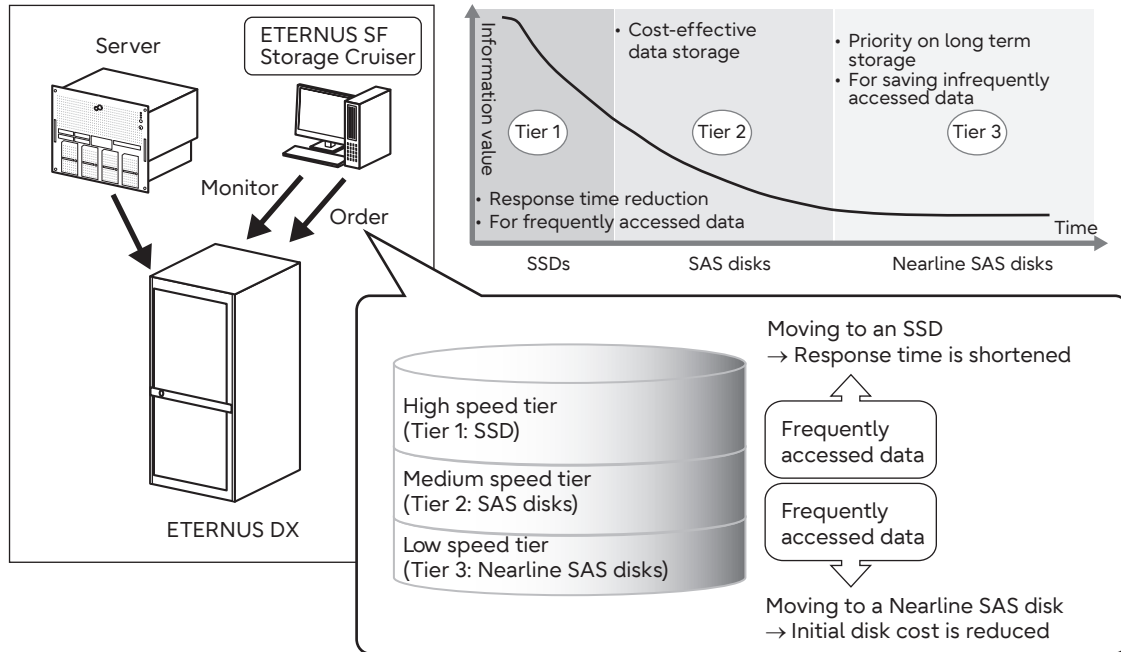


Flexible Tier

The Flexible Tier function automatically redistributes data in the ETERNUS DX according to access frequency in order to optimize performance and reduce operation cost. Storage layering is performed by moving frequently accessed data to high speed drives such as SSDs and less frequently accessed data to cost effective disks with large capacities.

Data is redistributed based on the performance information that is monitored and obtained by ETERNUS SF Storage Cruiser. Using Nearline SAS disks can reduce the storage cost without resulting in any loss of performance.

Figure 12 Flexible Tier



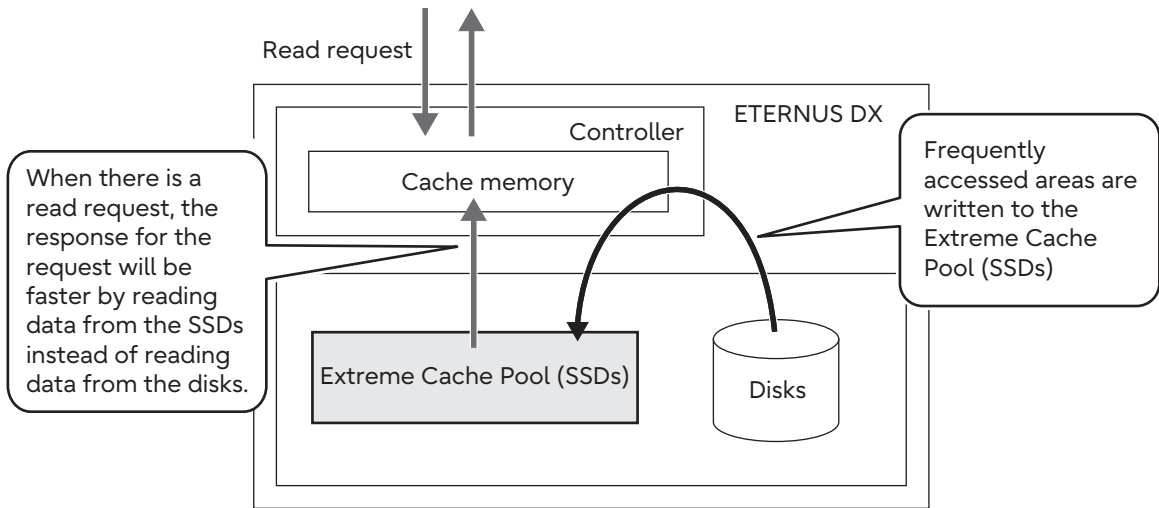
Extreme Cache Pool

The Extreme Cache Pool function uses SSDs in enclosures as the secondary cache to improve the read access performance from the server.

Frequently accessed areas are written asynchronously to specified SSDs for Extreme Cache Pools. When a read request is issued from the server, data is read from the faster SSD to speed up the response.

400GB SSDs (MLC SSDs) can be used for Extreme Cache Pools. Value SSDs cannot be used.

Figure 13 Extreme Cache Pool



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.

Security

The ETERNUS DX provides various enhanced security functions.

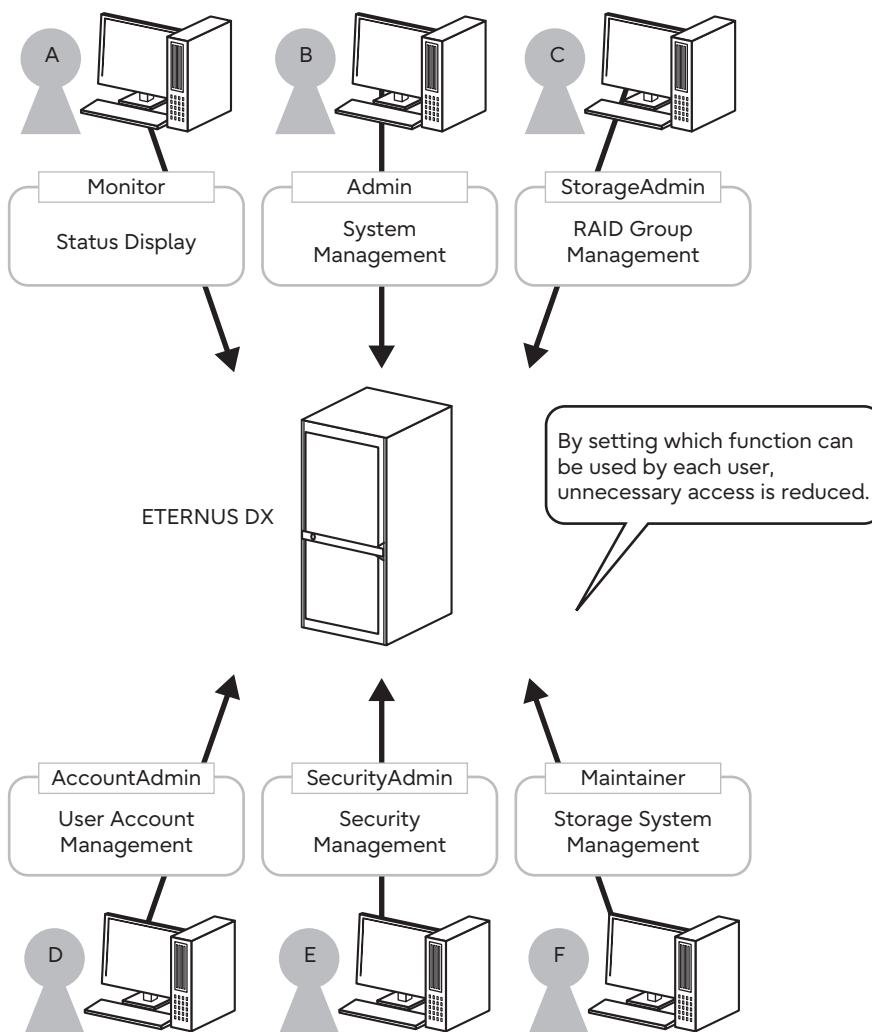
Account Management

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

The ETERNUS DX uses roles to allocate 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 14 Account Management



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.

Data Encryption

Encrypting data as it is being written to the drive prevents information leakage caused by fraudulent decoding.

Even if a drive is removed and stolen by malicious third parties, data cannot be decoded.

This function only encrypts the data stored on the drives, so server access results in the transmission of plain text.

Therefore, this function does not prevent data leakage from server access. It only prevents data leakage from drives that are physically removed.

The following two types of data encryption are supported:

- Self Encrypting Drive

The encryption function of a Self Encrypting Drive (SED) is used to encrypt data. The encryption method is AES.

An SED uses an encryption key when encrypting and writing data. An encryption key cannot be extracted from the encryption drive.

By linking with the key server, the authentication key of an SED can be managed from the key server. Creating and storing an authentication key in a key server makes it possible to manage the authentication key more securely.

- Firmware data encryption

Data is encrypted on a volume basis by the controllers (CMs) of the ETERNUS DX. Data is encrypted and unencrypted in the cache memory when data is written or read.

AES (*1) or Fujitsu Original Encryption can be selected as the encryption method. The Fujitsu Original Encryption method uses a Fujitsu original algorithm that has been specifically created for ETERNUS DX storage systems.

***1:** AES (Advanced Encryption Standard: Federal Information Processing Standards) method

Data encryption with the SED function is recommended. Data encryption with the SED function does not affect performance.

Figure 15 Data Encryption

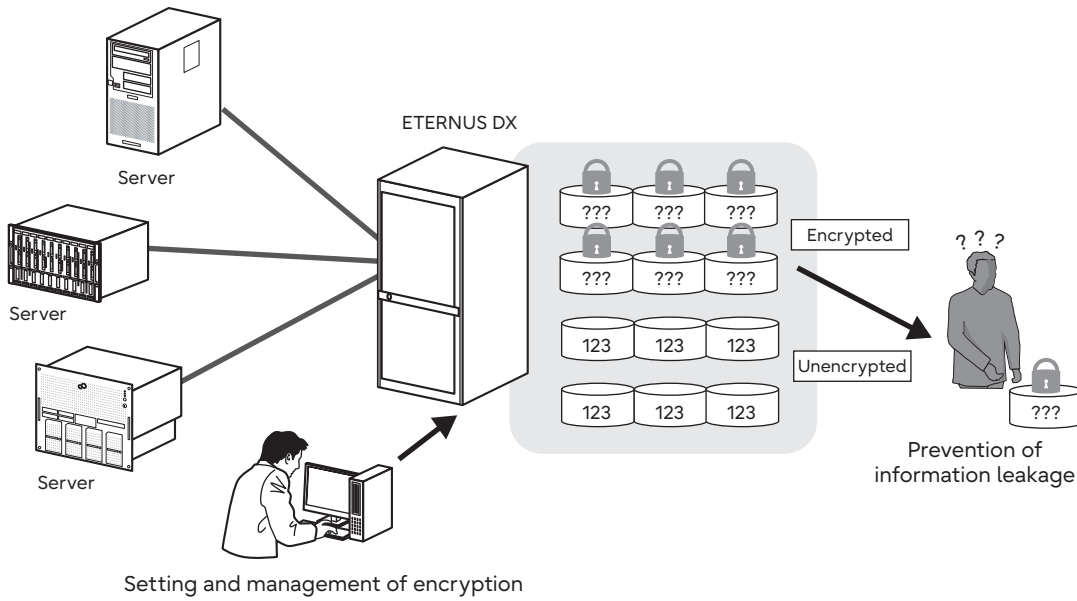


Table 7 Data Encryption Function Specifications

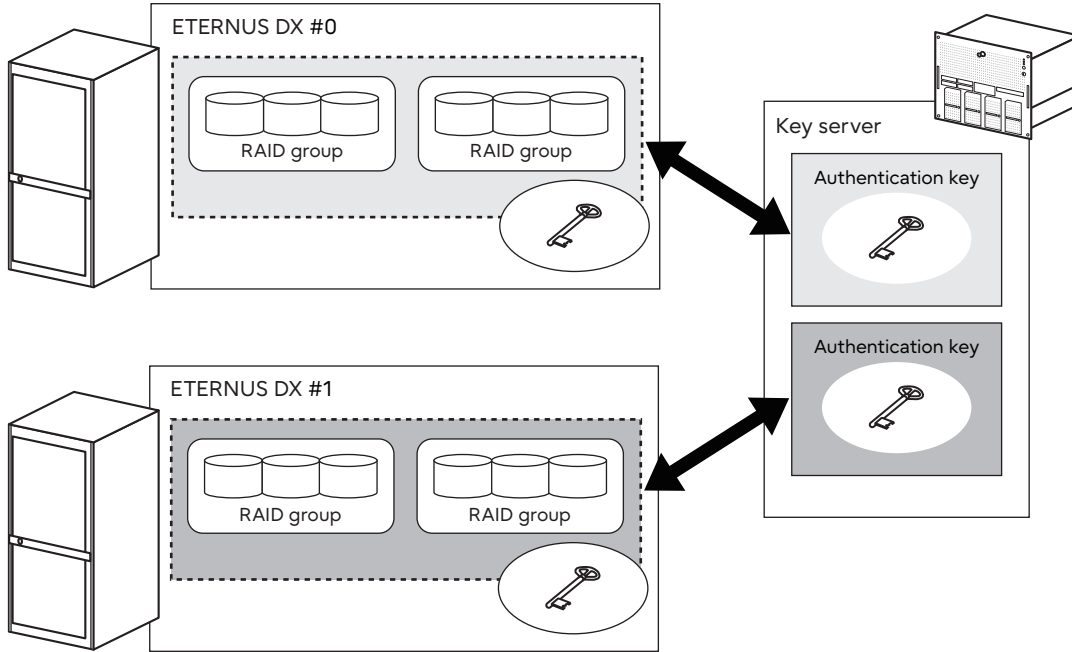
Function specification	Self Encrypting Drive (SED)	Firmware data encryption
Type of key	Authentication key	Encryption key
Encryption unit	Drive	Volume, Pool
Encryption method	AES-256	Fujitsu Original Encryption/AES-128/AES-256
Key management server linkage	Yes	No

Key Management Server Linkage

Security against information leakage is enhanced by creating and managing the authentication key for a Self Encrypting Drive (SED) in a key server and by updating the key regularly.

The management cost of authentication keys can be reduced by consolidating the keys for multiple ETERNUS DX storage systems in the key server. Note that ETERNUS SF KM is required when linking with the key management server.

Figure 16 Key Server



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.

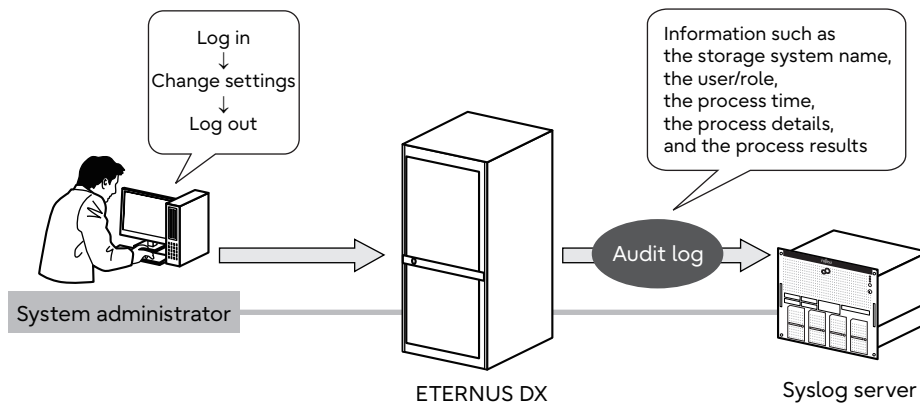
Audit logs are audit trail information that record operations that are executed for the ETERNUS DX and the response from the system. This information is required for auditing.

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 17 Audit Log



Drive Sanitization

Drive sanitization is a function that deletes data in a drive using the sanitization function of the drives (SSDs, Online SAS disks, or Nearline SAS disks). The drive sanitization function can be used to delete user data when, for example, discarding drives.

The Maintenance Operation policy is required to sanitize the drives.

Environmental Burden Reduction

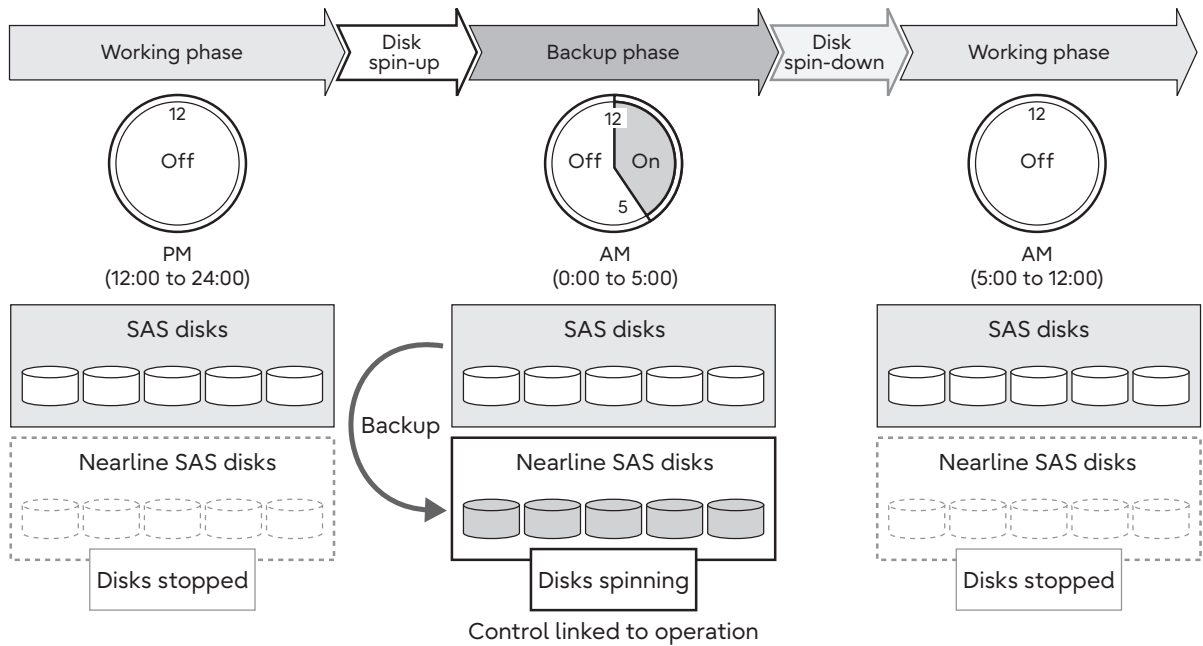
The ETERNUS DX has energy and power savings that reduce CO2 emissions and lessen the burden on the environment.

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 18 Eco-mode Overview

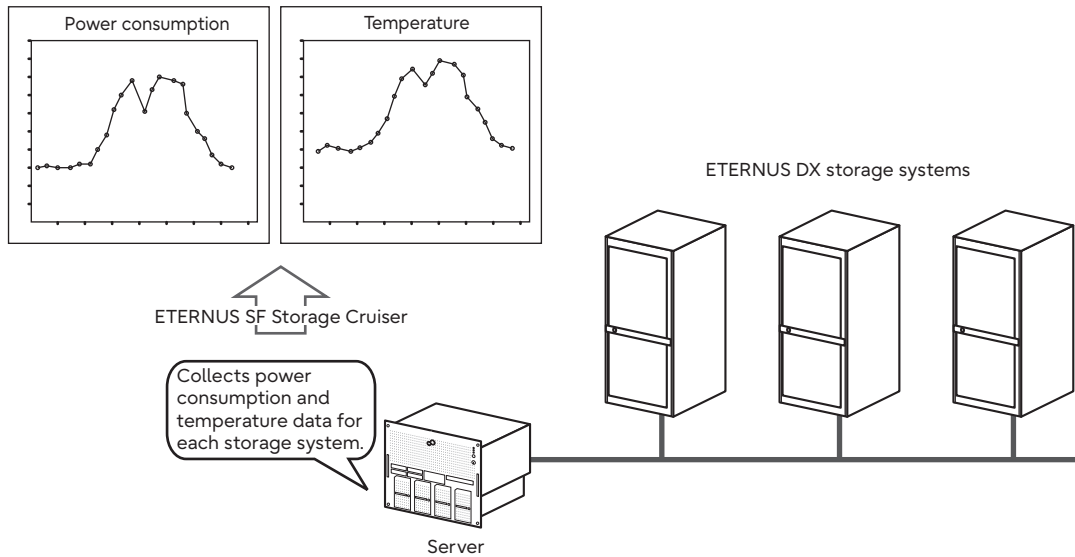


Power Consumption Visualization

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 19 Power Consumption Visualization



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.

Operation Management Interface

Operation management software can be selected in the ETERNUS DX according to the 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).

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

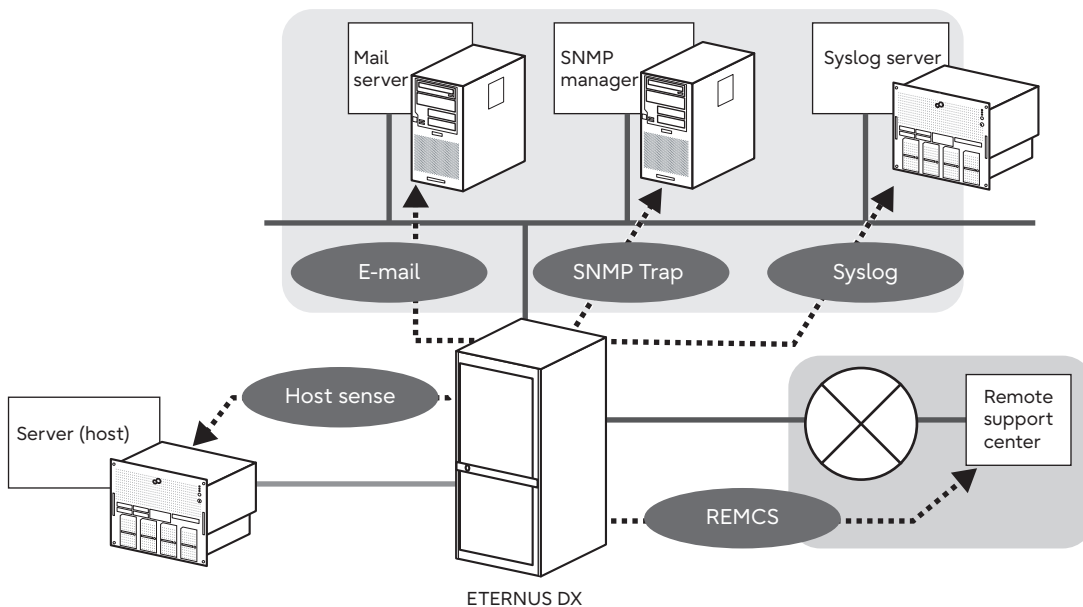
The errors that occur in the ETERNUS DX are notified to the remote support center. Additional information (logs and system configuration information) for checking the error is also sent. This shortens the time to collect information.

- 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 20 Event Notification



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), QoS information (IOPS values, throughput values, delay time), 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.

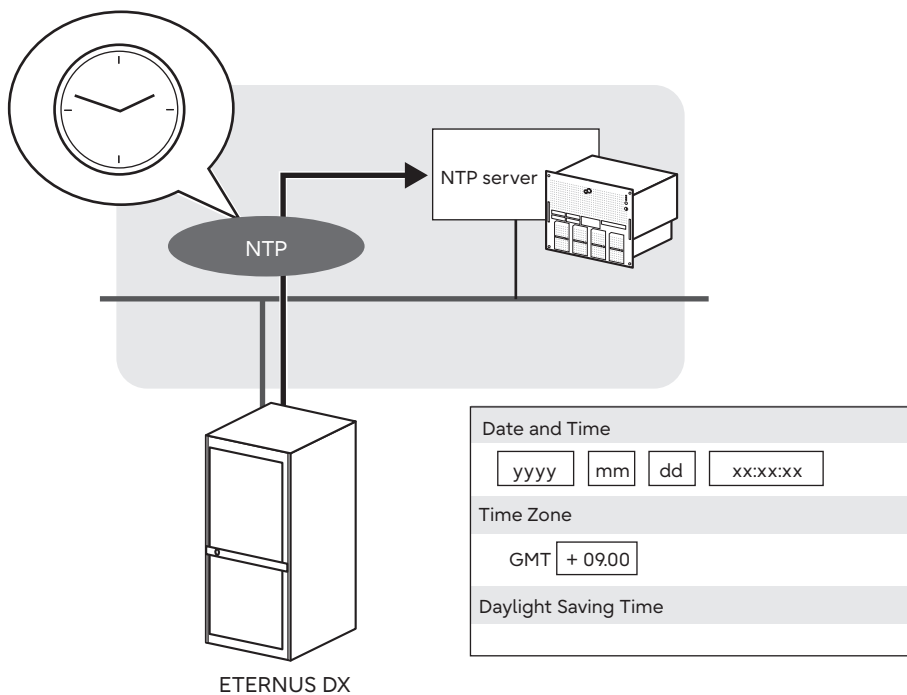
Device Time Synchronization

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, remote copy, 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 21 Device Time Synchronization



Power Control

Power control methods for the ETERNUS DX are described below.

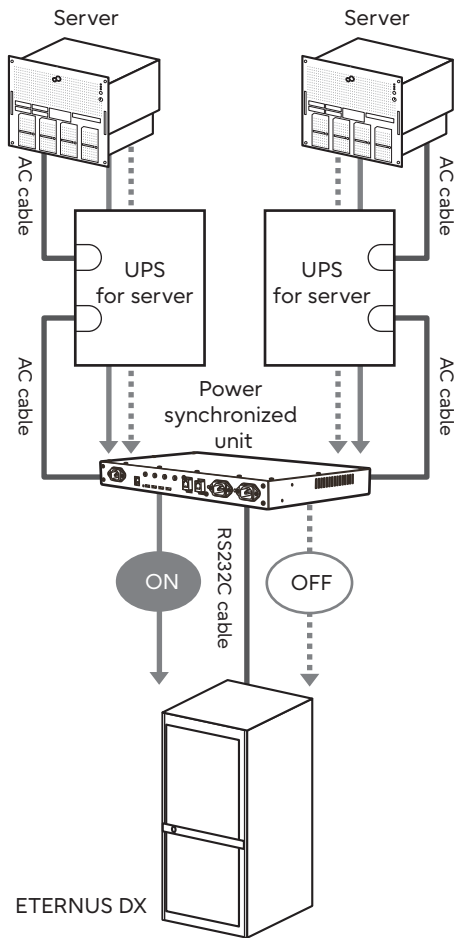
- Power synchronized unit
- Wake On LAN

■ 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 22 Power Synchronized Unit Diagram



■ Remote Power Operation (Wake On LAN)

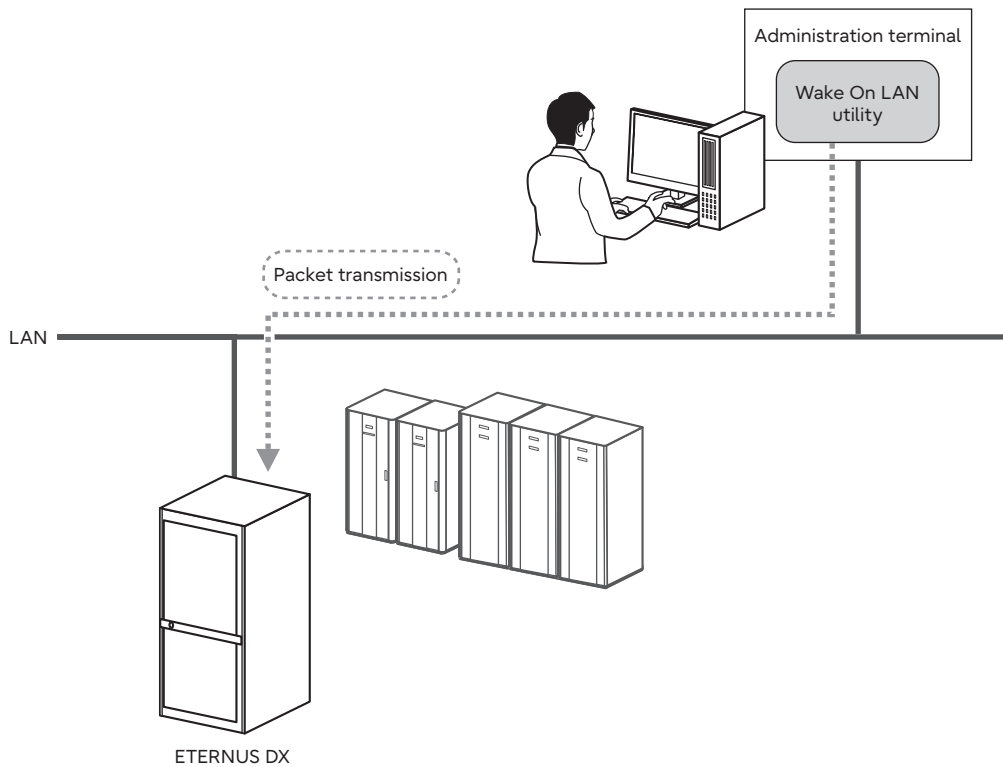
Wake On LAN is a function that turns on the ETERNUS DX via a network.

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 23 Power Supply Control Using Wake On LAN



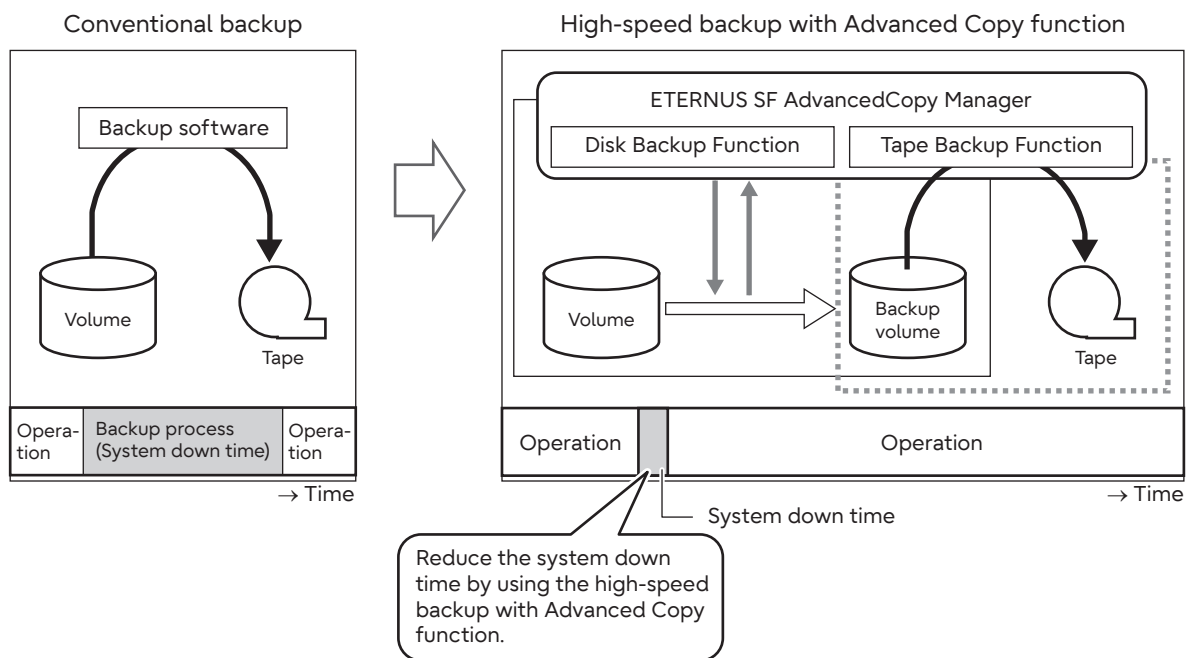
Backup (Advanced Copy)

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 24 Example of Advanced Copy



There are two types of Advanced Copy: a local copy that is performed within a single ETERNUS DX and a remote copy that is performed between multiple ETERNUS DX/AF storage systems.

The following copy methods are available.

Table 8 Available Copy Methods

Environment	Available copy methods	
	Local copy	Remote copy
SAN environment	One Point Copy (OPC), QuickOPC, SnapOPC, SnapOPC+, Equivalent Copy (EC)	Remote Equivalent Copy (REC)
NAS environment	QuickOPC, SnapOPC+	Remote Equivalent Copy (REC)

4. SAN Functions

This chapter describes the functions that are available when a SAN connection is used.

Operations Optimization (Deduplication/Compression)

IMPORTANT

- A single controller configuration differs from a dual controller configuration as follows:
 - The Deduplication/Compression function cannot be used.
 - The Deduplication/Compression function cannot be used if the Unified kit/Unified License is installed.
-

Deduplication/Compression

The Deduplication/Compression function analyzes duplicated data in every 4KB of the write data from the server, and writes the duplicated data only once. After the first write, the data is referenced instead of writing the same data again. This reduces the total write size. Also, with the Compression function further data reduction is realized.

The Deduplication/Compression function can be used for the ETERNUS DX200 S4.

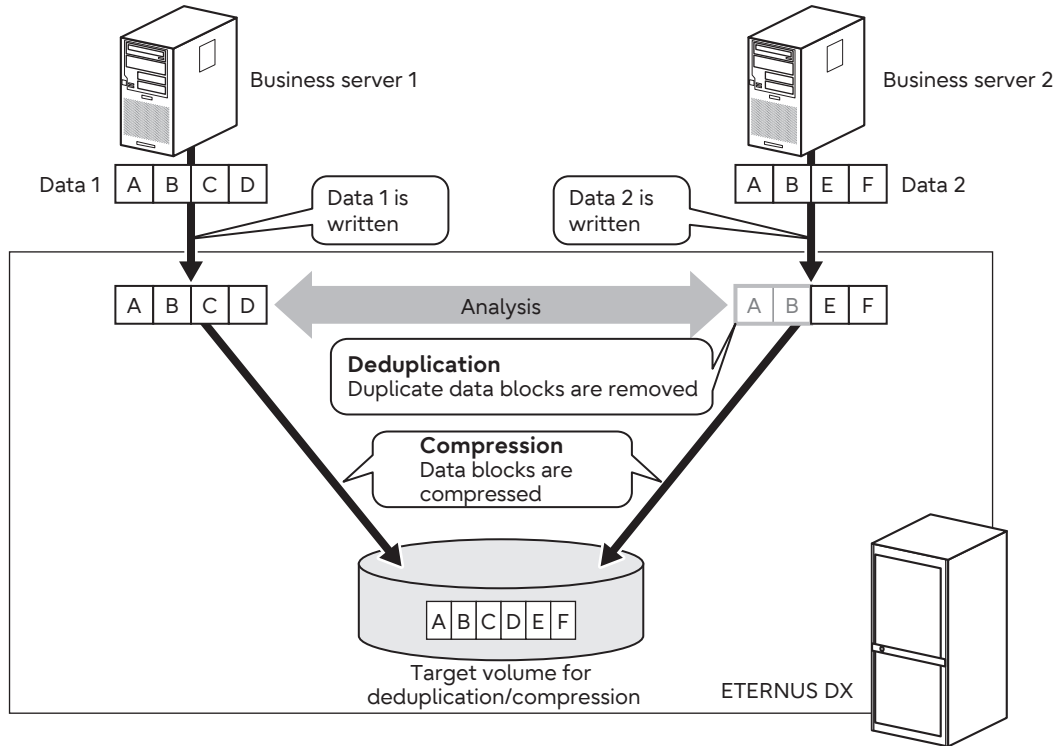
The Deduplication/Compression function can not only perform both deduplication and compression at the same time, but can also perform only deduplication or compression individually.

Overviews of the Deduplication/Compression function, the Deduplication function, and the Compression function are described below.

● **Deduplication/Compression Function**

This function removes duplicate data blocks, compresses the remaining data blocks, and then stores the data.

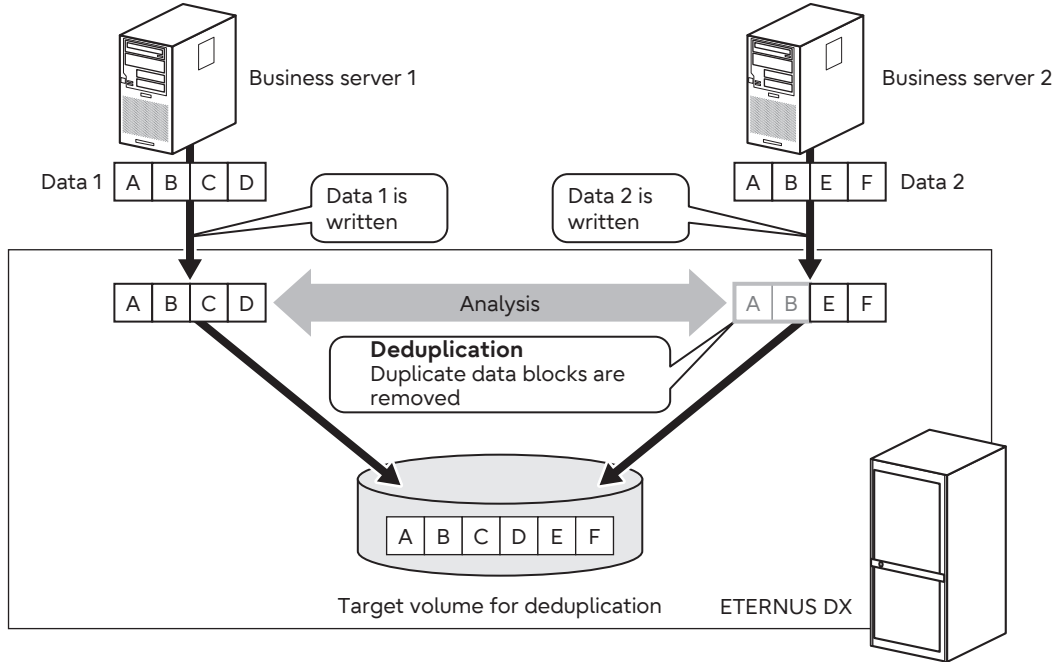
Figure 25 Deduplication/Compression Overview



● **Deduplication Function**

This function removes duplicate data blocks and stores the data.

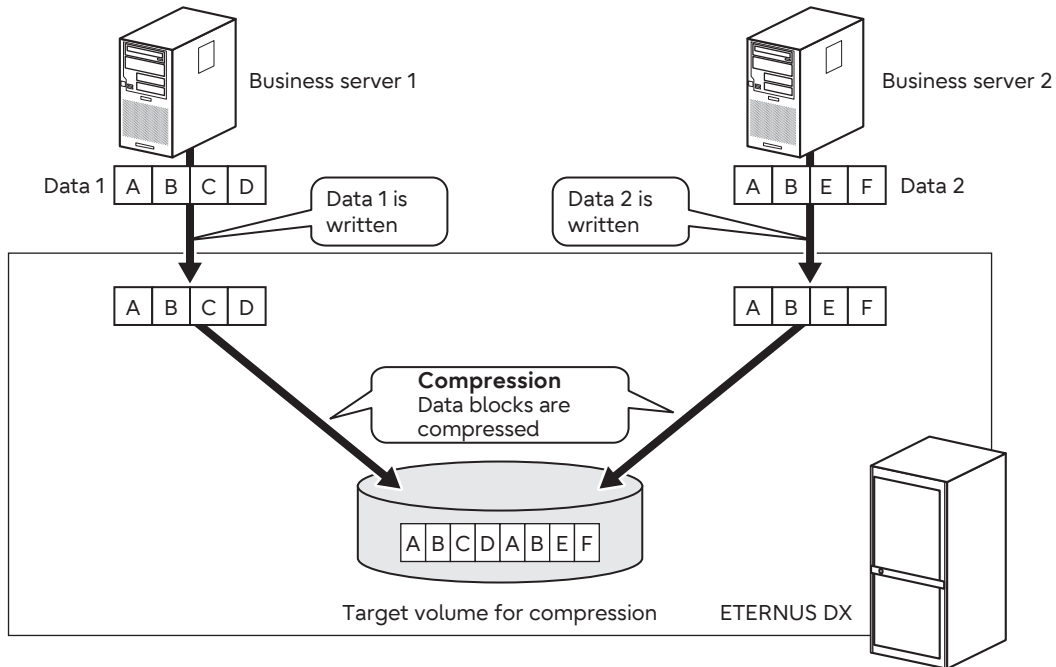
Figure 26 Deduplication Overview



● **Compression Function**

This function compresses each data block and stores the data.

Figure 27 Compression Overview



Security Measures (Unauthorized Access Prevention)

In a SAN environment, one storage is shared by multiple servers. The ETERNUS DX has functions to protect data from unauthorized access and functions to return appropriate responses for server access from various environments in order to improve security and responses.

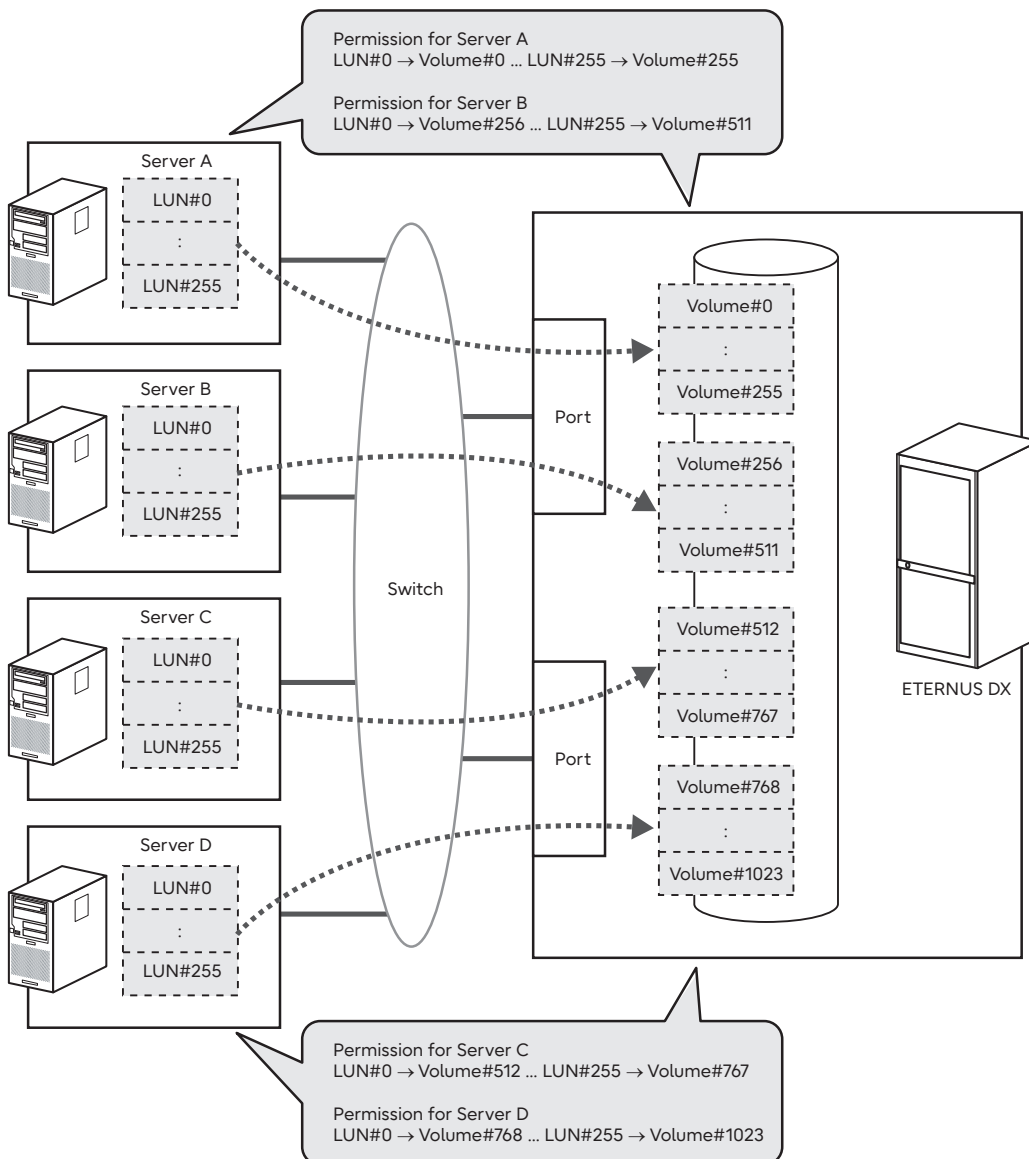
Host Affinity

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 28 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.

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.

Note that the Internet Storage Name Service (iSNS) is also supported as an iSCSI name resolution.

Stable Operation

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

Quality of Service (QoS)

The I/O performance of a server with higher priority is guaranteed by configuring the performance limit of each connected server.

When loads from one application are high in a storage integrated environment and sufficient resources to process other operations cannot be secured, performance may be reduced.

If the QoS function is used, the processing performance of the server given priority for a process can be maintained. The workload limit can be configured on each server, and even if workload has been changed by a server processing request, the prioritized operation will not be affected.

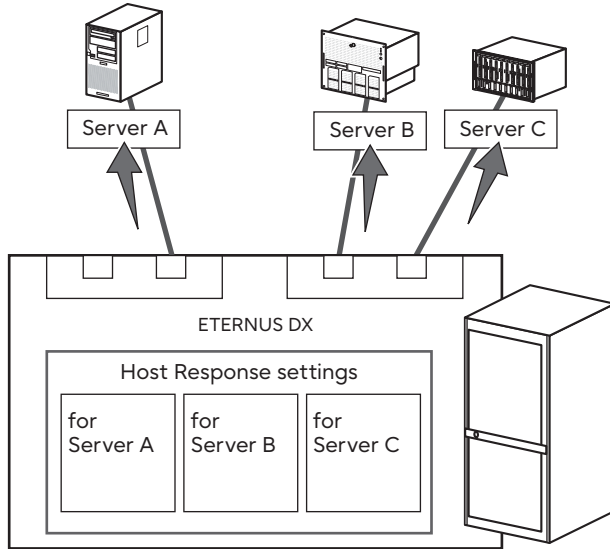
The storage resource can be automatically adjusted using ETERNUS SF Storage Cruiser to link the QoS automation with Automated Storage Tiering.

In addition, an upper bandwidth limit can be set for each copy path. Even if a specific path fails, a steady load can be maintained without centralizing the load to other paths.

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 29 Host Response (Connection Operation Mode)



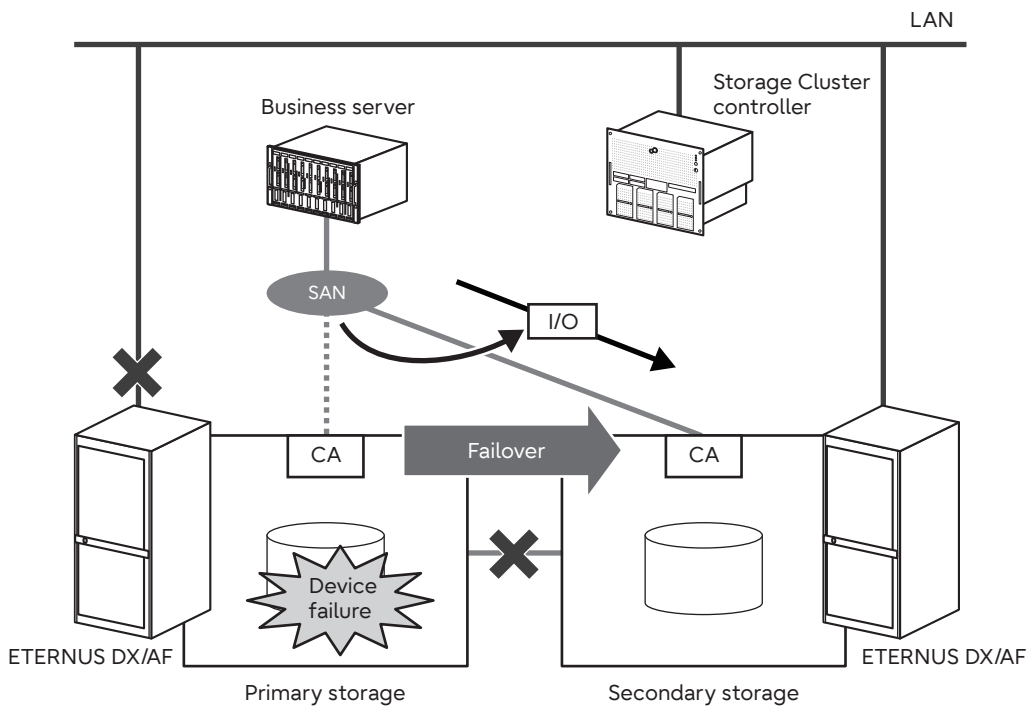
Storage Cluster

Storage Cluster is a function that allows continuous operations by using redundant connections to two ETERNUS DX/AF storage systems so that even if the Primary storage fails, operations are switched to the Secondary storage. Operations can continue without stopping access from the server if there are unexpected problems or if the storage system is in an error state due to severe failures.

Volumes that are accessed from business servers remain accessible with the same drive or mount point even after switching to the ETERNUS DX/AF. Transparent access from business servers is possible even after switching to the ETERNUS DX/AF. Reallocating volumes or switching mount points is not required.

The time it takes to perform a required storage system switchover for a failover or a failback varies depending on the connection configuration (FC or iSCSI).

Figure 30 Storage Cluster



Data Migration

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

Storage Migration

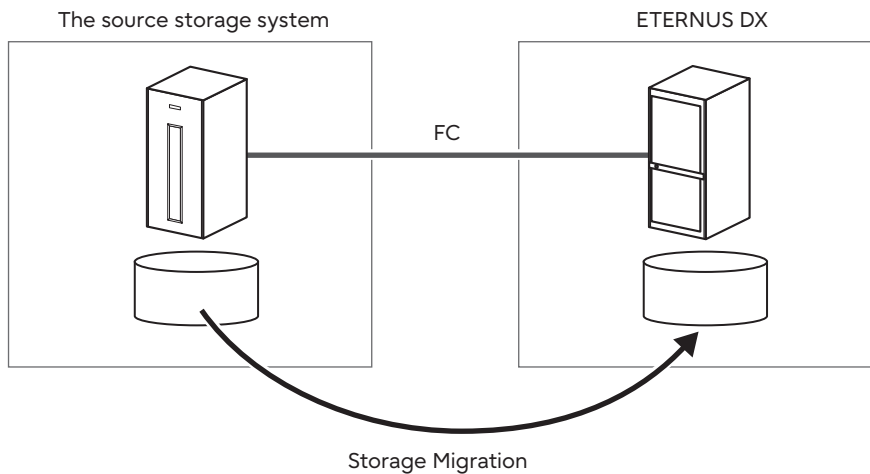
Storage Migration is a function that migrates the volume data from an old storage system to volumes in a new storage system without using a host in cases such as when replacing a storage system.

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.

Online Storage Migration and offline Storage Migration are supported.

Figure 31 Storage Migration

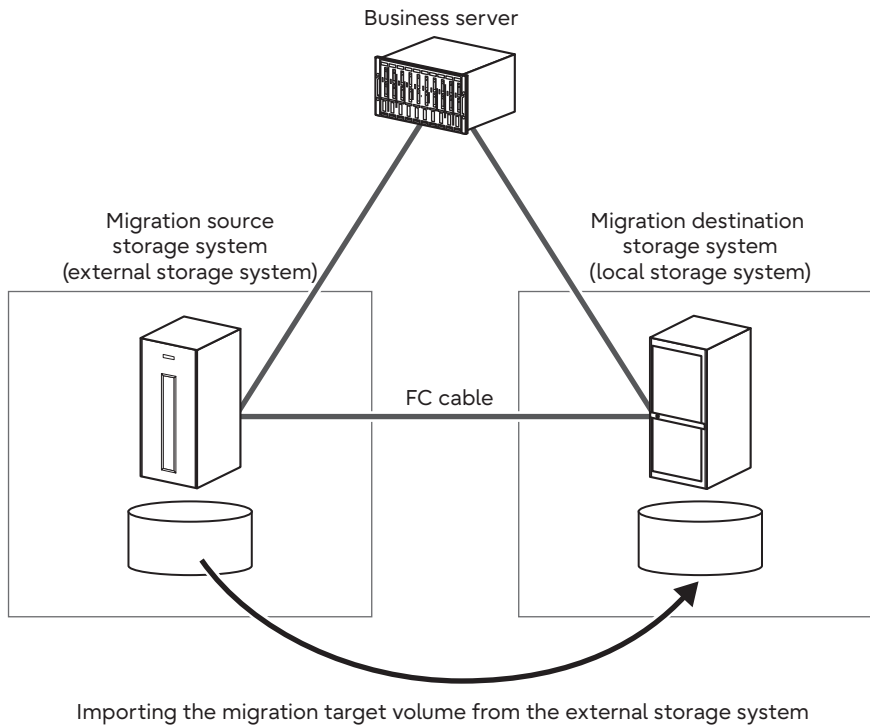


Non-disruptive Storage Migration

Non-disruptive Storage Migration is a function that migrates the volume data from an old storage system to volumes in a new storage system without stopping a business server in cases such as when replacing a storage system.

The connection interface between the migration source storage system (external storage system) and the migration destination storage system (local storage system) is only FC cable. In addition, the direct connection and switch connection topologies are supported.

Figure 32 Non-disruptive Storage Migration



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:

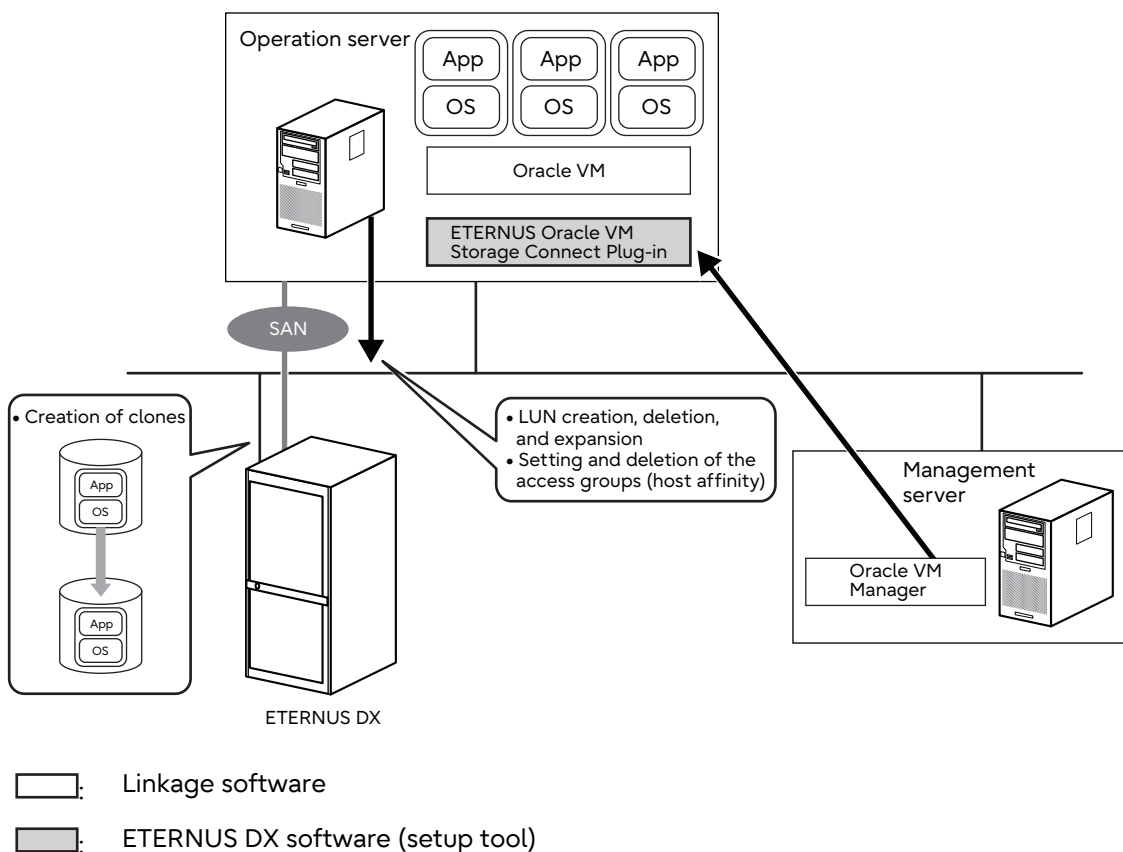
<https://www.fujitsu.com/global/support/products/computing/storage/download/>

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, and expansion, and snapshots are supported.

Figure 33 Oracle VM Linkage

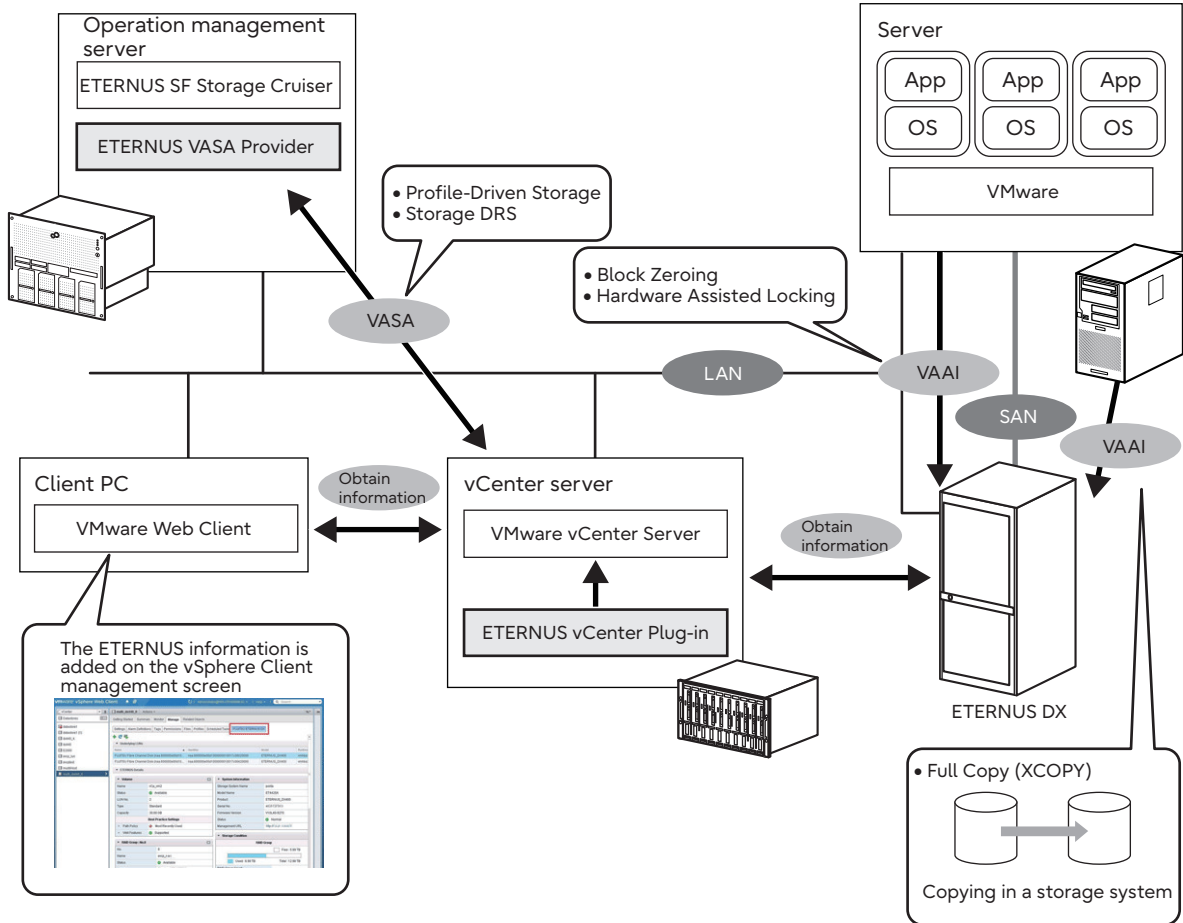


VMware Linkage

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.

In addition, by supporting VVOLs that are also supported by VMware vSphere 6, the system can be efficiently operated.

Figure 34 VMware Linkage



- : Linkage software
- : ETERNUS DX software (setup tool)

■ 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.

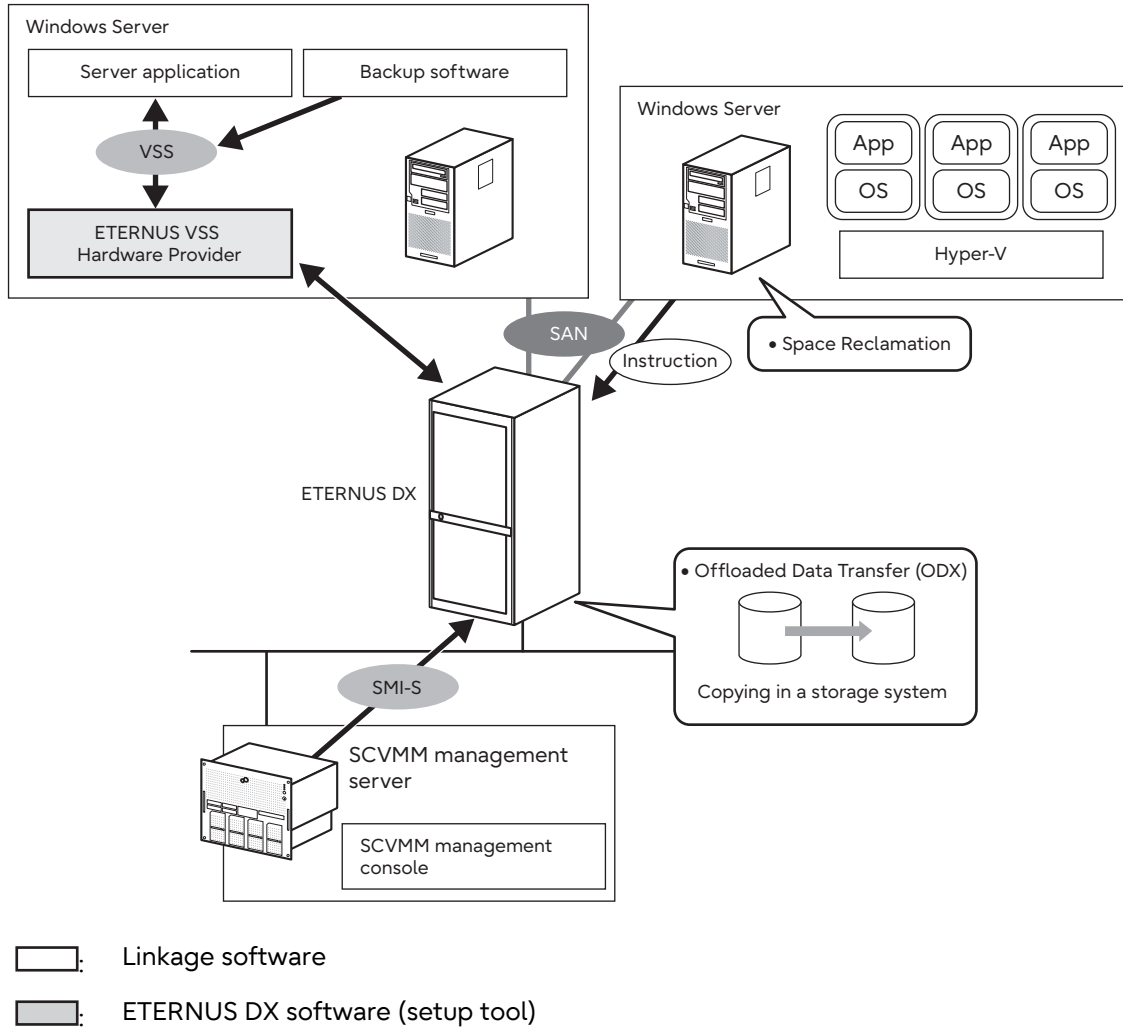
Veeam Storage Integration

The operability and efficiency of Virtual Machine backups in virtual environments (VMware) are improved by using the ETERNUS DX storage snapshot integration with Veeam Backup & Replication provided by Veeam Software.

Microsoft Linkage

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

Figure 35 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 or later 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 or later 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 or 2016 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.

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 Block Storage for cinder. Creating volumes in the ETERNUS DX and assigning created volumes to VM instances can be performed via an OpenStack standard interface (Horizon).

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.

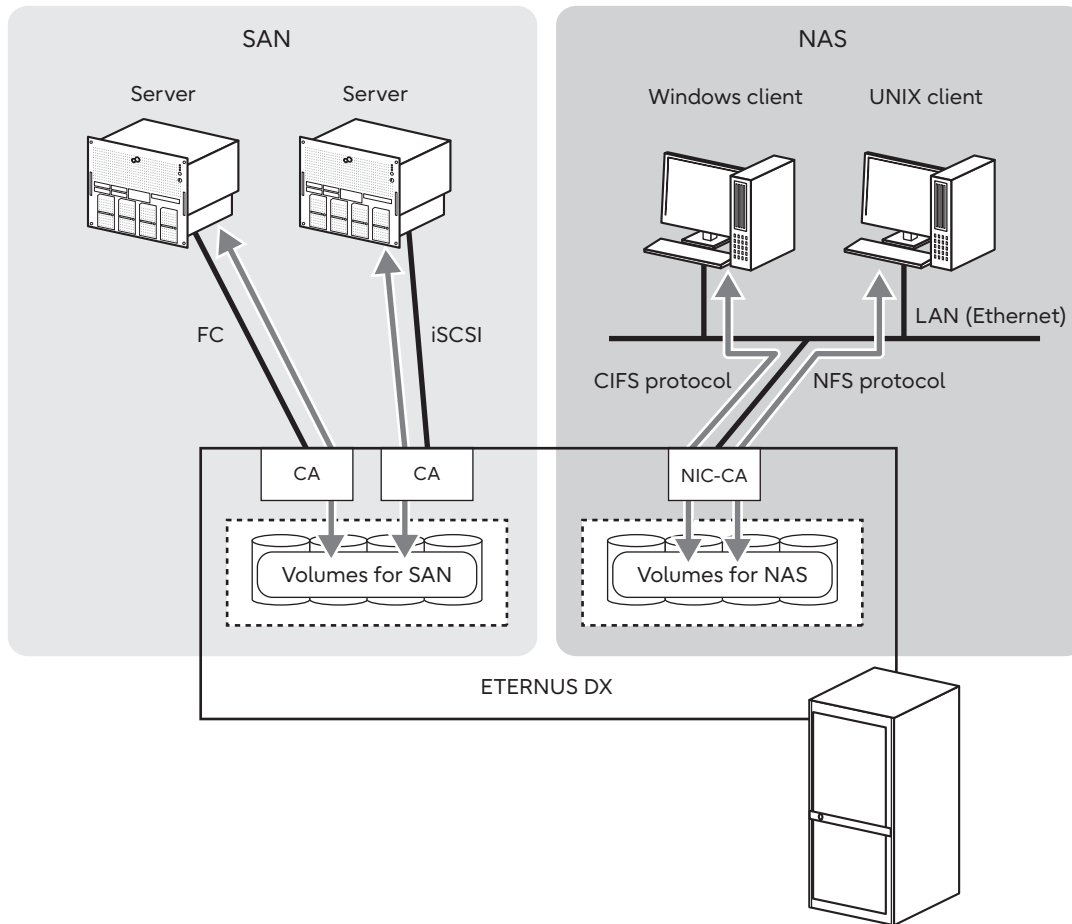
5. NAS Functions

An ETERNUS DX can be used with a NAS connection in a Unified environment.

In a NAS environment, data is accessed with files by using the NFS protocol or the CIFS protocol via Ethernet. ETERNUS DX storage systems can be used as file servers because files can be shared between client PCs that have different OSs.

SAN/NAS connection diagrams in a Unified environment are shown below.

Figure 36 SAN/NAS Connection Diagrams



This chapter explains the available functions when a NAS connection is used.

IMPORTANT

Unified kit/Unified License cannot be installed if the Deduplication/Compression function is used.

Supported Protocols

The ETERNUS DX supports the CIFS protocol, the NFS protocol, and FTP/FXP. The CIFS protocol and NFS protocol can be used simultaneously and enable file sharing between clients in which different OSs (such as UNIX and Windows) are running. CIFS and NFS are client/server protocols that can perform file management such as exclusive control on the NAS side, which allows exclusive control over each file and simultaneous access.

CIFS

The Common Internet File System (CIFS) is a protocol that is used for file sharing in Windows system environments.

Files on the network can be shared.

NFS

Network File System (NFS) is a protocol that is used for file sharing in Linux or UNIX system environments.

File sharing for NFS can be performed by mounting a shared directory from a client.

FTP/FXP

With File Transfer Protocol (FTP), the shared folder can be accessed. With File eXchange Protocol (FXP), data in the shared folder can be transferred between ETERNUS DX storage systems.

NAS Volume Management

Thin Provisioning Volumes (TPVs) that are virtual volumes are used for NAS.

User Management

When the ETERNUS DX is used as a file server, access control over shared files is required. If no control is performed, access from any user is allowed.

If a directory service such as the Active Directory service or the LDAP service is used for access control, user management and group management can be consolidated.

Active Directory Service

The ETERNUS DX supports authentication by an Active Directory domain controller (user management server) in a Windows Server.

A directory is stored in a file on the server that is called a domain controller and can be accessed from network applications and services.

Security is maintained by controlling user access through logon authentication and access control over the objects in the directories. The Active Directory stores user qualification information and access control information. Users obtain authentication to log on to the network and privileges to access system resources.

Group accounts can also be created and effective management for user access privileges is available.

LDAP Service

Lightweight Directory Access Protocol (LDAP) is a protocol to access the directory database. The management of system user authentication can be centralized in the LDAP server.

Local User Authentication

Local user authentication allows CIFS access on a per created local user/local group basis in the ETERNUS DX. This function can manage users and groups that are allowed access to the shared folders without using the authentication server.

ACL Function

The Access Control List (ACL) function can be used for management of the users with access privileges when the CIFS and NFS protocols are shared to access shared folders.

ACL can manage access privileges to directories and files as well as the type of granted access for each user and group.

If ACL is set up for a directory or a file, control is performed regardless of the protocol type (NFS or CIFS) that is used to access the directory or the file.

Quota

Quota is a function that limits drive space and the number of files used on a user, group or shared folder basis.

The drive capacity can be protected from being used exclusively by a specific user, group, or shared folder by setting the upper limit of the drive space and the number of files available for the user, group, or shared folder. The Quota function allows the scale of the organization and the use of the system to be taken into consideration to realize flexible operations.

The Quota settings can be referred to from the target client.

Figure 37 Quota (for Each User or Group)

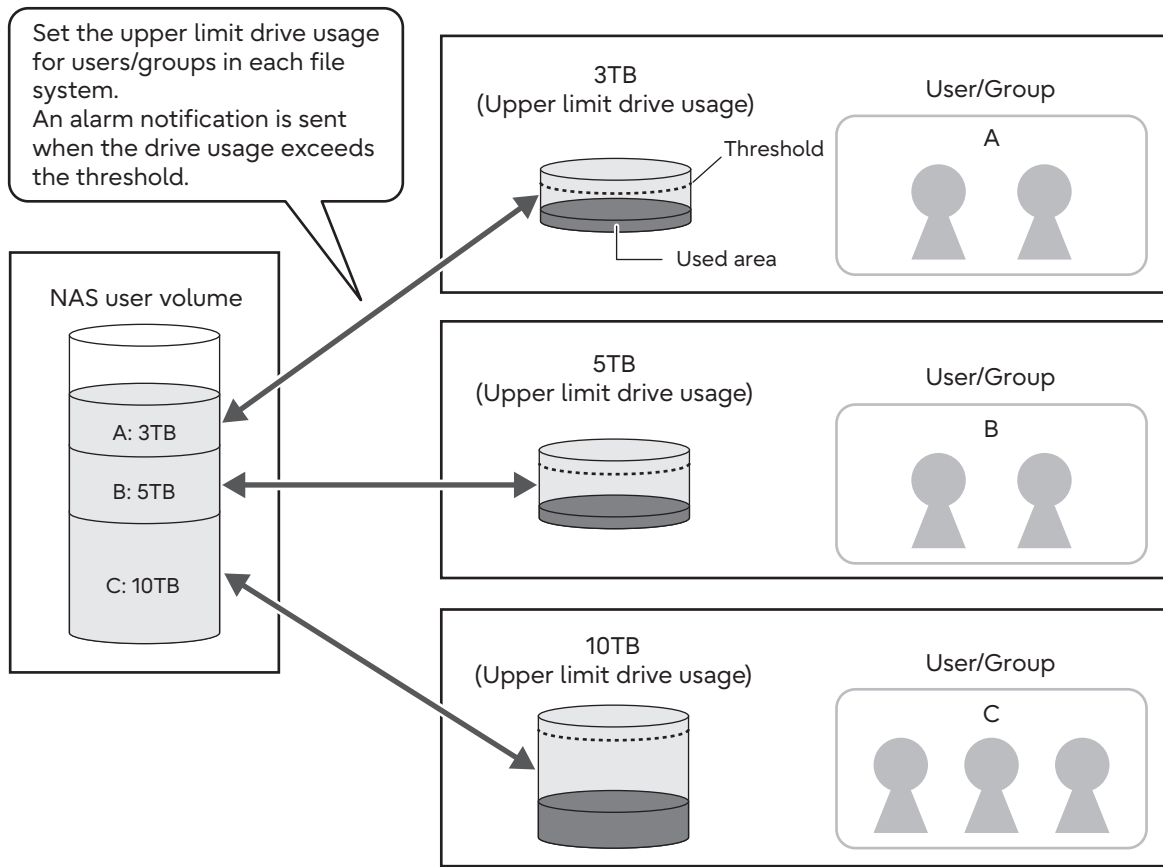
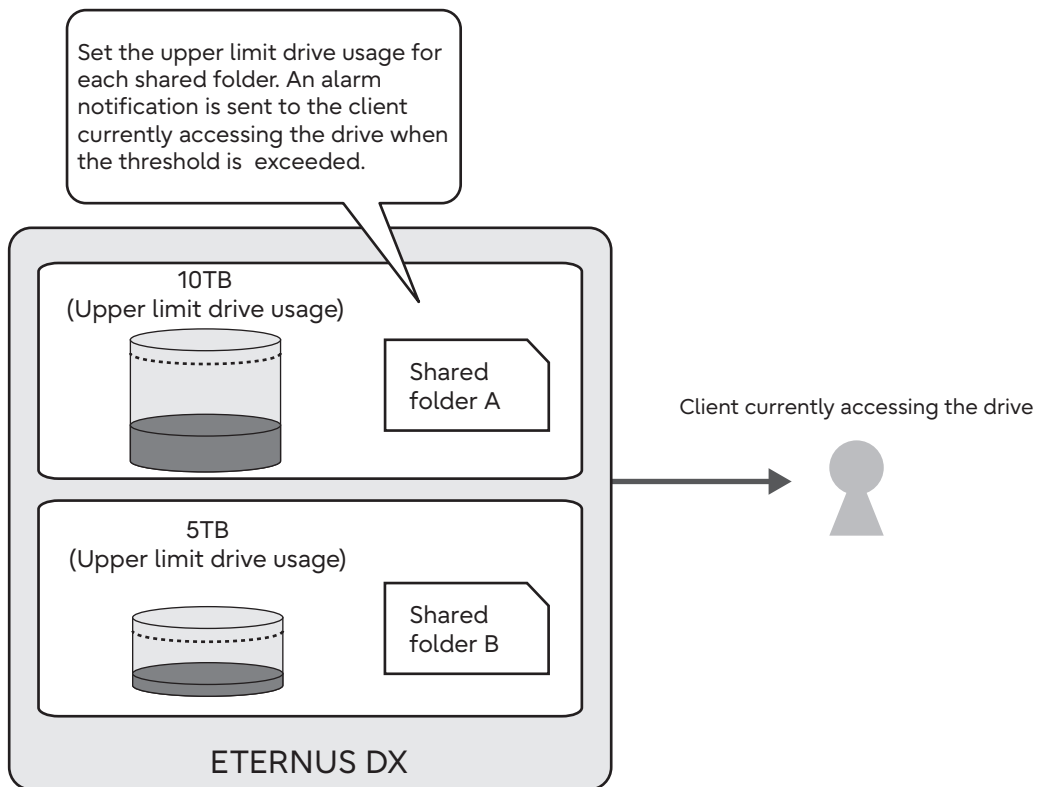


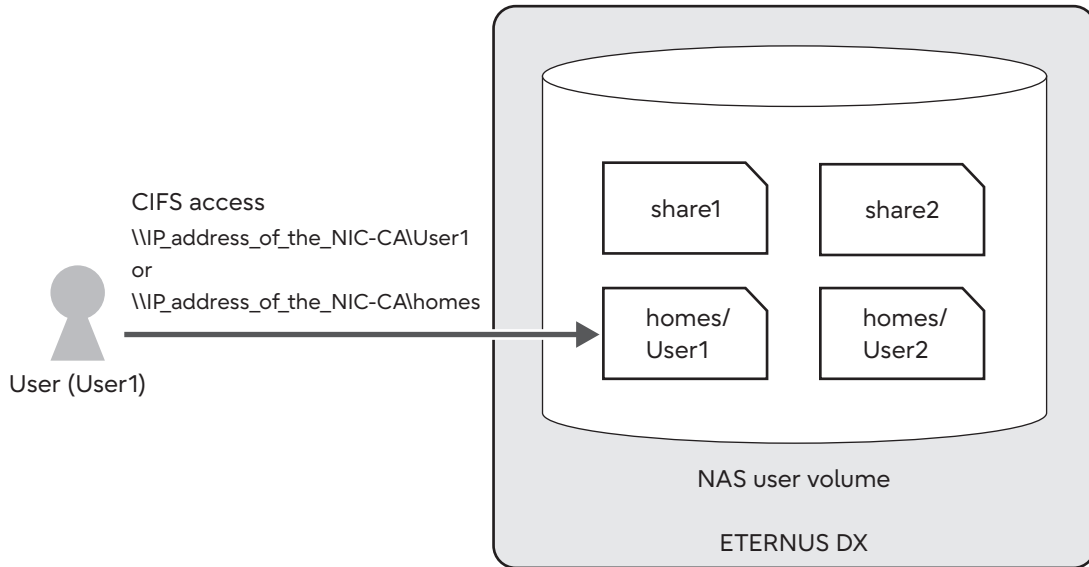
Figure 38 Quota (for Each Shared Folder)



Home Directories

A dedicated shared folder (home directory) can be used when a CIFS connection is used. The home directory can be accessed with Active Directory authentication or local user authentication.

Figure 39 Home Directories

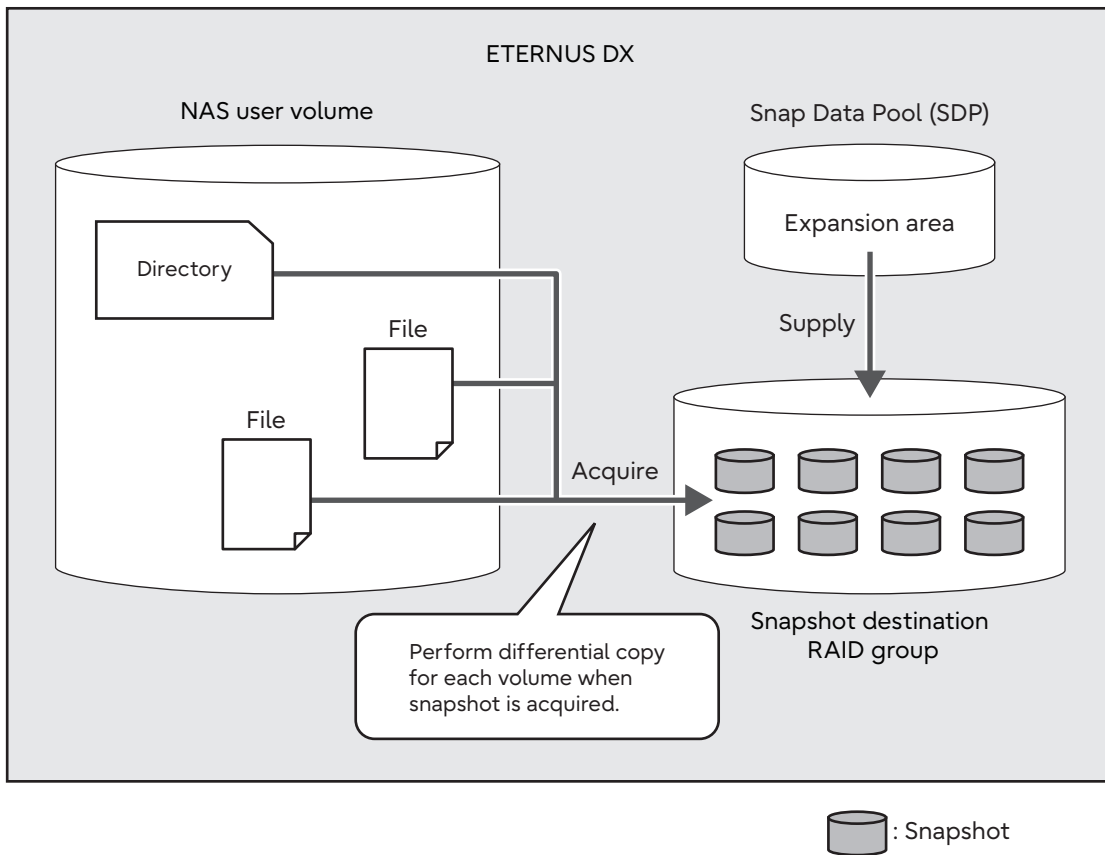


Snapshot

Snapshot is a function that automatically backs up volume data at a certain point. Unlike usual backup copies, this function only copies differential data from the source volume data. Therefore, the disk space necessary for backup is reduced.

Acquiring snapshots of the NAS user volume enables file restore from a snapshot even if a file is deleted by mistake. Data can be restored from a client.

Figure 40 Snapshot



6. Hardware Configurations

This chapter explains hardware configurations for the ETERNUS DX.

Controller Enclosure

This section explains the main components in the controller enclosure.

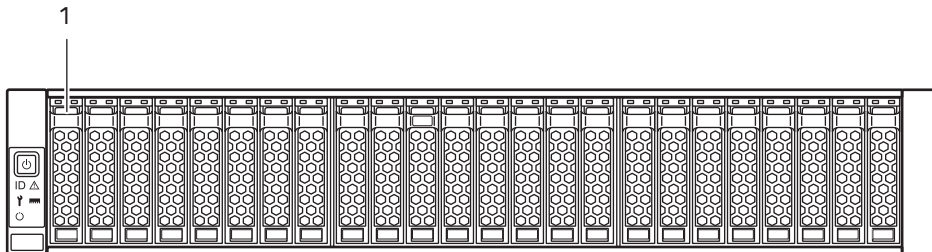
The controller enclosure contains drives installed in the front, and controllers and power supply units in the rear.

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 41 Front View of a 2.5" Type Controller Enclosure

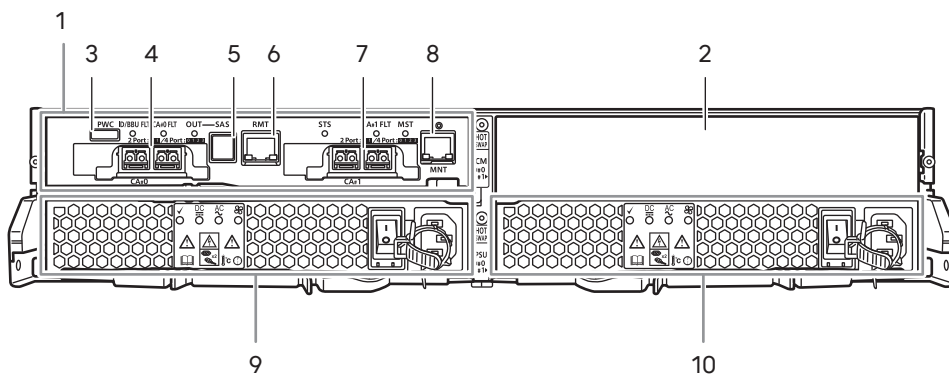


- 1. 2.5" disk or 2.5" SSD

Rear View

- When only one controller is installed

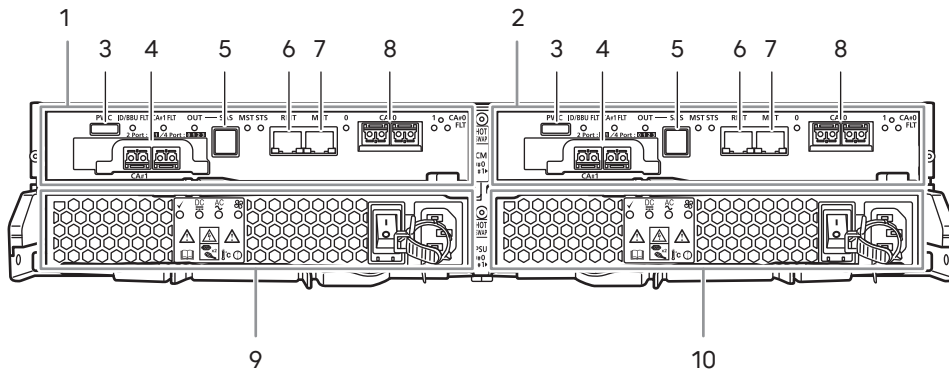
Figure 42 Rear View of a 2.5" Type Controller Enclosure (with One Controller Installed)



- 1. Controller (CM#0)
- 2. Cover
- 3. PWC port
- 4. Host interface (CA#0)
- 5. Drive interface (OUT) port

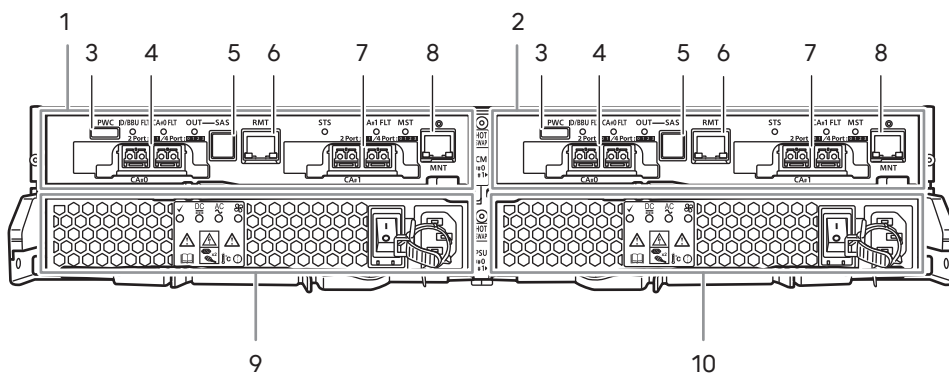
- 6. RMT (LAN) port
 - 7. Host interface (CA#1)
 - 8. MNT (LAN) port
 - 9. Power supply unit (PSU#0)
 - 10. Power supply unit (PSU#1)
- When two controllers are installed
There are two types of configurations that correspond to the combination of host interfaces.

Figure 43 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. Host interface (CA#1)
- 5. Drive interface (OUT) port
- 6. RMT (LAN) port
- 7. MNT (LAN) port
- 8. Host interface (CA#0)
- 9. Power supply unit (PSU#0)
- 10. Power supply unit (PSU#1)

Figure 44 Rear View of a 2.5" Type Controller Enclosure (with Two Controllers Installed)



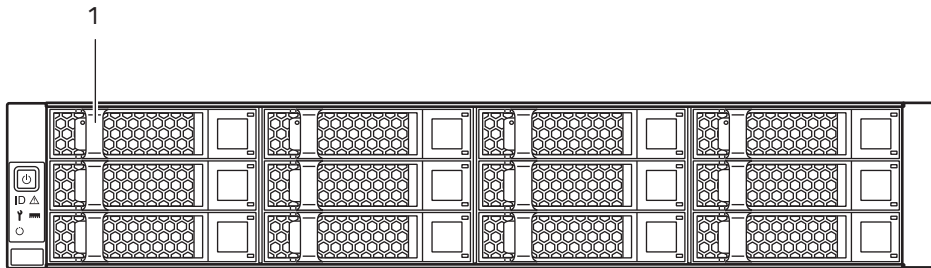
- 1. Controller (CM#0)
- 2. Controller (CM#1)

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

■ External Views of a 3.5" Type Controller Enclosure

● Front View

Figure 45 Front View of a 3.5" Type Controller Enclosure

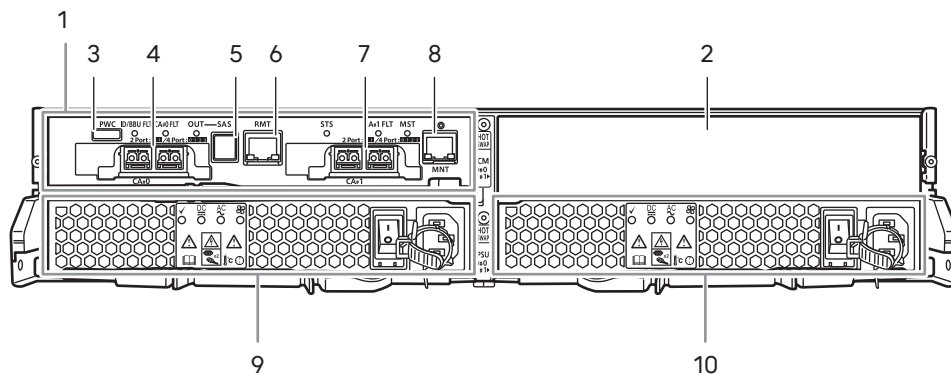


1. 3.5" disk or 3.5" SSD

● Rear View

- When only one controller is installed

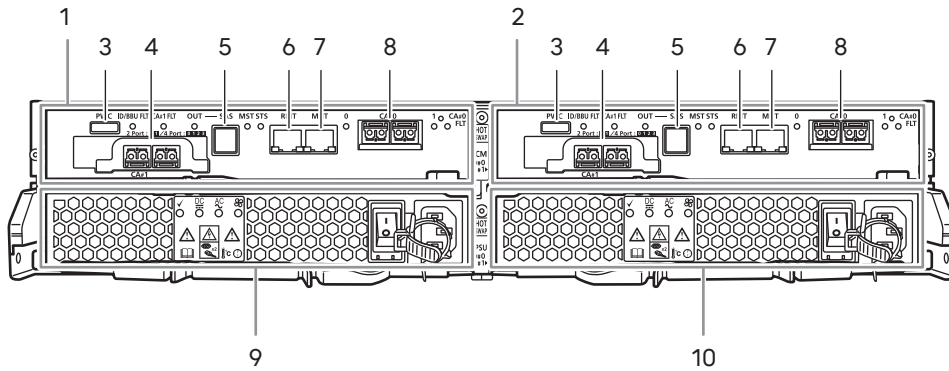
Figure 46 Rear View of a 3.5" Type Controller Enclosure (with One Controller Installed)



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

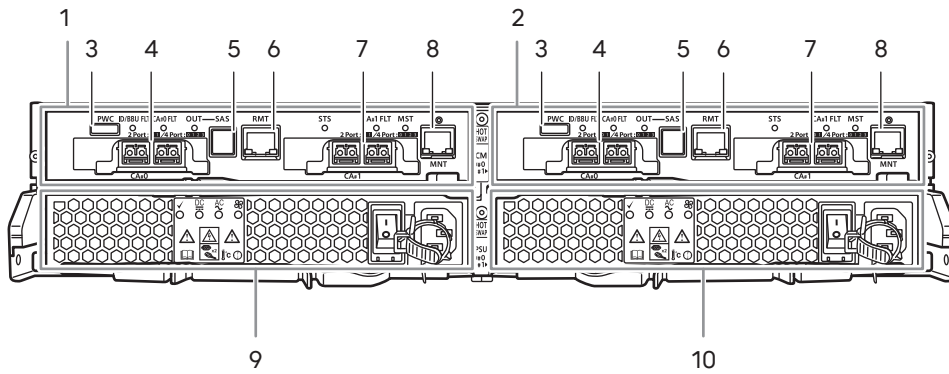
- 7. Host interface (CA#1)
 - 8. MNT (LAN) port
 - 9. Power supply unit (PSU#0)
 - 10. Power supply unit (PSU#1)
- When two controllers are installed
There are two types of configurations that correspond to the combination of host interfaces.

Figure 47 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. Host interface (CA#1)
- 5. Drive interface (OUT) port
- 6. RMT (LAN) port
- 7. MNT (LAN) port
- 8. Host interface (CA#0)
- 9. Power supply unit (PSU#0)
- 10. Power supply unit (PSU#1)

Figure 48 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. Host interface (CA#0)
5. Drive interface (OUT) port
6. RMT (LAN) port
7. Host interface (CA#1)
8. MNT (LAN) port
9. Power supply unit (PSU#0)
10. Power supply unit (PSU#1)

Controllers

The controller contains a CPU, system memory, battery, 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.
 - The Flexible Tier function cannot be used.
 - The Deduplication/Compression function cannot be used.
 - The Unified kit (NAS connection) is not available.
 - High-density drive enclosures cannot be installed.
- 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.

■ System Memory

The system memory is a memory module that has the following two types of area.

- Cache area, which stores frequently used data
- System area, which stores data for speeding up controller processing

The maximum system memory capacity of each controller is 16GB for the ETERNUS DX100 S4 and 32GB for the ETERNUS DX200 S4.

If the ETERNUS DX is equipped with two controllers and the system memory fails, it 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 cache data in the system 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 Interfaces

A host interface (CA) is a board that has interface ports to connect a controller to a server.

Up to two host interfaces can be installed in a single controller.

Host interfaces can be added during system operation. When an error occurs, a replacement can be made while the system is running.

FC, iSCSI, and SAS are available as the SAN host interface. Ethernet is available as the NAS host interface. Different types of interfaces can exist together in the same controller.

FC and iSCSI are available as the host interface. Different types of interfaces can exist together in the same controller.

The host interface specifications are shown below.

Table 9 Host Interface Specifications

Interface	Transfer rate (max.)	Connector type	Number of ports for each CA
FC	32Gbit/s	LC	2
FC	16Gbit/s	LC	2
FC (Long Wave Length type SFP+ module) (*1)	16Gbit/s	LC	1 / 2
FC	8Gbit/s	LC	2
iSCSI (*2)	10Gbit/s	LC	2
iSCSI	10Gbit/s	SFP+ (direct attach twinax copper)	2
iSCSI	10Gbit/s	RJ-45	2
iSCSI	1Gbit/s	RJ-45	2
SAS	12Gbit/s	miniSAS HD (SFF-8644)	2
Ethernet (*2)	10Gbit/s	LC	2
Ethernet	10Gbit/s	SFP+ (direct attach twinax copper)	2
Ethernet	1Gbit/s	RJ-45	4

***1:** Specifications that apply when a Short Wave Length type SFP+ module is replaced with a Long Wave Length type SFP+ module.

***2:** The SFP+ module is required.

■ Drive Interface Ports

This port is used to connect drive enclosures.

The drive interface port specifications are shown below.

Table 10 Drive Interface Port Specification (Controller)

Interface	Transfer rate (max.)	Connector type	Number of ports for each controller
SAS	12Gbit/s	miniSAS HD (SFF-8644)	1

■ MNT Ports/RMT Ports

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 shown below.

Table 11 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)

■ Batteries

A battery is installed in the controller as backup power supply sources.

The batteries are charged from an external power source while the ETERNUS DX is running normally. If a power failure is detected, the cache data in the system memory is saved to the BUD in the controller by using battery power. 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 12 PWC Port Specifications

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

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.

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 13 2.5" Drive Specifications (2.5" Type Controller Enclosure)

Product name	Drive interface (maximum transfer rate)	Storage media	Storage capacity	Rotational speed
SAS disks	Serial Attached SCSI (12Gbit/s)	Hard disk	300GB, 600GB, 900GB, 1.2TB, 1.8TB, 2.4TB (*1)	10,000rpm
			300GB, 600GB, 900GB	15,000rpm
SAS self encrypting disks (SEDs)	Serial Attached SCSI (12Gbit/s)	Hard disk	1.2TB, 2.4TB (*1)	10,000rpm
Nearline SAS disks	Serial Attached SCSI (12Gbit/s)		1TB, 2TB (*1)	7,200rpm
SSDs	Serial Attached SCSI (12Gbit/s)	Flash memory	400GB, 960GB, 1.92TB, 3.84TB, 7.68TB, 15.36TB, 30.72TB (*2)	—
Self encrypting SSDs (SEDs)	Serial Attached SCSI (12Gbit/s)		400GB, 1.92TB, 3.84TB, 7.68TB	

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

- 1.8TB SAS disks
- 2.4TB SAS disks
- 2.4TB SAS self encrypting disks
- 2TB Nearline SAS disks

***2:** There are two types for the SSDs listed below: MLC SSDs and Value SSDs.

- 400GB SSD

● **3.5" Drives**

The 3.5" drive specifications are shown below.

Table 14 3.5" Drive Specifications (3.5" Type Controller Enclosure)

Product name	Drive interface (maximum transfer rate)	Storage media	Storage capacity	Rotational speed
Nearline SAS disks	Serial Attached SCSI (12Gbit/s)	Hard disk	2TB, 4TB, 6TB, 8TB, 10TB, 12TB, 14TB (*1)	7,200rpm
Nearline SAS self-encrypting disks (SEDs)	Serial Attached SCSI (12Gbit/s)		4TB, 8TB, 12TB (*1)	
SSDs	Serial Attached SCSI (12Gbit/s)	Flash memory	400GB, 960GB, 1.92TB, 3.84TB (*2)	—
Self encrypting SSDs (SEDs)	Serial Attached SCSI (12Gbit/s)		400GB, 1.92TB, 3.84TB	

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

- 6TB Nearline SAS disks
- 8TB Nearline SAS disks
- 10TB Nearline SAS disks
- 12TB Nearline SAS disks
- 14TB Nearline SAS disks
- 8TB Nearline SAS self-encrypting disks
- 12TB Nearline SAS self-encrypting disks

***2:** There are two types for the SSDs listed below: MLC SSDs and Value SSDs.

- 400GB SSD

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.

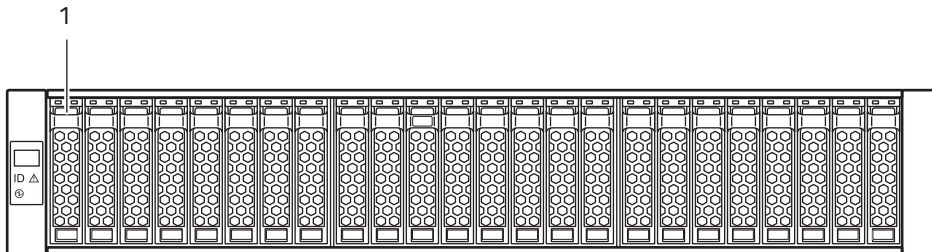
Three types of drive enclosures are available; a 2.5" type, a 3.5" type, and a high-density type.

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 49 Front View of a 2.5" Type Drive Enclosure

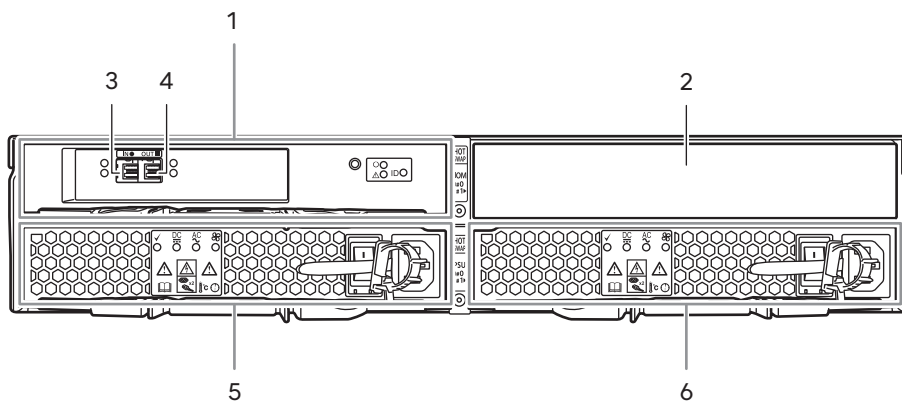


1. 2.5" disk or 2.5" SSD

Rear View

- When a single I/O module is installed

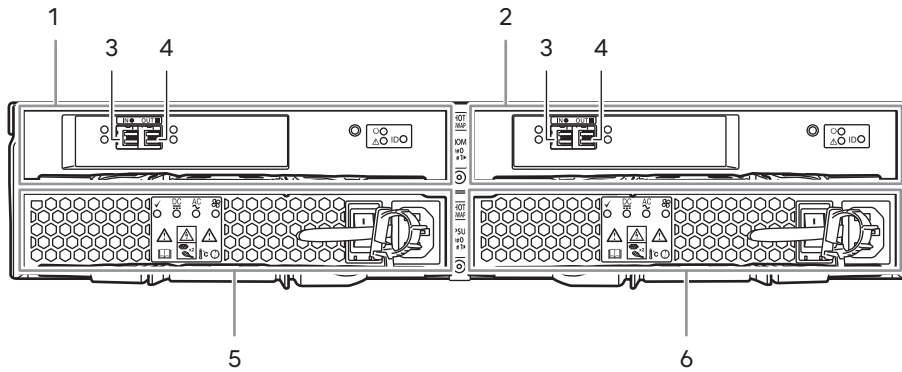
Figure 50 Rear View of a Drive Enclosure with a Single I/O Module



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 51 Rear View of a Drive Enclosure with Two I/O Modules

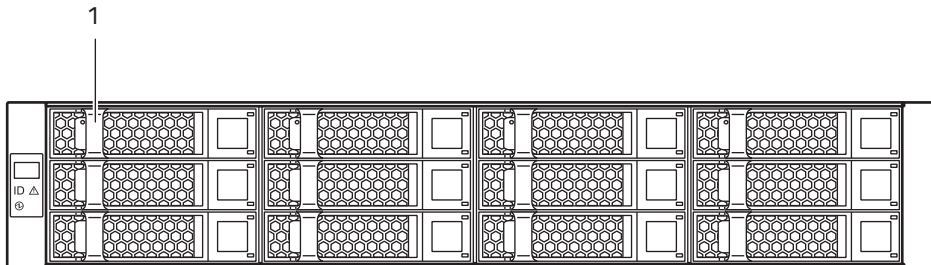


1. I/O module (IOM#0)
2. I/O module (IOM#1)
3. Drive interface (IN) port
4. Drive interface (OUT) port
5. Power supply unit (PSU#0)
6. Power supply unit (PSU#1)

External Views of a 3.5" Type Drive Enclosure

- Front View

Figure 52 Front View of a 3.5" Type Drive Enclosure

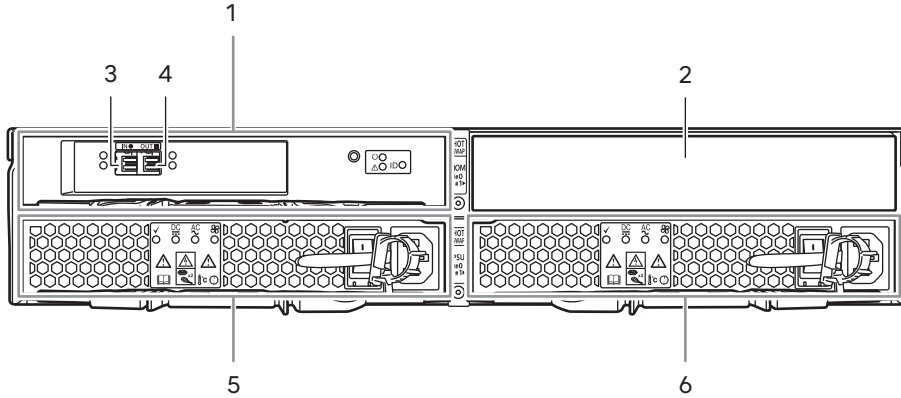


1. 3.5" disk or 3.5" SSD

● Rear View

- Single-IOM type

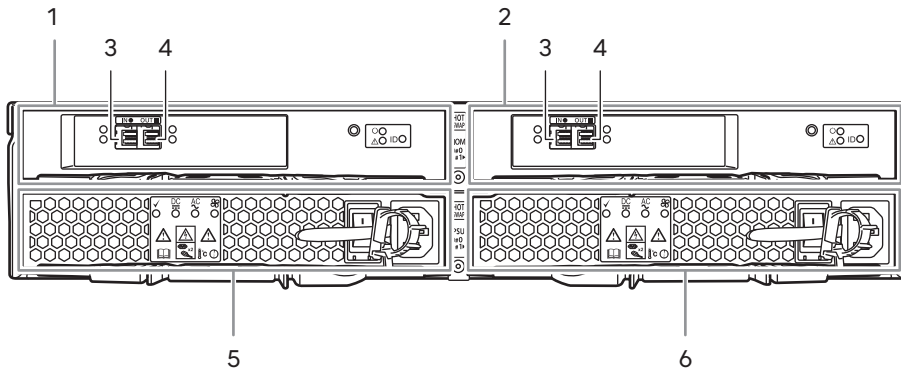
Figure 53 Rear View of a Drive Enclosure (Single-IOM Type)



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

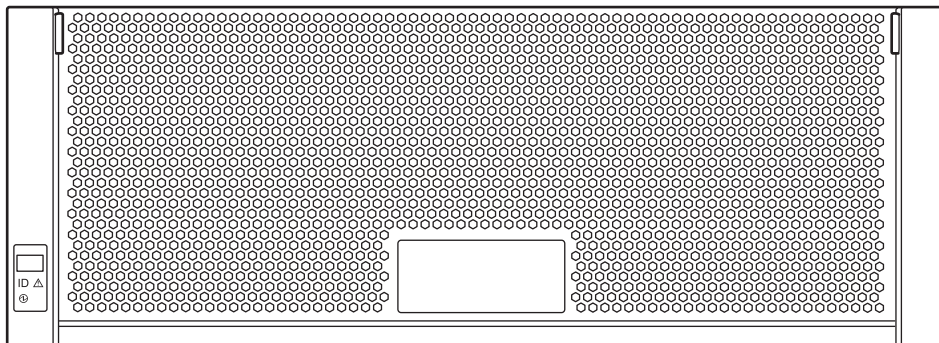


1. I/O module (IOM#0)
2. I/O module (IOM#1)
3. Drive interface (IN) port
4. Drive interface (OUT) port
5. Power supply unit (PSU#0)
6. Power supply unit (PSU#1)

■ External Views of a High-Density Drive Enclosure

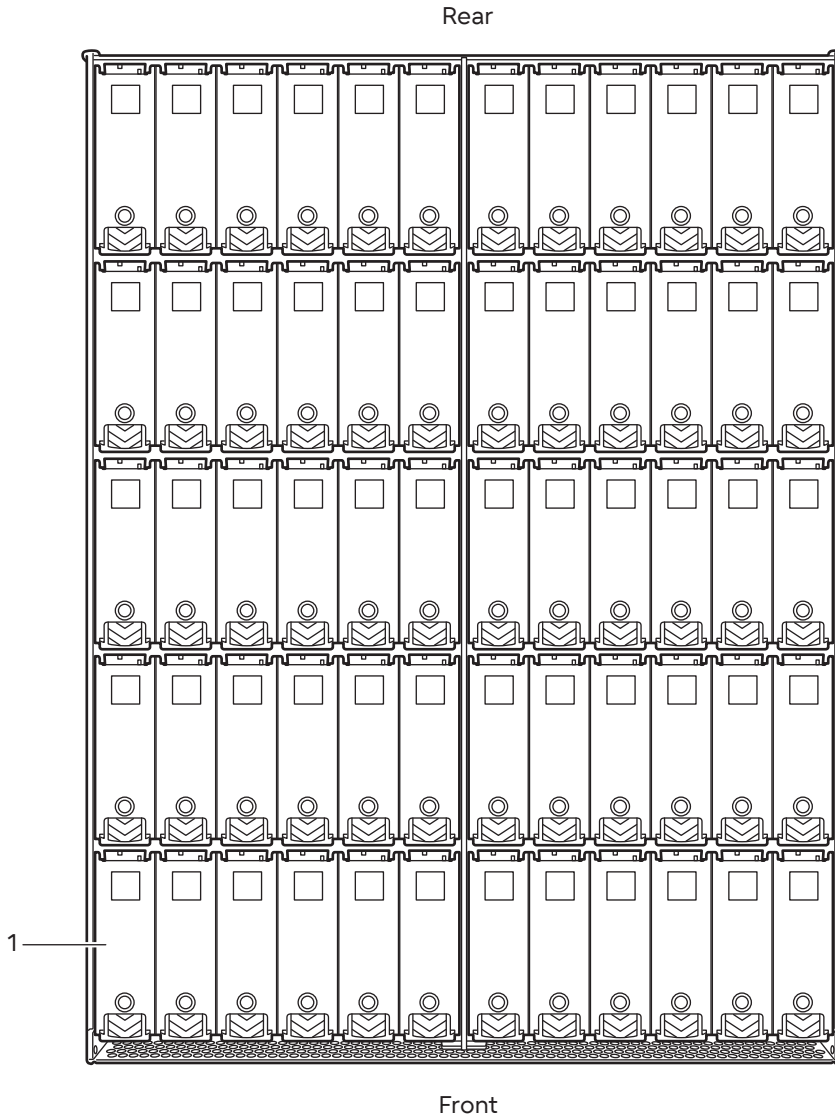
● Front View

Figure 55 Front View of a High-Density Drive Enclosure



● Top View

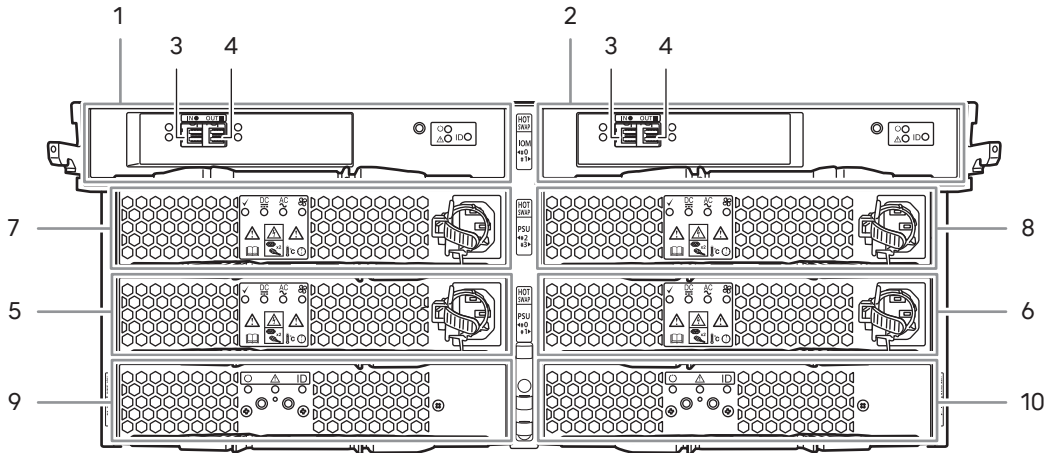
Figure 56 Top View of a High-Density Drive Enclosure with the Cover Opened



1. 3.5" type high-density drive enclosure

● Rear View

Figure 57 Rear View of a High-Density 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)
7. Power supply unit (PSU#2)
8. Power supply unit (PSU#3)
9. Fan expander module (FEM#0)
10. Fan expander module (FEM#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 15 Drive Interface Port Specification (I/O Module)

Interface	Transfer rate (max.)	Connector type	Number of ports for each I/O module
SAS	12Gbit/s	miniSAS HD (SFF-8644)	1 (IN) 1 (OUT)

Fan Expander Module (FEM)

An FEM is a cooling fan module. Two FEMs are installed in a high-density drive enclosure.

If one of the FEMs fails, the failed FEM can be replaced while the system is running.

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 2.5" type drive enclosure and a 3.5" type drive enclosure have two power supply units, which makes it possible for a failed unit to be replaced while the system is running.

A high-density drive enclosure has four power supply units and up to two failed units can be replaced while the system is running.

Drives

Three types of drives are available; 2.5" drives, 3.5" drives, and 3.5" drives for high-density drive enclosures.

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.

Up to sixty 3.5" drives for high-density drive enclosures can be installed in a single high-density 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 16 2.5" Drive Specifications (2.5" Type Drive Enclosure)

Product name	Drive interface (maximum transfer rate)	Storage media	Storage capacity	Rotational speed
SAS disks	Serial Attached SCSI (12Gbit/s)	Hard disk	300GB, 600GB, 900GB, 1.2TB, 1.8TB, 2.4TB (*1)	10,000rpm
			300GB, 600GB, 900GB	15,000rpm
SAS self encrypting disks (SEDs)	Serial Attached SCSI (12Gbit/s)		1.2TB, 2.4TB (*1)	10,000rpm
Nearline SAS disks	Serial Attached SCSI (12Gbit/s)		1TB, 2TB (*1)	7,200rpm
SSDs	Serial Attached SCSI (12Gbit/s)	Flash memory	400GB, 960GB, 1.92TB, 3.84TB, 7.68TB, 15.36TB, 30.72TB (*2)	—
Self encrypting SSDs (SEDs)	Serial Attached SCSI (12Gbit/s)		400GB, 1.92TB, 3.84TB, 7.68TB	

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

- 1.8TB SAS disks
- 2.4TB SAS disks
- 2.4TB SAS self encrypting disks
- 2TB Nearline SAS disks

***2:** There are two types for the SSDs listed below: MLC SSDs and Value SSDs.

- 400GB SSD

● 3.5" Drives

The 3.5" drive specifications are shown below.

Table 17 3.5" Drive Specifications (3.5" Type Drive Enclosure)

Product name	Drive interface (maximum transfer rate)	Storage media	Storage capacity	Rotational speed
Nearline SAS disks	Serial Attached SCSI (12Gbit/s)	Hard disk	2TB, 4TB, 6TB, 8TB, 10TB, 12TB, 14TB (*1)	7,200rpm
Nearline SAS self-encrypting disks (SEDs)	Serial Attached SCSI (12Gbit/s)		4TB, 8TB, 12TB (*1)	

Product name	Drive interface (maximum transfer rate)	Storage media	Storage capacity	Rotational speed
SSDs	Serial Attached SCSI (12Gbit/s)	Flash memory	400GB, 960GB, 1.92TB, 3.84TB (*2)	—
Self encrypting SSDs (SEDs)	Serial Attached SCSI (12Gbit/s)		400GB, 1.92TB, 3.84TB	

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

- 6TB Nearline SAS disks
- 8TB Nearline SAS disks
- 10TB Nearline SAS disks
- 12TB Nearline SAS disks
- 14TB Nearline SAS disks
- 8TB Nearline SAS self-encrypting disks
- 12TB Nearline SAS self-encrypting disks

***2:** There are two types for the SSDs listed below: MLC SSDs and Value SSDs.

- 400GB SSD

● 3.5" Drives for High-Density Drive Enclosures

The 3.5" drive specifications for high-density drive enclosures are shown below.

Table 18 3.5" Drive Specifications for High-Density Drive Enclosures

Product name	Drive interface (maximum transfer rate)	Storage media	Storage capacity	Rotational speed
SAS disks	Serial Attached SCSI (12Gbit/s)	Hard disk	1.2TB	10,000rpm
Nearline SAS disks	Serial Attached SCSI (12Gbit/s)		2TB, 4TB, 6TB, 8TB, 10TB, 12TB, 14TB (*1)	7,200rpm
Nearline SAS self-encrypting disks (SEDs)	Serial Attached SCSI (12Gbit/s)		4TB, 8TB, 12TB (*1)	
SSDs	Serial Attached SCSI (12Gbit/s)	Flash memory	1.92TB, 3.84TB	—

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

- 6TB Nearline SAS disks
- 8TB Nearline SAS disks
- 10TB Nearline SAS disks
- 12TB Nearline SAS disks
- 14TB Nearline SAS disks
- 8TB Nearline SAS self-encrypting disks
- 12TB Nearline SAS self-encrypting disks

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

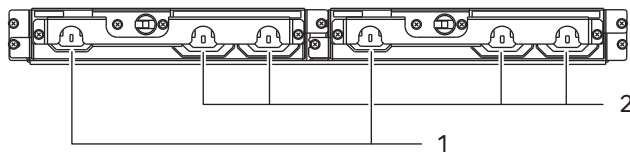
There are two sizes for power distribution units: 1U and 2U. In addition, multiple types of exteriors are available.

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 58 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.

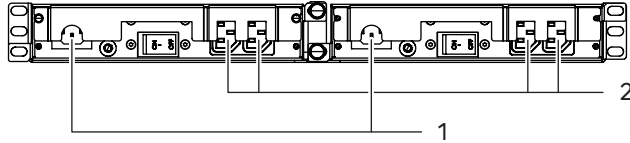
Table 19 Power Distribution Unit (AC200-240V, 1U, 4 Outlets) and Provided AC Cable Specifications

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 (AC8A/200-240V, 1U, 4 Outlets)

There are four outlets and two inlets.

Figure 59 Power Distribution Unit (AC8A/200-240V, 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.

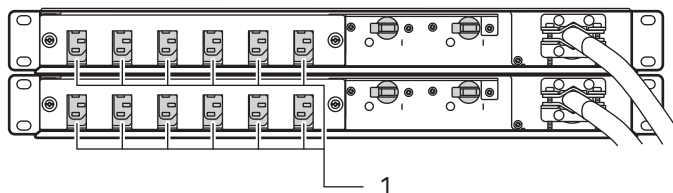
Table 20 Power Distribution Unit (AC8A/200-240V, 1U, 4 Outlets) and Provided AC Cable Specifications

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 60 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 21 Power Distribution Unit (AC200-240V, 2U, 12 Outlets) and Provided AC Cable Specifications

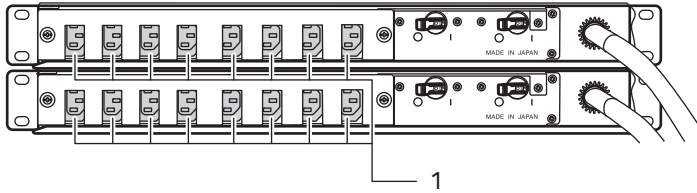
Item		Specifications
Power	Voltage	AC 200 – 240V
	Phase	Single
	Frequency	50Hz/60Hz

Item		Specifications
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 61 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.

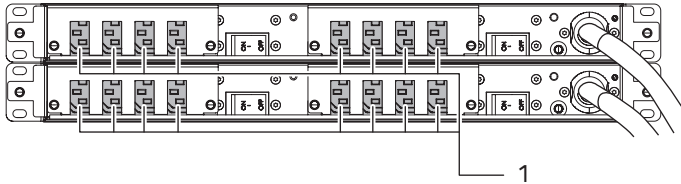
Table 22 Power Distribution Unit (AC200-240V, 2U, 16 Outlets) and Provided AC Cable Specifications

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

■ Power Distribution Unit (AC16A/200-240V, 2U, 16 Outlets)

There are 16 outlets.

Figure 62 Power Distribution Unit (AC16A/200-240V, 2U, 16 Outlets)



1. Outlet (OUTPUT)

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

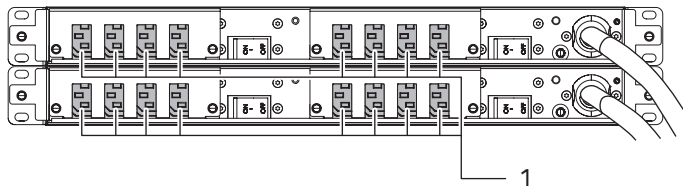
Table 23 Power Distribution Unit (AC16A/200-240V, 2U, 16 Outlets) and Provided AC Cable Specifications

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

■ Power Distribution Unit (AC24A/200-240V, 2U, 16 Outlets)

There are 16 outlets.

Figure 63 Power Distribution Unit (AC24A/200-240V, 2U, 16 Outlets)



1. Outlet (OUTPUT)

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

Table 24 Power Distribution Unit (AC24A/200-240V, 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

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)".

7. Release Information

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

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 25 Release Information List

Firmware version	Release date	Detail of functional modification
V10L70 V10L71	April 2017	New version
V10L80 V10L81	December 2017	<ul style="list-style-type: none">• Features added [SAN environment]<ul style="list-style-type: none">- Non-disruptive Storage Migration- Host interfaces (FC 32Gbit/s)
V10L82 V10L83	July 2018	<ul style="list-style-type: none">• Features added<ul style="list-style-type: none">- Added RAID configuration patterns for configuring TPPs and FTSPs (RAID5(6D+1P) and RAID6(7D+2P))- Expanded the maximum Extreme Cache Pool capacity- Expanded the number of characters that can be specified for the volume name (previously 16 characters, now 32 characters)
V10L84 V10L85	November 2018	<ul style="list-style-type: none">• Features added [SAN environment]<ul style="list-style-type: none">- Smart Setup Wizard
V10L86 V10L87	April 2019	<ul style="list-style-type: none">• Features added<ul style="list-style-type: none">- Support for disabling the user information initialization function using the buttons on the operation panel[SAN environment]<ul style="list-style-type: none">- Veeam Storage Integration
V10L88-0000 V10L89-0000	February 2020	<ul style="list-style-type: none">• Features added<ul style="list-style-type: none">- Drive data deletion (sanitization) function- Modification of Veeam Storage Integration- New supported browsers for ETERNUS Web GUI- ETERNUS Web GUI security enhancements- Event log export function
V10L88-6000 V10L89-6000	December 2020	<ul style="list-style-type: none">• Features added<ul style="list-style-type: none">- New supported browsers for ETERNUS Web GUI
V10L90-1000 V10L91-1000	October 2021	<ul style="list-style-type: none">• Features added<ul style="list-style-type: none">- Improved notification for signs of RAID failures
V10L90-2000 V10L91-2000	November 2021	<ul style="list-style-type: none">• Features added<ul style="list-style-type: none">- Storage Cluster support for Veeam Storage Integration

Fujitsu Storage ETERNUS DX100 S4/DX200 S4 Hybrid Storage Systems Overview

P3AG-2092-15ENZO

Date of issuance: August 2023
Issuance responsibility: Fujitsu Limited

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