Fujitsu Storage
ETERNUS AF250 S2 All-Flash Arrays

Overview

Functions/features

FUJITSU

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Preface

Fujitsu would like to thank you for purchasing the Fujitsu Storage ETERNUS AF250 S2 (hereinafter referred to as ETERNUS AF).

The ETERNUS AF 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 AF.

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

Please carefully review the information outlined in this manual.

Twelfth 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 AF system or use the ETERNUS AF.

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:

▷ Caution	Indicates information that you need to observe when using the ETERNUS storage system. Make sure to read the information.
● N o t e	Indicates information and suggestions that supplement the descriptions included in this manual.

Fujitsu Storage ETERNUS AF250 S2 All-Flash Arrays Overview

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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.

⚠ WARNING — This symbol indicates the possibility of serious or fatal injury if the ETERNUS AF is not used properly.

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

▌ **IMPORTANT** This symbol indicates IMPORTANT information for the user to note when using the ETERNUS AF.

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

⚠ CAUTION   Do

Warning level indicator

Warning type indicator

• To avoid damaging the ETERNUS storage system, pay attention to the following points when cleaning the ETERNUS storage system:
  - Make sure to disconnect the power when cleaning.
  - Be careful that no liquid seeps into the ETERNUS storage system when using cleaners, etc.
  - Do not use alcohol or other solvents to clean the ETERNUS storage system.

Warning details

Warning layout ribbon

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1. Overview

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

Figure 1 External View (Controller Enclosure)
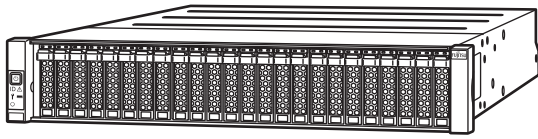
Figure 2 External View (Drive Enclosure)
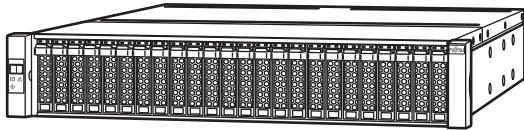
■ Scalability

Host interfaces and drives can be added according to the operations of the ETERNUS AF.

● Unit Size

The base unit (controller enclosure) size is 2U (*1). The size of the expansion unit (or drive enclosure) is 2U (24 drives for each enclosure). One expansion unit can be added.

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

● Drives

The ETERNUS AF supports Solid State Drives (SSDs) that provide super-fast access.
Up to 48 drives can be installed.
SSDs with different capacity sizes can exist in the same storage system.

● Host Interfaces

Host interfaces can be selected from FC 32Gbit/s, FC 16Gbit/s, and iSCSI 10Gbit/s. Up to eight ports can be installed in a single ETERNUS AF.
Different types of host interfaces can exist together in the same ETERNUS AF.

● System Memory Capacity

The installable system memory capacity is up to 64GB for the ETERNUS AF.

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■ **Flash Optimization**

● **Access Optimization to SSDs**

Alignment access of 4K is performed by matching the block size of the flash device. Enhancing the performance of SSD write processes reduces the frequency of performance degradations due to garbage collection. In addition, effective data writing reduces the amount of data to be written.

● **Automatic Selection of Optimization Process for Write I/Os (Flexible Write Through)**

For the target I/O that is to perform a sequential access, by applying a non-mirrored data cache, communication between CMs can be kept to a minimum. The CPU load is reduced and the sequential write performance is enhanced.

● **Performance Optimization When Garbage Collection Occurs**

By monitoring the access and the garbage collection process for each SSD, the write back process is controlled and the write response is balanced.

Reducing the load on the CPU and preventing impacts on the performance of front processes provide stable write performance.

■ **High Reliability**

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

● **Data Integrity**

The ETERNUS AF 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.

● **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 AF 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 AF 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 AF 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 AF 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 AF.

  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 stabilizing the process performance and using the Automated Storage Tiering function, the ETERNUS AF is able to utilize its resources more efficiently. Operation management for the ETERNUS AF can also be performed easily.

- **Easy Operation Management**

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

- **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.

- **Automated Storage Tiering**

  The ETERNUS AF supports Automated Storage Tiering. This function detects data access frequency and redistributes data between drives according to the policy that is set. This function interoperates with ETERNUS SF Storage Cruiser to allow the optimization of the performance and the storage efficiency. Server settings do not need to be changed after redistribution.

- **Power Control**

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

■ Business Continuity

The ETERNUS AF supports business continuity from the two perspectives of "data protection" and "disaster control".

● Data Protection

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

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

● Energy Efficiency

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

● RoHS Compliance

The ETERNUS AF complies with RoHS, as mandated by the European Parliament and Council. RoHS limits the use of specific chemicals in electrical and electronic equipment.

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2. Specifications

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

Specifications

This section describes ETERNUS AF specifications.

Table 1 ETERNUS AF Specifications

Item		ETERNUS AF250 S2
Physical capacity (max.) (*1)		1,475TB
Number of controllers		2
System memory capacity		64GB
Host interface		FC (32Gbit/s) FC (16Gbit/s) iSCSI (10Gbit/s, 10GBASE-SR/ 10GBASE-CR) iSCSI (10Gbit/s, 10GBASE-T)
Number of host interface adapters		2 / 4
Number of host interface ports		4 / 8
Number of drive enclosures (max.)		1
Number of drives		2 – 48
Drive capacity	Non-self-encrypting	400GB, 960GB, 1.92TB, 3.84TB, 7.68TB, 15.36TB, 30.72TB
	Self-encrypting	1.92TB, 3.84TB, 7.68TB
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.

Function Specifications

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

Table 2 Function Specifications

Item		ETERNUS AF250 S2
Supported RAID levels		0 (*1), 1, 1+0, 5, 5+0, 6, 6-FR (*2)
RAID groups	Number of RAID groups (max.) (*3)	24
	Number of volumes per RAID group (max.)	128
Thin Provisioning Pool (TPP)/ Flexible Tier Sub Pool (FTSP)	Number of pools (max.) (*4)	24
	Number of volumes per pool (max.) (*5)	3,071
Volumes	Number of volumes (max.)	3,072
	Volume capacity (max.)	128TB
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 AF.

Operating Environment

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

Supported OSs

Servers and OSs that are supported by the ETERNUS AF 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 3 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 4 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

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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

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ETERNUS Web GUI/ETERNUS CLI Operating Environment

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

ETERNUS Web GUI or ETERNUS CLI can be started by accessing the ETERNUS AF 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. Functions

This chapter explains the available functions for the ETERNUS AF.

Data Protection

The ETERNUS AF 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 3 Data Block Guard
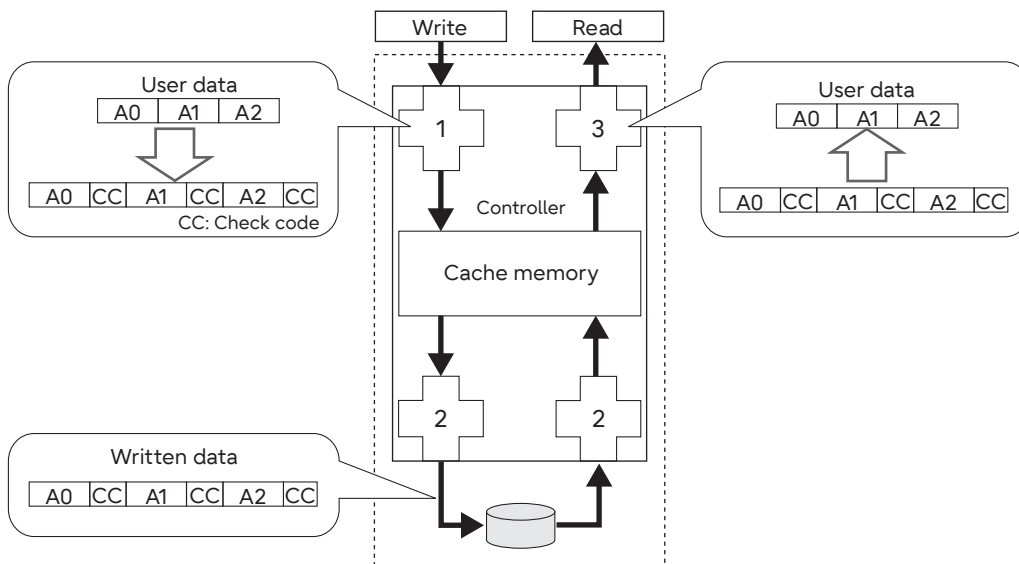
1. The check codes are added
2. The check codes are confirmed
3. The check codes are confirmed and removed

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 AF, 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 AF 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 AF. Drives are checked (read check) regularly as a background process.

Figure 4 Drive Check

The data is read and checked

D1

RAID group
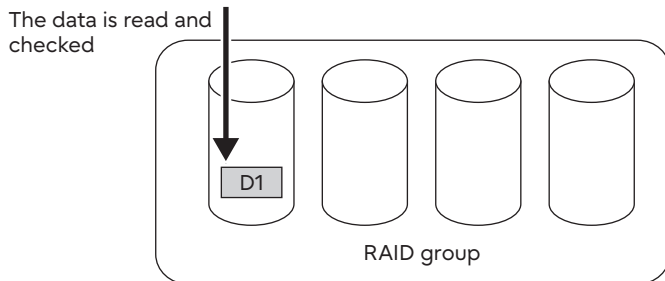
Redundant Copy

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 5 Redundant Copy Function

Sign of failure

RAID5 (Redundant)

Hot spare

Creates data from the drives other than the maintenance target drive, and writes data into the hot spare.

RAID5 (Redundant)

Disconnects the maintenance target drive and switches it to the hot spare.

Disconnected
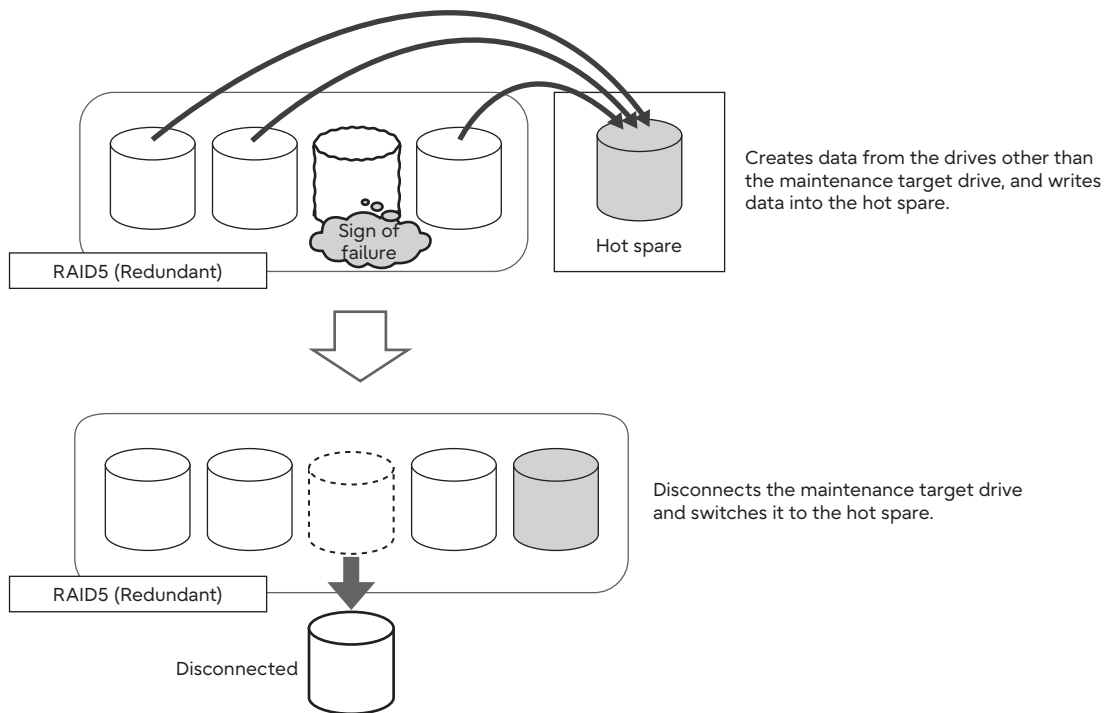
Rebuild/Copyback

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.

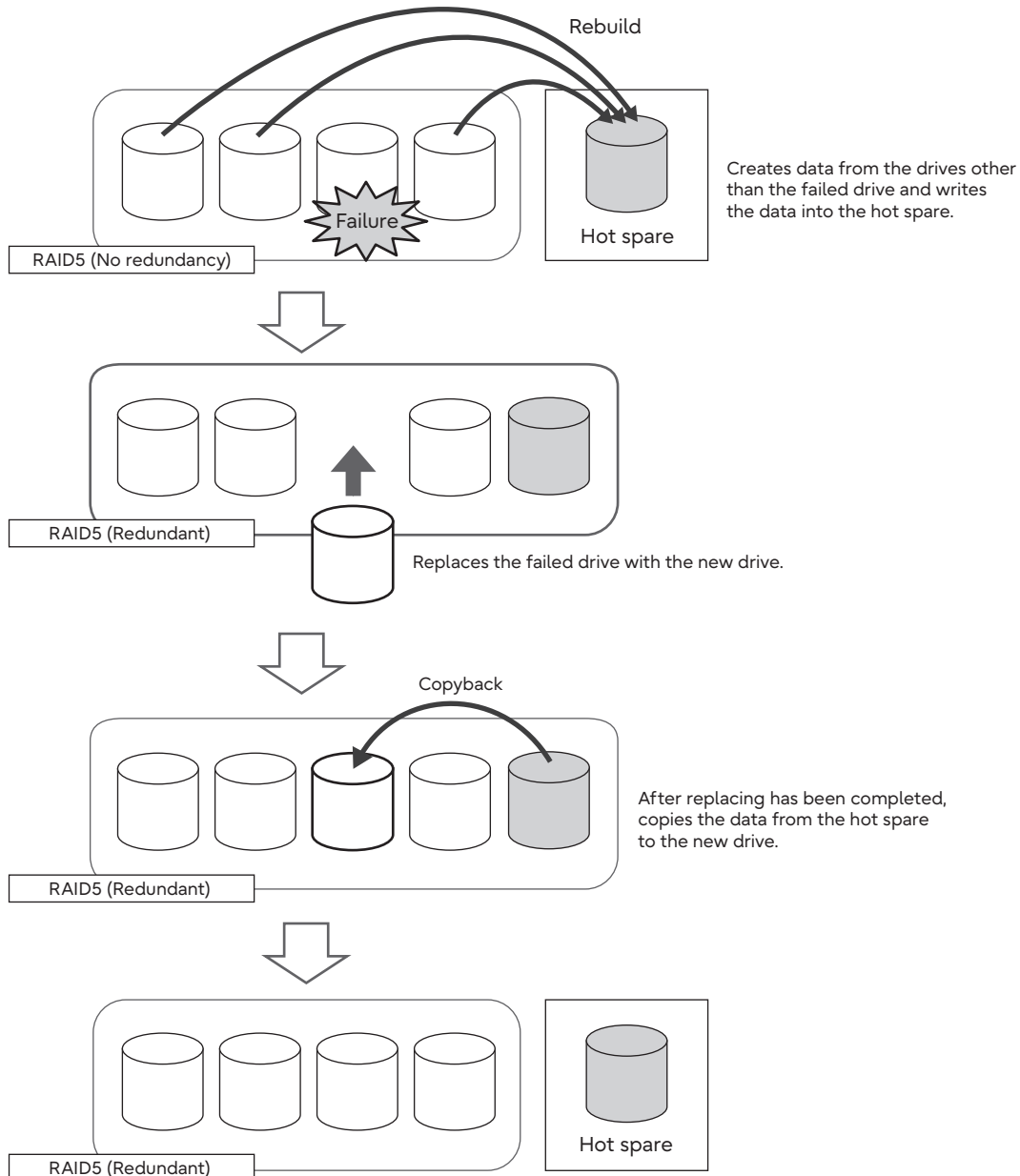Copyback can be performed automatically by changing the copyback setting. Copyback is not automatically performed by default when a failed drive is replaced and the replacement drive is used as a hot spare (Copybackless).

Figure 6 Rebuild/Copyback Function

Rebuild

RAID5 (No redundancy)   Failure   Hot spare

Creates data from the drives other than the failed drive and writes the data into the hot spare.

RAID5 (Redundant)

Replaces the failed drive with the new drive.

Copyback

RAID5 (Redundant)

After replacing has been completed, copies the data from the hot spare to the new drive.
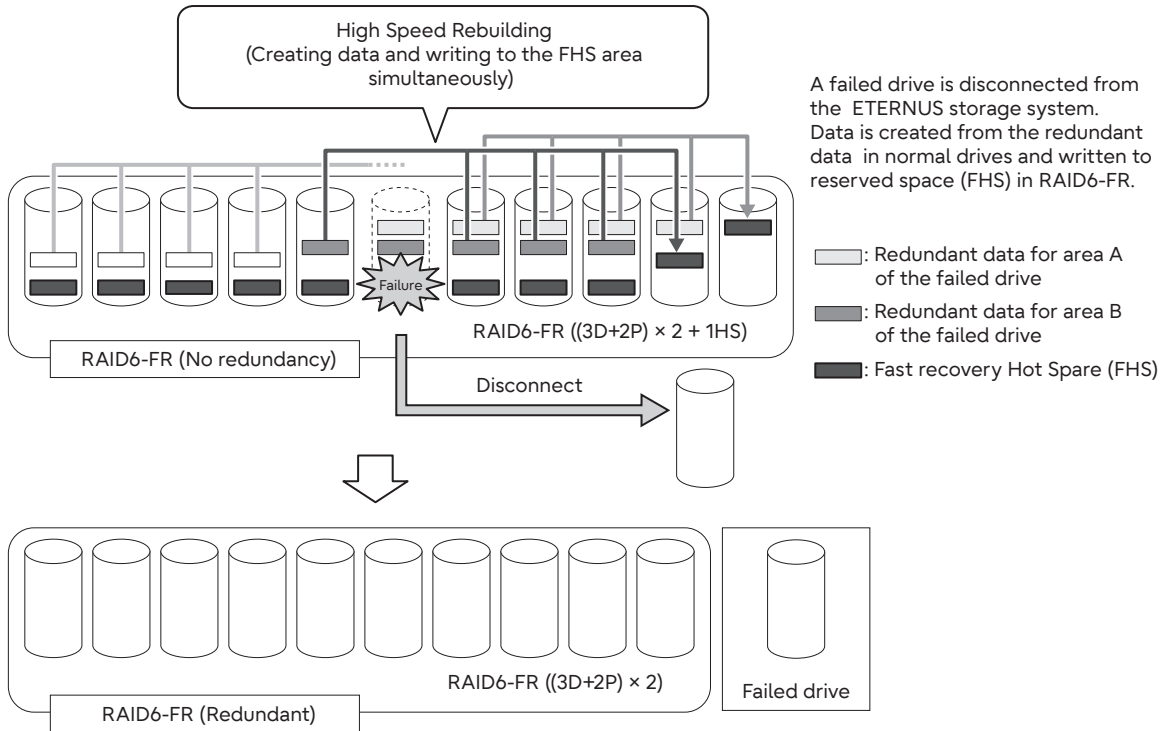
RAID5 (Redundant)   Hot spare

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 7 Fast Recovery

High Speed Rebuilding
(Creating data and writing to the FHS area simultaneously)

A failed drive is disconnected from the ETERNUS storage system. Data is created from the redundant data in normal drives and written to reserved space (FHS) in RAID6-FR.

RAID6-FR (No redundancy)

RAID6-FR ((3D+2P) × 2 + 1HS)

Disconnect

: Redundant data for area A of the failed drive

: Redundant data for area B of the failed drive

: Fast recovery Hot Spare (FHS)

RAID6-FR (Redundant)

RAID6-FR ((3D+2P) × 2)

Failed drive

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 (Deduplication/Compression and Storage Virtualization)

The Deduplication/Compression function, Thin Provisioning function, and Flexible Tier function can be used to optimize storage efficiency through pool management of data. These functions reduce the initial cost. The power consumption requirements can also be reduced because a fewer number of drives are 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.
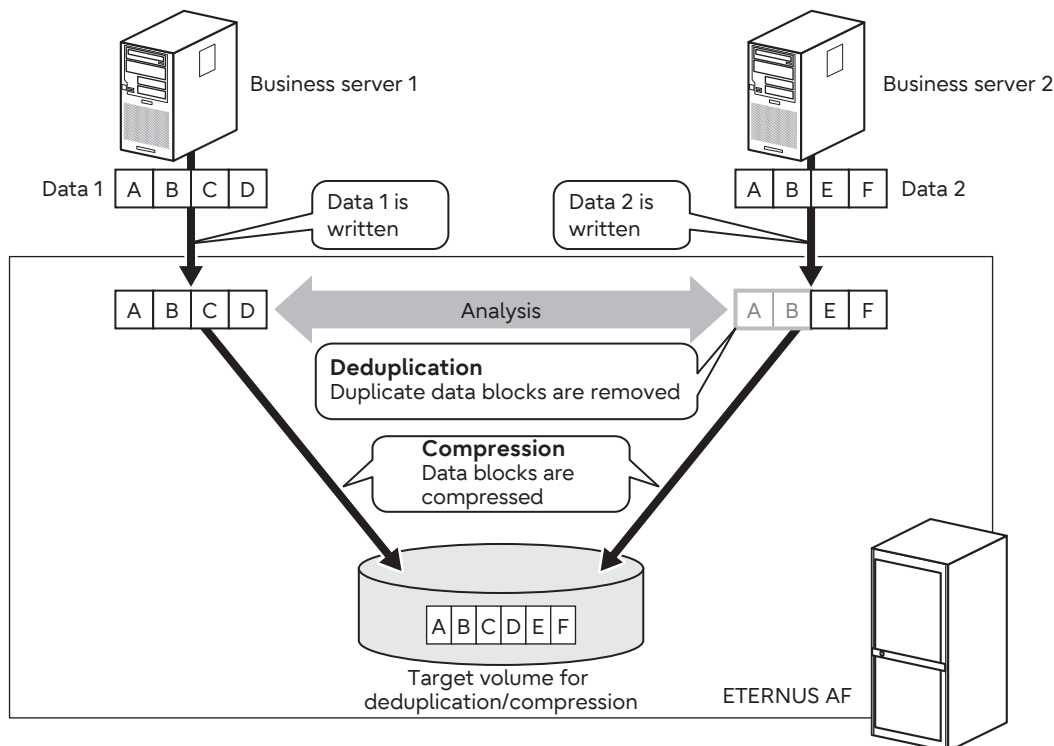
The Deduplication/Compression function can not only perform both deduplication and compression at the same time, but can also perform only deduplication or compression individually.

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

● **Deduplication/Compression Function**

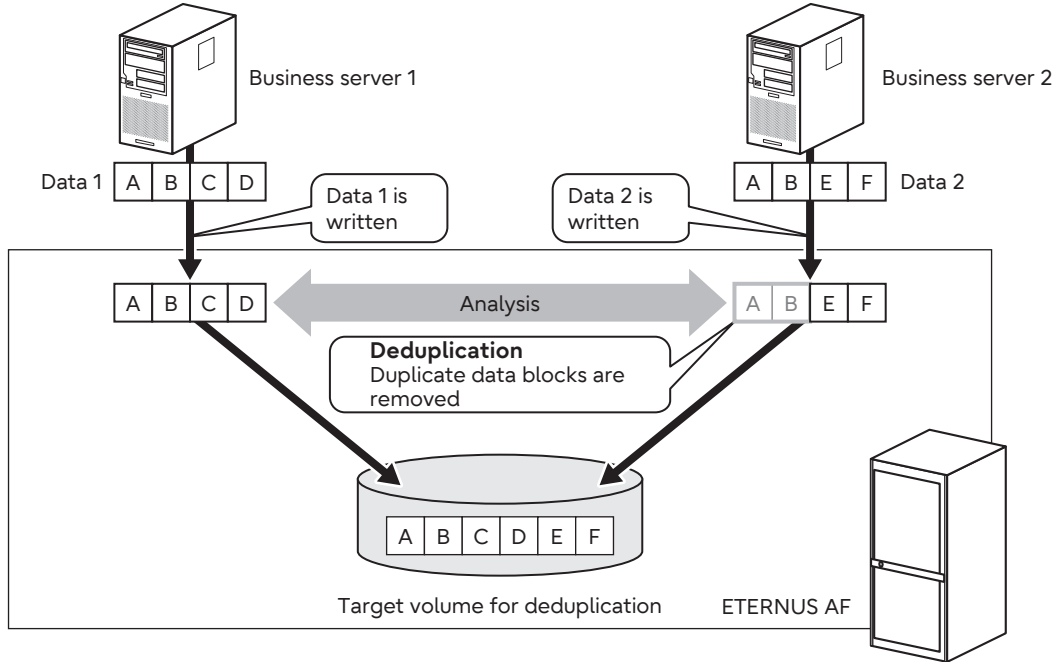This function removes duplicate data blocks, compresses the remaining data blocks, and then stores the data.

Figure 8 Deduplication/Compression Overview

● **Deduplication Function**

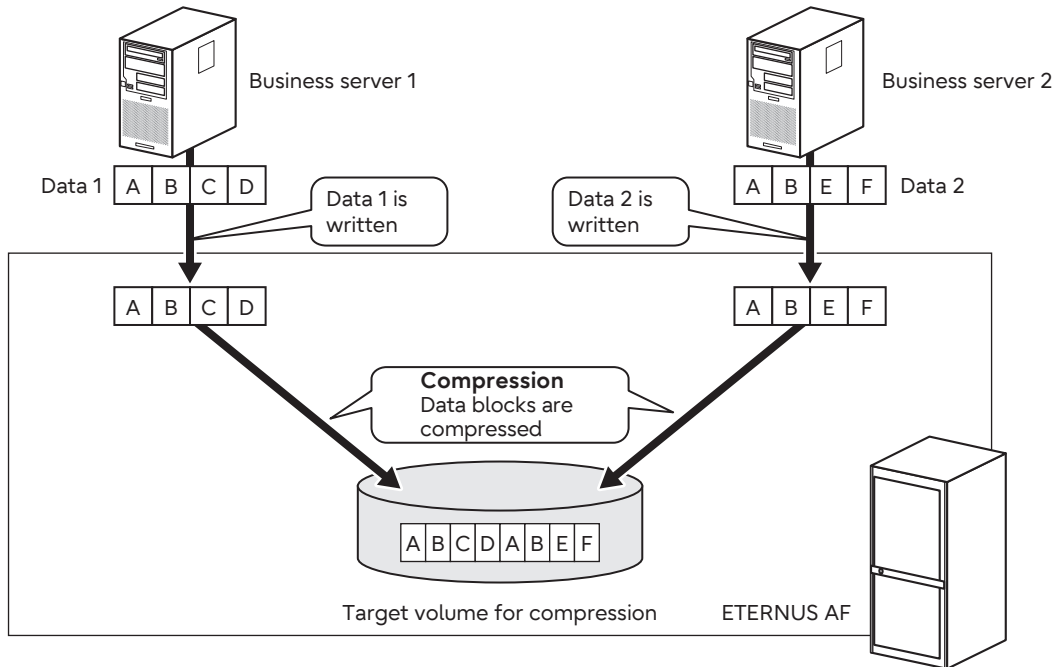This function removes duplicate data blocks and stores the data.

Figure 9 Deduplication Overview

● **Compression Function**

This function compresses each data block and stores the data.

Figure 10 Compression Overview

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
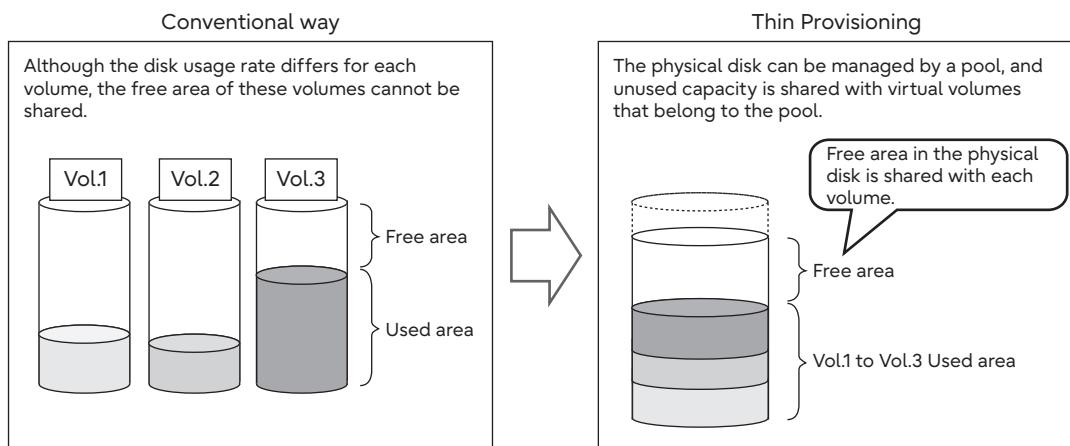
Flexible Tier

The Flexible Tier function automatically redistributes data in the ETERNUS AF in the hierarchical storage according to the access frequency by setting the access priority of each RAID level and SSD type (MLC SSD and Value SSD).

Data is redistributed based on the performance information that is monitored and obtained by ETERNUS SF Storage Cruiser. The Flexible Tier function allows proper use of high write endurance MLC SSDs and large capacity Value SSDs, and allows the optimization of the RAID levels according to the performance and storage efficiency.

Optimization of Volume Configurations

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

The ETERNUS AF 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

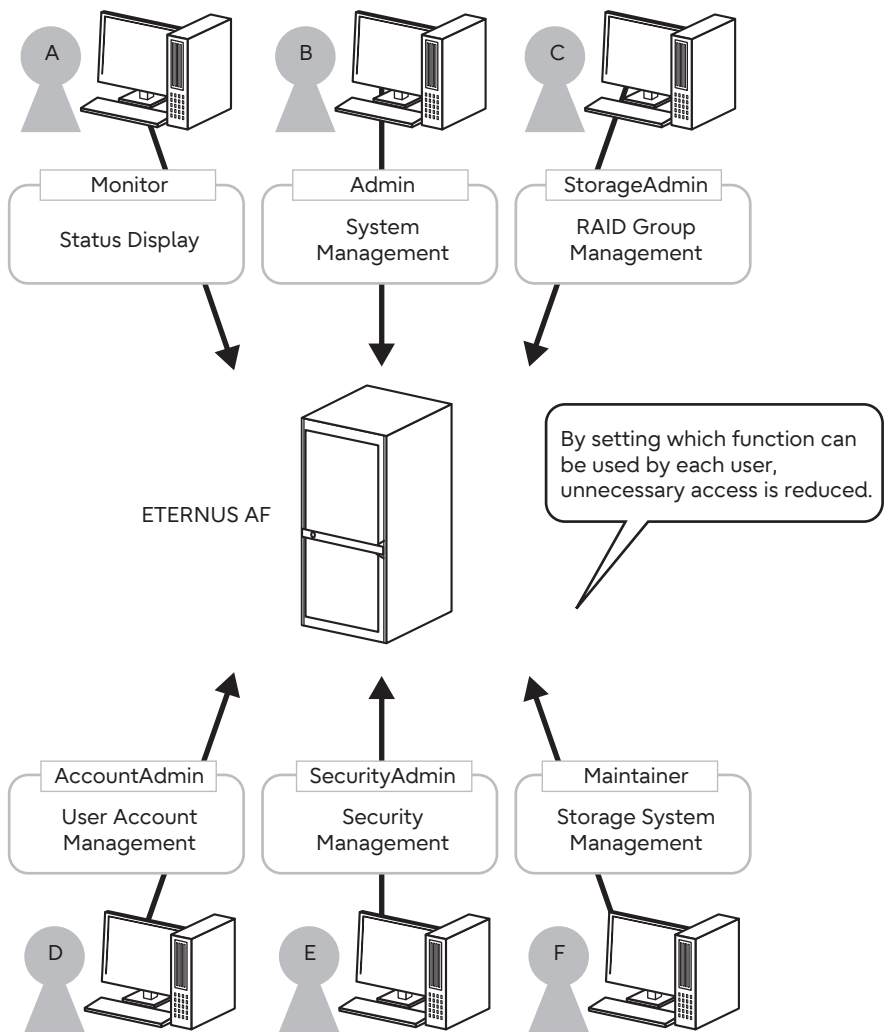The ETERNUS AF provides various enhanced security functions.

Account Management

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

The ETERNUS AF 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 12 Account Management

ETERNUS AF

By setting which function can be used by each user, unnecessary access is reduced.

A	Monitor	Status Display
B	Admin	System Management
C	StorageAdmin	RAID Group Management
D	AccountAdmin	User Account Management
E	SecurityAdmin	Security Management
F	Maintainer	Storage System 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 AF 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 AF. 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 AF 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 13 Data Encryption

Setting and management of encryption
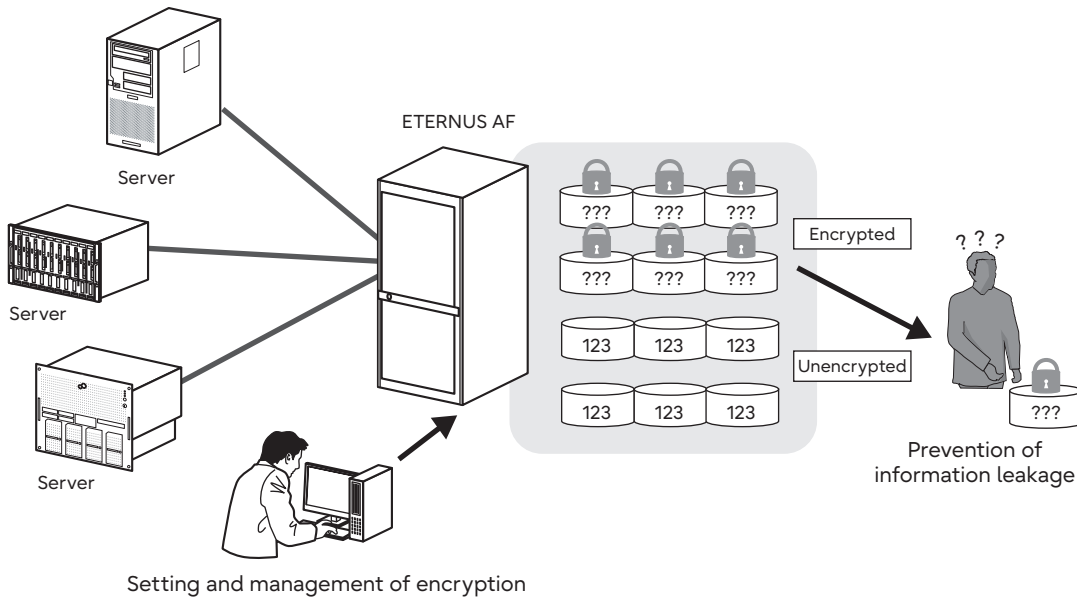
Table 5 Data Encryption Function Specifications

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 AF storage systems in the key server. Note that ETERNUS SF KM is required when linking with the key management server.

Figure 14 Key Server
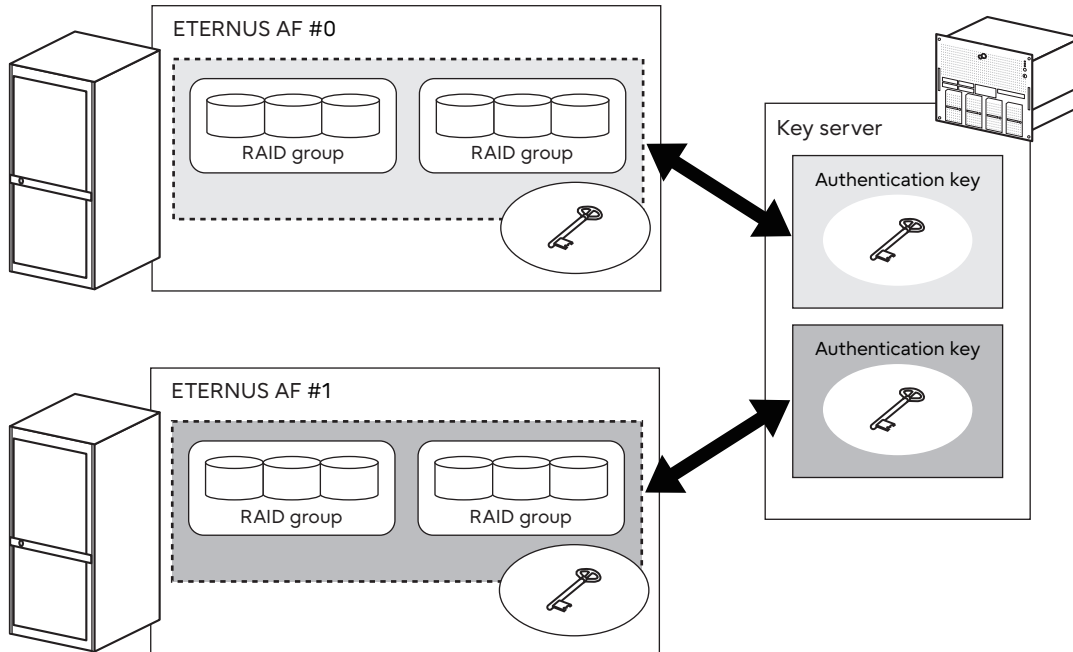
Audit Log

The ETERNUS AF 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 AF 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 AF 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 15 Audit Log
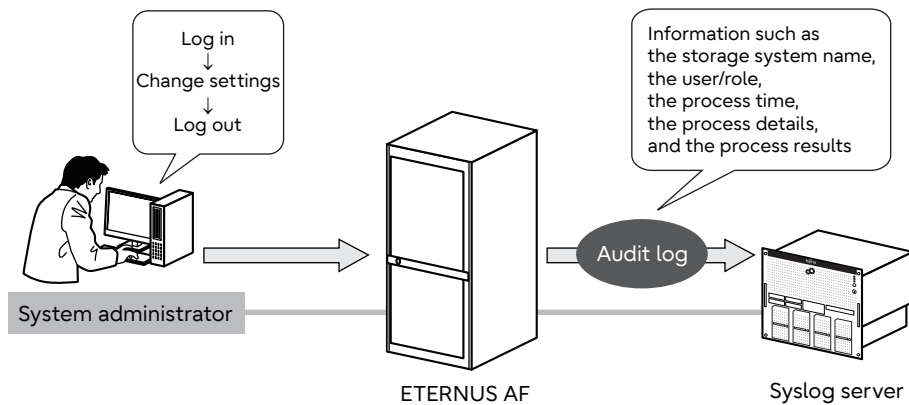
Drive Sanitization

Drive sanitization is a function that deletes data in a drive using the sanitization function of the drives (SSDs). 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.
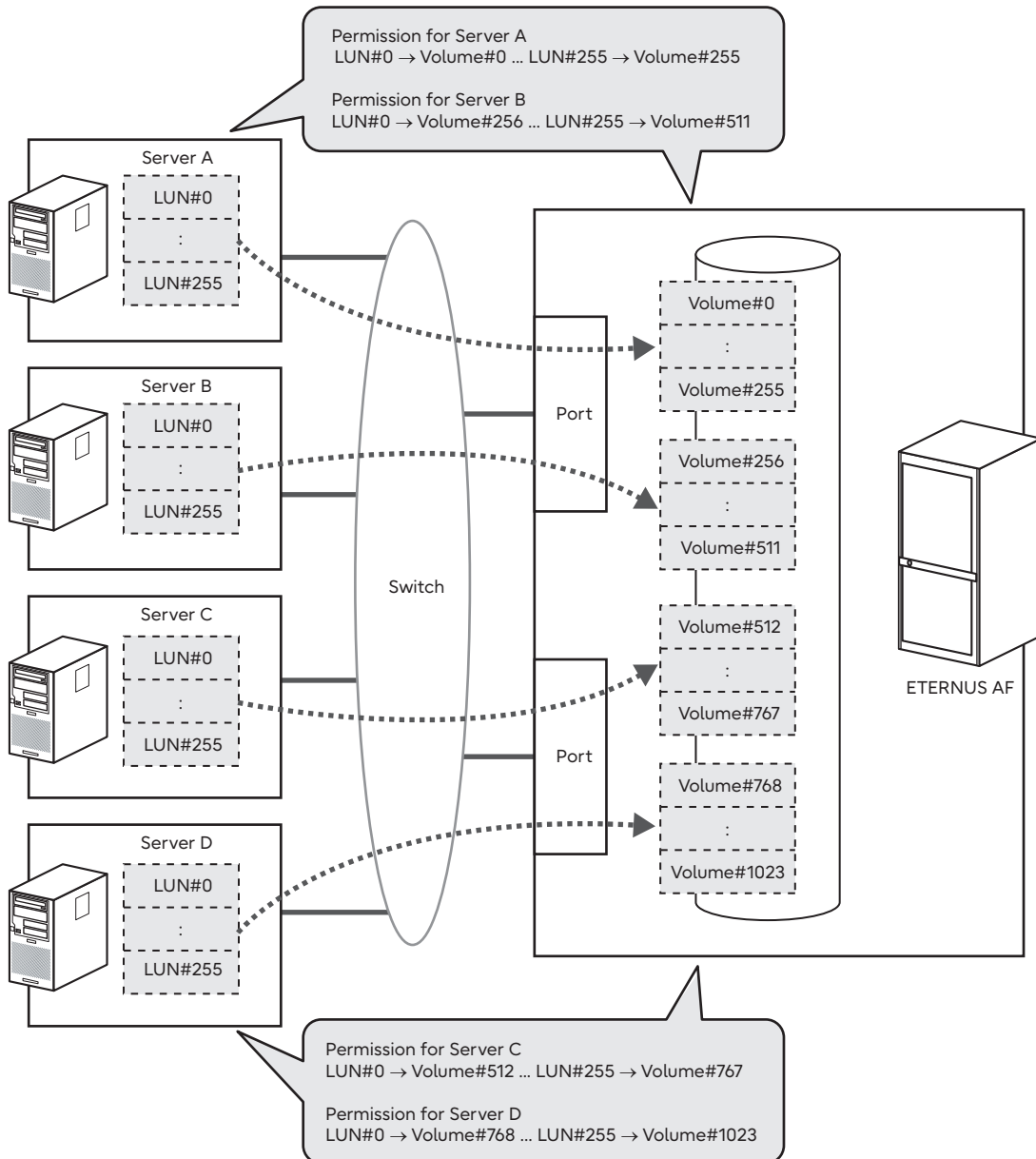
Host Affinity

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 16 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.

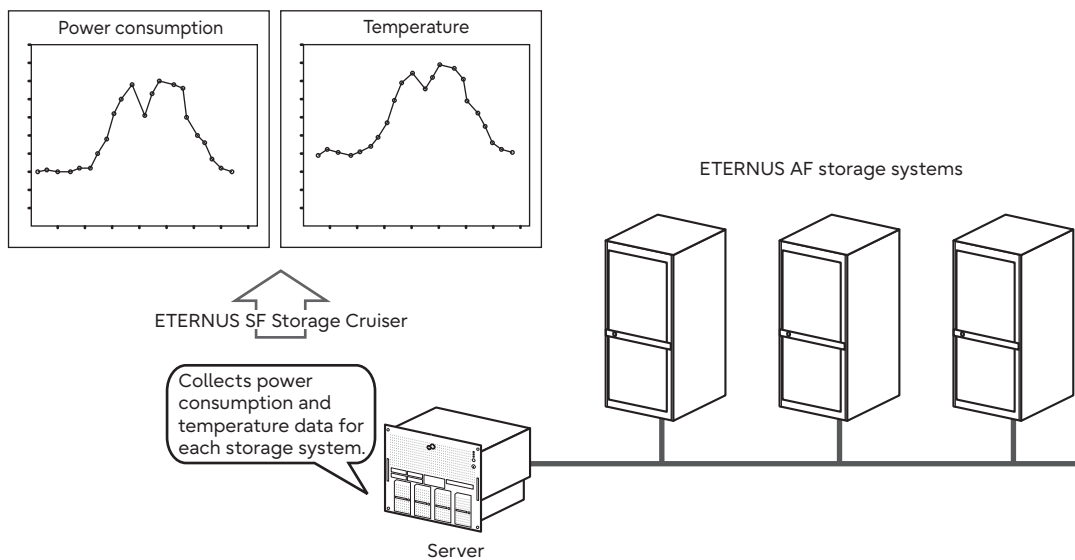Note that the Internet Storage Name Service (iSNS) is also supported as an iSCSI name resolution.

Environmental Burden Reduction

The ETERNUS AF has energy and power savings that reduce CO_2 emissions and lessen the burden on the environment.

Power Consumption Visualization

The power consumption and the temperature of the ETERNUS AF 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.

Figure 17 Power Consumption Visualization

Fujitsu Storage ETERNUS AF250 S2 All-Flash Arrays Overview
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Operation Management

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

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 AF according to the environment of the user.

ETERNUS Web GUI (Graphical User Interface) and ETERNUS CLI (Command Line Interface) are embedded in the ETERNUS AF controllers.

■ ETERNUS Web GUI

ETERNUS Web GUI is a program for settings and operation management that is embedded in the ETERNUS AF 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 AF 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 AF 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 AF, 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 AF, various events that are detected by the ETERNUS AF are sent to the Syslog server as event logs.

- Remote support

  The errors that occur in the ETERNUS AF 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 AF 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 18 Event Notification

39
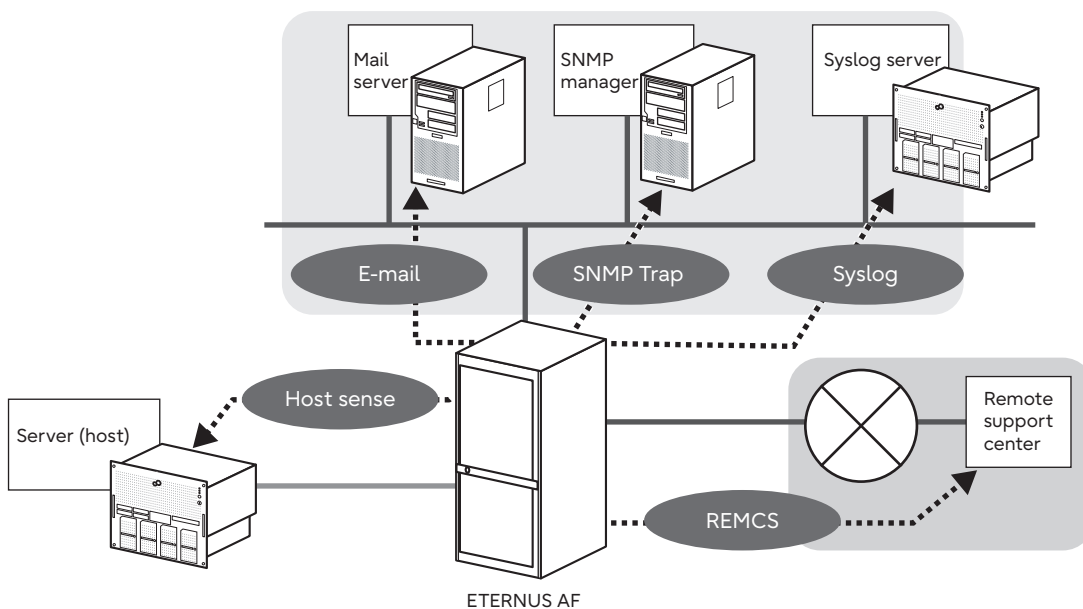
Performance Information Management

The ETERNUS AF 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 AF 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 AF 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 AF has a clock function and manages time information of date/time and the time zone (the region in which the ETERNUS AF is installed). This time information is used for internal logs and for functions such as 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 19 Device Time Synchronization
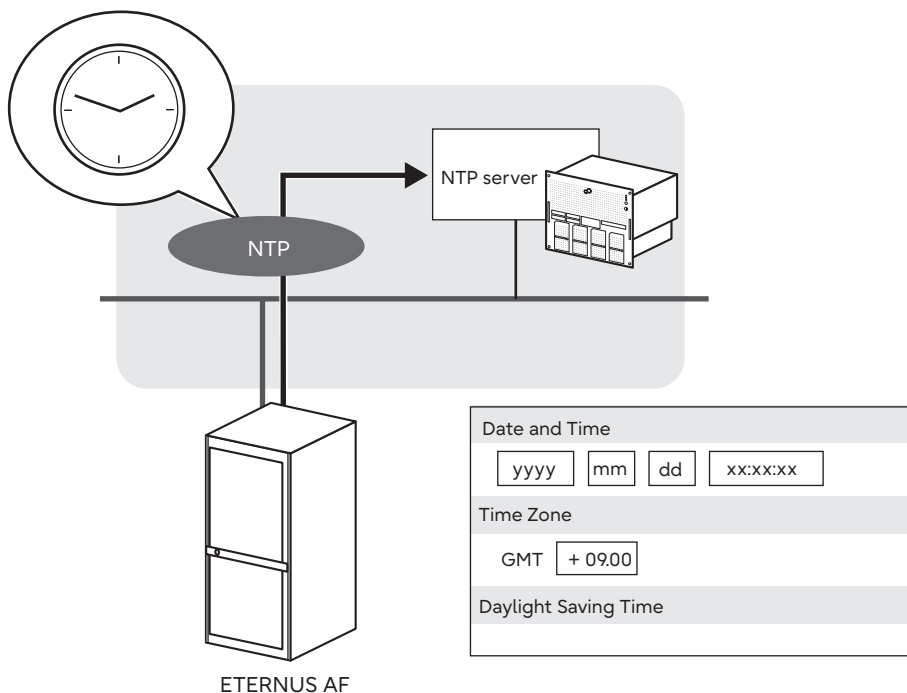
Power Control

Power control methods for the ETERNUS AF 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 AF.

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

Figure 20 Power Synchronized Unit Diagram

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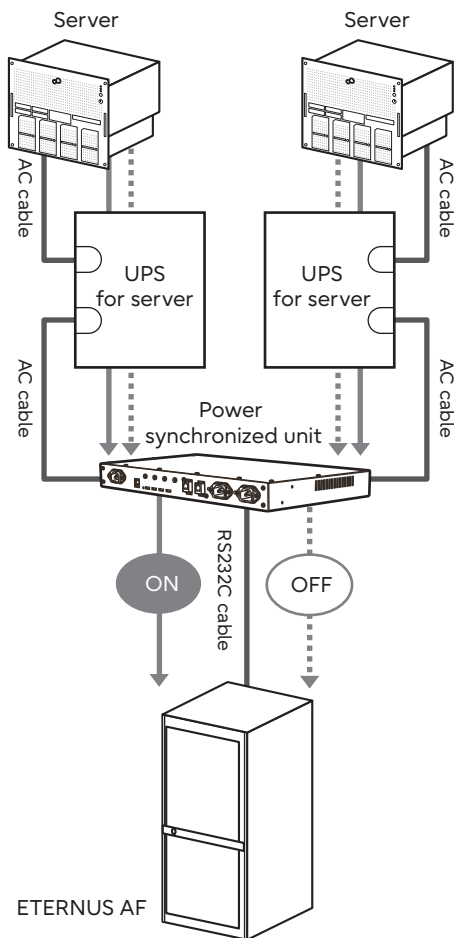
## ■ Remote Power Operation (Wake On LAN)

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

When "magic packet" data is sent from an administration terminal, the ETERNUS AF 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 AF can be checked on ETERNUS CLI.

Figure 21 Power Supply Control Using Wake On LAN
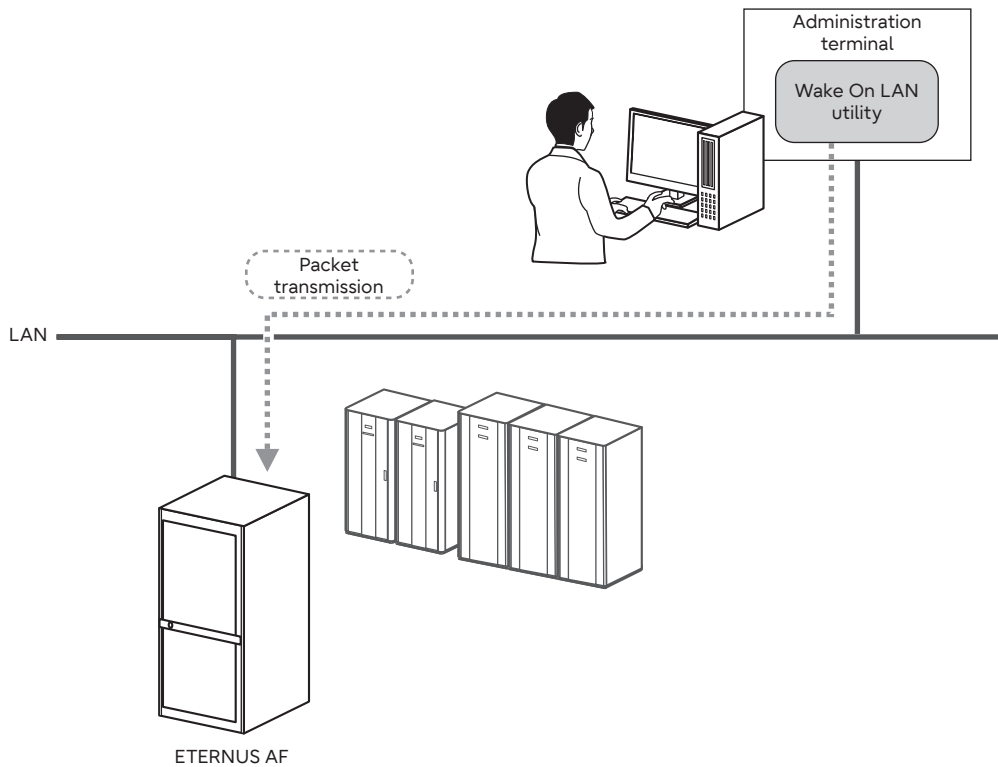
Backup (Advanced Copy)

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

For an ETERNUS AF 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 22 Example of Advanced Copy
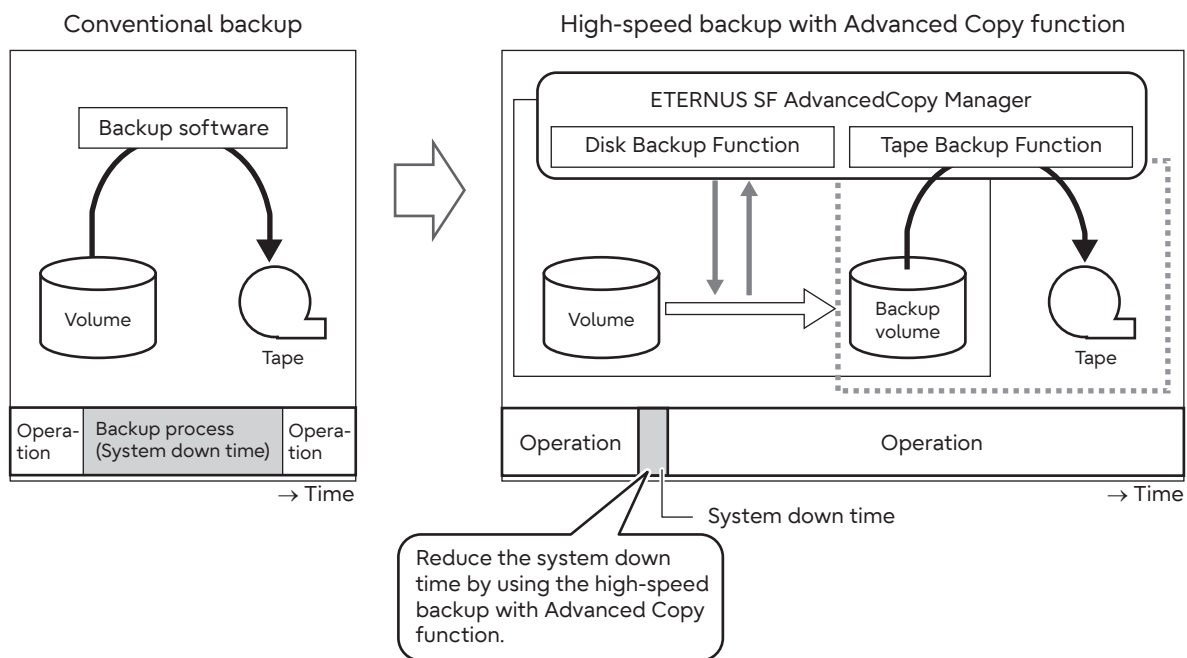
There are two types of Advanced Copy: a local copy that is performed within a single ETERNUS AF and a remote copy that is performed between multiple ETERNUS DX/AF storage systems.

The following copy methods are available.

Table 6 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)

Stable Operation

This section explains the function that sets the operation mode according to the connection environment of the ETERNUS AF 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.

If the ETERNUS SF Storage Cruiser QoS management option is used to configure automated QoS, I/O performance can be automatically optimized depending on the operation priority.

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 AF can be changed to the optimal one by specifying the appropriate operation mode for the connection environments.

Figure 23 Host Response (Connection Operation Mode)
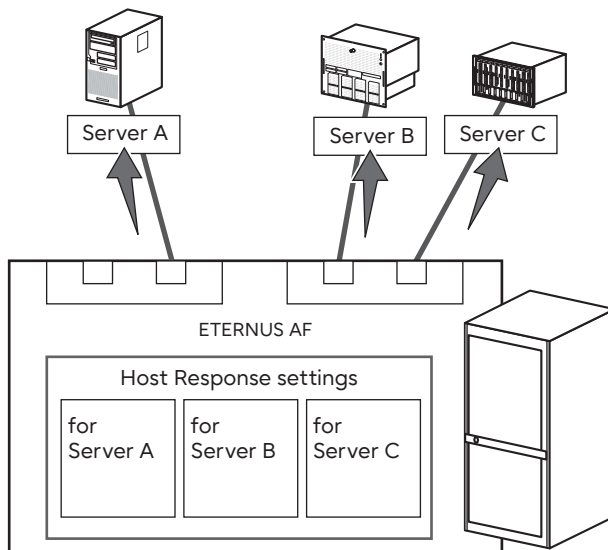
Storage Cluster

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 24 Storage Cluster
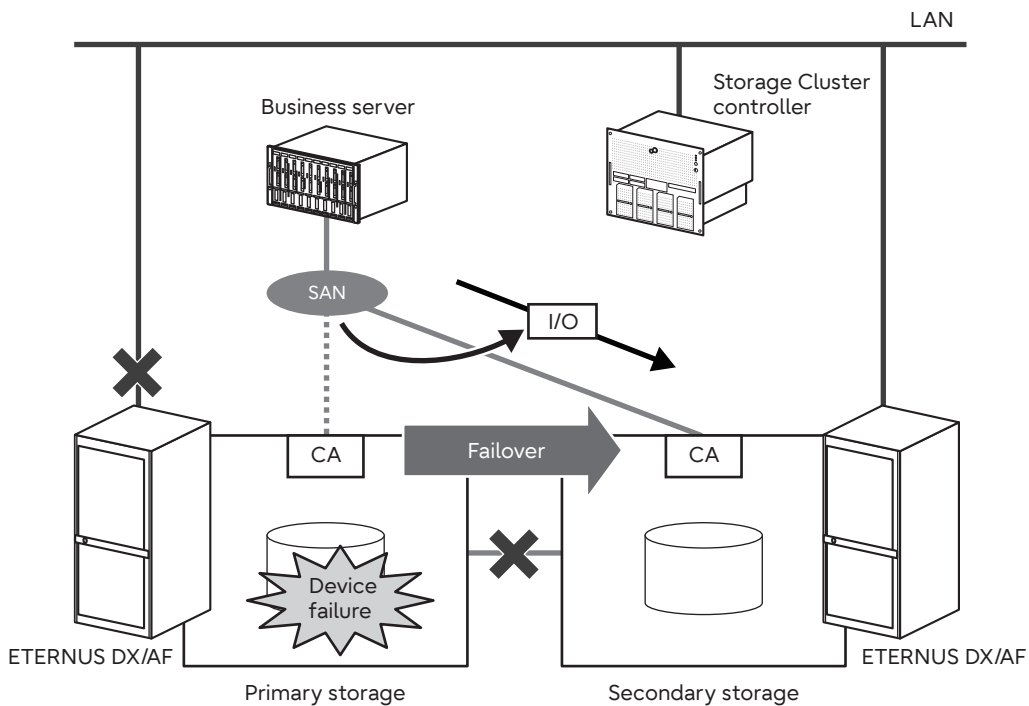
Data Migration

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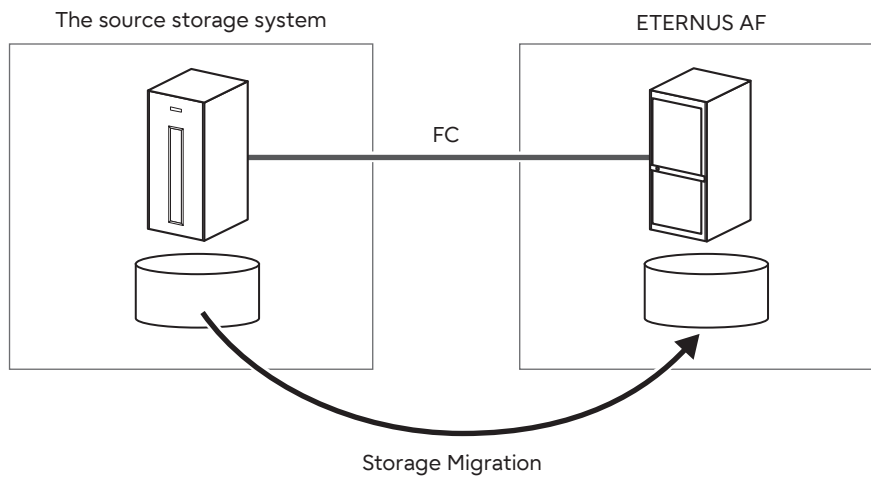
Storage Migration

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 AF 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 AF.

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

Online Storage Migration and offline Storage Migration are supported.

Figure 25 Storage Migration

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 26 Non-disruptive Storage Migration

Importing the migration target volume from the external storage system
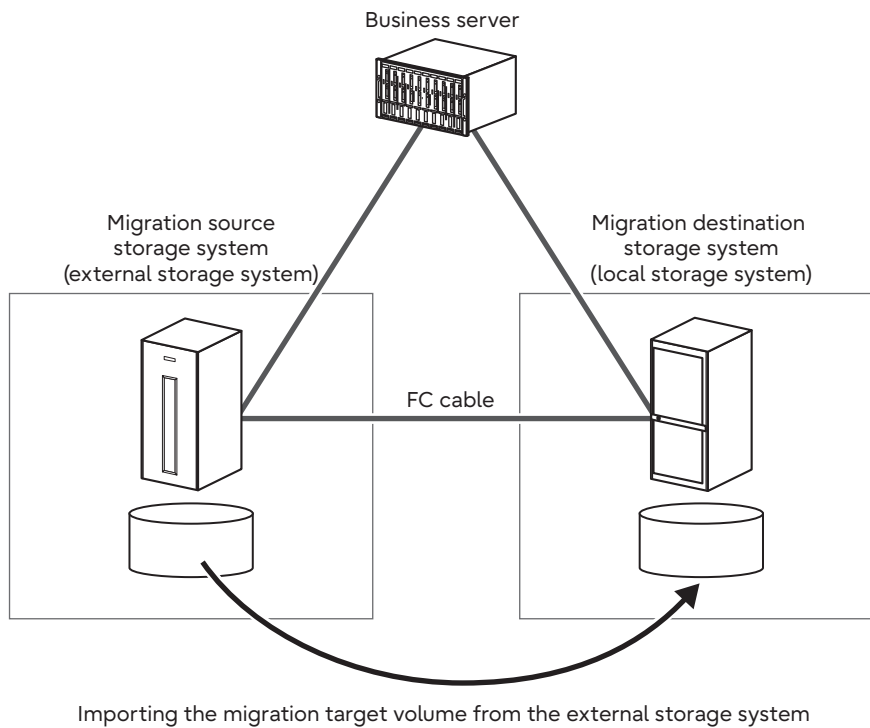
Server Linkage Functions

The ETERNUS AF 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 AF 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 AF.

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

Figure 27 Oracle VM Linkage
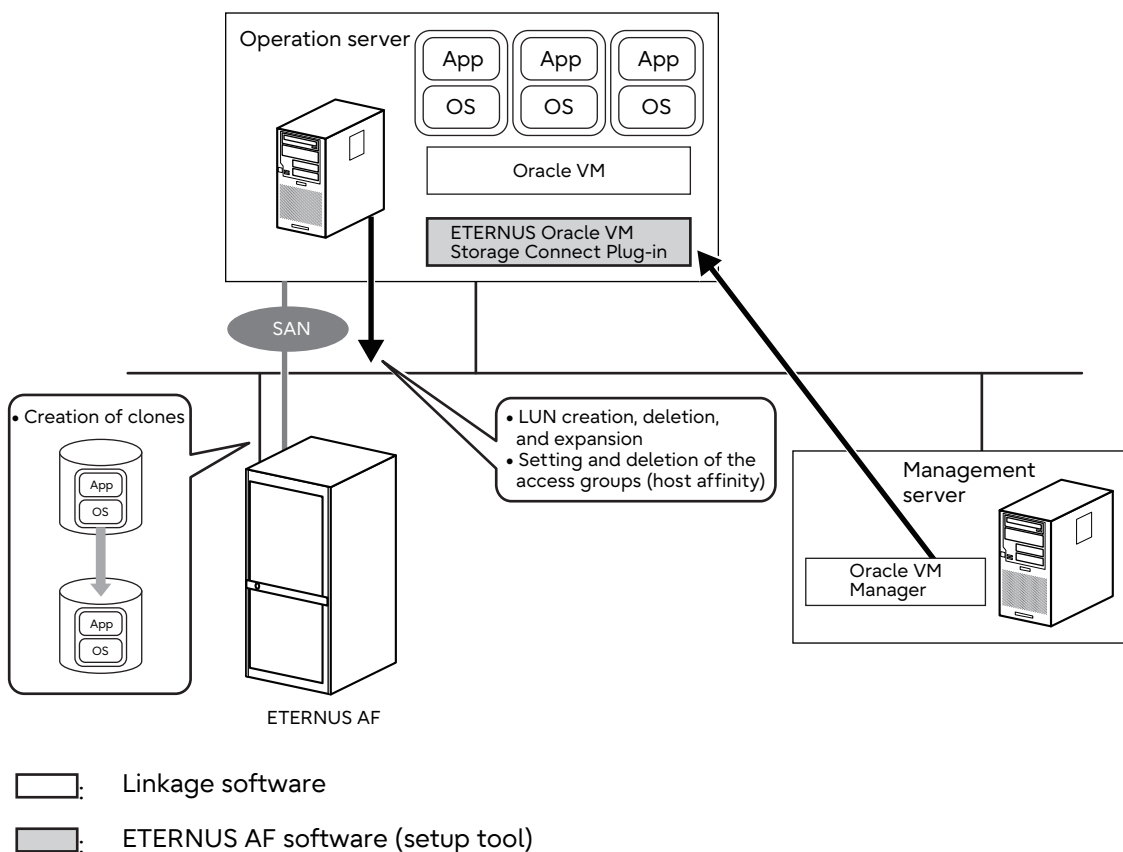
VMware Linkage

By linking with "VMware vSphere" (which virtualizes platforms) and "VMware vCenter Server" (which supports integrated management of VMware vSphere), the resources of the ETERNUS AF 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 28 VMware Linkage
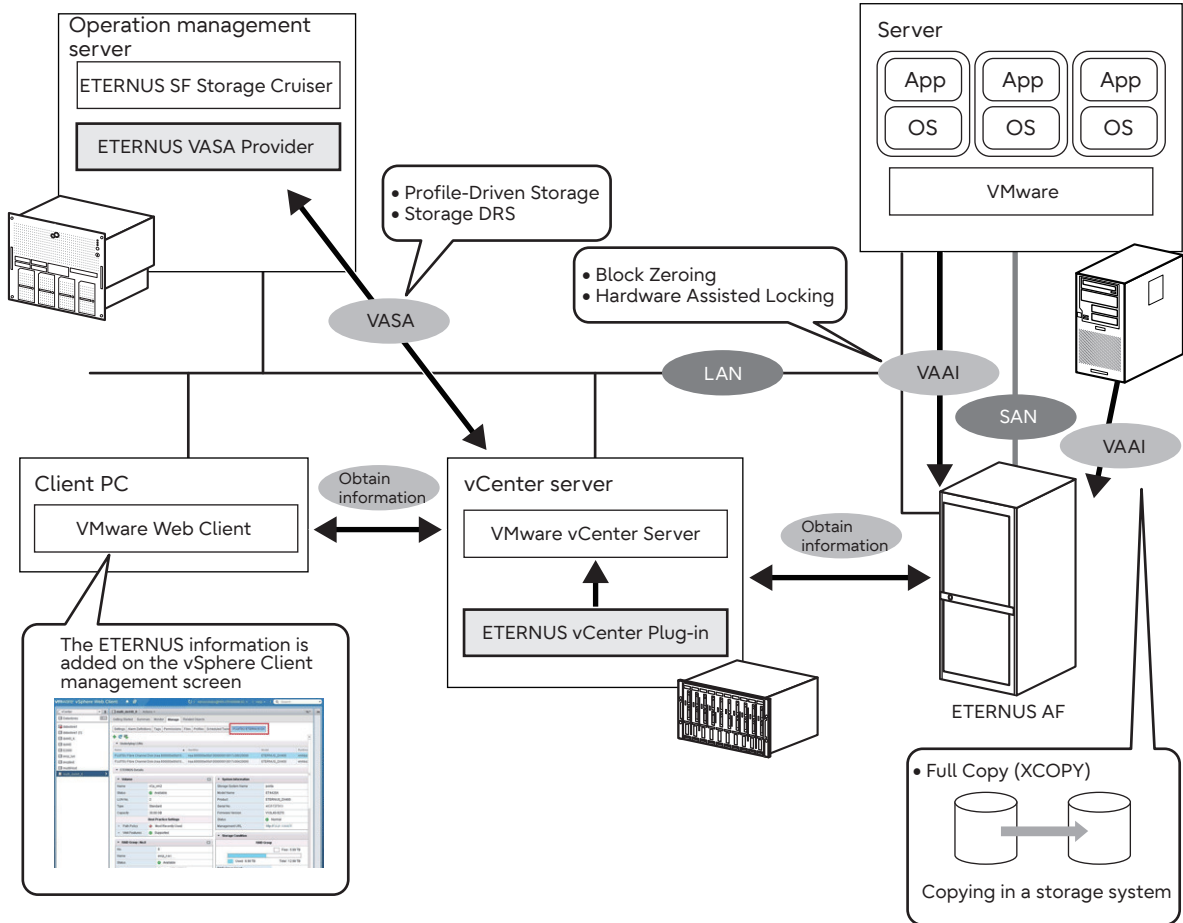
: Linkage software

: ETERNUS AF 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 AF supports the following features.

• Full Copy (XCOPY)

Data copying processes can be performed in the ETERNUS AF 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 AF 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 AF 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 AF 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 AF storage snapshot integration with Veeam Backup & Replication provided by Veeam Software.

Microsoft Linkage

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

Figure 29 Microsoft Linkage

☐ : Linkage software

▨ : ETERNUS AF software (setup tool)
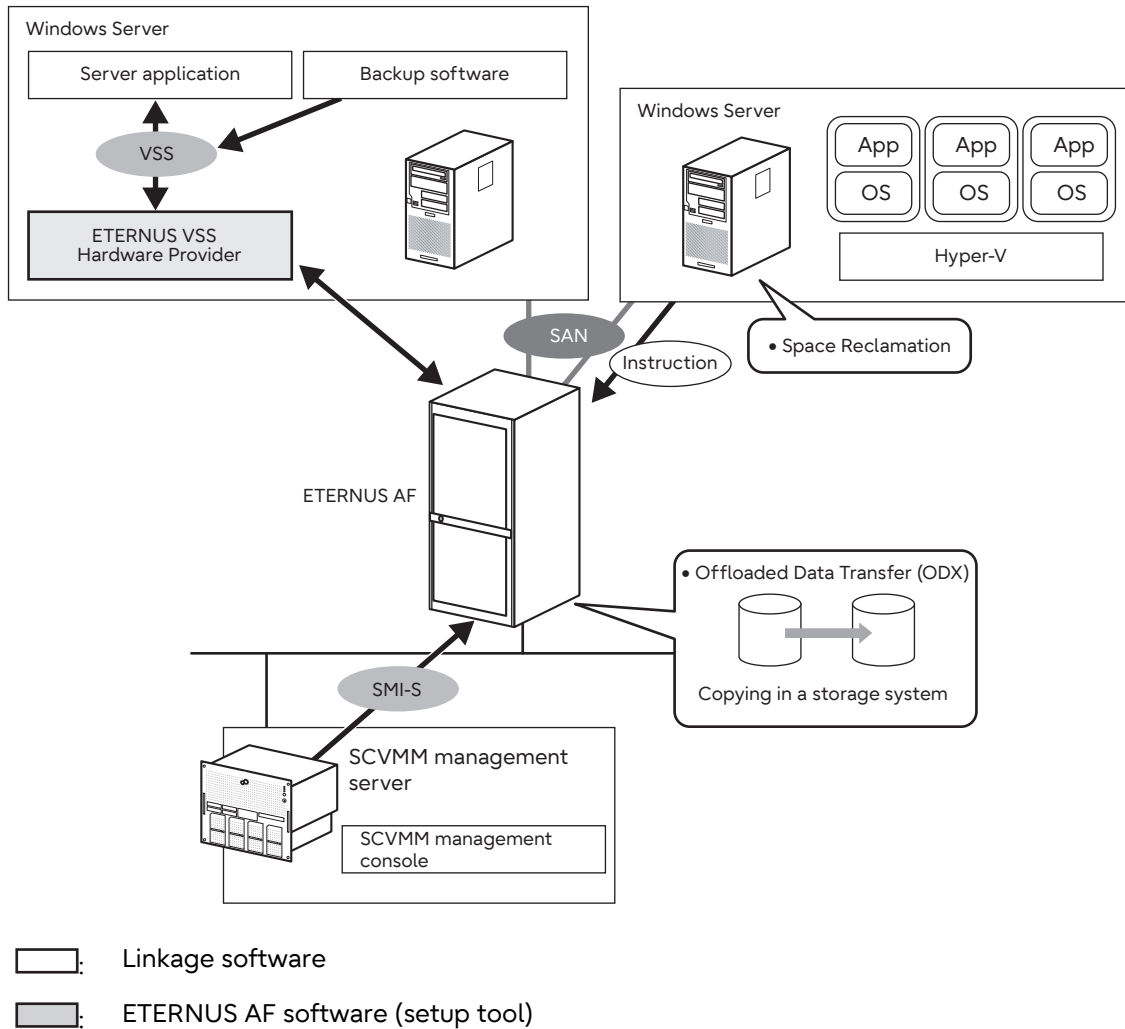
■ **Windows Server**

The ETERNUS AF 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 AF 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 AF.

■ **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 AF can be managed from SCVMM by using the SMI-S functions of the ETERNUS AF.

OpenStack Linkage

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

By using the VolumeDriver for the ETERNUS AF, the ETERNUS AF can be used as a Block Storage for cinder. Creating volumes in the ETERNUS AF 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.

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4. Hardware Configurations

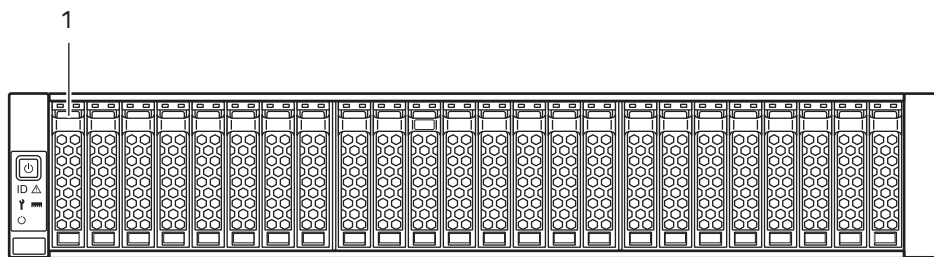This chapter explains hardware configurations for the ETERNUS AF.

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.
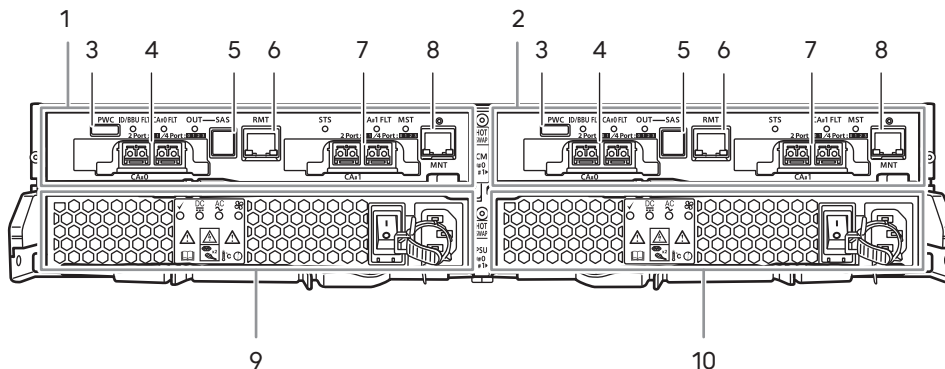
■ Front View

Figure 30 Front View of a Controller Enclosure

1. SSD

■ Rear View

Figure 31 Rear View of a Controller Enclosure

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 AF.

An ETERNUS AF has two controllers. This makes it possible for a failed controller to be replaced while the system is running.

■ 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 system memory capacity for each controller is 32GB.

If the system memory fails, the failed system memory can be replaced while the system is running.

■ BUD

A BUD is non-volatile memory in which the firmware of an ETERNUS AF 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 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 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 7 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
iSCSI (*2)	10Gbit/s	LC	2
iSCSI	10Gbit/s	SFP+ (direct attach twinax copper)	2
iSCSI	10Gbit/s	RJ-45	2

***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 8 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 9 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 AF 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 10 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

Up to 24 drives can be installed in a single controller enclosure.

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

Table 11 Drive Specifications (Controller Enclosure)

Product name	Drive interface	Storage media	Storage capacity
SSDs	Serial Attached SCSI (12Gbit/s)	Flash memory	400GB, 960GB, 1.92TB, 3.84TB, 7.68TB, 15.36TB, 30.72TB
Self encrypting SSDs (SED SSDs)	Serial Attached SCSI (12Gbit/s)		1.92TB, 3.84TB, 7.68TB

Drive Enclosure

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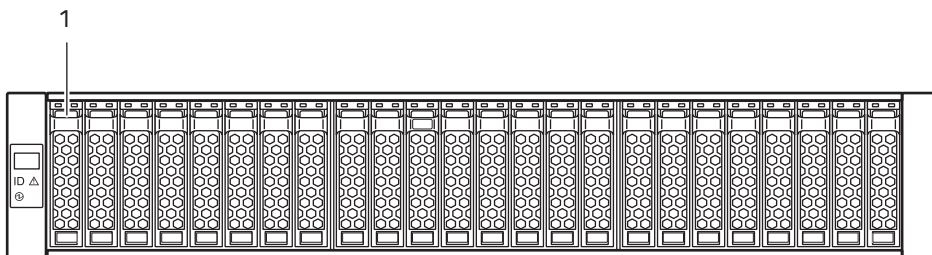
The drive enclosure contains drives installed in the front, and I/O modules and power supply units in the rear.

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

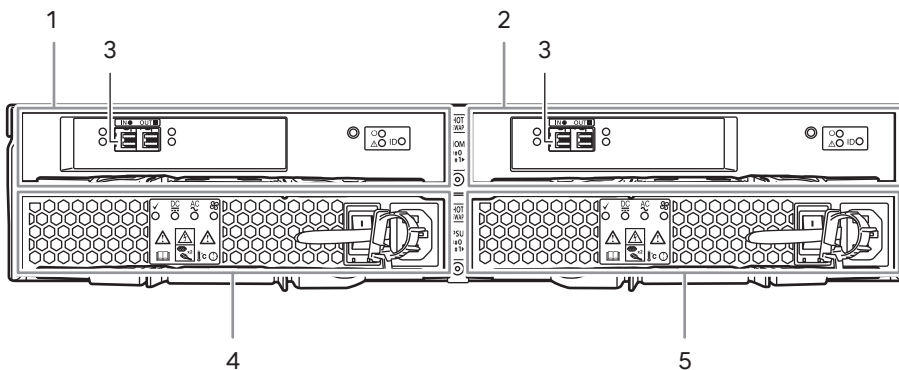## ■ External Views of a Drive Enclosure

● Front View

Figure 32 Front View of a Drive Enclosure

1.   SSD

● Rear View

Figure 33 Rear View of a Drive Enclosure

1.   I/O module (IOM#0)

2.   I/O module (IOM#1)

3.   Drive interface (IN) port

4.   Power supply unit (PSU#0)

5.   Power supply unit (PSU#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.

A drive enclosure has two I/O modules, which makes it possible for a failed I/O module to be replaced while the system is running.

■ Drive Interface Ports

This port is for connecting controller enclosures or drive enclosures.

The drive interface port specifications are shown below.

Table 12 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)

Power Supply Units

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

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

Drives

Up to 24 drives can be installed in a single drive enclosure.

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

Table 13 Drive Specifications (Drive Enclosure)

Product name	Drive interface	Storage media	Storage capacity
SSDs	Serial Attached SCSI (12Gbit/s)	Flash memory	400GB, 960GB, 1.92TB, 3.84TB, 7.68TB, 15.36TB, 30.72TB
Self encrypting SSDs (SED SSDs)	Serial Attached SCSI (12Gbit/s)		1.92TB, 3.84TB, 7.68TB

Power Distribution Unit (Only for Regions other than the EMEIA, 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 34 Power Distribution Unit (AC200-240V, 1U, 4 Outlets)
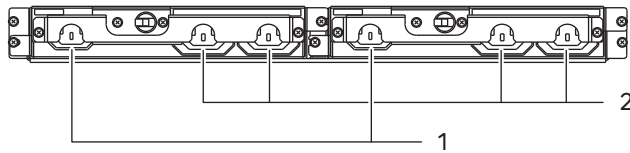
1.   Inlet (INPUT)

2.   Outlet (OUTPUT)

The specifications of a power distribution unit and the AC cables that are provided are shown below.
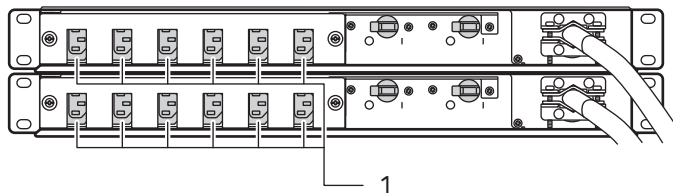
Table 14 Power Distribution Unit (AC200-240V, 1U, 4 Outlets) and Provided AC Cable Specifications

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

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■ Power Distribution Unit (AC8A/200-240V, 1U, 4 Outlets)

There are four outlets and two inlets.

Figure 35 Power Distribution Unit (AC8A/200-240V, 1U, 4 Outlets)
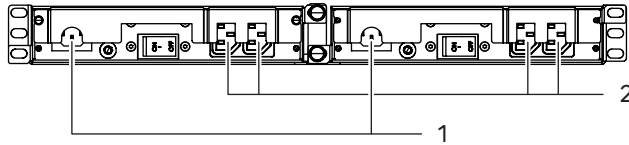
1. Inlet (INPUT)

2. Outlet (OUTPUT)

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

Table 15 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 36 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.
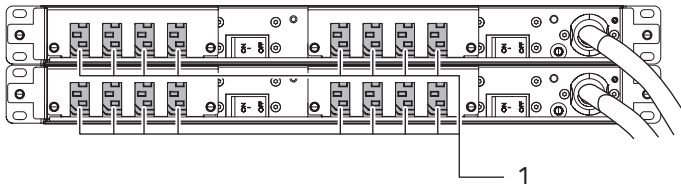
Table 16 Power Distribution Unit (AC200-240V, 2U, 12 Outlets) and Provided AC Cable Specifications

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

1. Outlet (OUTPUT)

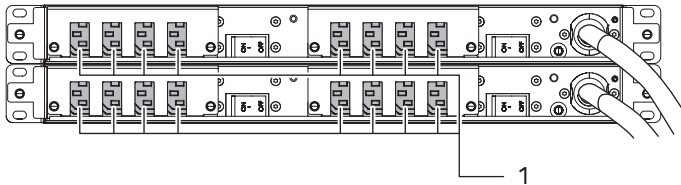The specifications of a power distribution unit and the AC cables that are provided are shown below.

Table 17 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 38 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 18 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 39 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 19 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 AF.

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

5. 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 AF 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.

Table 20 Release Information List

Firmware version	Release date	Detail of functional modification
V10L80	December 2017	New version

V10L82	July 2018	• Features added
		  - Added RAID configuration patterns for configuring TPPs and FTSPs (RAID5(6D+1P) and RAID6(7D+2P))
		  - Expanded the number of characters that can be specified for the volume name (previously 16 characters, now 32 characters)

V10L84	November 2018	• Features added - Smart Setup Wizard

V10L86	April 2019	• Features added
		  - Support for disabling the user information initialization function using the buttons on the operation panel
		  - Veeam Storage Integration

V10L88-0000	February 2020	• Features added
		  - 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	December 2020	• Features added - New supported browsers for ETERNUS Web GUI
V10L90-1000	October 2021	• Features added - Improved notification for signs of RAID failures
V10L90-2000	November 2021	• Features added - Storage Cluster support for Veeam Storage Integration

Fujitsu Storage ETERNUS AF250 S2 All-Flash Arrays
Overview

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