FUJITSU Storage
ETERNUS DX

Configuration Guide -Server Connection-

(SAS) for Windows®

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Preface

This manual briefly explains the operations that need to be performed by the user in order to connect an ETERNUS DX to a server running Windows® via a SAS interface.

This manual should be used in conjunction with any other applicable user manuals, such as those for the ETERNUS DX, server, OS, SAS cards, and drivers.

Refer to "Configuration Guide -Server Connection- Notations" for the notations used in this manual such as product trademarks and product names. For storage systems that are supported by the OS, refer to the Server Support Matrix of the ETERNUS DX.

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The Contents and Structure of this Manual

This manual is composed of the following 11 chapters.

  This chapter describes the workflow required to connect a server running Windows® to an ETERNUS DX.

  This chapter describes which servers can be connected to ETERNUS DX storage systems.

  This chapter describes issues that should be noted when connecting the ETERNUS DX storage systems and server.

  This chapter describes how to set up the ETERNUS DX storage systems using the ETERNUS Web GUI.

  This chapter describes how to set up the SAS switches.

  This chapter describes how to install an OS when it is not installed on a server.

  This chapter describes how to install the SAS cards and drivers.

  This chapter describes how to check the registry information.

  This chapter describes how to check the connection status between the server and ETERNUS DX.

  This chapter describes how to create disk partitions.

  This chapter describes issues that should be noted when building a cluster system.

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Chapter 1
Workflow

This chapter describes how to connect the ETERNUS DX storage systems to a server. The workflow is shown below.

Required Documents

- "Server Support Matrix"
- "Configuration Guide -Server Connection- Storage System Settings" that corresponds to the ETERNUS DX to be connected
- "ETERNUS Web GUI User's Guide"

Workflow

1

Setting Up the ETERNUS DX

Set up the ETERNUS DX using ETERNUS Web GUI.

- "Chapter 4 Setting Up the ETERNUS DX" (page 17)
- Checking the setup and maintenance operations
    - "ETERNUS Web GUI User's Guide"
- Setting up the ETERNUS DX
    - "Configuration Guide -Server Connection- Storage System Settings" that corresponds to the ETERNUS DX to be connected

2

Setting Up the SAS Switches

Set up the SAS switch.

- "Chapter 5 Setting Up the SAS Switches" (page 18)

3

Installing the Driver

Install the appropriate driver for the SAS card and Multipath Driver to be used.

- Installing and setting up the card and driver
  - "Chapter 7 Installing the Drivers" (page 21)
- Checking the SAS card driver versions
  - "Server Support Matrix"

▼

4

Checking the Connected Devices

Check the ETERNUS DX LUNs and status of the connection to the server.

- "Chapter 9 Checking the Connected Devices" (page 26)

▼

5

Preparing for Operation

Create disk partitions and set up the cluster configuration as necessary.

- "Chapter 10 Creating the Disk Partitions" (page 28)
- "Chapter 11 Setting Up the Cluster Configuration" (page 29)

Chapter 2
Checking the Server Environment

Connection to servers is possible in the following environments.
Check the "Server Support Matrix" for server environment conditions.

2.1 Hardware

Refer to the "Server Support Matrix".

2.2 Operating System (OS)

Refer to the "Server Support Matrix".

2.3 SAS Cards

Refer to the "Server Support Matrix".

Chapter 3
Notes

Note the following issues when connecting the ETERNUS DX to a server.

3.1 Connection Notes for PRIMERGY

- To ensure reliable access to the storage systems, the following methods are recommended:
  - Connection via multiple paths
  - Use of multipath drivers which support path redundancy control

    Configure a multipath environment and select a multipath driver that supports path redundancy control to increase redundancy and reliability of the connection between the ETERNUS DX storage systems and the server.
- LUN recognition by the Windows® plug and play function cannot be guaranteed.
- The following cluster configuration is supported for Windows®:
  - WSFC (Windows Server Failover Cluster) configuration
  - MSCS (Microsoft Cluster Service) configuration

  For details on servers which support cluster configuration, consult your FUJITSU sales representative.

3.2 Connection Notes for Other Companies' Industry Standard Servers

- To build a cluster configuration for Windows®, use Microsoft Cluster Service (MSCS), Windows Server Failover Cluster (WSFC), and MSCS- and WSFC-compatible applications. This cluster configuration must also use only one type of SAS card. Operation cannot be guaranteed if the cluster is configured using multiple types of SAS cards.
- LUN recognition by the Windows® plug and play function cannot be guaranteed.
- To ensure reliable access to the storage systems, the following methods are recommended:
  - Connection via multiple paths
  - Use of drivers for ETERNUS DX storage systems which support path redundancy control

    Configure a multipath environment and select a driver for ETERNUS DX storage systems that supports path redundancy control to increase redundancy and reliability of the connection between the ETERNUS DX storage systems and the server.

3.3 SAS Card Driver Notes

- When the same type of chip is used for both the SAS card and the server's onboard RAID or RAID card, the driver installed for the SAS card may also control the onboard RAID or RAID card.

  Contact the server vendor for details of how each onboard RAID or RAID card is affected by the SAS card driver.

- The ETERNUS Multipath Driver supports path redundancy control (path fail-over).

  For product information, refer to the following URL:

  http://www.fujitsu.com/global/products/computing/storage/software/eternus-mpd/

3.4 Notes about Driver for ETERNUS DX Storage Systems

When connecting the server to the ETERNUS DX with multipath configuration, using the path redundancy control (path fail-over) function with a driver for ETERNUS DX storage systems, one of the following drivers is required by the server:

OS	Driver
Windows Server® 2019 Windows Server® 2016 Windows Server® 2012 R2 Windows Server® 2012 Windows Server® 2008 R2 Windows Server® 2008	ETERNUS Multipath Driver

For product information, refer to the following URL:

http://www.fujitsu.com/global/products/computing/storage/software/eternus-mpd/

Even when single-path connection is used between the ETERNUS DX and server, an ETERNUS DX compatible driver (ETERNUS device driver) is not required.

3.5 MSCS and WSFC Notes

- To use MSCS or WSFC configuration, install either the driver for ETERNUS DX storage systems or the standard multipath driver (msdsm) for Windows Server® 2019, Windows Server® 2016, Windows Server® 2012 R2, Windows Server® 2012, Windows Server® 2008 R2 or Windows Server® 2008 on each node (server), and then check the connections before MSCS or WSFC installation.

- Check the registry values by following the instructions in "Chapter 8 Checking the Registry Information" (page 25), after installing MSCS or WSFC.

- When setting up the MSCS, a reset group must be set for the ETERNUS DX. A reset group does not need to be set for WSFC.

3.6   ETERNUS VDS Hardware Provider Notes

ETERNUS VDS Hardware Provider is provided for the ETERNUS DX storage systems. The storage management tool for Windows Server® 2008 R2 or Windows Server® 2008 (Storage Manager for SANs) may be used for volume creation and host affinity settings after installing this software.

ETERNUS VDS Hardware Provider can be downloaded from the following site. Refer to the ETERNUS VDS Hardware Provider product manual for usage details.

http://www.fujitsu.com/global/support/products/computing/storage/download/vdshp.html

3.7   Notes about Standard Multipath Driver (msdsm) for Windows Server®

Various settings, such as the load balance policy and retry count, can be adjusted by using the standard multipath drivers (msdsm) for Windows Server® 2019, Windows Server® 2016, Windows Server® 2012 R2, Windows Server® 2012, Windows Server® 2008 R2 or Windows Server® 2008. However the following settings should not be changed from their default values.

Screen name	Parameters that may not be changed
MPIO tab of Multi-Path Disk Device properties	Load balance policy, [Details] button, [Edit] button
Details of DSM	Timer counter (path checking period, enable path checking, number of retires, retry interval, PDO deletion period)
Details of MPIO paths	Path status

3.8   Server Startup Notes

Before turning the server on, check that the ETERNUS DX storage systems are all "Ready". If the server is turned on and they are not "Ready", the server will not be able to recognize the ETERNUS DX storage systems.

Also, when the ETERNUS DX power supply is being controlled by a UPS power supply linkage, make sure that the ETERNUS DX is never turned off before the connected servers. If turned off, data writes from the running server cannot be saved to the ETERNUS DX storage systems, and already saved data may also be affected.

3.9   System Design Sheet Notes

The system design sheet is a spreadsheet program work sheet that is used to simplify the process of installing the ETERNUS DX. It is important that the system details be recorded after first installing the system and also each time the system is subsequently modified, expanded, or has maintenance work performed on it. Creating a system design sheet makes installation and maintenance of the system easy.

3.10   Notes about Connections with a Windows Server®

When Windows Server® and the ETERNUS DX S4/S3 series are connected and Windows Server® is rebooted after a firmware is applied to the ETERNUS DX S4/S3 series, the status of the disks on Windows Server® may become offline.

The status of the disks on Windows Server® can be checked with the following procedure.

Click the [Start] button, select [Computer Management] under [Administrative Tools] and then select [Manage Discs] (or [Disk Management]) in the left pane.

Note that the occurrence condition and the workaround differ depending on the path configuration of Windows Server®.

For single-path configurations, change the SAN Policy setting before a firmware is applied to prevent the disk from becoming offline after the firmware is applied.

For multi-path configurations, there is no workaround. The procedure in "● Measure to take after a problem occurs" (page 15) must be performed to recover from the offline status.

■ Single-path configuration

The offline status can be avoided only when updating the firmware by changing the SAN Policy setting to "Online All".

If operations are possible with the SAN Policy setting set to "Online All", Step 4 in "● Method for proactively preventing occurrences" (page 13) is not required.

● Checking the SAN Policy setting

The following shows how to check the SAN Policy setting.

1   Execute the "diskpart" command in the command prompt.

The prompt changes to DISKPART.

2   Enter "san" and press the [Enter] key.

```
DISKPART> san
```

3   One of the following SAN Policies appears.
   • "Offline Shared"
   • "Offline All"
   • "Online All"

4   Enter "exit" and press the [Enter] key to complete the "diskpart" command.

● Method for proactively preventing occurrences

Change the SAN Policy setting by performing the following procedure and then update the firmware.

1   Change the SAN Policy setting.

   (1)   Execute the "diskpart" command in the command prompt.
       The prompt changes to DISKPART.

   (2)   Enter "san policy=onlineall" and press the [Enter] key.
       Example:

```
DISKPART> san policy=onlineall
```

   (3)   To apply the SAN Policy setting, reboot Windows Server®.

2   Execute the "diskpart" command again in the command prompt and confirm that "Online All" is specified for the SAN Policy setting.
   Example:

```
DISKPART> san
SANPolicy : Online All
```

3   Update the firmware.

   (1)   Update the firmware of the ETERNUS DX.

   (2)   To get OS to recognize the new instance ID, reboot Windows Server®.

4   Revert the SAN Policy setting to the previous value.

   (1)   Execute the following command to revert the SAN Policy setting.
       Example:

```
DISKPART> san policy=Offline Shared
```

   (2)   To apply the SAN Policy setting, reboot Windows Server®.

   (3)   Execute the "diskpart" command again in the command prompt and confirm that the previous value is specified for the SAN Policy setting.
       Example:

```
DISKPART> san
SANPolicy : Offline Shared
```

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● Measure to take after a problem occurs

Manually change the offline disks to online with the following procedure.

1   Click the [Start] button, select [Computer Management] under [Administrative Tools] and then select [Manage Discs] (or [Disk Management]) in the left pane.

2   Select each offline disk, then right-click the selected disk to change the status to online.

If a firmware update of the ETERNUS DX is performed in a Hyper-V environment where a pass-through disk is configured for the guest OS, the disk is recognized as a new disk and the pass-through disk is removed from the physical hard disk. Therefore, the pass-through disk must be manually reconfigured to be restored.

The procedure for restoring (or reconfiguring) the disk is as follows:

1   Start "Hyper-V Manager".

2   Select the offline guest OS and click [Settings] in the right pane.
The settings pop-up for the guest OS appears.

3   In the settings pop-up under [SCSI Controller], select the hard drive that has the message "Physical drive not found".

4   Select the appropriate disk for the [Physical hard disk] area in the right side of the window.

5   Click the [OK] button.

● SAN Policy supported OSs

- Windows Server® 2019
- Windows Server® 2016
- Windows Server® 2012 R2
- Windows Server® 2012
- Windows Server® 2008 R2
- Windows Server® 2008

● SAN Policy default value

OS	SAN Policy default value
Windows Server® 2019 (all editions)	Offline Shared
Windows Server® 2016 (all editions)	
Windows Server® 2012 R2 (all editions)	
Windows Server® 2012 (all editions)	
Windows Server® 2008 R2 Datacenter	
Windows Server® 2008 R2 Enterprise	
Windows Server® 2008 Datacenter	
Windows Server® 2008 Enterprise	

OS	SAN Policy default value
Windows Server® 2008 R2 Standard	Online All
Windows Server® 2008 Standard	

■ **Multipath configuration**

The server starts up with the same disk status (online or offline) as when the multipathing was set up regardless of the SAN Policy setting.

- When the multipathing of an online disk is set up during the configuration of the environment

  The multipath disk starts up in the online status after the firmware is updated.

- When the multipathing of an offline disk is set up during the configuration of the environment

  The multipath disk starts up in the offline status after the firmware is updated.

● Method for proactively preventing occurrences

For multi-path configurations, there are no proactive measures (such as a setting change) to prevent the disk from becoming offline after the environment is configured. In addition, the disk status when multipathing was set up cannot be checked after the environment is configured.

Perform the procedure in "● Measure to take after a problem occurs" (page 15) if the disk becomes offline while the firmware is updated.

● Measure to take after a problem occurs

- When the OS can be started up

  Manually change the offline disks to online by following the procedure below.

  1 Click the [Start] button, select [Computer Management] under [Administrative Tools] and then select [Manage Discs] (or [Disk Management]) in the left pane.

  2 Select each offline disk, then right-click the selected disk to change the status to online.

- When the OS cannot be started up

  If the Active Directory database is located in a disk other than the OS area, the OS may not be able to start up because the disk is offline and the OS cannot access the Active Directory database.

  In this case, the disk can be recovered by starting the OS in the Directory Services Restore Mode and changing the disk status to online.

  The procedure for restoring (or reconfiguring) the disk is as follows:

  1 Start the server.

  2 Press the [F8] key on the server start-up screen.

  3 The Advanced Boot Options screen appears.

  4 Select Directory Services Restore Mode.

  5 Log in as Administrator after the OS starts.

  6 Select [Computer Management] under [Administrative Tools] and then select [Manage Discs] (or [Disk Management]) in the left pane.

  7 Select each offline disk, then right-click the selected disk to change the status to online.

8   Restart the OS.

If a firmware update of the ETERNUS DX is performed in a Hyper-V environment where a pass-through disk is configured for the guest OS, the disk is recognized as a new disk and the pass-through disk is removed from the physical hard disk. Therefore, the pass-through disk must be manually reconfigured to be restored.

The procedure for restoring (or reconfiguring) the disk is as follows:

1   Start "Hyper-V Manager".

2   Select the offline guest OS and click [Settings] in the right pane.
     The settings pop-up for the guest OS appears.

3   In the settings pop-up under [SCSI Controller], select the hard drive that has the message "Physical drive not found".

4   Select the appropriate disk for the [Physical hard disk] area in the right side of the window.

5   Click the [OK] button.

3.11   Notes for Formatting a LUN of the ETERNUS DX from a Windows Server®

If a LUN of the ETERNUS DX is formatted from a Windows Server®, the following problems may occur.

- The formatting operation takes longer to complete.
- If the formatting operation is canceled, the canceled operation becomes unresponsive.

These are the problems caused by performance degradation due to the command being issued to release the storage capacity for the entire formatting area.

Performance degradation can be prevented by executing the following command to change the parameter value to stop the command from releasing the storage capacity of all the volumes.

```
# fsutil behavior set disabledeletenotify 1
```

After all formatting operations have been completed, execute the following command to re-enable the command that releases the storage capacity of all the volumes.

```
# fsutil behavior set disabledeletenotify 0
```

Chapter 4
Setting Up the ETERNUS DX

Set up the ETERNUS DX storage systems using ETERNUS Web GUI.

ETERNUS DX setup can be performed independently of server setup. For details on how to perform these settings, refer to the following manuals.

- "Configuration Guide -Server Connection- Storage System Settings" that corresponds to the ETERNUS DX to be connected
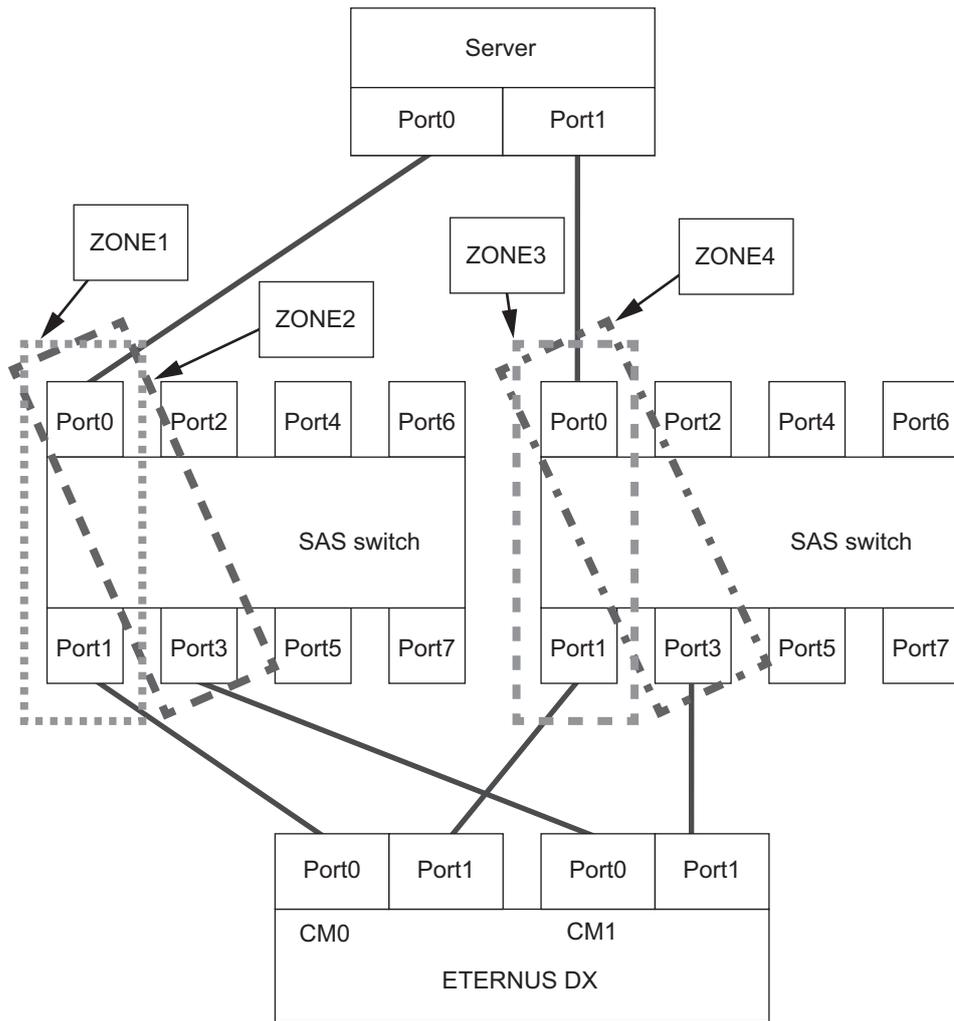- "ETERNUS Web GUI User's Guide"

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Chapter 5
Setting Up the SAS Switches

The following describes the required settings when connecting the server and the ETERNUS DX storage systems using a SAS switch. For details, refer to the SAS switch manual.

The following examples show configurations in which a server is connected to a SAS switch with zoning.

The following example shows a configuration in which multiple servers are connected to multiple CAs.
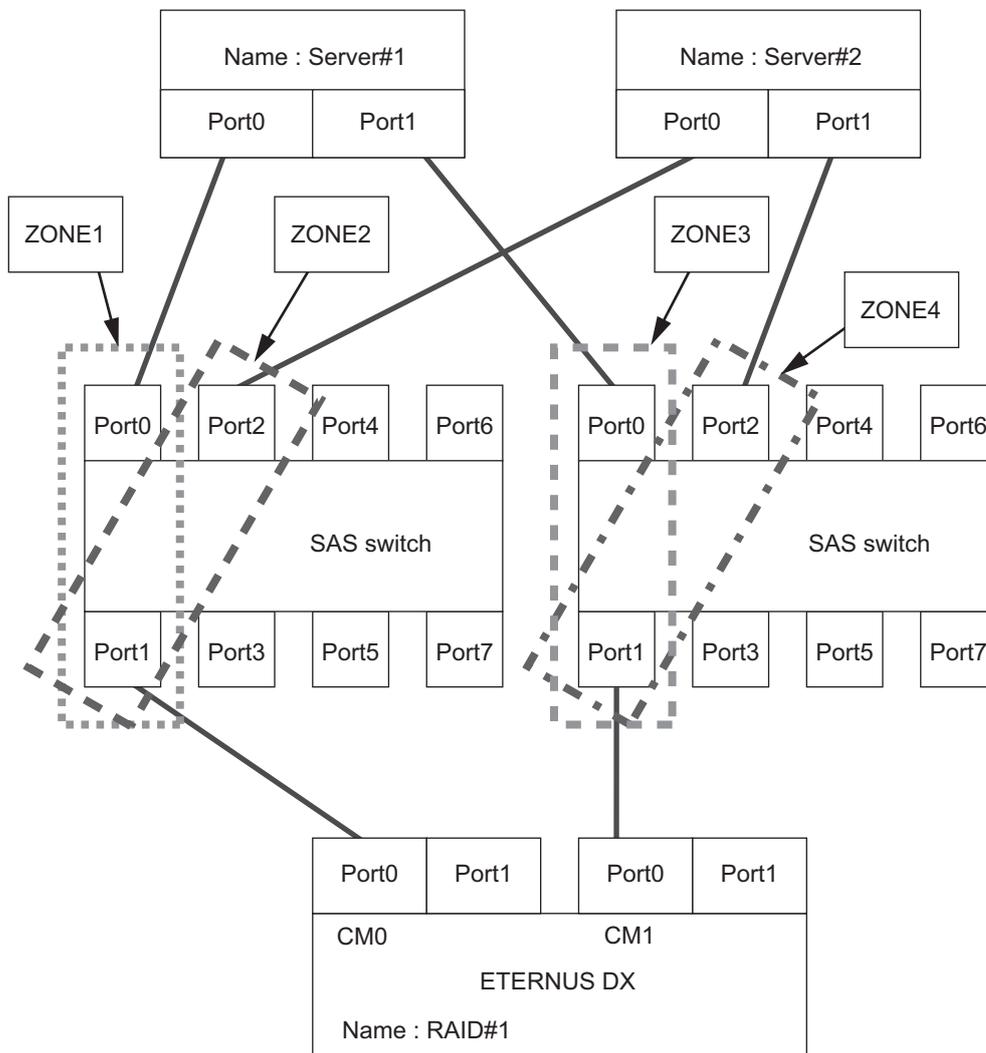
The following example shows a configuration in which a single server is connected to multiple CAs.

```
                                    Server
                            ┌──────────────────┐
                            │  Port0  │  Port1 │
```

ZONE1, ZONE2, ZONE3, ZONE4

SAS switch — Port0, Port2, Port4, Port6 / Port1, Port3, Port5, Port7

SAS switch — Port0, Port2, Port4, Port6 / Port1, Port3, Port5, Port7

ETERNUS DX — CM0 (Port0, Port1), CM1 (Port0, Port1)

Chapter 6
Installing the OS

Install the OS and Service Pack (SP) to the server if the OS has not yet been installed.

> **▶ Caution**
>
> Check that the power for the ETERNUS DX storage systems are turned off before installing the OS. If the power for the ETERNUS DX storage systems are turned on when installing the OS, the server recognizes the ETERNUS DX storage systems and problems may occur.

Chapter 7
Installing the Drivers

7.1 SAS Card Driver Installation and Settings

Install the SAS card on the server that is connected to ETERNUS DX storage systems.

7.1.1 For PRIMERGY

When a PRIMERGY server is connected to the ETERNUS DX, install the SAS card and driver according to the following manuals provided with the SAS card.

- Manual that is provided with the SAS card [PG-228B/BL, PY-SC1Y0L]
- Manual that is provided with the SAS card [PG-22DC/PG-22DCL, PY-SC2Z0]
- Manual that is provided with the SAS card [PY-SCD08]
- User's Guide of PRIMERGY SAS card

7.1.2 Other Companies' Industry Standard Servers

When an industry standard server of another company is connected to the ETERNUS DX, install the SAS card and driver according to that company's specific procedures for servers and SAS cards.

7.2 Multipath Environment Configuration

Multipath environment configuration differs depending on the multipath driver that is used.

- When the driver for ETERNUS DX storage systems is used

  Refer to "7.2.1 ETERNUS Multipath Driver" (page 21).

- When the standard multipath driver (msdsm) for Windows Server® 2019, Windows Server® 2016, Windows Server® 2012 R2, Windows Server® 2012, Windows Server® 2008 R2, or Windows Server® 2008 is used

  Refer to "7.2.2 Standard Multipath Driver (msdsm) for Windows Server®" (page 22).

7.2.1 ETERNUS Multipath Driver

Install the ETERNUS Multipath Driver as required.

Refer to "3.4 Notes about Driver for ETERNUS DX Storage Systems" (page 10) for notes about the ETERNUS Multipath Driver.

For the procedure about how to install (or uninstall), setup, and use the ETERNUS Multipath Driver, refer to the ETERNUS Multipath Driver manuals.

7.2.2 Standard Multipath Driver (msdsm) for Windows Server®

This section describes how to configure the environment to use the standard multipath driver (msdsm) for Windows Server® 2019, Windows Server® 2016, Windows Server® 2012 R2, Windows Server® 2012, Windows Server® 2008 R2, and Windows Server® 2008.

7.2.2.1 Installing Multipath I/O

Procedure

1   Click [Add Features] in the [Server Manager] screen.

Select the "Multipath I/O" checkbox in the "Features" screen of the Add Features Wizard, and install the Multipath I/O function.
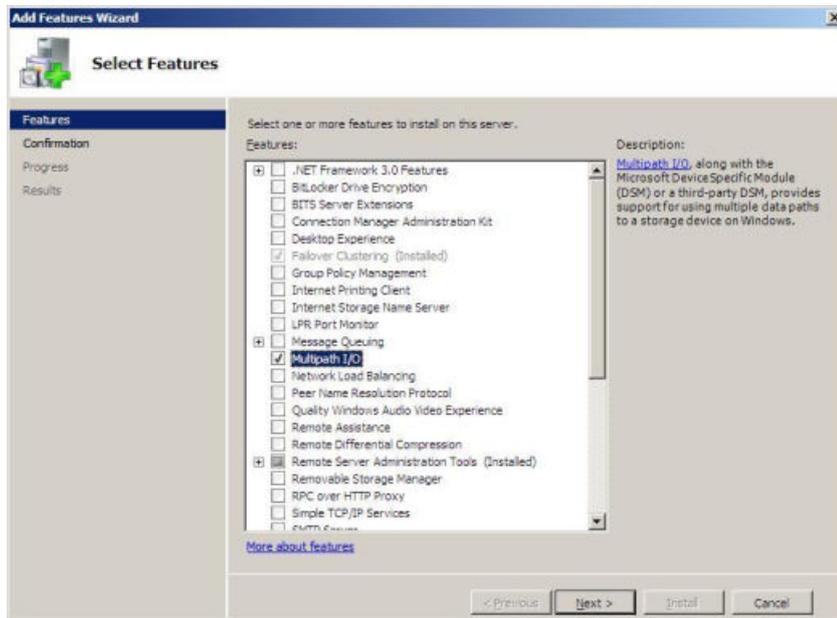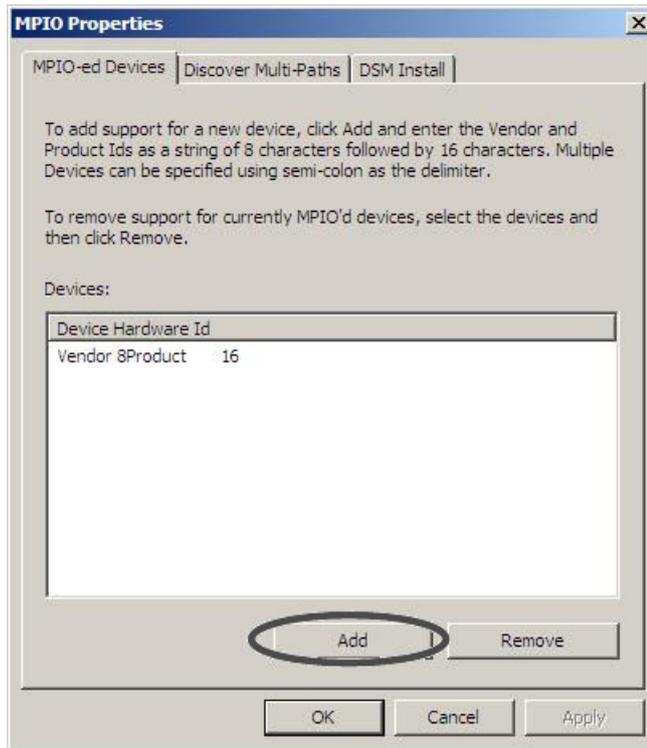

2   Reboot the server.

End of procedure

7.2.2.2 Detailed Setup for MPIO

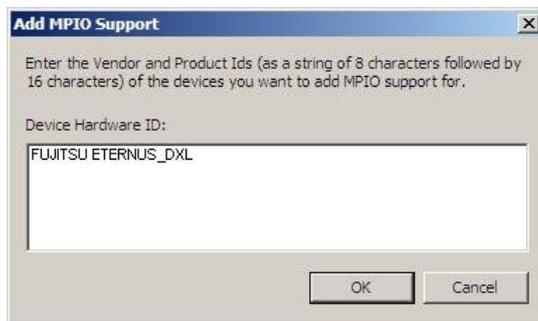Perform settings to apply the installed Multipath I/O to the ETERNUS DX.

Procedure

1   Click [Control Panel] — [MPIO].
The MPIO properties window appears.

2   In the MPIO properties window, select the [MIPO-ed Devices] tab, and click the [Add] button.

3   Enter the ID of the ETERNUS DX that is to be connected in the [Device Hardware ID] field.

Enter "FUJITSU ETERNUS_DXL".

▶ **Caution**

A space must be entered between "FUJITSU" and "ETERNUS_DXL".

4   Connect the ETERNUS DX using multipath configuration with the server turned off, and then turn the server on.

End of procedure

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7.3   Single-Path Environment Configuration

In a single-path environment, it is not required to install the ETERNUS Multipath Driver or driver for ETERNUS DX storage systems such as ETERNUS device driver.

Chapter 8
Checking the Registry Information

Check the value of the "TimeOutValue" registry key. If the "TimeOutValue" registry key does not exist, then create it.

The registry file should be backed up before creating or changing any registry values.

Procedure

1   Click the [Start] button, and then click [Run].

2   In the [Run] dialog box, type "regedit", and then click the [OK] button.
    Registry Editor starts.

3   Follow the path described below:

```
\HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Disk
```

4   Check the value of the "TimeOutValue" registry key.

    Check that the value of the "TimeOutValue" registry key is "0x3C". If the name or value is not "0x3C", change it to "0x3C".

    > **Caution**

    - If the "TimeOutValue" key does not exist, add a registry key with the following values:
    - The "Name" field is case-sensitive.

Name	TimeOutValue
Type	REG_DWORD
Radix	Hexadecimal
Data	3C

5   If any registry values were added or modified, reboot the server.
    The modified settings will be enabled after the reboot.

    End of procedure

Chapter 9
Checking the Connected Devices

9.1 Turning On the Devices

To turn on the connected devices, use the following procedure:

Procedure

1   Turn on the ETERNUS DX.

2   Check that the Ready LED is lit on the ETERNUS DX.

3   Turn on the server.

End of procedure

9.2 Checking the LUNs

Check the LUNs using the following procedure:

Procedure

1   Open [Device Manager] to show [Disk drives].

2   If the ETERNUS DX storage systems' LUNs are recognized by the server, the ETERNUS DX storage systems' device (LUNs) are displayed under [Disk drives].

> **◯ N o t e**
>
> For multipath configuration with Windows Server® 2019, Windows Server® 2016, Windows Server® 2012 R2, Windows Server® 2012, Windows Server® 2008 R2, or Windows Server® 2008, each ETERNUS DX LUN shows as a single "Multi-Path Disk Device".

End of procedure

9.3 Checking the ETERNUS DX Storage Systems' Connection Status

The following items can be set and displayed in the "ETERNUS Multipath Manager" main window when "ETERNUS Multipath Driver" is used.

- ETERNUS DX storage systems' connection status
- Connected LUNs
- Path status
- Path restoration or release

These describe ETERNUS DX storage systems' connection status and the checking of paths.

Procedure

1   Start up ETERNUS DX storage systems (assuming that LUNs are already set up), and check that it is "Ready" before starting up the server.

2   When the server is Ready, start up Multipath Manager.

3   The main window will appear.

 The status of the ETERNUS DX storage systems connected to the server (connection status, path status) can be checked.

End of procedure

For details on "ETERNUS Multipath Manager" operations, refer to the manual provided with the "ETERNUS Multipath Driver".

Chapter 10
Creating the Disk Partitions

Create disk partitions as necessary, using the following procedure.

Procedure

1   Open [Disk Management] via [Computer Management].
     If unsigned disks exist, a query about whether or not to sign disks for the connected devices is made.

2   Sign disks and create partitions as necessary.

> **N o t e**
>
> • This setup can also be used to upgrade to dynamic disks.
> • 2TB or larger disks must be converted to GPT disks.

End of procedure

Chapter 11
Setting Up the Cluster Configuration

If configuring a cluster (WSFC/MSCS), install the cluster related applications, as necessary. After cluster configuration is finished, recheck the registry information according to the instructions in "Chapter 8 Checking the Registry Information" (page 25). Correct the information, if necessary.

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