

# **ExpressCluster<sup>®</sup> X 3.2 *for Windows***

## **Installation and Configuration Guide**

7/11/2014  
3rd Edition



## Revision History

| Edition | Revised Date | Description                                |
|---------|--------------|--|
| 1st     | 2/19/2014    | New manual                                 |
| 2nd     | 5/23/2014    | Corresponds to the internal version 11.21. |
| 3rd     | 7/11/2014    | Corresponds to the internal version 11.22. |

© Copyright NEC Corporation 2014. All rights reserved.

## **Disclaimer**

Information in this document is subject to change without notice. No part of this document may be reproduced or transmitted in any form by any means, electronic or mechanical, for any purpose, without the express written permission of NEC Corporation.

## **Trademark Information**

ExpressCluster<sup>®</sup> X is a registered trademark of NEC Corporation.

Intel, Pentium and Xeon are registered trademarks or trademarks of Intel Corporation.

Microsoft and Windows are registered trademarks of Microsoft Corporation in the United States and other countries.

Oracle, Java and all Java-based trademarks and logos are trademarks or registered trademarks of Oracle and/or its affiliates.

WebOTX is a registered trademark of NEC Corporation.

Android is a trademark or registered trademark of Google, Inc.

Other product names and slogans written in this manual are trademarks or registered trademarks of their respective companies.



# Table of Contents

|  |           |
|--|-----------|
| <b>Preface</b>   | <b>ix</b> |
| Who Should Use This Guide.....   | ix        |
| How This Guide is Organized.....   | ix        |
| ExpressCluster X Documentation Set .....   | x         |
| Conventions .....  | xi        |
| Contacting NEC .....   | xii       |
| <b>Section I     Configuring a cluster system.....</b>   | <b>13</b> |
| <b>Chapter 1     Determining a system configuration.....</b>   | <b>15</b> |
| Steps from configuring a cluster system to installing ExpressCluster .....   | 16        |
| What is ExpressCluster? .....  | 18        |
| ExpressCluster modules .....   | 19        |
| Planning system configuration.....   | 20        |
| Shared disk type and mirror disk type .....  | 20        |
| Example 1: Configuration using a shared disk with 2 nodes.....   | 21        |
| Example 2: Configuration using mirror disks with 2 nodes.....  | 22        |
| Example 3: Configuration using mirror partitions on the disks for OS with 2 nodes.....   | 23        |
| Example 4: Configuring a remote cluster by using asynchronous mirror disks with 2 nodes .....  | 24        |
| Example 5: Configuration using a shared disk with 3 nodes.....   | 25        |
| Example 6: Configuration using both mirror disks and a shared disk with 3 nodes.....   | 26        |
| Example 7: Configuration using the hybrid type with 3 nodes .....  | 27        |
| Example 8: Configuration using BMC-related functions with two nodes.....   | 28        |
| Checking system requirements for each ExpressCluster module .....  | 29        |
| Determining a hardware configuration .....   | 29        |
| Settings after configuring hardware.....   | 29        |
| 1. Shared disk settings (Required for shared disk) .....   | 30        |
| 2. Mirror partition settings (Required for mirror disks).....  | 31        |
| 3. Adjustment of the operating system startup time (Required) .....  | 32        |
| 4. Verification of the network settings (Required).....  | 32        |
| 5. Verification of the firewall settings (Required).....   | 33        |
| 6. Server clock synchronization (Recommended).....   | 33        |
| 7. Power saving function – OFF (Required).....   | 33        |
| 8. Setup of SNMP service (Required if ESMPRO Server is to be used cooperated with ExpressCluster).....   | 33        |
| 9. Setup of BMC and ipmiutil (Required for using the forced stop function of a physical machine and chassis ID lamp association) .....                         | 34        |
| 10. Setup of the Subsystem for UNIX Application (SUA) (Required when the network warning light is used on Windows Server 2008).....                            | 34        |
| 11. Setup of a function equivalent to rsh provided by the network warning light vendor (Required if network warning light is used on Windows Server 2012)..... | 34        |
| <b>Chapter 2     Configuring a cluster system.....</b>   | <b>35</b> |
| Configuring a cluster system .....   | 36        |
| Determining a cluster topology.....  | 37        |
| Failover in uni-directional standby cluster .....  | 38        |
| Failover in multi-directional standby cluster.....   | 39        |
| Determining applications to be duplicated.....   | 40        |
| Server applications .....  | 40        |
| Note 1: Data recovery after an error.....  | 40        |
| Note 2: Application termination.....   | 40        |
| Note 3: Location to store the data .....   | 40        |
| Note 4: Multiple application service groups.....   | 41        |
| Note 5: Mutual interference and compatibility with applications.....   | 42        |
| Configuration relevant to the notes .....  | 42        |
| Solutions to the problems relevant to the notes .....  | 43        |
| How to determine a cluster topology .....  | 43        |
| Planning a failover group.....   | 44        |

|   |            |
|---|------------|
| Considering group resources .....   | 45         |
| Understanding monitor resources .....   | 46         |
| Understanding heartbeat resources .....   | 48         |
| Understanding network partition resolution resources .....                                | 49         |
| <b>Section II     Installing and configuring ExpressCluster X .....</b>                   | <b>53</b>  |
| <b>Chapter 3     Installing ExpressCluster .....</b>                                      | <b>55</b>  |
| Steps from Installing ExpressCluster to creating a cluster.....                           | 56         |
| Installing the ExpressCluster Server.....   | 57         |
| Installing the ExpressCluster Server for the first time.....                              | 58         |
| Upgrading ExpressCluster Server from the previous version.....                            | 60         |
| Installing the ExpressCluster Builder (offline version) .....                             | 64         |
| Setting up the SNMP linkage function manually .....                                       | 65         |
| <b>Chapter 4     Registering the license.....</b>   | <b>67</b>  |
| Registering the license .....   | 68         |
| Registering the license by entering the license information.....                          | 69         |
| Registering the license by specifying the license file .....                              | 70         |
| Referring and/or deleting the license .....   | 71         |
| How to refer to and/or delete the registered license .....                                | 71         |
| <b>Chapter 5     Creating the cluster configuration data .....</b>                        | <b>73</b>  |
| Creating the cluster configuration data .....   | 74         |
| Starting up the ExpressCluster X WebManager .....   | 75         |
| What is ExpressCluster X WebManager? .....  | 75         |
| Browsers supported by the WebManager.....   | 76         |
| Setting up Java Runtime Environment .....   | 76         |
| Starting the WebManager .....   | 76         |
| Checking the values to be configured.....   | 77         |
| Sample cluster environment .....  | 77         |
| Creating the cluster configuration data .....   | 87         |
| 1. Create a cluster .....   | 88         |
| 1-1. Create a cluster .....   | 88         |
| 1-2. Add a server.....  | 89         |
| 1-3. Create a server group .....  | 90         |
| 1-4. Set up the network configuration .....   | 91         |
| 1-5. Set up network partition resolution .....  | 92         |
| 2. Create a failover group .....  | 95         |
| 2-1. Add a failover group.....  | 95         |
| 2-2. Add a group resource (floating IP resource) .....                                    | 96         |
| 2-3. Add a group resource (disk resource/mirror disk resource/hybrid disk resource) ..... | 96         |
| 2-4. Add a group resource (application resource) .....                                    | 98         |
| 3. Create monitor resources .....   | 99         |
| 3-1. Add a monitor resource (disk RW monitor resource) .....                              | 99         |
| 3-2. Add a monitor resource (IP monitor resource for the ManagementGroup).....            | 99         |
| 3-3. Add a monitor resource (IP monitor resource for failover group).....                 | 100        |
| 4. Disabling recovery action caused by monitor resource error.....                        | 101        |
| Saving the cluster configuration data.....  | 102        |
| Saving the cluster configuration data .....   | 102        |
| Starting a cluster .....  | 103        |
| How to create a cluster.....  | 103        |
| <b>Chapter 6     Verifying a cluster system .....</b>                                     | <b>105</b> |
| Verifying the status using the WebManager.....  | 106        |
| Verifying status using commands.....  | 108        |
| <b>Section III    Evaluation before operating a cluster system.....</b>                   | <b>111</b> |
| <b>Chapter 7     Verifying operation .....</b>  | <b>113</b> |
| Operation tests .....   | 114        |

|   |            |
|---|------------|
| Backup and restoration .....  | 118        |
| <b>Chapter 8 Preparing to operate a cluster system .....</b>  | <b>119</b> |
| Operating the cluster .....   | 120        |
| Activating a cluster .....  | 120        |
| Shutting down a cluster and server.....   | 120        |
| Shutting down the entire cluster.....   | 120        |
| Shutting down a server.....   | 120        |
| Suspending/resuming a cluster.....  | 121        |
| How to suspend a cluster.....   | 121        |
| How to resume a cluster .....   | 121        |
| Suspending ExpressCluster.....  | 122        |
| Stopping the ExpressCluster Server service.....   | 122        |
| Setting the ExpressCluster Server service to be manually activated .....                                    | 122        |
| Changing the setting of the ExpressCluster Server service from the manual startup to automatic startup..... | 122        |
| Modifying the cluster configuration data.....   | 123        |
| Modifying the cluster configuration data by using the ExpressCluster Builder (online version) .....         | 123        |
| Modifying the cluster configuration data by using the ExpressCluster Builder (offline version).....         | 123        |
| Applying the modified cluster configuration data .....  | 124        |
| Only uploading the data .....   | 124        |
| Restarting the ExpressCluster X WebManager .....  | 125        |
| Uploading the data by suspending the cluster .....  | 125        |
| Uploading the data by stopping the cluster .....  | 125        |
| Shutting down and restarting a cluster after uploading the data .....                                       | 125        |
| Checking the log collection procedure .....   | 126        |
| Collecting logs by using the WebManager .....   | 126        |
| <b>Chapter 9 Uninstalling and reinstalling ExpressCluster .....</b>   | <b>129</b> |
| Uninstallation.....   | 130        |
| Uninstalling the ExpressCluster Server.....   | 130        |
| Uninstalling the offline version ExpressCluster X Builder .....   | 131        |
| Reinstallation .....  | 132        |
| Reinstalling the ExpressCluster Server .....  | 132        |
| <b>Appendix A. Troubleshooting .....</b>  | <b>135</b> |
| Error messages when installing the ExpressCluster Server.....   | 135        |
| Troubleshooting for licensing .....   | 135        |
| <b>Appendix B. Glossary.....</b>  | <b>137</b> |
| <b>Appendix C. Index.....</b>   | <b>141</b> |



# Preface

## Who Should Use This Guide

The *Installation and Configuration Guide* is intended for system engineers and administrators who want to build, operate, and maintain a cluster system. Instructions for designing, installing, and configuring a cluster system with ExpressCluster are covered in this guide.

## How This Guide is Organized

|                    |   |
|--------------------|---|
| <b>Section I</b>   | <b>Configuring a cluster system</b><br>Determines cluster hardware configuration required before installing ExpressCluster and how to create the cluster configuration data with the ExpressCluster X Builder before installing ExpressCluster.                                   |
| <b>Chapter 1</b>   | <b>Determining a system configuration</b><br>Provides instructions for how to verify system requirements and determine the system configuration.  |
| <b>Chapter 2</b>   | <b>Configuring a cluster system</b><br>Helps you understand how to configure a cluster system.  |
| <b>Section II</b>  | <b>Installing and configuring ExpressCluster X</b><br>Install ExpressCluster on server machines and configure a cluster system using the cluster configuration data that you have created in Section I. Then run the operation tests and verify the system operates successfully. |
| <b>Chapter 3</b>   | <b>Installing ExpressCluster</b><br>Provides instructions for how to install ExpressCluster.  |
| <b>Chapter 4</b>   | <b>Registering the license</b><br>Provides instructions for how to register the license.  |
| <b>Chapter 5</b>   | <b>Creating the cluster configuration data</b><br>Provides instructions for how to create the cluster configuration data with the ExpressCluster X Builder.   |
| <b>Chapter 6</b>   | <b>Verifying a cluster system</b><br>Verify that the cluster system you have configured operates successfully.  |
| <b>Section III</b> | <b>Evaluation before operating a cluster system</b><br>Evaluate the system before starting to operate the cluster. Verify the required settings after checking the behavior of the cluster system. Instruction on how to uninstall and reinstall ExpressCluster is provided.      |
| <b>Chapter 7</b>   | <b>Verifying operation</b><br>Run the dummy-failure test and adjust the parameters.   |
| <b>Chapter 8</b>   | <b>Preparing to operate a cluster system</b><br>Provides information on what you need to consider before starting to operate ExpressCluster.  |
| <b>Chapter 9</b>   | <b>Uninstalling and reinstalling ExpressCluster</b><br>Provides instructions for how to uninstall and reinstall ExpressCluster.   |
| <b>Appendix A</b>  | <b>Troubleshooting</b>  |
| <b>Appendix B</b>  | <b>Glossary</b>   |
| <b>Appendix C</b>  | <b>Index</b>  |

## ExpressCluster X Documentation Set

The ExpressCluster X manuals consist of the following five guides. The title and purpose of each guide is described below:

### **Getting Started Guide**

This guide is intended for all users. The guide covers topics such as product overview, system requirements, and known problems.

### **Installation and Configuration Guide**

This guide is intended for system engineers and administrators who want to build, operate, and maintain a cluster system. Instructions for designing, installing, and configuring a cluster system with ExpressCluster are covered in this guide.

### **Reference Guide**

This guide is intended for system administrators. The guide covers topics such as how to operate ExpressCluster, function of each module, maintenance-related information, and troubleshooting. The guide is supplement to the *Installation and Configuration Guide*.

### **Integrated WebManager Administrator's Guide**

This guide is intended for system administrators who manage cluster system using ExpressCluster with ExpressCluster Integrated WebManager and for system engineers who introduce the Integrated WebManager. In this guide, details on required items for introducing the cluster system using the Integrated WebManager are explained in accordance with the actual procedures.

### **ExpressCluster X WebManager Mobile Administrator's Guide**

This guide is intended for system administrators who manage cluster system using ExpressCluster with ExpressCluster WebManager Mobile and for system engineers who introduce the WebManager. In this guide, details on those items required for introducing the cluster system using the WebManager Mobile are explained in accordance with the actual procedures.

## Conventions

In this guide, **Note**, **Important**, **Related Information** are used as follows:

---

**Note:**

Used when the information given is important, but not related to the data loss and damage to the system and machine.

---

---

**Important:**

Used when the information given is necessary to avoid the data loss and damage to the system and machine.

---

---

**Related Information:**

Used to describe the location of the information given at the reference destination.

---

The following conventions are used in this guide.

| Convention                             | Usage  | Example  |
|--|--|--|
| <b>Bold</b>                            | Indicates graphical objects, such as fields, list boxes, menu selections, buttons, labels, icons, etc.                 | In <b>User Name</b> , type your name.<br>On the <b>File</b> menu, click <b>Open Database</b> . |
| Angled bracket within the command line | Indicates that the value specified inside of the angled bracket can be omitted.  | <code>clpstat -s[-h <i>host_name</i>]</code>   |
| Monospace (courier)                    | Indicates path names, commands, system output (message, prompt, etc), directory, file names, functions and parameters. | <code>c:\Program files\EXPRESSCLUSTER</code>   |
| <b>Monospace bold</b> (courier)        | Indicates the value that a user actually enters from a command line.   | Enter the following:<br><code>clpcl -s -a</code>   |
| <i>Monospace italic</i> (courier)      | Indicates that users should replace italicized part with values that they are actually working with.                   | <code>clpstat -s [-h <i>host_name</i>]</code>  |

## **Contacting NEC**

For the latest product information, visit our website below:

<http://www.nec.com/global/prod/expresscluster/>

# **Section I      Configuring a cluster system**

Before installing ExpressCluster, it is important to plan your cluster system considering the hardware configuration and the operation requirements and needs.

This section describes how to determine the hardware configuration required before installing ExpressCluster.

- Chapter 1    Determining a system configuration
- Chapter 2    Configuring a cluster system



# Chapter 1      Determining a system configuration

This chapter provides instructions for determining the cluster system configuration that uses ExpressCluster.

This chapter covers:

- Steps from configuring a cluster system to installing ExpressCluster..... 16
- What is ExpressCluster?..... 18
- Planning system configuration ..... 20
- Checking system requirements for each ExpressCluster module ..... 29
- Determining a hardware configuration ..... 29
- Settings after configuring hardware..... 29

## Steps from configuring a cluster system to installing ExpressCluster

Before you set up a cluster system that uses ExpressCluster, you should carefully plan the cluster system with due consideration for factors such as hardware requirements, software to be used, and the way the system is used. When you have built the cluster, check to see if the cluster system is successfully set up before you start its operation.

This guide explains how to create a cluster system with ExpressCluster through step-by-step instructions. Read each chapter by actually executing the procedures to install the cluster system. The following is the steps you take from designing the cluster system to operating ExpressCluster:

---

### **Related Information:**

Refer to the *Reference Guide* as you need when operating ExpressCluster by following the procedures introduced in this guide. See the *Getting Started Guide* for the latest information including system requirements and lease information.

---

### **Configuring a cluster system (Section I)**

Before installing ExpressCluster, create the hardware configuration, the cluster system configuration and the information on the cluster system configuration.

#### **Step 1 Determining a system configuration (Chapter 1)**

Review the overview of ExpressCluster and determine the configurations of the hardware, network and software of the cluster system.

#### **Step 2 Configuring a cluster system (Chapter 2)**

Plan a failover group that is to be the unit of a failover, and determine the information required to install the cluster system.

### **Installing and configuring ExpressCluster X (Section II)**

Install ExpressCluster and apply the license registration and the cluster configuration data to it.

#### **Step 3 Installing ExpressCluster (Chapter 3)**

Install ExpressCluster on the servers that constitute a cluster.

#### **Step 4 Registering the license (Chapter 4)**

Register the license required to operate ExpressCluster.

#### **Step 5 Creating the cluster configuration data (Chapter 5)**

Based on the failover group information determined in the step 2, create the cluster configuration data by using the Builder, and then configure a cluster.

#### **Step 6 Verifying a cluster system (Chapter 6)**

Check if the cluster system has been created successfully.

**Evaluation before operating a cluster system (Section III)**

Conduct a dummy test, parameter tuning and operational simulation required to be done before operating the cluster system. The procedures to uninstall and reinstall are also explained in this section.

**Step 7 Verifying operation (Chapter 7)**

Check the operation and perform parameter tuning by a dummy-failure.

**Step 8 Preparing to operate a cluster system (Chapter 8)**

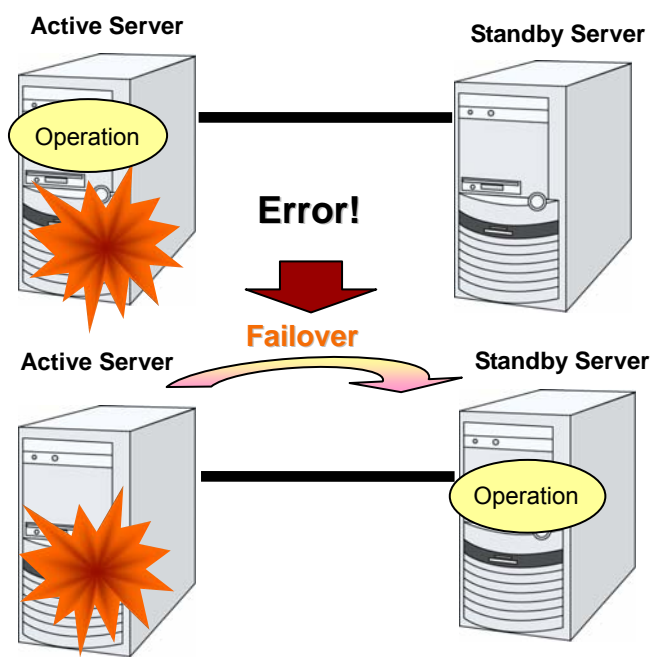
Check the task simulation, backup and/or restoration and the procedure to handle an error, which are required to operate a cluster system.

**Step 9 Uninstalling and reinstalling ExpressCluster (Chapter 9)**

This chapter explains how to uninstall, and reinstall the ExpressCluster.

## What is ExpressCluster?

ExpressCluster is software that enhances availability and expandability of systems by a redundant (clustered) system configuration. The application services running on the active server are automatically inherited to the standby server when an error occurs on the active server.



The following can be achieved by installing a cluster system that uses ExpressCluster.

- ◆ High availability  
The down time is minimized by automatically failing over the applications and services to a “healthy” server when one of the servers which configure a cluster stops.
- ◆ High expandability  
Both Windows and Linux support large scale cluster configurations having up to 32 servers.

---

### Related Information:

For details on ExpressCluster, refer to Chapter 2 “Using ExpressCluster” in the *Getting Started Guide*.

---

## ExpressCluster modules

ExpressCluster X consists of following three modules:

- ◆ **ExpressCluster Server**

The main module of ExpressCluster and has all high availability functions of the server. Install this module on each server constituting the cluster.

- ◆ **ExpressCluster X WebManager**

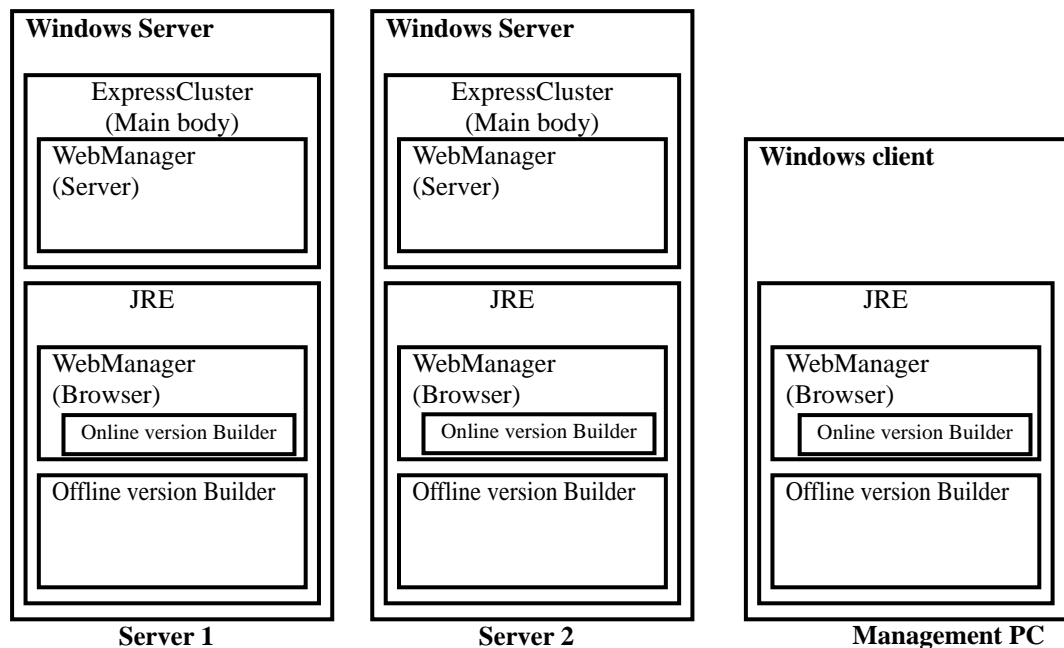
A tool to manage ExpressCluster operations and uses a Web browser as a user interface. The WebManager is installed in ExpressCluster Server, but it is distinguished from the ExpressCluster Server because the WebManager is operated through a Web browser on the management PC.

- ◆ **ExpressCluster X Builder**

A tool for editing the cluster configuration data.

The following two versions of Builder are provided: an online version that operates as the setup mode of WebManager, and an offline version that is individually installed on the management PC. The online version is incorporated into WebManager.

The Builder also uses a Web browser as a user interface the same way as the WebManager.



The WebManager and the ExpressCluster X Builder are Java applets that run on Java VM. The Builder and WebManager can run on any Windows machines as long as Java Runtime Environment (JRE) is installed. The WebManager and the Builder can be used on a server in the cluster as long as JRE is installed.

## Planning system configuration

You need to determine an appropriate hardware configuration to install a cluster system that uses ExpressCluster. The configuration examples of ExpressCluster are shown below.

---

### Related Information:

For latest information on system requirements, refer to Chapter 3, “Installation requirements for ExpressCluster” and Chapter 4 “Latest version information” in the *Getting Started Guide*.

---

## Shared disk type and mirror disk type

There are three types of system configurations: shared disk type, mirror disk type and hybrid disk type.

### ◆ Shared disk type

When the shared disk type configuration is used, application data is stored on a shared disk that is physically connected to servers, by which access to the same data after failover is ensured.

You can make settings that block the rest of the server from accessing the shared disk when one server is using a specific space of the shared disk.

The shared disk type is used in a system such as a database server where a large volume of data is written because performance in writing data does decrease.

### ◆ Mirror disk type

When the mirror disk type configuration is used, application data is mirrored between disks of two servers, by which access to the same data after failover is ensured.

When data is written on the active server, the data also needs to be written on the standby server. As a result, the writing performance will decrease.

However, the cost of the system can be reduced because no external disk such as a shared disk is necessary, and the cluster can be achieved only by disks on servers.

When configuring a remote cluster by placing the standby server in a remote site for disaster control, a shared disk cannot be used. Thus the mirror disk type is used.

### ◆ Hybrid type

This configuration is a combination of the shared disk type and the mirror disk type. By mirroring the data on the shared disk, the data is placed in the third server, which prevents the shared disk being a single point of failure.

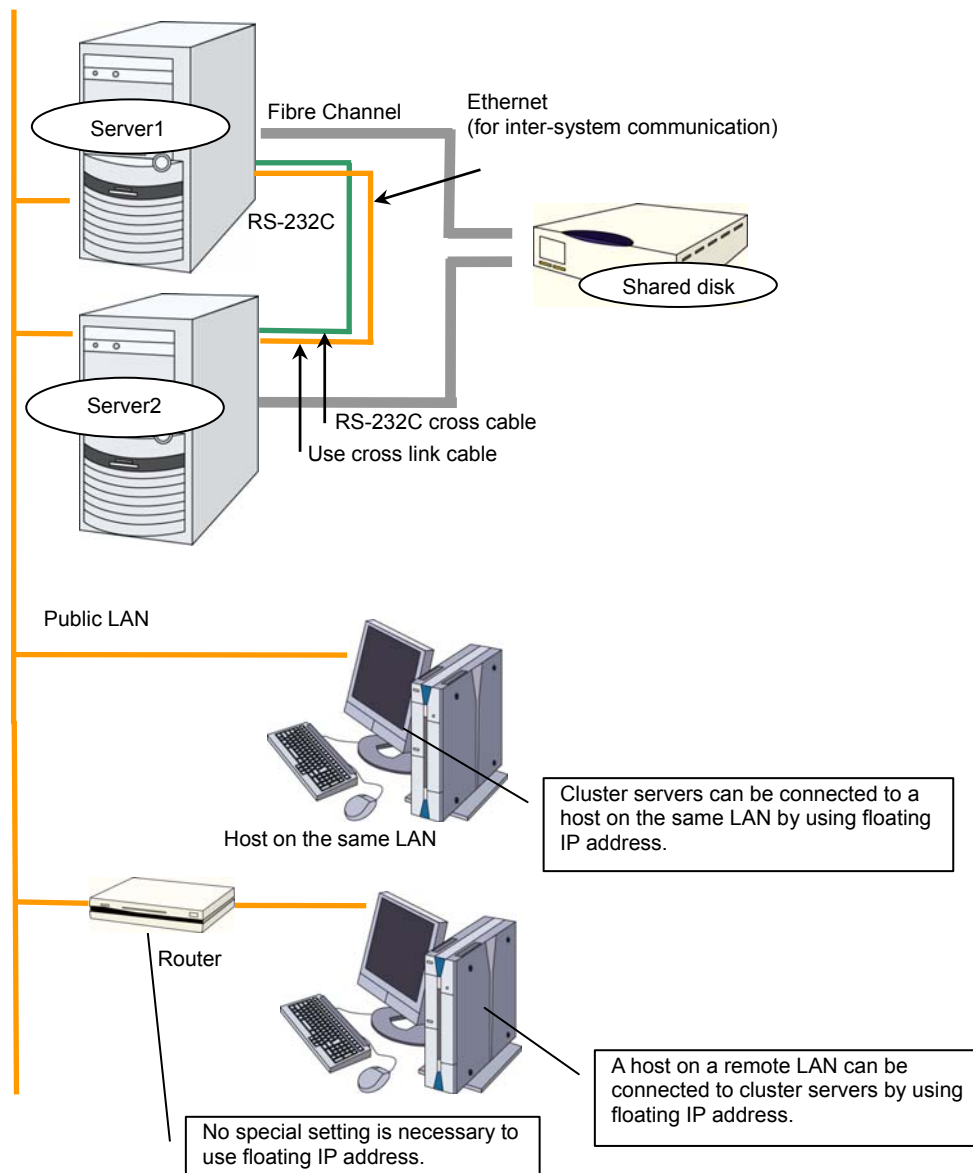
Data writing performance, operational topology and precautions of the mirror disk type apply to the hybrid type.

The following pages show examples of shared disk type, mirror disk type, and hybrid type configurations. Use these examples to design and set up your system.

## Example 1: Configuration using a shared disk with 2 nodes

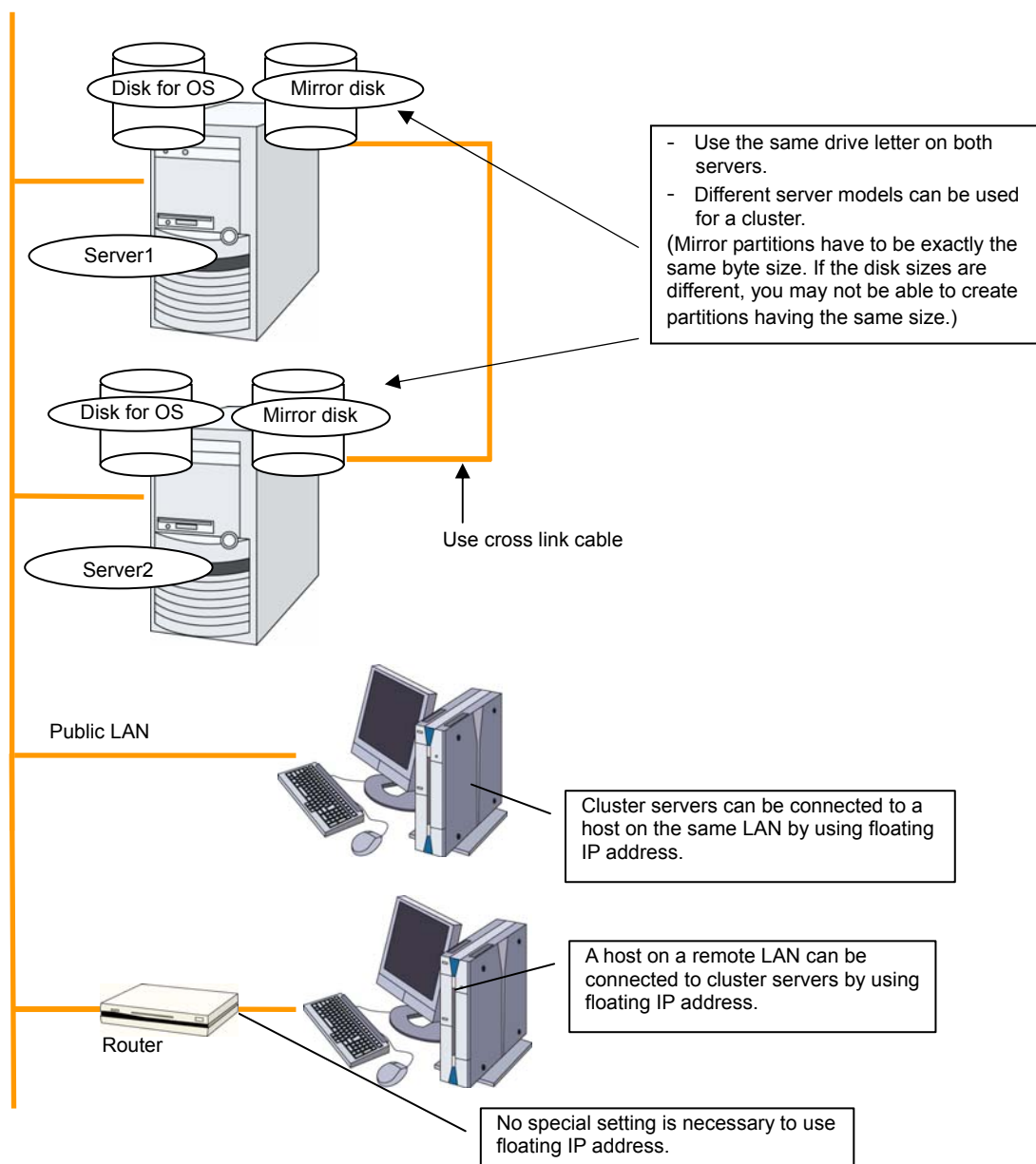
This is the most commonly used system configuration:

- ◆ Different models can be used for servers. However, mirroring disks should have the same drive letter in both servers.
- ◆ Use cross cables for interconnection. A dedicated HUB can be used for connection the same way as 3-nodes configuration.
- ◆ Connect COM (RS-232C) ports using a cross cable.



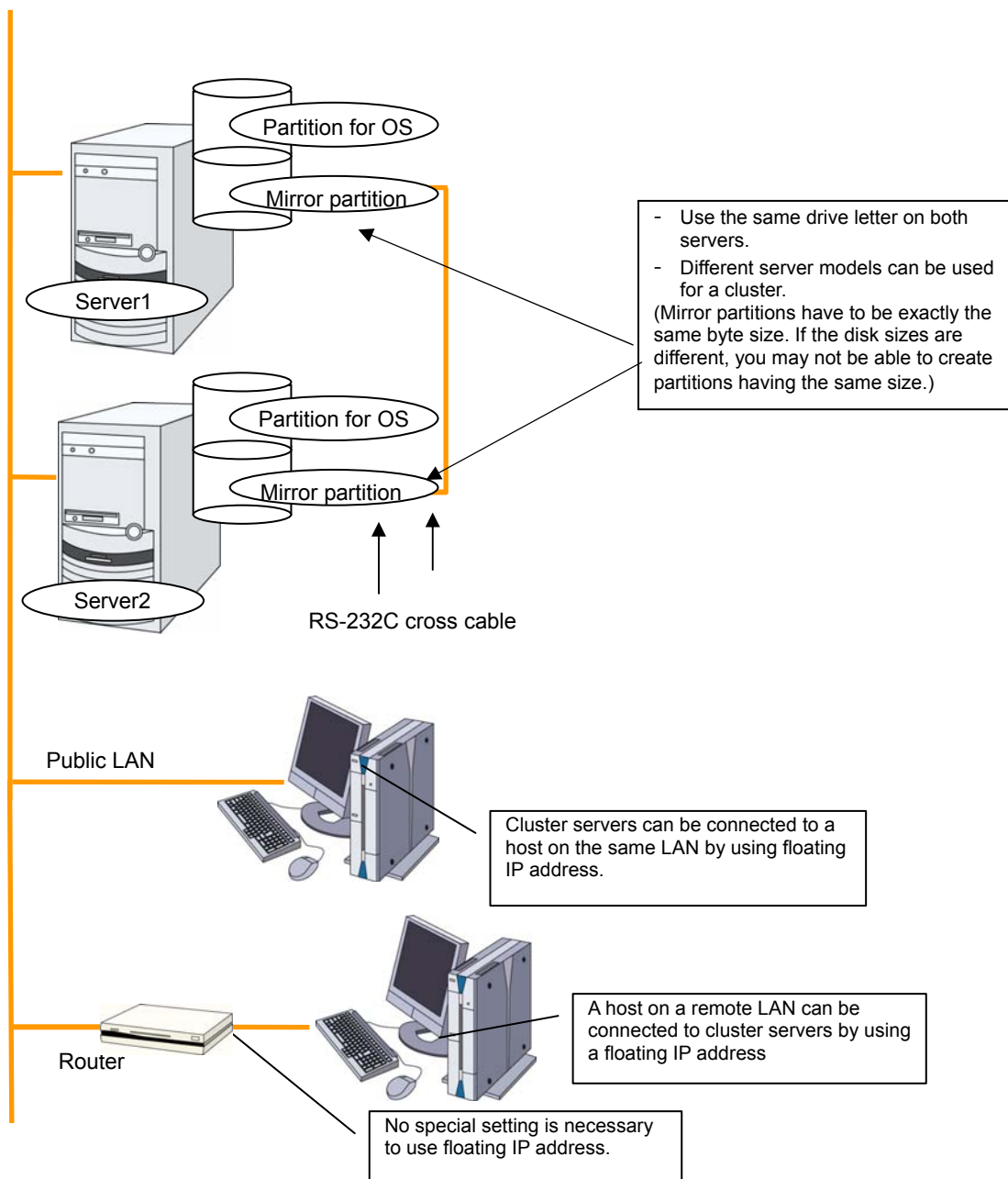
## Example 2: Configuration using mirror disks with 2 nodes

- ◆ Different models can be used for servers. However, the mirror disk should have the same drive letter on both servers.
- ◆ It is recommended to use cross cables for interconnection. A HUB can also be used.



### Example 3: Configuration using mirror partitions on the disks for OS with 2 nodes

- ◆ A mirroring partition can be created on the disk used for the OS.

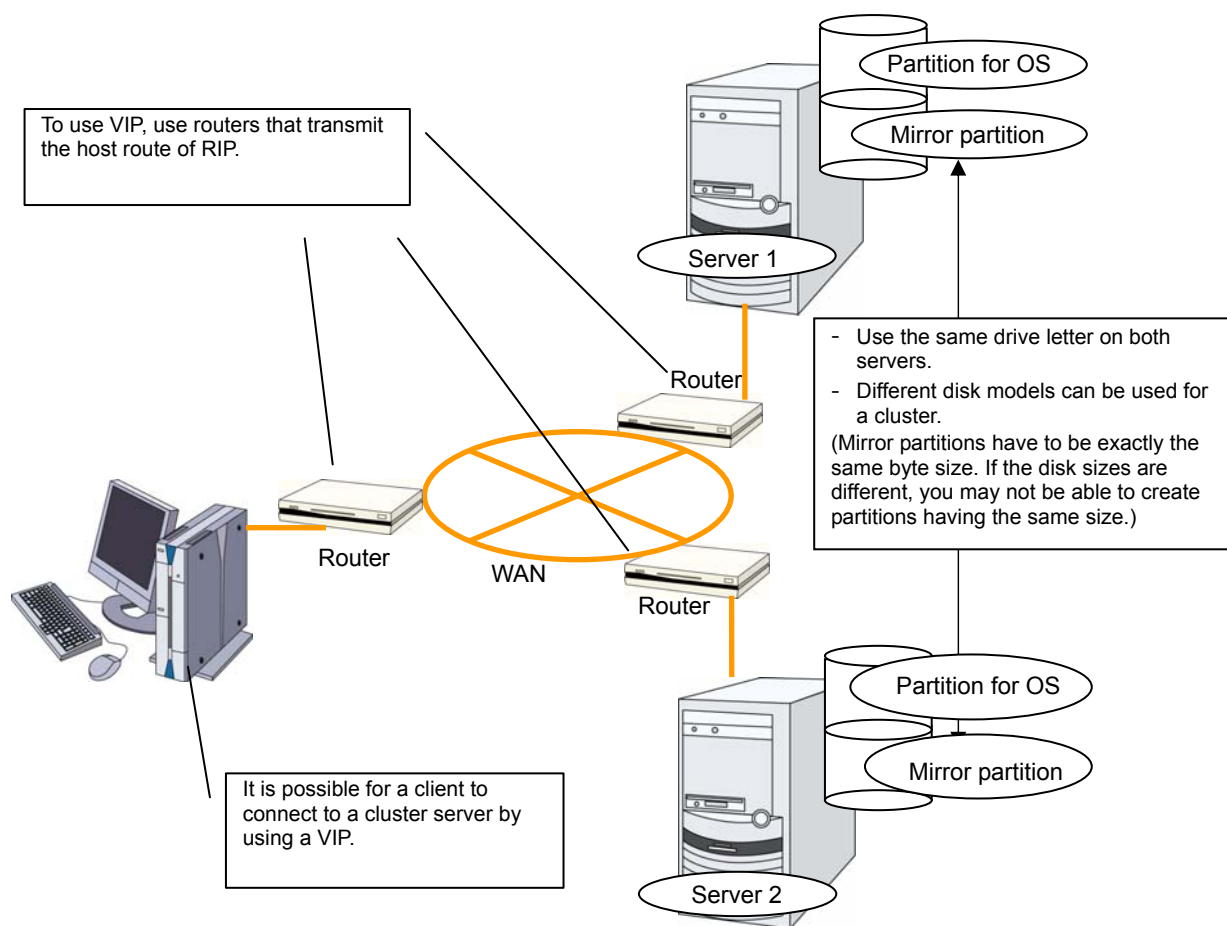


#### Related Information:

For mirror partition settings, refer to Chapter 5, "Group resource details" and "Understanding mirror disk resource" in the *Reference Guide*.

## Example 4: Configuring a remote cluster by using asynchronous mirror disks with 2 nodes

- ◆ Configuring a cluster between servers in remote sites by using WAN, as shown below, is a solution for disaster control.
- ◆ Because there is one communication path (interconnect) between servers, the chance of network partition due to network failures is high. Ping must be used to address network partition problems.
- ◆ Using asynchronous mirror disks can curb a decrease in disk performance due to the network delay. There is still a chance that the information updated immediately before a failover gets lost.
- ◆ It is necessary to secure enough communication bandwidth for the traffic amount of updated information on mirror disks. Insufficient bandwidth can cause delay of communication with a business operation client or interruption of mirroring.
- ◆ Because the IP address needs to be inherited from one network segment to another, use the IP address that is a virtual IP address (VIP), but not a floating IP address.

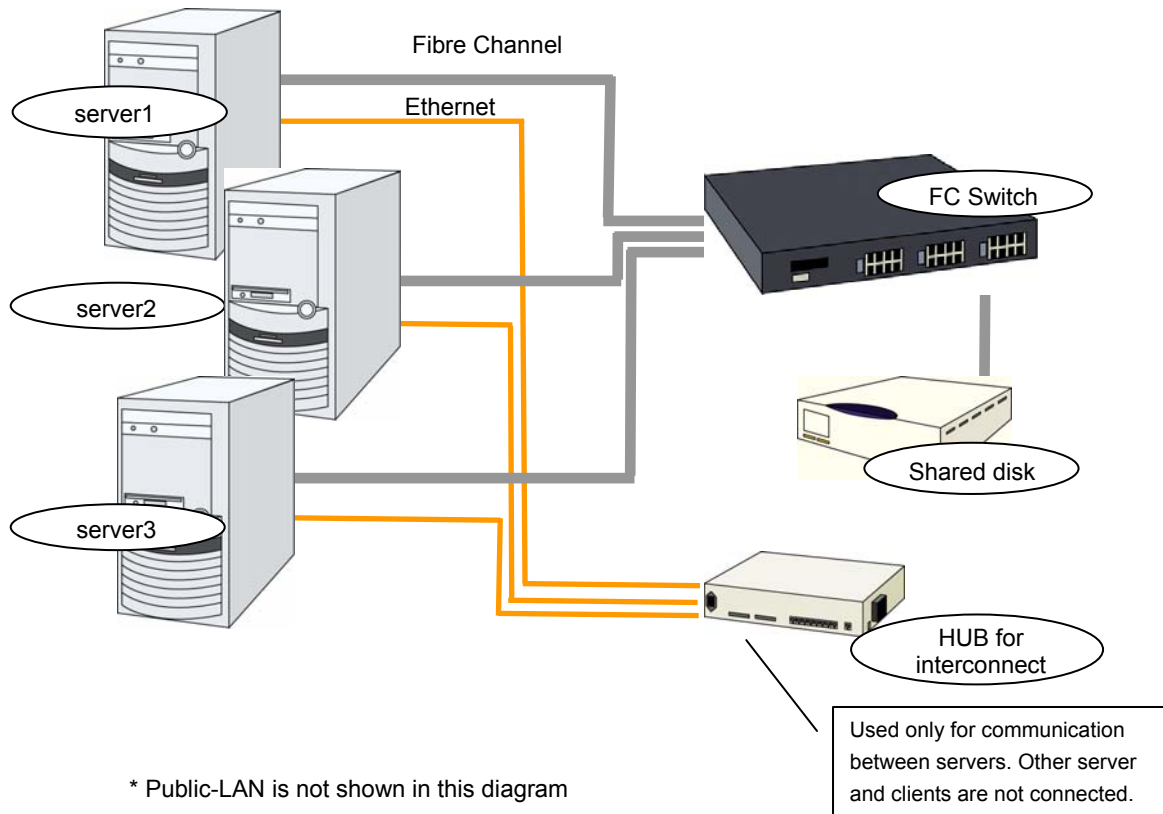


### Related Information:

For information on resolving network partition and the VIP settings, see “Understanding virtual IP resource” in Chapter 5, “Group resource details” and Chapter 8, “Details on network partition resolution resources” in the *Reference Guide*.

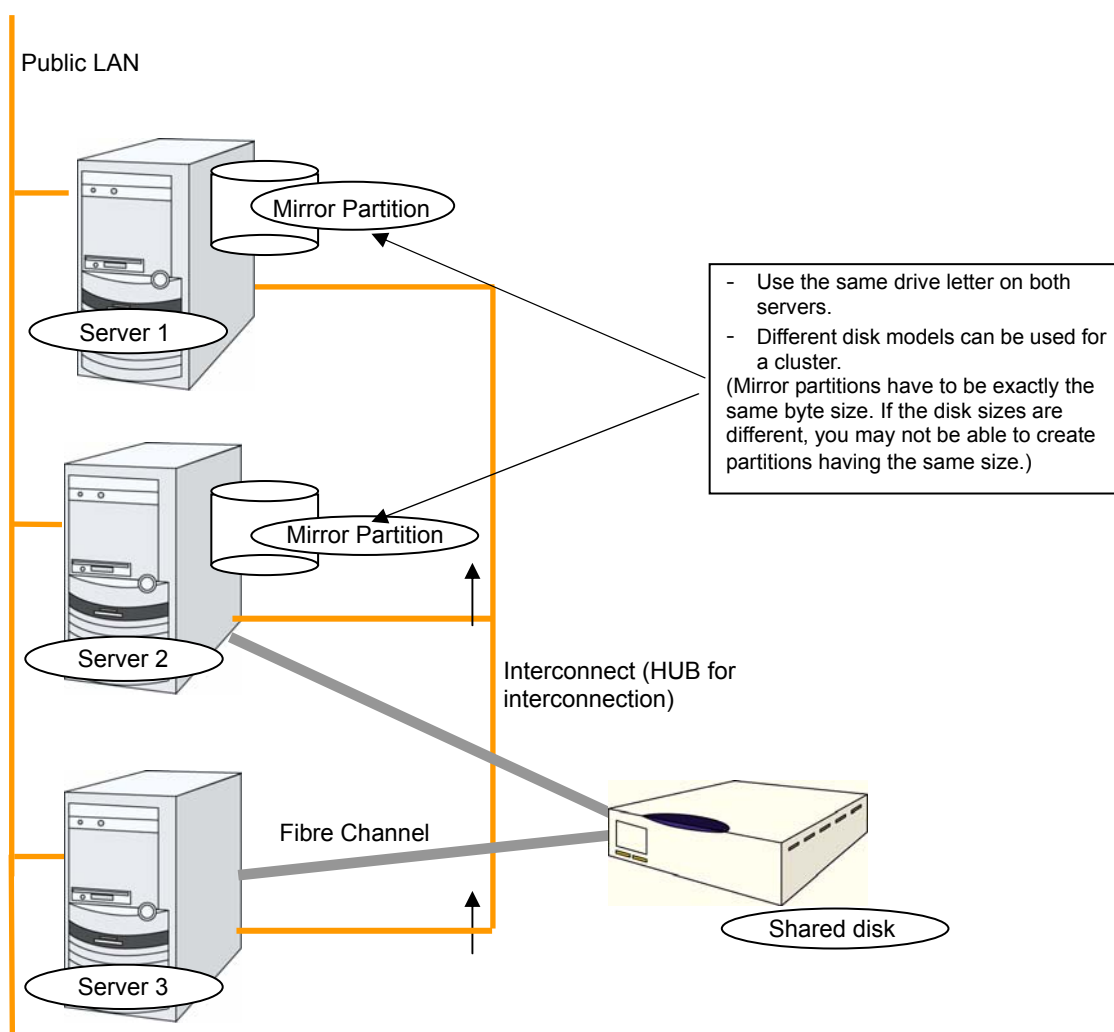
### Example 5: Configuration using a shared disk with 3 nodes

- ◆ The same way as 2 nodes-configuration, connect servers to a shared disk. The shared disk should have the same drive letter on all servers.
- ◆ Install a dedicated HUB for interconnection.
- ◆ It is not necessary to establish connectivity between servers using the connect COM (RS-232C).



## Example 6: Configuration using both mirror disks and a shared disk with 3 nodes

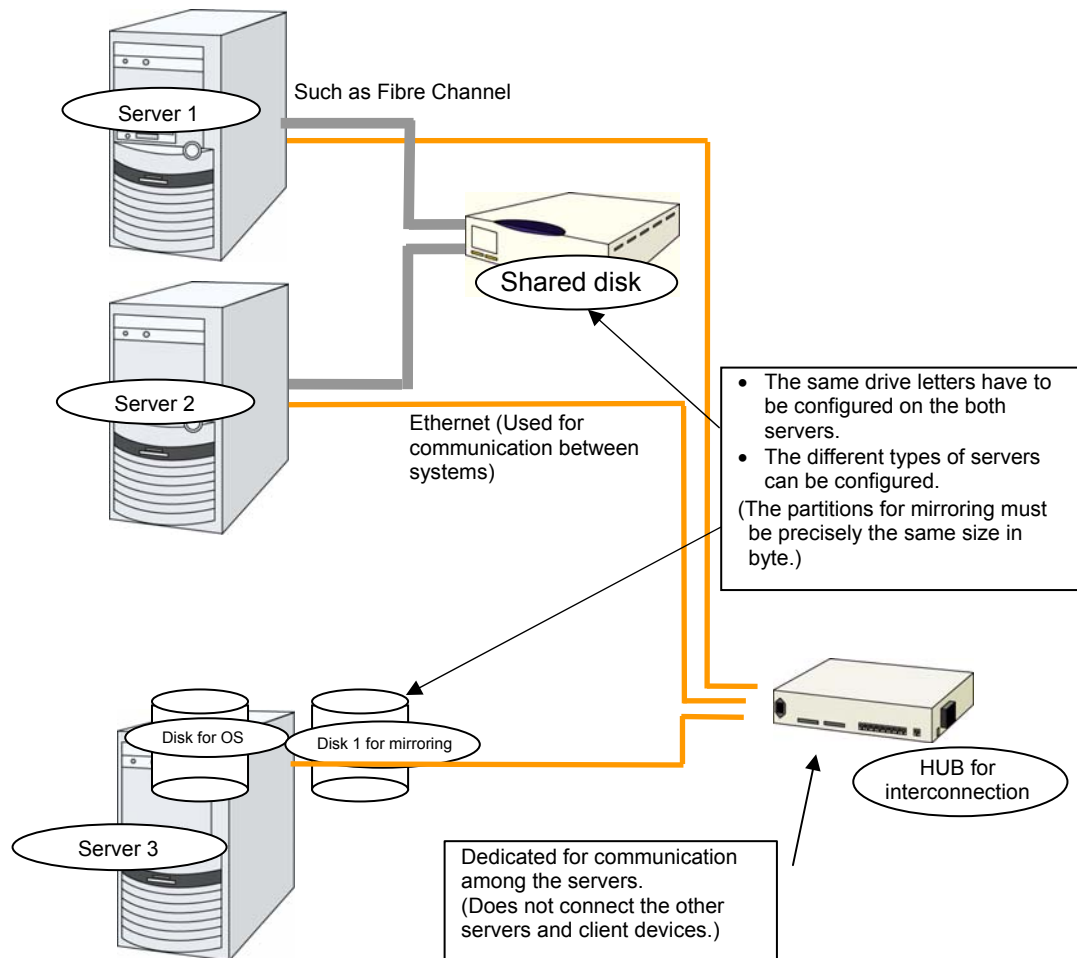
- ◆ It is possible to use both mirror disks and a shared disk on one cluster. In this example, the system is configured with three nodes: one for a shared disk type, one for a mirror disk type and, and one for standby.
- ◆ It is not necessary to connect a shared disk to the server where business applications using the shared disk do not run. However the shared disk needs to have the same drive letter on the all connecting servers.
- ◆ Install a dedicated HUB for interconnection.
- ◆ It is not necessary to establish connectivity between servers using the connect COM (RS-232C).



## Example 7: Configuration using the hybrid type with 3 nodes

This is a configuration with three nodes that consists of two nodes connected to the shared disk and one node having a disk to be mirrored.

- ◆ The servers should not necessarily be the same model.
- ◆ Install a dedicated HUB for interconnection and LAN of mirror disk connect.
- ◆ Use a HUB with faster performance as much as possible.

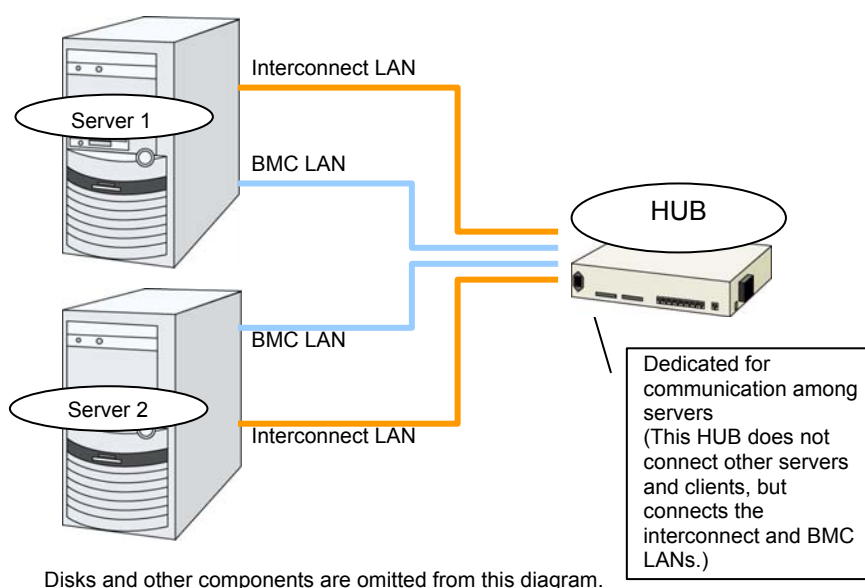


In this picture, public-LAN is abbreviated.

## Example 8: Configuration using BMC-related functions with two nodes

This is an example of 2-node cluster configuration for using the forced stop function of a physical machine, chassis identify function, BMC heartbeat resources, and the BMC linkage functions of the external linkage monitor.

- ◆ Different models of server can be used together, but each server must support the use of BMC linkage functions. For details about the available models, refer to “System requirements for hardware” of Chapter 3 “Installation Requirements for ExpressCluster” in the *Getting Started Guide*.
- ◆ When using BMC-related functions other than BMC heartbeat resources, connect the interconnect LAN and BMC management LAN via a dedicated HUB.
- ◆ Use as fast a HUB as is available.



## Checking system requirements for each ExpressCluster module

ExpressCluster X consists of three modules: ExpressCluster Server (main module), ExpressCluster X WebManager, and ExpressCluster X Builder. Check configuration and operation requirements of each machine where these modules will be used. For details about the operating environments, see Chapter 3 “Installation Requirements for ExpressCluster” in the *Getting Started Guide*.

## Determining a hardware configuration

Determine a hardware configuration considering an application to be duplicated on a cluster system and how a cluster system is configured. Read Chapter 2, “Configuring a cluster system” before you determine a hardware configuration.

---

**Related Information:**

Refer to Chapter 2, “Configuring a cluster system.”

---

## Settings after configuring hardware

After you have determined the hardware configuration and installed the hardware, verify the following:

1. Configuration of the shared disk settings (Required for shared disk)
2. Configuration of the mirror partition settings (Required for mirror disk)
3. Adjustment of the operating system startup time (Required)
4. Verification of the network settings (Required)
5. Verification of the firewall settings (Required)
6. Synchronization of the server clock (Recommended)
7. Power saving function – OFF (Required)
8. Setup of SNMP service (Required if ESM PRO Server is to be used cooperated with ExpressCluster)
9. Setup of BMC and `ipmiutil` (Required if the forced stop function of a physical machine and chassis ID lamp association are used)
10. Setup of the sub-system for UNIX base application (SUA) (Required if network warning light is used on Windows Server 2008)
11. Setup of a function equivalent to `rsh` provided by the network warning light vendor (Required if network warning light is used on Windows Server 2012)

## 1. Shared disk settings (Required for shared disk)

Set up the shared disk by following the steps below:

---

**Important:**

When you continue using the data on the shared disk (in the cases such as reinstalling the server), do not create partitions or a file system. If you create partitions or a file system, data on the shared disks will be deleted.

---

---

**Note:**

The partition to be allocated as described below cannot be used by mounting it on an NTFS folder.

---

**1.** Allocate a partition for disk heartbeat.

Allocate a partition on a shared disk to be used by the DISK Network Partition Resolution Resources in ExpressCluster. Create a partition on one of the servers in the cluster that uses the shared disk. Create the partition in the same way as you create ordinary partitions through “Disk Management” function of OS and set a drive letter. Configure it as RAW partition without formatting. Perform this operation on one of the servers to which a shared disk is connected. And then set the same drive letter on other servers that also use the same shared disk. Because the partition has been already created, you do not need to create a partition. Set only the drive letter without formatting from the OS disk management.

---

**Note:**

A disk heartbeat partition should be 17 MB (17,825,792 bytes) or larger. Leave the disk heartbeat partitions as RAW partition without formatting.

---

**2.** Allocate a cluster partition if you are using the hybrid disk type. 1.

Create a partition to be used for controlling the status of hybrid disk on the shared disk to be mirrored with hybrid disk resource. The procedures for making the cluster partition are the same as the ones for a partition of disk heartbeat resources.

---

**Important:**

A cluster partition should be 17 MB (17,825,792 bytes) or larger. Leave the cluster partition as RAW partition without formatting.

---

**3.** Allocate a switchable partition for disk resources or a data partition for hybrid disk resources on the shared disk.

Create a switchable partition for disk resources or a data partition for hybrid disk resources on a shared disk. Create a partition on one of the servers in the cluster that uses the shared disk. Create the partition through “Disk Management” function of OS, set a drive letter, and format NTFS.

Configure the same drive letter on the other server connected to the shared disk. Because the partition has been already created, you do not need to create a partition or format it. Because the access control for the shared disk starts performing after the setup of cluster has completed, do not start the multiple servers connected to the shared disk until the setup has completed. Otherwise, files or folders stored on the shared disk may be corrupted. Thus, make sure not to start the multiple servers connected to the shared disk at once till the server with ExpressCluster installed has been rebooted after a partition for disk resources has been formatted.

**Important:**

Do not start multiple servers connected with the shared disk simultaneously. The data on the shared disk may be corrupted.

---

## 2. Mirror partition settings (Required for mirror disks)

Set up partitions for mirror disk resources by following the steps below. This is required for a local disk (a disk connected to only one of the servers) to be mirrored with the shared disk in the hybrid configuration.

---

**Note 1:**

When you cluster a single server and continue using data on the existing partitions, do not re-create the partitions. If you re-create partitions, data on the shared disks will be deleted.

**Note 2:**

The partition to be allocated as described below cannot be used by mounting it on an NTFS folder.

---

### 1. Allocate cluster partitions.

Create partitions to be used by the mirror disk resources/hybrid disk resources. The partition is used for managing the status of mirror disk resources/hybrid disk resources. Create the partition in every server in the cluster that uses mirror resources. Create partitions by using “Disk Management” function of OS, and leave them as raw partition without formatting. Configure a drive letter for them.

---

**Note:**

The cluster partition should be 17 MB (17,825,792 bytes) or larger. Leave the disk cluster partition as RAW partition without formatting.

---

### 2. Allocate data partitions

Create the data partitions for mirroring by mirror disk resources/hybrid disk resources. For mirror disk resources, create the data partitions on the two servers on which disk mirroring is performed.

Format partitions with NTFS from “Disk Management” function of OS and configure a drive letter.

---

**Note:**

When partitions (drive) to be mirrored already exist (in the cases such as reinstalling ExpressCluster), you do not need to create partitions again. When data that should be mirrored already exist on partitions, if you create partitions again or format partitions, the data will be deleted.

A drive with a system drive and/or page file and a drive where ExpressCluster is installed cannot be used as partitions for mirror disk resources. The data partitions in both servers must be precisely the same size in byte. If the geometries of the servers differ among the servers, it might not be able to create precisely same size of partitions. Check the partition sizes with the `clpvolsz` command and adjust them. The same drive letter must be configured on the partitions in the servers.

---

### 3. Adjustment of the operating system startup time (Required)

It is necessary to configure the time from power-on of each node in the cluster to the server operating system startup to be longer than the following:

- ◆ The time from power-on of the shared disk to the point they become available.
- ◆ Heartbeat timeout time (30 seconds by default.)

Adjustment of the startup time is necessary to prevent the following problems:

- ◆ If the cluster system is started by powering on the shared disk and servers, starting a shared disk is not completed before the OS is rebooted. OS is started in the status where the shared disk is not recognized, and activation of disk resources fails.
- ◆ A failover fails if a server, with data you want to fail over by rebooting the server, reboots within the heartbeat timeout. This is because a remote server assumes that the heartbeat is continued.

Consider the times durations above and adjust the operating system startup time by following the procedure.

Windows Server 2003

Configure **Time to display list of operation systems** of **Startup and Recovery** setting in **System Properties**.

Windows Server 2008 / Windows Server 2012

Use the `bcdedit` command of Windows.

---

**Note:**

If only one OS is installed in the system, the wait time that you configured may be disabled. So that, add copy of operating system information.

Windows Server 2003:

Edit the `boot.ini` file manually.

Windows Server 2008 / Windows Server 2012

Use the `bcdedit` command with the `/copy` option specified.

---

### 4. Verification of the network settings (Required)

On all servers in the cluster, verify the status of the following network resources using the `ipconfig` or `ping` command.

- ◆ Public LAN (used for communication with all the other machines)
- ◆ LAN dedicated to interconnect (used for communication between ExpressCluster Servers)
- ◆ Host name

---

**Note:**

It is not necessary to specify the IP addresses of floating IP resources virtual resources used in the cluster in the operating system.

---

## 5. Verification of the firewall settings (Required)

ExpressCluster uses several port numbers for communication between the modules. For details about the port numbers to be used, see “Before Installing ExpressCluster” of Chapter 5 “Notes and Restrictions” in the *Getting Started Guide*.

## 6. Server clock synchronization (Recommended)

It is recommended to regularly synchronize the clocks of all the servers in the cluster. Make the settings that synchronize server clocks through protocol such as ntp on a daily basis.

---

**Note 1:**

When the time of each server is not synchronized, the system time on the server from a client’s point of view may change at a failover or group moving, which can lead to a failure of the operation of the application used in this system. The times of logs become different between servers, resulting in delay of failure analysis at occurrence of error.

**Note 2:**

If the date or time setting on the OS is changed while a system monitor resource is operating, the system resource may not operate normally.

---

## 7. Power saving function – OFF (Required)

In ExpressCluster, power saving function (for example, standby or hibernation) with OnNow, ACPI, and/or APM functions cannot be used. Make sure to turn off the power saving function by following the procedures below:

1. Click **Control Panel**, and select **Power Options**.
2. Click the **Power Schemes** tab, and then specify **Always On Power schemes**.  
In **Settings for Always On power scheme**, specify **Never** to **Turn off monitor** and **Turn off hard disks**.  
Specify **Never** to **System standby**.

---

**Note:**

Nothing needs to be specified if there is no option to specify for **Turn off monitor**, **Turn off hard disks**, and **System standby**.

---

3. Click the **Hibernate** tab, and clear the **Enable hibernation** check box.
4. Click **OK** and check if the status does not become OnNow.

## 8. Setup of SNMP service (Required if ESMPRO Server is to be used cooperated with ExpressCluster)

SNMP service is required if ESMPRO Server is to be used cooperated with ExpressCluster. Set up SNMP service first before installing ExpressCluster.

## 9. Setup of BMC and `ipmiutil` (Required for using the forced stop function of a physical machine and chassis ID lamp association)

For using the forced stop function of a physical machine and Chassis ID lamp association, configure the Baseboard Management Controller (BMC) of the servers to enable the communication between IP addresses of LAN ports for managing BMC and IP addresses used by the OS. These functions are not available when BMC is not installed on the server or when the network for managing BMC is disabled. For information on how to configure the BMC, refer to the manuals of your server.

These functions are used to control the BMC firmware in the servers by using IPMI Management Utilities (`ipmiutil`) provided as open source by the BSD license. `ipmiutil` must be installed on the servers to use these functions.

As of June 2012, `ipmiutil` can be obtained from the Website below.

<http://ipmiutil.sourceforge.net/>

Use `ipmiutil` of the versions 2.0.0 to 2.8.0

The following shows the combination of supported command and server.

| Version of <code>ipmiutil</code>                                       | Server   |
|--|--|
| <code>ipmiutil-2.0.7-win32</code>                                      | Express5800/110GR-1d<br>Express5800/120Rf-1<br>Express5800/120Rg-1 |
| <code>ipmiutil-2.0.0-win32</code><br><code>ipmiutil-2.8.0-win32</code> | Express5800/110GR-1d   |

ExpressCluster uses the `hwreset` command or `ireset` command, and `alarms` command or `ialarms` command of `ipmiutil`. To execute these commands without specifying path, include the path of the `ipmiutil` execution file in the system environment variable `PATH` or copy the execution file to the folder including the variable in its path (for example, the `bin` folder in the folder where ExpressCluster is installed).

Because ExpressCluster does not use the function that requires the IPMI driver, it is not necessary to install the IPMI driver.

To control BMC via LAN by the above commands, an IPMI account with Administrator privilege in BMC in each server. When you use NEC Express5800/100 series server, use User IDs 4 or later to add or change the account, because User IDs 3 or earlier are reserved by other tools. Use tools complying with the IPMI standards such as `IPMITool` for checking and changing account configuration.

## 10. Setup of the Subsystem for UNIX Application (SUA) (Required when the network warning light is used on Windows Server 2008)

For using the network warning light on Windows Server 2008, the Subsystem for UNIX Application (SUA) is required. Set up the Subsystem for UNIX Application (SUA) before installing ExpressCluster.

## 11. Setup of a function equivalent to `rsh` provided by the network warning light vendor (Required if network warning light is used on Windows Server 2012)

For using the network warning light on Windows Server 2012, set up a command equivalent to `rsh` supported by the warning light vendor.

# Chapter 2      Configuring a cluster system

This chapter provides information required to configure a cluster including requirements of applications to be duplicated, cluster topology, and explanation on resources constituting a cluster.

This chapter covers:

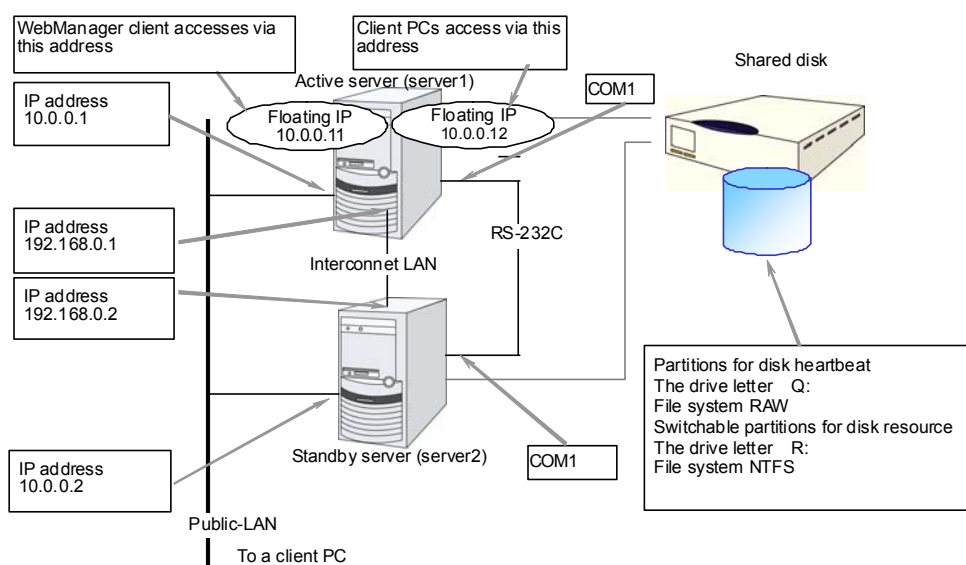
- Configuring a cluster system..... 36
- Determining a cluster topology..... 37
- Determining applications to be duplicated..... 40
- Planning a failover group ..... 44
- Considering group resources..... 45
- Understanding monitor resources ..... 46
- Understanding heartbeat resources..... 48
- Understanding network partition resolution resources ..... 49

## Configuring a cluster system

This chapter provides information necessary to configure a cluster system, including the following topics:

1. Determining a cluster system topology
2. Determining applications to be duplicated
3. Creating the cluster configuration data

The following is a typical example of cluster environment with 2 nodes where standby is uni-directional.

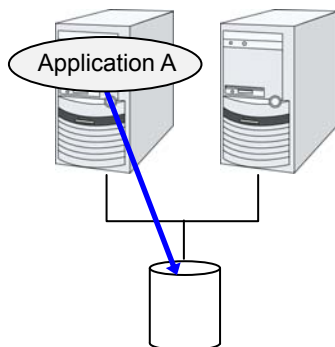


## Determining a cluster topology

ExpressCluster supports multiple cluster topologies. There are uni-directional standby cluster system that considers one server as an active server and other as standby server, and multi-directional standby cluster system in which both servers act as active and standby servers for different operations.

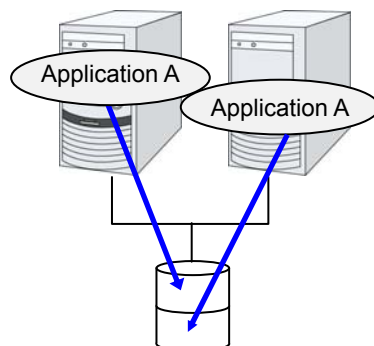
◆ **Uni-directional standby cluster system**

In this operation, only one application runs on an entire cluster system. There is no performance deterioration even when a failover occurs. However, resources in a standby server will be wasted.



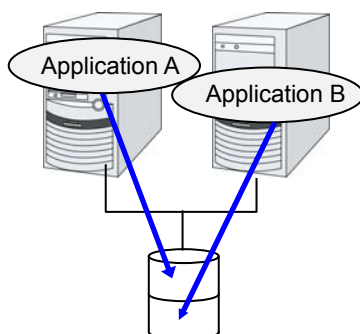
◆ **The same application – multi-directional standby cluster system**

In this operation, the same application runs on more than one server simultaneously in a cluster system. Applications used in this system must support multi-directional standby operations.



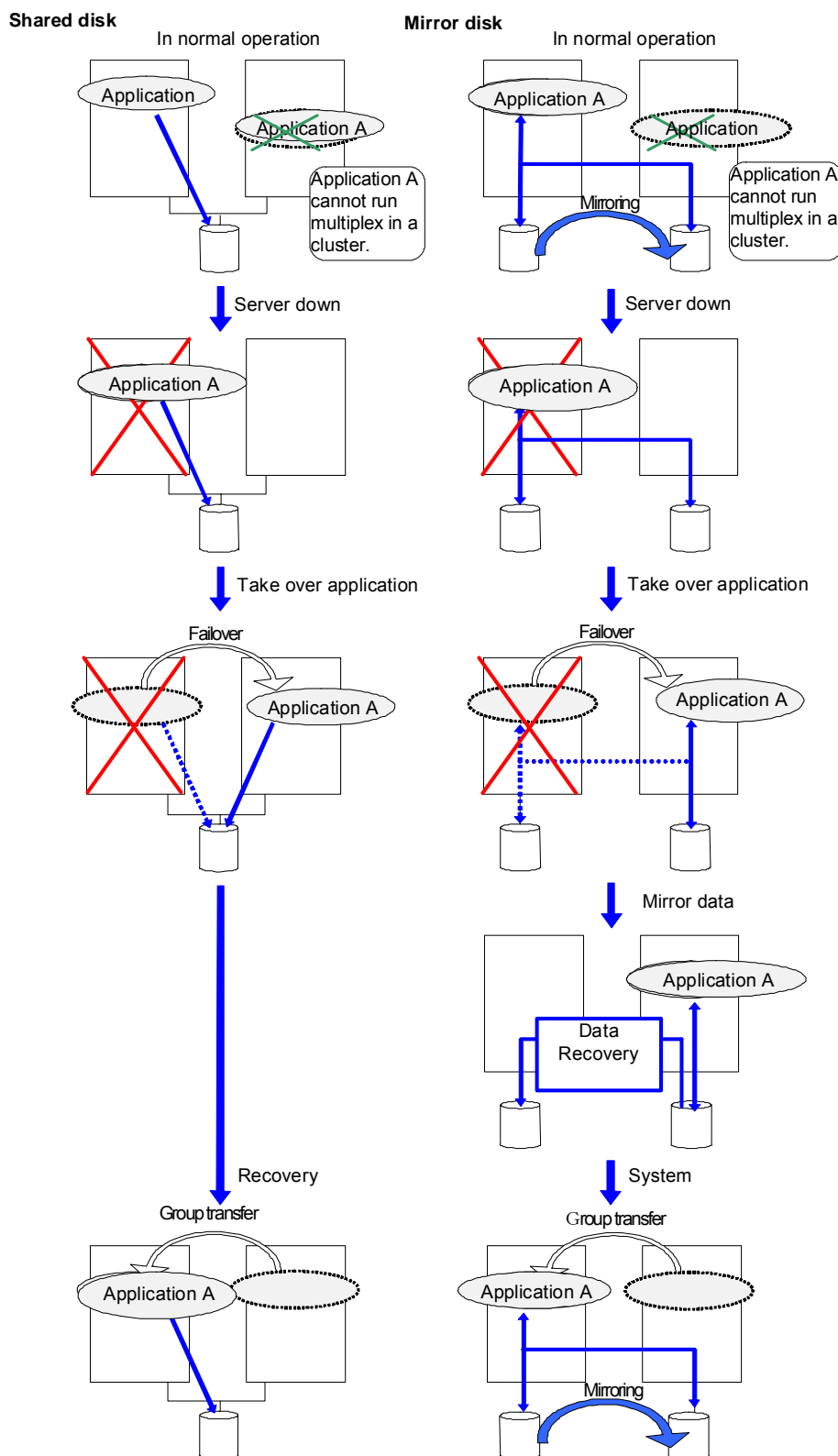
◆ **Different applications multi-directional standby cluster system**

In this operation, different applications run on different servers and standby each other. Resources will not be wasted during normal operation; however, two applications run on one server after failing over and system performance deteriorates.



## Failover in uni-directional standby cluster

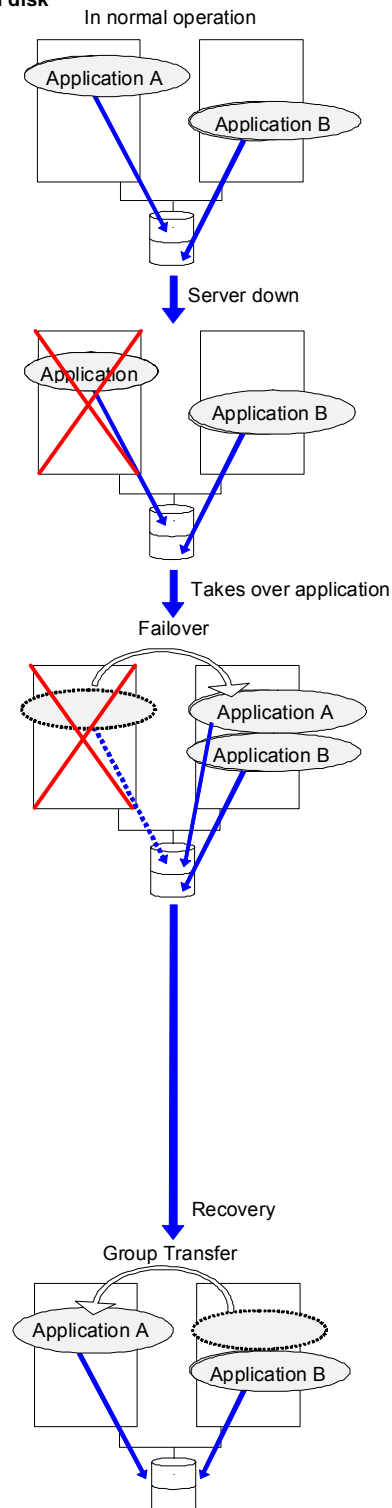
On a uni-directional standby cluster system, the number of groups for an operation service is limited to one as described in the diagrams below:



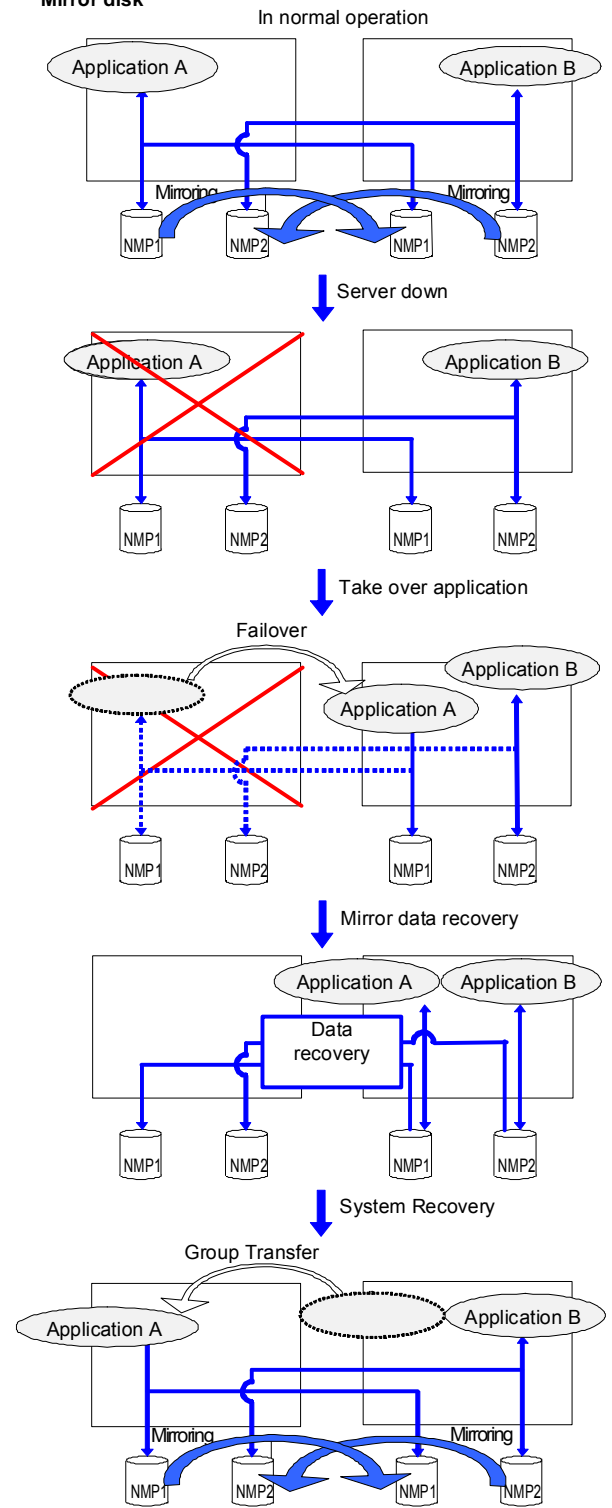
## Failover in multi-directional standby cluster

On a multi-directional standby cluster system, different applications run on servers. If a failover occurs on the one server, multiple applications start to run on the other server. As a result, the failover destination server is more loaded than the time of normal operation and performance decreases.

### Shared disk



### Mirror disk



## Determining applications to be duplicated

When you determine applications to be duplicated, study candidate applications taking what is described below into account to see whether or not they should be clustered in your ExpressCluster cluster system.

### Server applications

#### Note 1: Data recovery after an error

If an application was updating a file when an error has occurred, the file update may not be completed when the standby server accesses to that file after the failover.

The same problem can happen on a non-clustered server (single server) if it goes down and then is rebooted. In principle, applications should be ready to handle this kind of errors. A cluster system should allow recovery from this kind of errors without human interventions (from a script).

#### Note 2: Application termination

When ExpressCluster stops or transfers (performs online failback of) a group for application, it unmounts the file system used by the application group. Therefore, you have to issue an `exit` command for applications so that all files on the shared disk or mirror disk are stopped.

Typically, you give an `exit` command to applications in their stop scripts; however, you have to pay attention if an `exit` command completes asynchronously with termination of the application.

#### Note 3: Location to store the data

ExpressCluster can pass the following types of data between servers:

- ◆ Data in the switchable partition on the disk resource, or data in the data partition on the mirror disk resource/hybrid disk resource.
- ◆ The value of a registry key synchronized by a registry synchronous resource

Application data should be divided into the data to be shared among servers and the data specific to the server, and these two types of data should be saved separately. .

| Data type                       | Example                      | Where to store  |
|---------------------------------|------------------------------|---|
| Data to be shared among servers | User data, etc.              | Switching partition of the disk resource or data partition of the mirror disk resource/hybrid disk resource |
| Data specific to a server       | Programs, configuration data | On server's local disks   |

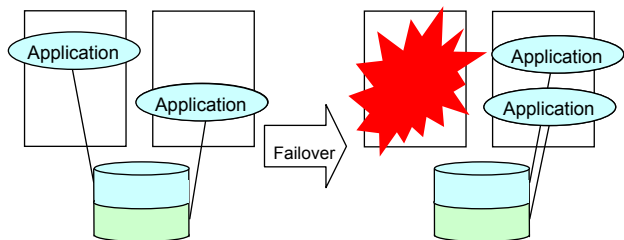
## Note 4: Multiple application service groups

When you run the same application service in the multi-directional standby operation, you have to assume (in case of degeneration due to a failure) that multiple application groups are run by the same application on a server.

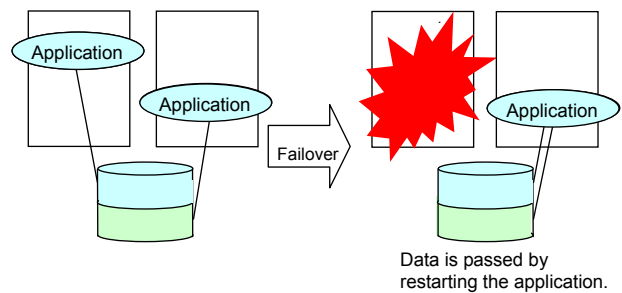
Applications should have capabilities to take over the passed resources by one of the following methods described in the diagram below. A single server is responsible for running multiple application groups.

The figures displayed below are the same with an example of a shared disk and/or mirror disk.

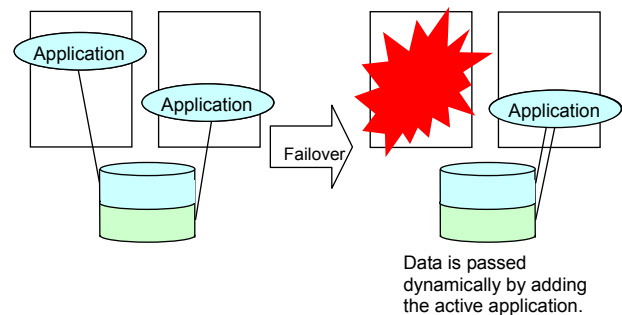
**Starting up multiple instances**  
This method invokes a new process.  
More than one application should co-exist and run.



**Restarting the application**  
This method stops the application which was originally running. Added resources become available by restarting it.



**Adding dynamically**  
This method adds resources in running applications automatically or by instructions from script.



## Note 5: Mutual interference and compatibility with applications

Sometimes mutual interference between applications and ExpressCluster functions or the operating system functions required to use ExpressCluster functions prevents applications or ExpressCluster from working properly.

- ◆ Access control of a shared disk and mirror disk  
Access to switchable partitions managed by a disk resource or the data partitions mirrored by a mirror disk resource/hybrid disk resource is restricted when such resource is inactive. The partitions become not readable and writable. If a shared disk or a mirror disk whose application is inactive (in other words not being accessible from user or application), is accessed, an I/O error occurs.  
  
Generally, you can assume when an application that is started up by ExpressCluster is started, the switchable partition or data partition to which it should access is already accessible.
- ◆ Multi-home environment and transfer of IP addresses  
In general, one server has multiple IP addresses in a cluster system. The IP address configuration of each server changes dynamically because a floating IP address and a virtual address move between servers. If an application used in the system does not support such multi-home environment, the system can malfunction. For example, an attempt to acquire the IP address of the local server may result in acquisition of the LAN address for interconnection, which is different from the address used for communicating with clients. For applications that should be conscious of the IP address on a server, IP address to be used should be specified explicitly.
- ◆ Access to shared disks or mirror disks from applications  
The stopping of application groups is not notified to other applications that coexist with the application. Therefore, if such an application is accessing a switchable partition or data partition used by an application group at the time when the application group stops, disk isolation will fail.  
  
Some applications like those responsible for system monitoring service periodically access all disk partitions. To use such applications in your cluster environment, they need a function that allows you to specify monitoring partitions.

## Configuration relevant to the notes

What you need to consider differs depending on which standby cluster system is selected for an application. Following is the notes for each cluster system. The numbers corresponds to the numbers of notes (1 through 5) described below:

- ◆ Note for uni-directional standby [Active-Standby]: 1, 2, 3, and 5
- ◆ Note for multi-directional standby [Active-Active]: 1 2 3 4 and 5
- ◆ Note for co-existing behaviors: 5  
(Applications co-exist and run. The cluster system does not fail over the applications.)

## Solutions to the problems relevant to the notes

| Problems  | Solution   | Note to refer                        |
|---|--|--------------------------------------|
| When an error occurs while updating a data file, the application does not work properly on the standby server.    | Modify the program, or add/modify script source to run a process to recover being updated during failover. | Note 1: Data recovery after an error |
| The application keeps accessing shared disk or mirror disk for a certain period of time even after it is stopped. | Execute the <code>sleep</code> command during stop script execution.                                       | Note 2: Application termination      |
| The same application cannot be started more than once on one server.  | In multi-directional operation, reboot the application at failover and pass the shared data.               | Note 3: Location to store the data   |

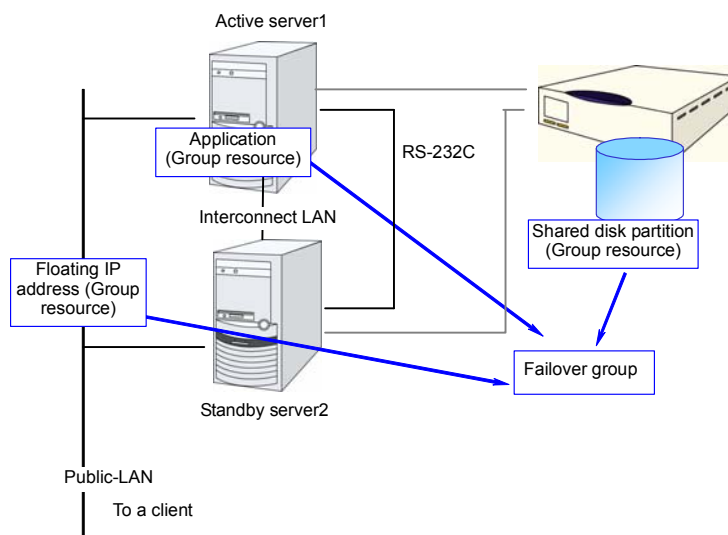
## How to determine a cluster topology

Carefully read this chapter and determine the cluster topology that suits your needs:

- ◆ When to start which application
- ◆ Actions that are required at startup and failover
- ◆ Data to be placed in switchable partitions or data partitions

## Planning a failover group

A failover group (hereafter referred to as group) is a set of resources required to perform an independent operation service in a cluster system. Failover takes place by the unit of group. A group has its own group name and the attribute of the group resources.



Resources in each group are handled by the unit of the group. If a failover occurs in group1 that has disk resource1 and floating IP address1, a failover of disk resource1 and a failover of floating IP address1 are concurrent. (Disk resource 1 never fails over alone.) Likewise, a resource is never included in other groups.

## Considering group resources

For a failover to occur in a cluster system, a group that works as a unit of failover must be created. A group consists of group resources. In order to create an optimal cluster, you must understand what group resources to be added to the group you create, and have a clear vision of your operation.

---

**Related Information:**

For details on each resource, refer to Chapter 5, “Group resource details” in the *Reference Guide*.

---

The following are currently supported group resources:

| Group Resource Name               | Abbreviation |
|-----------------------------------|--------------|
| Application resource              | appli        |
| CIFS resource                     | cifs         |
| Dynamic DNS resource              | ddns         |
| Floating IP resource              | fip          |
| Hybrid disk resource              | hd           |
| Mirror disk resource              | md           |
| NAS resource                      | nas          |
| Registry synchronization resource | regsync      |
| Script resource                   | script       |
| Disk resource                     | sd           |
| Service resource                  | service      |
| Print spooler resource            | spool        |
| Virtual computer name resource    | vcom         |
| Virtual IP resource               | vip          |
| VM resource                       | vm           |

## Understanding monitor resources

Monitor resources monitor specified targets. If an error is detected in a target, a monitor resource restarts and/or fails over the group resources.

There are two types of timing for monitoring monitor resources: always monitor and monitor when active.

**Always monitors** Monitoring is performed from when the cluster is started up until it is shut down.

**Monitors while activated:** Monitoring is performed from when a group is activated until it is deactivated.

---

### Related Information:

For the details of each resource, see Chapter 6, “Monitor resource details” in the *Reference Guide*.

---

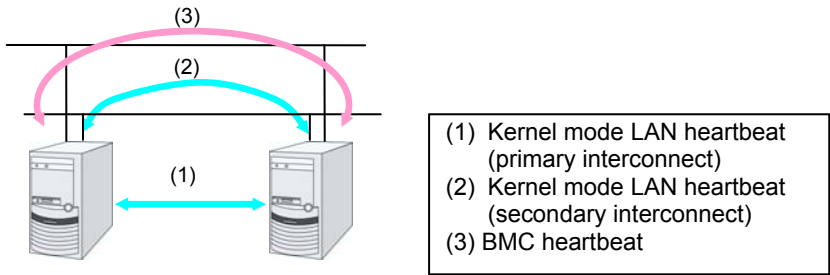
The following are currently supported monitor resources:

| Monitor Resource Name             | Abbreviation | Always monitors | Monitors While activated |
|-----------------------------------|--------------|-----------------|--------------------------|
| Application monitor resource      | appliw       |                 | ✓                        |
| CIFS monitor resource             | cifsw        |                 | ✓                        |
| DB2 monitor resource              | db2w         |                 | ✓                        |
| Dynamic DNS monitor resource      | ddnsw        |                 | ✓                        |
| Disk RW monitor resource          | diskw        | ✓               |                          |
| Floating IP monitor resource      | fipw         |                 | ✓                        |
| FTP monitor resource              | ftpw         |                 | ✓                        |
| Custom monitor resource           | genw         | ✓               |                          |
| Hybrid disk monitor resource      | hdw          | ✓               |                          |
| Hybrid disk TUR monitor resource  | hdtw         | ✓               |                          |
| HTTP monitor resource             | httpw        |                 | ✓                        |
| IMAP4 monitor resource            | imap4w       |                 | ✓                        |
| IP monitor resource               | ipw          | ✓               |                          |
| Mirror disk monitor resource      | mdw          | ✓               |                          |
| Mirror connect monitor resource   | mdnw         | ✓               |                          |
| NIC Link UP/Down monitor resource | miiw         | ✓               |                          |
| Multi-target Monitoring Resource  | mtw          | ✓               |                          |
| NAS monitor resource              | nasw         |                 | ✓                        |
| ODBC monitor resource             | odbcw        |                 | ✓                        |
| Oracle monitor resource           | oraclew      |                 | ✓                        |
| OfficeScan CL monitor resource    | oscw         | ✓               |                          |
| OfficeScan SV monitor resource    | ossww        |                 | ✓                        |
| OracleAS monitor resource         | oracleasw    |                 | ✓                        |

| Monitor Resource Name                     | Abbreviation | Always monitors | Monitors While activated |
|---|--------------|-----------------|--------------------------|
| WebOTX monitor resource                   | otxw         |                 | ✓                        |
| Pop3 monitor resource                     | pop3w        |                 | ✓                        |
| PostgreSQL monitor resource               | psqlw        |                 | ✓                        |
| Registry synchronization monitor resource | regsyncw     |                 | ✓                        |
| Disk TUR monitor resource                 | sdw          | ✓               |                          |
| Service monitor resource                  | servicew     |                 | ✓                        |
| SMTP monitor resource                     | smtpw        |                 | ✓                        |
| Print spooler monitor resource            | spoolw       |                 | ✓                        |
| SQL Server monitor resource               | sqlserverw   |                 | ✓                        |
| Tuxedo monitor resource                   | tuxw         |                 | ✓                        |
| Virtual computer name monitor resource    | vcomw        |                 | ✓                        |
| Virtual IP monitor resource               | vipw         |                 | ✓                        |
| Websphere monitor resource                | wasw         |                 | ✓                        |
| Weblogic monitor resource                 | wls          |                 | ✓                        |
| VM monitor resource                       | vmw          |                 | ✓                        |
| Message receive monitor resource          | mrw          | ✓               |                          |
| JVM monitor resource                      | jraw         | ✓               | ✓                        |
| System monitor resource                   | sraw         | ✓               |                          |
| Process name monitor resource             | psw          | ✓               | ✓                        |
| User space monitor resource               | userw        | ✓               |                          |

# Understanding heartbeat resources

Servers in a cluster system monitor whether or not other servers in the cluster are active.



| Type of Heartbeat Resource                  | Abbreviation | Functional Overview   |
|---|--------------|---|
| Kernel mode LAN heartbeat resource (1), (2) | lankhb       | A kernel mode module uses a LAN to monitor whether or not servers are active. |
| BMC heartbeat                               | bmchb        | A module uses BMC to monitor whether or not servers are active.               |

- ◆ At least one kernel mode LAN heartbeat resource needs to be set. Setting up more than two is recommended.

## Understanding network partition resolution resources

Network partitioning or the “Split Brain Syndrome” refers to the status where all communication channels have problems and the network between servers is partitioned.

In a cluster system that is not equipped with solutions for the “Split Brain Syndrome,” a failure on a communication channel cannot be distinguished from an error on a server. This can cause data corruption brought by access from multiple servers to the same resource. ExpressCluster, on the other hand, distinguishes a failure on a server from the “Split Brain Syndrome” when the heartbeat from a server is lost. If the lack of heartbeat is determined to be caused by the server failure, the system performs a failover by activating each resource and rebooting applications on a server running normally. When the lack of heartbeat is determined to be caused by the “Brain Split Syndrome,” emergency shutdown is executed because protecting data has higher priority over continuity of the operation. Network partitions can be resolved by the following methods:

### ◆ COM method

- Available in a 2-nodes cluster
- Cross cables are needed.
- The COM channel is used to check if the other server is active and then to determine whether or not the problem is caused by the Brain Split syndrome.
- If a server failure occurs when there is a failure in the COM channel (such as COM port and serial cross cable), resolving the network partition fails. Thus, a failover does not take place. Emergency shutdown takes place in servers including the normal server.
- If a failure occurs on all network channels when the COM channel is working properly, it is regarded as network partitions. In this case, emergency shutdown takes place in all servers except the master server.
- If a failure occurs on all network channels when there is a problem in the COM channel (such as COM port and serial cross cable), emergency shutdown takes in all servers excluding the master server.
- If failures occur in all network channels between cluster server and the COM channel simultaneously, both active and standby servers fail over. This can cause data corruption due to access to the same resource from multiple servers.

### ◆ PING method

- A device that is always active to receive and respond to the `ping` command (hereafter described as ping device) is required.
- More than one ping device can be specified.
- When the heartbeat from the other server is lost, but the ping device is responding to the `ping` command, it is determined that the server without heartbeat has failed and a failover takes place. If there is no response to the `ping` command, the local server is isolated from the network due to the Split Brain syndrome, and emergency shutdown takes place. This will allow a server that can communicate with clients to continue operation even if the Split Brain syndrome occurs.
- When the status where no response returns from the `ping` command on all servers continues before the heartbeat is lost, which is caused by a failure in the ping device, the network partitions cannot be resolved. If the heartbeat is lost in this status, a failover takes place in all servers. Because of this, using this method in a cluster with a shared disk can cause data corruption due to access to a resource from multiple servers.

### ◆ **DISK method**

- Available to a cluster that uses a shared disk.
- A dedicated disk partition (disk heartbeat partition) is required on the shared disk.
- The Brain Split syndrome is determined by writing data periodically on a shared disk and calculating the last existing time of the other server.
- If the heartbeat from other server is lost while there is any failure in the shared disk or channel to the shared disk (such as SCSI bus), resolving network partitions fails, which means failover does not take place. In this case, emergency shutdown takes place in servers working properly.
- If failures occur on all network channels while the shared disk is working properly, a network partition is detected. Then failover takes place in the master server and a server that can communicate with the master server. Emergent shutdown takes place in the rest of servers.
- Compared to the other methods, the time needed to resolve network partitions is longer in the shared disk method because the delay of the disk I/O must be taken into account. The time is about twice as long as the heartbeat time-out and disk I/O wait time.
- If the I/O time to the shared disk is longer than the disk I/O wait time, the resolving network may time out, and failover may not take place.

---

#### **Note:**

Shared DISK method cannot be used if VERITAS Storage Foundation is used.

---

### ◆ **COM + DISK method**

- This is a method that combines the COM method and the DISK method. This method is available in a cluster that uses a shared disk with two nodes.
- This method requires serial cross cables. A dedicated disk partition (disk heartbeat partition) must be allocated on the shared disk.
- When the COM channel (such as a COM port and serial cross cable) is working properly, this method works in the same way as the COM method. When an error occurs on the COM channel, this method switches to the shared DISK method. This mechanism offers higher availability than the COM method. The method also achieves network partition resolving faster than the DISK method.
- Even if failures occur on all network channels between cluster servers and the COM channel simultaneously, emergency shutdown takes place at least on one of the servers. This will prevent data corruption.

**◆ PING + DISK method**

- This is a method that the PING method and the DISK are combined.
- This method requires a device (a ping device) that can always receive the `ping` command and return response. You can specify more than one ping device. This method also requires the dedicated disk partition (disk heartbeat partition) on the shared disk.
- This method usually works in the same way as the PING method. However, if the state where a response to the `ping` command on all servers does not return continues, due to a failure of the ping device before the heartbeat is lost, the method is switched to the DISK method. If the servers using the NP resolution resources of the PING method and those using the NP resolution resources of the DISK method do not match (such as when the PING method resources are used by all servers, but the DISK method resources are used only by some servers connected to a shared disk), the resources of these two types work independently. Therefore, the DISK method works as well, regardless of the state of the ping device.
- If the heartbeat from the other server is lost while there is a failure in the shared disk and/or a path to the shared disk, emergency shutdown takes place even if there is response to the `ping` command.

**◆ Majority method**

- This method can be used in a cluster with three or more nodes.
- This method prevents data corruption caused by the Split Brain syndrome by shutting down a server that can no longer communicate with the majority of the servers in the entire cluster because of network failure. When communication with exactly half of the servers in the entire cluster is failing, emergency shutdown takes place in a server that cannot communicate with the master server.
- When more than half of the servers are down, the rest servers running properly also go down.
- If all servers are isolated due to a hub error, all servers go down.

**◆ Not solving the network partition**

- This method can be selected in a cluster that does not use any disk resource (a shared disk).
- If a failure occurs on all network channels between servers in a cluster, all servers failover.

- ◆ The following are the recommended methods to resolve the network partition:
  - The PING method is recommended for a remote cluster.
  - The ping + shared disk method is recommended for a cluster that uses a shared disk with three or more nodes. When using the hybrid type, use the PING + DISK method for the servers connected to the DISK, and use only the PING method for the servers not connected to the shared disk.
  - The PING method is recommended for a cluster with three or more nodes but without a shared disk.
  - The COM + DISK method or the PING + DISK method is recommended for a cluster that uses a shared disk with two nodes.
  - The COM method or the PING method is recommended for a cluster with two nodes but without a shared disk.

| Method to resolve a network partition | Number of nodes | Required hardware   | Circumstance where failover cannot be performed | When all network channels are disconnected                      | Circumstance where both servers fail over  | Time required to resolve network partition                                 |
|---------------------------------------|-----------------|---|---|---|--|--|
| COM                                   | 2               | Serial cable  | COM error                                       | The master server survives                                      | COM error and network disconnection occur simultaneously   | 0  |
| DISK                                  | No limit        | Shared disk   | Disk error                                      | The master server survives                                      | None   | Time calculated by the heartbeat timeout and disk I/O wait time is needed. |
| PING                                  | No limit        | Device to receive the ping command and return a response              | None  | Server that responds to the ping command survives               | All networks are disconnected after the ping command timeouts the specified times consecutively. | 0  |
| COM + DISK                            | 2               | Serial cables shared disk   | COM error and disk error                        | The master server survives                                      | None   | 0  |
| PING + DISK                           | No limit        | Device to receive the ping command and return response<br>Shared disk | None  | Server responding to the ping command survives                  | None   | 0  |
| Majority                              | 3 or more       | None  | Majority of servers go down                     | A server that can communicate with majority of servers survives | None   | 0  |
| None                                  | No limit        | None  | None  | All servers fail over   | All networks are disconnected  | 0  |

## **Section II   Installing and configuring ExpressCluster X**

This section describes procedures to install ExpressCluster. Install ExpressCluster on server machines and create configuration data by using the ExpressCluster X Builder to build a cluster system. Then run operation tests and verify the system operates successfully.

- Chapter 3   Installing ExpressCluster
- Chapter 4   Registering the license
- Chapter 5   Creating the cluster configuration data
- Chapter 6   Verifying a cluster system



# Chapter 3      Installing ExpressCluster

This chapter provides instructions for installing ExpressCluster. Installing ExpressCluster means installing the ExpressCluster Server. A management tool, ExpressCluster X WebManager, will be automatically installed when accessing the ExpressCluster Server from the browser on the management PC. It is not necessary to install the ExpressCluster X WebManager separately.

This chapter covers:

- Steps from Installing ExpressCluster to creating a cluster ..... 56
- Installing the ExpressCluster Server ..... 57

## Steps from Installing ExpressCluster to creating a cluster

The following describes the steps from installing ExpressCluster, license registration, cluster system creation, to verifying the cluster system status.

Before proceeding to the steps, make sure to read Section I and check system requirements and the configuration of a cluster.

### 1. Install the ExpressCluster Server

Install the ExpressCluster Server, which is the core ExpressCluster module, to each server that constitutes a cluster. When installing the Server, a license registration is performed as well. (See Chapter 3, “Installing ExpressCluster.”)

#### Reboot the server

### 2. Create the cluster configuration data using ExpressCluster X Builder

Create the cluster configuration data by using the Builder. (See Chapter 5, “Creating the cluster configuration data.”)

### 3. Create a cluster

Create a cluster by applying the cluster configuration data created with the Builder. (See Chapter 5, “Creating the cluster configuration data.”)

### 4. Verify the cluster status using the WebManager

Verify the status of a cluster that you have created using the WebManager. (See Chapter 6, “Verifying a cluster system.”)

---

#### Related Information:

You need to refer to the *Reference Guide* as needed by following the steps written in this guide to perform operation following this guide. For the latest information on the system requirements and lease information, refer to Chapter 3, “Installation requirements for ExpressCluster” and Chapter 4, “Latest version information” in the *Getting Started Guide*.

---

## Installing the ExpressCluster Server

Install the ExpressCluster Server, which is an ExpressCluster module, on each server machine constituting a cluster system.

License registration is required in installing the Server. Make sure to have the required license file or license sheet.

The ExpressCluster Server consists of the following system services:

| System Service Name                  | Description                                   |
|--------------------------------------|---|
| ExpressCluster                       | ExpressCluster                                |
| ExpressCluster Disk Agent            | Shared disk, mirror disk, hybrid disk control |
| ExpressCluster Event                 | Event log output                              |
| ExpressCluster Java Resource Agent   | Java Resource Agent                           |
| ExpressCluster Manager               | WebManager Server                             |
| ExpressCluster Old API Support       | Compatible API process                        |
| ExpressCluster Server                | ExpressCluster Server                         |
| ExpressCluster System Resource Agent | System Resource Agent                         |
| ExpressCluster Transaction           | Communication process                         |
| ExpressCluster Web Alert             | Alert synchronization                         |

## Installing the ExpressCluster Server for the first time

Install the ExpressCluster X on all servers that constitute the cluster by following the procedures below.

---

**Important:**

When a shared disk is used, make sure not to start more than one OS on servers connected to the shared disk before installing ExpressCluster. Data on the shared disk may be corrupted.

---

---

**Note 1:**

Install the ExpressCluster Server using Administrator account.

**Note 2:**

When installing ExpressCluster server, Windows media sense function which is the function to deactivate IP address due to disconnection of the cable at link down occurrence will be disabled.

**Note 3:**

If the Windows SNMP Service has already been installed, the SNMP linkage function will be automatically set up when the ExpressCluster Server is installed. If, however, the Windows SNMP Service has not yet been installed, the SNMP linkage function will not be set up.

When setting up the SNMP linkage function after installing the ExpressCluster Server, refer to "Setting up the SNMP linkage function manually."

---

1. Insert the installation CD-ROM into the CD-ROM drive.
2. After the menu window is displayed, select ExpressCluster® for Windows.

---

**Note:**

If the menu window does not open automatically, double-click the **menu.exe** in the root folder of the CD-ROM.

---

3. Select ExpressCluster® X 3.2 for Windows.
4. The **NEC ExpressCluster Setup** window is displayed. Click **Next**.
5. The **Choose Destination Location** dialog box is displayed. When changing the install destination, click **Browse** to select a directory.
6. In the **Ready to Install the Program** window, click **Install** to start installing.
7. After the installation is completed, click **Next** without changing the default value in **Port Number**.

---

**Note:**

The port number configured here needs to be configured again when creating the cluster configuration data. For details on port number, refer to "Parameter details" in Chapter 2 "Function of the Builder" in the *Reference Guide*.

---

8. In **Filter Settings of Shared Disk**, right-click **SCSI controller** or **HBA connected to a shared disk**, and click **Filtering**. Click **Next**.

---

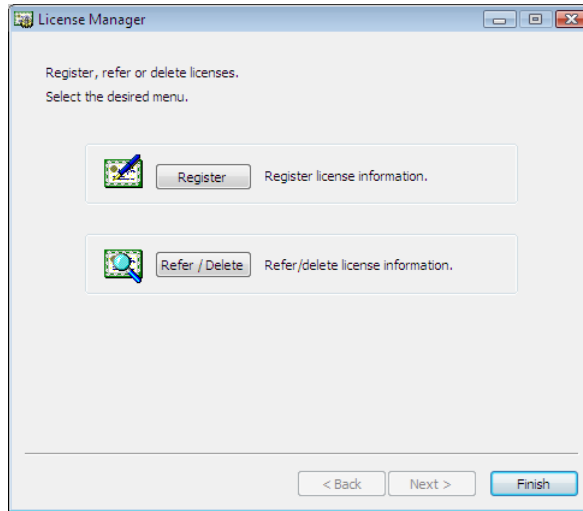
**Important:**

When a shared disk is used, configure filtering settings to the SCSI controller or HBA to be connected to the shared disk. If the shared disk is connected without configuring filtering settings, data on the shared disk may be corrupted. When the disk path is duplicated, it is necessary to configure the filter for all the HBAs physically connected with the shared disk though it may look the shared disk is connected to only one HBA.

When using mirror disk resources, do not perform filtering settings for SCSI controller/HBA which an internal disk for the mirroring target is connected. If the filter is activated on mirror disk resources, starting mirror disk resources fails. However, it is essential to perform filtering settings when shared disks are expected to consist mirroring.

---

9. The window that shows the completion of setting is displayed. Click **Yes**.
10. **License Manager** is displayed. Click **Register** to register the license. For detailed information on the registration procedure, refer to Chapter 4, "Registering the license" in this guide.



11. Click **Finish** to close the **License Manager** dialog box.
12. The **Complete InstallShield Wizard** dialog box is displayed. Select **Restarting** and click **Finish**. The server will be rebooted.

---

**Note:**

When a shared disk is used, it cannot be accessed due to access restriction after OS reboot.

---

## Upgrading ExpressCluster Server from the previous version

Before starting the upgrade, read the following notes.

- ◆ It is possible to upgrade version from ExpressCluster X 1.0, 2.0 or 2.1 to ExpressCluster X 3.2.
- ◆ You need CD-ROM contains setup files and software licenses for ExpressCluster X 3.2.
- ◆ You cannot use the cluster configuration data that was created by using ExpressCluster X higher than ExpressCluster X in use.
- ◆ The cluster configuration data that was created by using ExpressCluster X 1.0, 2.0, 2.1, 3.0, 3.1 or 3.2 for Windows is available for ExpressCluster X in use.

---

### Related Information:

It is not supported to update from X 3.0 / X3.1 to X 3.2 using following upgrade procedure.  
For details of update, please contact our software distributors.

---

The following procedures explain how to upgrade from ExpressCluster X 1.0, 2.0 or 2.1 to ExpressCluster X 3.2.

### Performing rolling upgrade

Rolling upgrade is a method to perform upgrade on one server at a time while moving the tasks being operated among the servers so that the system stoppage can be minimized.

The following shows the overview of the procedure.

- ◆ Perform the upgrade on one server at a time.
  - Move the failover group to another server.
  - Set the services related to ExpressCluster to start manually, and then restart the server.
  - Perform the upgrade.
  - Set the services related to ExpressCluster to start automatically, and then restart the server.
  - Restore the server to the cluster (only when **Off** is set to **Auto Return**).

Follow the steps to perform upgrade.

---

### Note:

Upgrade ExpressCluster Server using an account with the administrator's privilege.

---

- A) Confirm the servers being operated in the cluster and all the resources are in normal status by using WebManager or the command.
- B) Perform the steps from D) to K) on one server at a time.

---

### Note:

Perform the operation while connected to the old version of WebManager (ExpressCluster X 1.0/2.0/2.1 for Windows) until rolling upgrade is completed.

---

- C) When a failover group is working on the server, transfer the failover group to another server by using WebManager.

D) Set **Startup Type** of the services below to **Manual**.

- ExpressCluster
- ExpressCluster Alert
- ExpressCluster Disk Agent
- ExpressCluster Event
- ExpressCluster Manager
- ExpressCluster Old API Support
- ExpressCluster Server
- ExpressCluster Transaction
- ExpressCluster Web Alert

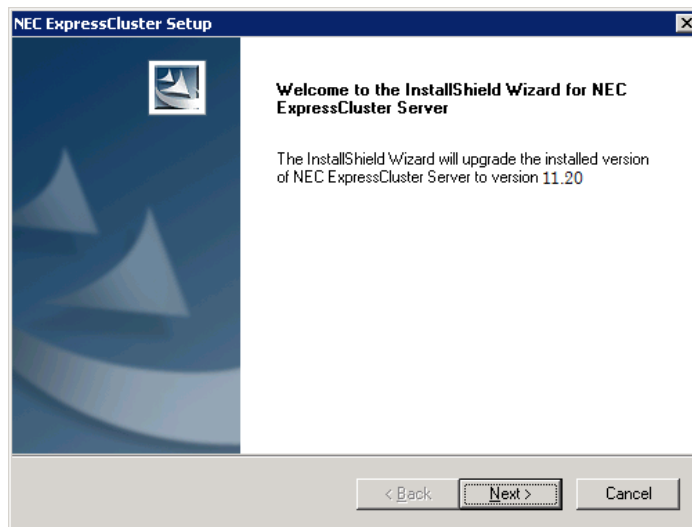
**Note:**

For ExpressCluster X 2.0 or later, ExpressCluster Alert service is not installed.

E) Restart the server by performing the server shutdown using WebManager or `clpdown` command.**Note:**

The server is shut down, but not the cluster.

- F) After the system is restarted, stop the SNMP service (only when the SNMP service exists and is running).
- G) To start the installer of ExpressCluster Server in version X 3.2, follow the steps 1 to 3 in “Installing the ExpressCluster Server for the first time” on page 58. The following dialog box is displayed.



Select **Next** to start upgrade.

- H) Select **Next** to upgrade. After file replacement, **License Manager** is started. If ExpressCluster X Alert Service license is registered, please terminate cluster status indicator (clpaltui.exe) in the taskbar. Register the required licenses. (The required licenses are the same as the one required when ExpressCluster X 3.2 is newly installed. For further information on the licenses, refer to Chapter 4, "Registering the license" in this guide.)

- I) Set **Startup type** of the following services to **Automatic**.
- ExpressCluster
  - ExpressCluster Event
  - ExpressCluster Manager
  - ExpressCluster Old API Support
  - ExpressCluster Server
  - ExpressCluster Transaction
  - ExpressCluster Web Alert

---

**Note:**

When upgrading from X 1.0, ExpressCluster Alert service will be removed. Because functions of ExpressCluster Alert Service is provided as execution file (\*.exe) in current version.

---

- J) Restart the server by operating the OS.
- K) When **Off** is selected in for **Auto Return**, make the server join the cluster by using WebManager.
- L) When **Off** is selected for **Auto Mirror Recovery**, start mirror recovery by using the mirror disk helper of WebManager or by using the `clpmdctrl` command.
- M) If a mirror resource exists, wait until all mirror resources are recovered.
- N) After upgrading ExpressCluster on all servers, please move failover group to the server where the failover group had been previously activated if you need.
- O) This completes the procedure for upgrading the ExpressCluster Server. Check that Internal Version of each server is “11.20” or later by `clpstat` command or WebManager and the servers are operating normally as the cluster.

### Not performing rolling upgrade

Follow the steps below to perform upgrade without using the rolling upgrade.

---

**Note:**

ExpressCluster Server must be upgraded with the account having the Administrator’s privilege.

---

- A) Before upgrading, confirm that the servers in the cluster and all the resources are in normal status by using WebManager or the command.
- B) On all the servers configuring the cluster, set **Startup Type** to **Manual**, perform the cluster shutdown by using WebManager or the command.
- ExpressCluster
  - ExpressCluster Alert
  - ExpressCluster Disk Agent
  - ExpressCluster Event
  - ExpressCluster Manager
  - ExpressCluster Old API Support
  - ExpressCluster Server
  - ExpressCluster Transaction
  - ExpressCluster Web Alert

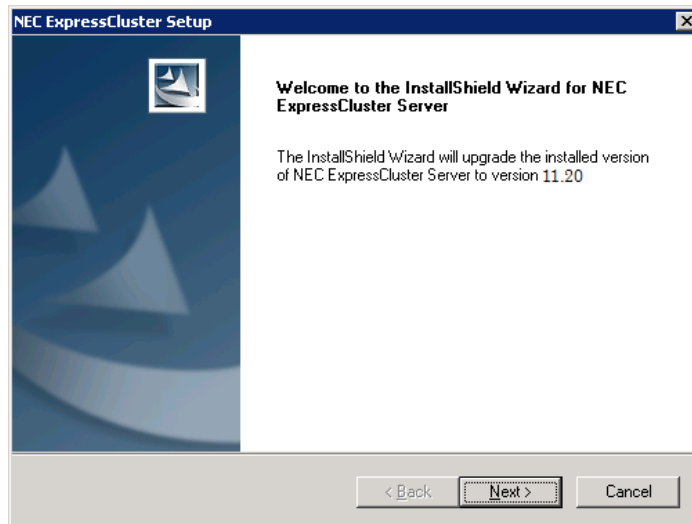
---

**Note:**

For ExpressCluster X 2.0 or later, ExpressCluster Alert service is not installed.

---

- C) Perform the steps from D) through G) for all the servers constituting the cluster.
- D) After the system is restarted, stop the SNMP service. (Only when the SNMP service exists and is running.)
- E) To start the installer of ExpressCluster Server in version X 3.2, follow the steps 1 to 3 in “Installing the ExpressCluster Server for the first time” on page 58. The following dialog box is displayed.



Select **Next** to start upgrade.

- F) After file replacement, **License Manager** is started.  
If ExpressCluster X Alert Service license is registered, please terminate cluster status indicator (clpaltui.exe) in the taskbar.  
Register the required licenses  
(The required licenses are the same as the one required when ExpressCluster X 3.2 is newly installed. For further information on the licenses, see Chapter 4 “Registering the license”)
- G) Set **Startup type** of the following services to **Automatic**.
  - ExpressCluster
  - ExpressCluster Event
  - ExpressCluster Manager
  - ExpressCluster Old API Support
  - ExpressCluster Server
  - ExpressCluster Transaction
  - ExpressCluster Web Alert

---

**Note:**

When upgrading from X 1.0, ExpressCluster Alert service will be removed. Because functions of ExpressCluster Alert Service is provided as execution file (\*.exe) in current version.

---

- H) Restart the system of all the servers constituting the cluster.
- I) This completes the procedure for upgrading the ExpressCluster Server. Check that Internal Version of each server is “11.20” by the clpstat command or WebManager and the servers are operating normally as the cluster.

## Installing the ExpressCluster Builder (offline version)

It is not necessary to install the ExpressCluster X Builder (offline version) to the server where configure a cluster. Install it when a PC that cannot connect to the cluster through a Web browser is used for creating and modifying the cluster configuration data. Follow the procedures below to install the ExpressCluster X Builder (offline version).

---

**Note:**

Install the ExpressCluster X Builder with the administrator privilege.

---

1. Insert the Installation CD-ROM to the CD-ROM drive.
  2. Select **ExpressCluster® for Windows**.
- 

**Note:**

If the menu screen does not open automatically, double-click menu .exe in the root folder of the CD-ROM.

---

3. Select **ExpressCluster® Accessories**.
4. Select **ExpressCluster® Builder**.
5. Select where to install in the **Cluster Builder self-extracting** dialog box and click **Extract**.
6. Click **OK** in the ZIP self-extract dialog box. Installation is completed.

## Setting up the SNMP linkage function manually

---

### Note:

If you are using only the SNMP trap transmission function, you do not need to perform this procedure.

---

To handle information acquisition requests on SNMP, the Windows SNMP Service must be installed separately and the SNMP linkage function must be registered separately.

If the Windows SNMP Service has already been installed, the SNMP linkage function will be automatically registered when the ExpressCluster Server is installed. If, however, the Windows SNMP Service has not been installed, the SNMP linkage function will not be registered.

When the Windows SNMP Service has not been installed, follow the procedure below to manually register the SNMP linkage function.

---

### Note:

Use an Administrator account to perform the registration.

---

1. Install the Windows SNMP Service.
2. Stop the Windows SNMP Service.
3. Register the SNMP linkage function of ExpressCluster with the Windows SNMP Service.

3-1. Start the registry editor.

3-2. Open the following key:

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\
Services\SNMP\Parameters\ExtensionAgents
```

3-3. Specify the following to create a string value in the opened key:

|            |   |
|------------|---|
| Value name | : mgtmib  |
| Value type | : REG_SZ  |
| Value data | : SOFTWARE\NEC\EXPRESSCLUSTER\<br>SnmpAgent\mgtmib\CurrentVersion |

3-4. Exit the registry editor.

4. Start the Windows SNMP Service.

---

### Note:

Specify the settings required for SNMP communication on the Windows SNMP Service.

---



# Chapter 4      Registering the license

To run ExpressCluster as a cluster system, you need to register the license. This chapter describes how to register an ExpressCluster license.

This chapter covers:

- Registering the license..... 68
- Referring and/or deleting the license ..... 71

## Registering the license

ExpressCluster licenses can be registered during installation, as well as be added or deleted after installation.

For the following licenses of the ExpressCluster main module, register the license to the master server of a cluster.

- ◆ ExpressCluster X 3.2 for Windows
- ◆ ExpressCluster X 3.2 for Windows VM

For the following ExpressCluster optional product licenses, register the license to each cluster server.

- ◆ ExpressCluster X Replicator 3.2 for Windows
- ◆ ExpressCluster X Replicator DR 3.2 for Windows
- ◆ ExpressCluster X Replicator DR 3.2 Upgrade for Windows
- ◆ ExpressCluster X Database Agent 3.2 for Windows
- ◆ ExpressCluster X Internet Server Agent 3.2 for Windows
- ◆ ExpressCluster X Application Server Agent 3.2 for Windows
- ◆ ExpressCluster X Anti-Virus Agent 3.2 for Windows
- ◆ ExpressCluster X Java Resource Agent 3.2 for Windows
- ◆ ExpressCluster X System Resource Agent 3.2 for Windows
- ◆ ExpressCluster X Alert Service 3.2 for Windows

---

**Note:**

If the licenses for optional products have not been installed, the resources and monitor resources corresponding to those licenses are not shown in the list on the Builder (online version).

---

There are two ways of license registration; specifying the license file and using the information on the license sheet.

- ◆ Entering the license information attached to the license product to register the license. Refer to “Registering the license by entering the license information.”
- ◆ Specifying the license file to register the license. Refer to page 70 “Registering the license by specifying the license file ”

## Registering the license by entering the license information

The following describes how to register the license by specifying the license.

Before you register the license, make sure that:

### ExpressCluster license (not includes optional product)

- ◆ You have the license sheet you officially obtained from the sales agent. The values on this license sheet are used for registration.
- ◆ You have the administrator privileges to log in the server intended to be used as master server in the cluster.

### ExpressCluster optional product license

- ◆ You have the license sheet you officially obtained from the sales agent. The number of license sheets you need is as many as the number of servers on which the option product will be used. The values on this license sheet are used for registration.
- ◆ You have the administrator privileges to log in the server intended to be used as master server in the cluster

1. On the Start menu, click Programs and click License Manager of the ExpressCluster Server.
2. In the **License Manager** dialog box, click **Register**.
3. In the window to select a license method, select **Register with License Information**.
4. In the **Product selection** dialog box, select the information on the license to be registered, the product category and the product information, and click **Next**. For ExpressCluster 3.2 for Windows VM, select ExpressCluster X 3.2 for Windows for the product information.
5. If **Cluster License** is selected for **License Type** in the step 4, the **License Unit Selection** dialog box is displayed. (This dialog box is not displayed when **Node License** is selected.) Select the license unit in the **License Unit Selection** dialog box. (If a node license product is selected, this dialog box is not displayed.) When you select **Node Unit**, enter the number of nodes. When you select **CPU Unit**, enter the number of CPUs. Click **Next**.
6. In the **License Key Entry** dialog box, enter the serial number and license key of the license sheet. Click **Next**.
7. Confirm what you have entered on the **License Registration Confirmation** dialog box. Click **Next**.
8. Make sure that the pop-up message, "The license was registered." is displayed. If the license registration fails, start again from the step 2.

## Registering the license by specifying the license file

The following describes how to register the license by specifying the license.

Before you register the license, check that:

### **ExpressCluster license (not includes optional product)**

- ◆ You have the administrator privileges to log in the server intended to be used as master server in the cluster.
- ◆ The license file is located in the server intended to be used as master server in the cluster.

### **ExpressCluster optional product license**

- ◆ You have the administrator privileges to log in the server on which you intend to use the option product.
1. On the **Start** menu, click **Programs** and click **License Manager** of the ExpressCluster Server.
  2. In the **License Manager** dialog box, click **Register**.
  3. In the window to select a license method is displayed, select **Register with License File**.
  4. In the **License File Specification** dialog box, select the license file to be registered and then click **Open**.
  5. The message confirming registration of the license is displayed. Click **OK**
  6. Click **Finish** to close the license manager.

## Referring and/or deleting the license

### How to refer to and/or delete the registered license

The following procedure describes how to refer to and delete the registered license.

1. On the **Start** menu, click **Programs** and click **License Manager** of the ExpressCluster Server.
2. In the **License Manager** dialog box, click **Refer / Delete**.
3. The registered licenses are listed.
4. Select the license to delete and click **Delete**.
5. The confirmation message to delete the license is displayed. Click **OK**.



# Chapter 5      Creating the cluster configuration data

In ExpressCluster, data that contains information on how a cluster system is configured is called “cluster configuration data” and it is created with the ExpressCluster Builder. This chapter provides the information on how to start the WebManager and the procedures to create the cluster configuration data using the Builder with a sample cluster configuration.

This chapter covers:

|   |     |
|---|-----|
| • Creating the cluster configuration data .....                       | 74  |
| • Starting up the ExpressCluster X WebManager.....                    | 75  |
| • Checking the values to be configured .....                          | 77  |
| • Creating the cluster configuration data .....                       | 87  |
| • 1. Create a cluster .....   | 88  |
| • 2. Create a failover group .....                                    | 95  |
| • 3. Create monitor resources .....                                   | 99  |
| • 4. Disabling recovery action caused by monitor resource error ..... | 101 |
| • Saving the cluster configuration data .....                         | 102 |
| • Starting a cluster.....   | 103 |

## Creating the cluster configuration data

Creating the cluster configuration data is performed by using the ExpressCluster X Builder (hereafter described as the Builder), the function for creating and modifying cluster configuration data

Create the cluster configuration data by starting the Builder from the ExpressCluster WebManager (hereafter described as the WebManager) accessed from the management PC. The cluster configuration data will be applied in the cluster system by the Builder.

## Starting up the ExpressCluster X WebManager

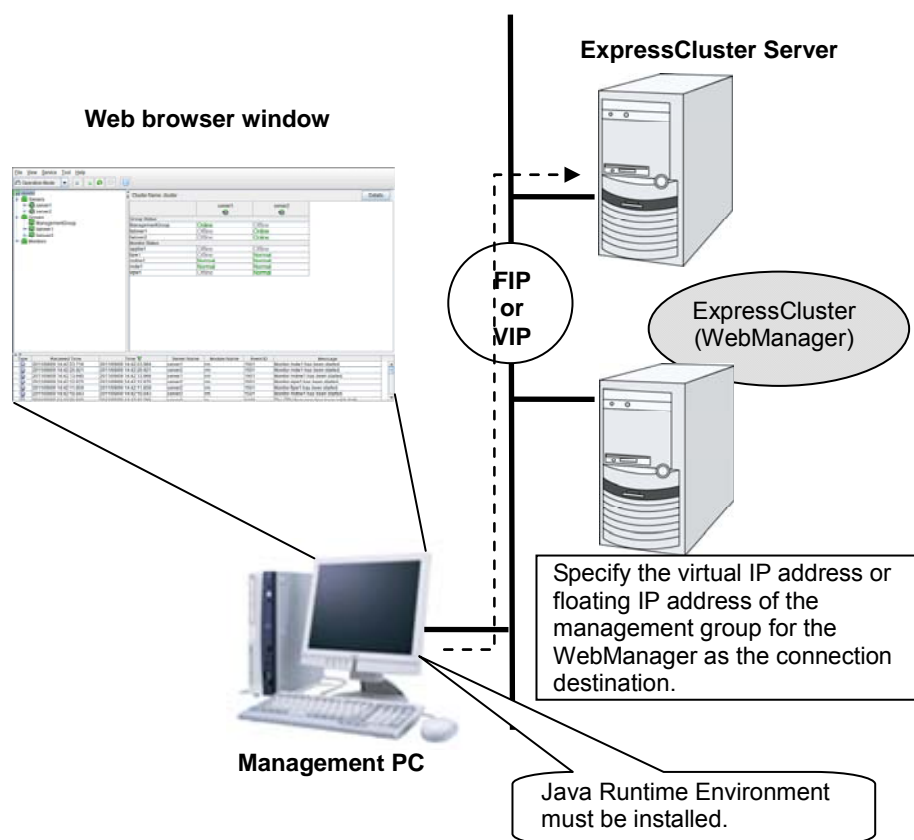
Accessing to the WebManager is required to create cluster configuration data. In this section, the overview of the WebManager is explained. After that, access to the WebManager. How to create cluster configuration data is explained.

### Related Information:

For the system requirements of the WebManager, refer to Chapter 3, “Installation requirements for ExpressCluster” in the *Getting Started Guide*.

## What is ExpressCluster X WebManager?

The ExpressCluster X WebManager is a function to start the Builder, set up the cluster, monitor the cluster status, start up and stop servers and groups, and collect cluster operation logs through a Web browser. The overview of the WebManager is shown in the following figures.



The WebManager in ExpressCluster Server is configured to start up at the time when the operating system starts up.

Specify the floating IP address or virtual IP address for accessing WebManager for the URL when connecting from a Web browser of the management PC. These addresses are registered as the resources of the management group. When the management group does not exist, you can specify the address of one of servers configuring the cluster (fixed address allocated to the server) to connect management PC with the server. In this case, the WebManager cannot acquire the status of the cluster if the server to be connected is not working.

## Browsers supported by the WebManager

For information about evaluated Web browsers, refer to the *Getting Started Guide*.

## Setting up Java Runtime Environment

In order to access the WebManager, a Java Runtime Environment (JRE) must be installed on the browser in a management PC. For a Java Runtime environment whose operation has been verified, refer to the *Getting Started Guide*.

If the JRE is not installed on the management PC, the browser might prompt you to install.

Make sure that the JRE version is supported by ExpressCluster WebManager when determining whether to install it.

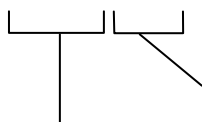
To install Java Plug-in on a browser, refer to the browser's help and the Java installation guide.

## Starting the WebManager

The following procedure describes how to start the WebManager.

1. Start your Web browser.
2. Enter the actual IP address and port number of the server where the ExpressCluster Server is installed in the Address bar of the browser.

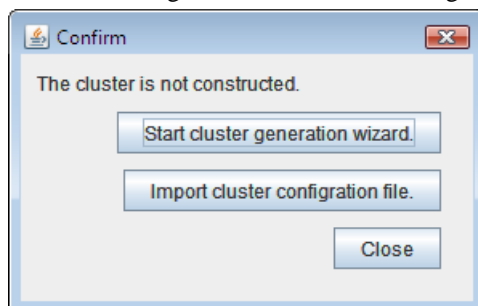
http://10.0.0.3:29003/



Specify the port number of the WebManager specified at installation. (Default: 29003)

Specify the actual IP address of the first server constituting the cluster because a management group does not exist right after the installation.

3. The WebManager starts and the following confirmation window is displayed..



4. Click **Start Cluster Generation Wizard** to start the wizard.

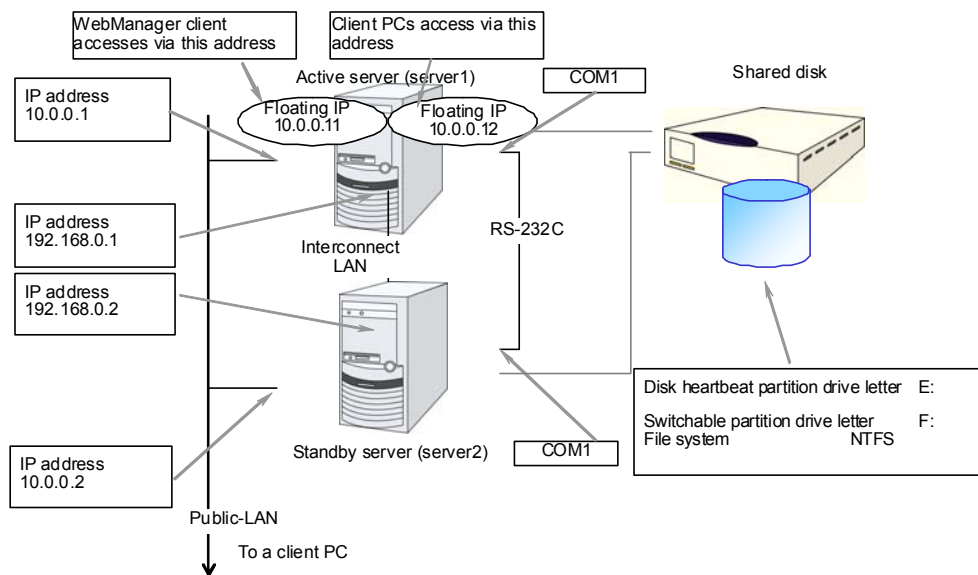
## Checking the values to be configured

Before you create the cluster configuration data using Cluster generation wizard, check values you are going to enter. Write down the values to see whether your cluster is efficiently configured and there is no missing information.

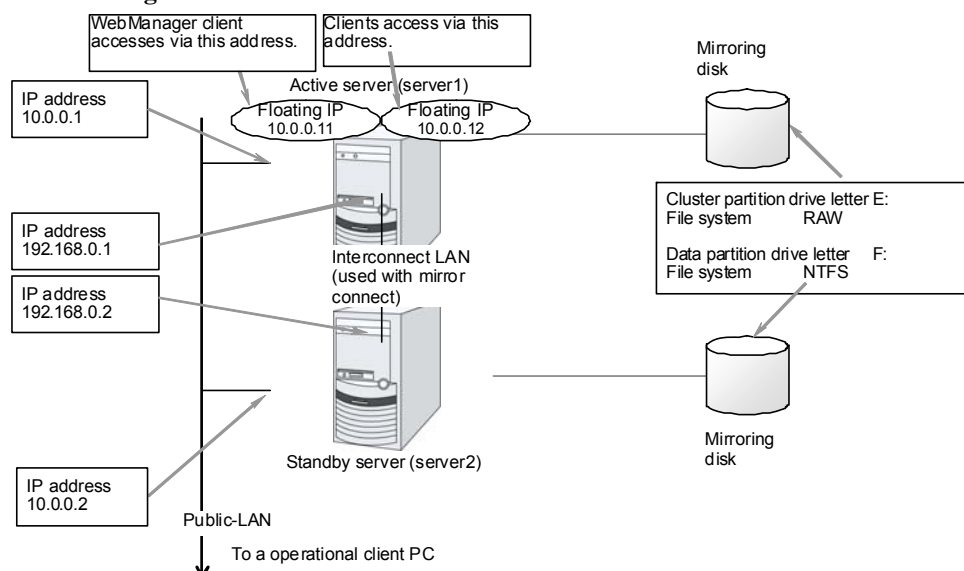
### Sample cluster environment

As shown in the below, this chapter uses a typical cluster configuration with two nodes and the hybrid disk configuration with three nodes.

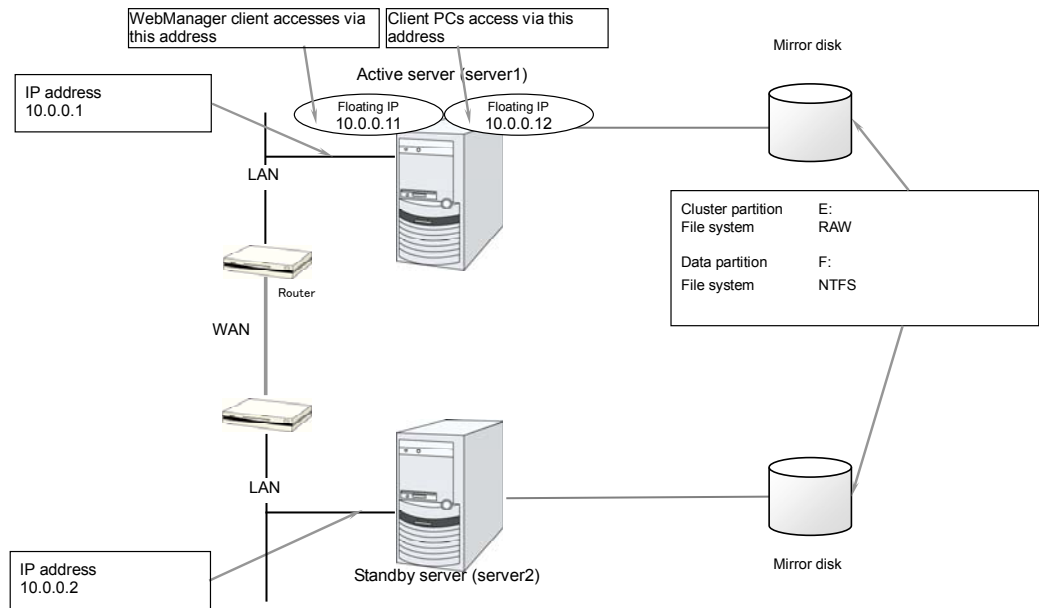
**When a shared disk with two nodes is used:**



**When mirroring disks with two nodes are used:**

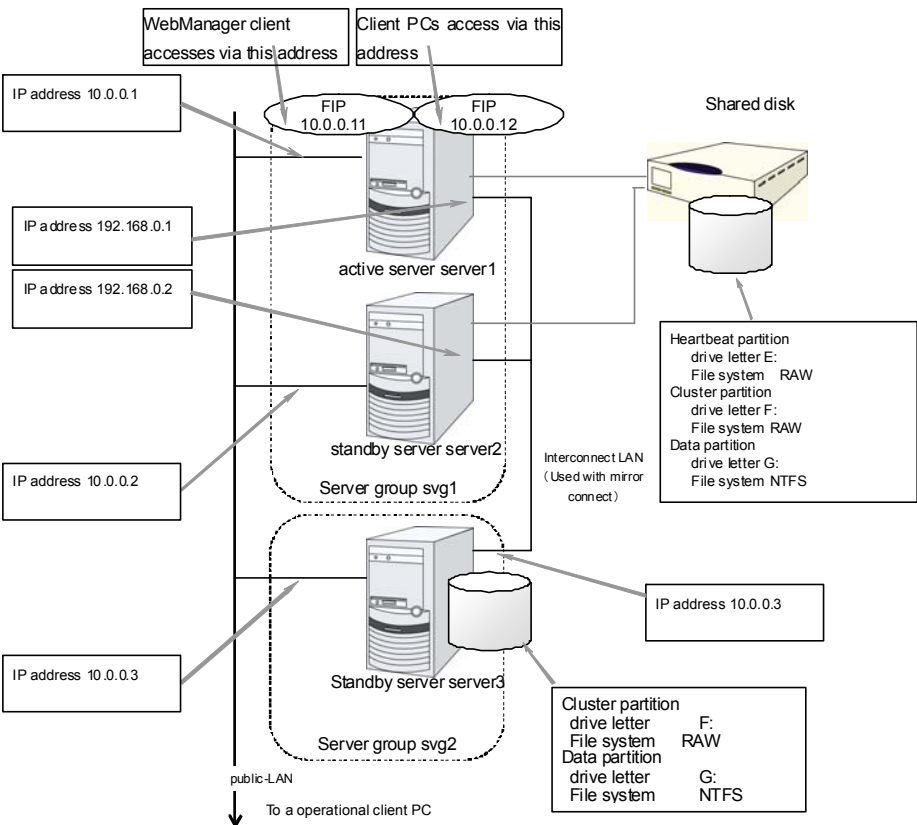


When mirror disk resources with remotely-constructed two nodes are used:



This configuration example is for when the WAN type is layer 2. (The same network address can be used between points.)

When hybrid disks with three nodes are used:



The following table lists sample values of the cluster configuration data to achieve the cluster system shown above. The step-by-step instruction for creating the cluster configuration data with these values is provided in the following sections. When you actually set the values, you may need to modify them according to the cluster you are intending to create. For information on how you determine the values, refer to the *Referenced Guide*.

**Example of configuration with 2 nodes**

| Target                                   | Parameter                            | Value (For shared disk)        | Value (For mirror disk) | Value (For remote construction) |
|--|--------------------------------------|--------------------------------|-------------------------|---------------------------------|
| Cluster configuration                    | Cluster name                         | Cluster                        | Cluster                 | Cluster                         |
|  | Number of servers                    | 2                              | 2                       | 2                               |
|  | Number of management groups          | 1                              | 1                       | -                               |
|  | Number of failover groups            | 1                              | 1                       | 1                               |
|  | Number of monitor resources          | 5                              | 6                       | 1                               |
| Heartbeat resources                      | Number of kernel mode LAN heartbeats | 2                              | 2                       | 1                               |
| First server information (Master server) | Server name                          | server1                        | server1                 | server1                         |
|  | Interconnect IP address (Primary)    | 192.168.0.1                    | 192.168.0.1             | 10.0.0.1                        |
|  | Interconnect IP address (Backup)     | 10.0.0.1                       | 10.0.0.1                | -                               |
|  | Public IP address                    | 10.0.0.1                       | 10.0.0.1                | 10.0.0.1                        |
|  | Mirror connect I/F                   | -                              | 192.168.0.1             | 10.0.0.1                        |
|  | HBA                                  | HBA connected to a shared disk | -                       |                                 |
| Second server information                | Server name                          | server2                        | server2                 | server2                         |
|  | Interconnect IP address (Primary)    | 192.168.0.2                    | 192.168.0.2             | 10.0.0.2                        |
|  | Interconnect IP address (Backup)     | 10.0.0.2                       | 10.0.0.2                | -                               |
|  | Public IP address                    | 10.0.0.2                       | 10.0.0.2                | 10.0.0.2                        |
|  | Mirror connect I/F                   | -                              | 192.168.0.2             | 10.0.0.2                        |
|  | HBA                                  | HBA connected to a shared disk | -                       | -                               |
| First NP resolution resource             | Type                                 | COM                            | -                       | Ping                            |
|  | Ping target                          | -                              | -                       | 10.0.0.254                      |
|  | Server1                              | COM1                           | -                       | Use                             |
|  | Server2                              | COM1                           | -                       | Use                             |
| Second NP resolution resource            | Type                                 | DISK                           | -                       | -                               |
|  | Ping target                          | -                              | -                       | -                               |
|  | Server1                              | E:                             | -                       | -                               |
|  | Server2                              | E:                             | -                       | -                               |

| Target                                    | Parameter   | Value (For shared disk)       | Value (For mirror disk)       | Value (For remote construction) |
|---|---|-------------------------------|-------------------------------|---------------------------------|
| Group for management (For the WebManager) | Type  | cluster                       | cluster                       | cluster                         |
|   | Group name  | ManagementGroup               | ManagementGroup               | Management Group                |
|   | Startup server                                      | all servers                   | all servers                   | all servers                     |
|   | Number of group resources                           | 1                             | 1                             | 1                               |
| Group resources for management *1         | Type  | floating IP resource          | floating IP resource          | floating IP resource            |
|   | Group resource name                                 | ManagementIP                  | ManagementIP                  | ManagementIP                    |
|   | IP address  | 10.0.0.11                     | 10.0.0.11                     | 10.0.0.11                       |
| Failover group                            | Type  | failover                      | failover                      | failover                        |
|   | Group name  | failover1                     | failover1                     | failover1                       |
|   | Startup server                                      | server1 → server2             | server1 → server2             | server1 → server2               |
|   | Number of group resources                           | 3                             | 3                             | 3                               |
| First group resources                     | Type  | floating IP                   | floating IP                   | floating IP                     |
|   | Group resource name                                 | fip1                          | fip1                          | fip1                            |
|   | IP address  | 10.0.0.12                     | 10.0.0.12                     | 10.0.0.12                       |
| Second group resources                    | Type  | disk resource                 | Mirror disk resource          | Mirror disk resource            |
|   | Group resource name                                 | sd1                           | md1                           | md1                             |
|   | Disk resource drive letter                          | F:                            | -                             | -                               |
|   | Mirror disk resource cluster partition drive letter | -                             | E:                            | E:                              |
|   | Mirror disk resource data partition drive letter    | -                             | F:                            | F:                              |
| Third group resources                     | Type  | Application resource          | Application resource          | Application resource            |
|   | Group resource name                                 | appli1                        | appli1                        | appli1                          |
|   | Resident type                                       | Resident                      | Resident                      | Resident                        |
|   | Start path  | Path of execution file        | Path of execution file        | Path of execution file          |
| First monitor resources                   | Type  | Disk RW monitor               | Disk RW monitor               | Disk RW monitor                 |
|   | Monitor resource name                               | diskw1                        | diskw1                        | diskw1                          |
|   | File name   | C:\check.txt*2                | C:\check.txt*2                | C:\check.txt*2                  |
|   | I/O size  | 2000000                       | 2000000                       | 2000000                         |
|   | Action to be taken when detecting stall error       | Intentional stop error occurs | Intentional stop error occurs | Intentional stop error occurs   |
|   | Action When Diskfull Is Detected                    | Recover                       | Recover                       | Recover                         |
|   | Recovery target                                     | cluster                       | cluster                       | cluster                         |

| Target  | Parameter              | Value (For shared disk)       | Value (For mirror disk)       | Value (For remote construction) |
|---|------------------------|-------------------------------|-------------------------------|---------------------------------|
|   | Final action           | Intentional stop error occurs | Intentional stop error occurs | Intentional stop error occurs   |
| Second monitor resources<br>(Automatically created after the creation of disk resources)  | Type                   | Disk TUR monitor              | -                             |                                 |
|   | Monitor resource name  | sdw1                          | -                             | -                               |
|   | Disk resource          | sd1                           | -                             | -                               |
|   | Recovery target        | failover1sd1                  | -                             | -                               |
|   | Final action           | None                          | -                             | -                               |
| Third monitor resources   | Type                   | IP monitor                    | IP monitor                    | IP monitor                      |
|   | Monitor resource name  | ipw1                          | ipw1                          | ipw1                            |
|   | Monitored IP address   | 10.0.0.254 (Gateway)          | 10.0.0.254 (Gateway)          | 10.0.0.254 (Gateway)            |
|   | Recovery target        | ManagementGroup               | ManagementGroup               | Management Group                |
|   | Reactivation Threshold | 1                             | 1                             | 1                               |
| Fourth monitor resources  | Type                   | IP monitor                    | IP monitor                    | IP monitor                      |
|   | Monitor resource name  | lpw2                          | lpw2                          | lpw2                            |
|   | Monitor IP address     | 10.0.0.254 (Gateway)          | 10.0.0.254 (Gateway)          | 10.0.0.254 (Gateway)            |
|   | Recovery target        | failover1                     | failover1                     | failover1                       |
|   | Reactivation Threshold | 0                             | 0                             | 0                               |
| Fifth monitor resource<br>(Automatically created after the creation of application resources when the application resources are of resident type) | Type                   | Application monitoring        | Application monitoring        | Application monitoring          |
|   | Monitor resource name  | appliw1                       | appliw1                       | appliw1                         |
|   | Target resource        | appli1                        | appli1                        | appli1                          |
|   | Recovery target        | failover1appli1               | failover1                     | failover1                       |
|   | Reactivation Threshold | 0                             | 0                             | 0                               |
| Sixth monitor resource<br>(Automatically created after creation of mirror disk resource)  | Type                   | -                             | mirror connect monitoring     | mirror connect monitoring       |
|   | Monitor resource name  | -                             | mdnw1                         | mdnw1                           |
|   | Mirror disk resource   | -                             | md1                           | md1                             |
|   | Recovery target        | -                             | md1                           | md1                             |
|   | Final action           | -                             | None                          | None                            |
| Seventh monitor resource<br>(Automatically created after creation of mirror disk resource)  | Type                   | -                             | Mirror disk monitor           | Mirror disk monitor             |
|   | Monitor resource name  | -                             | mdw1                          | mdw1                            |
|   | Mirror disk resource   | -                             | md1                           | md1                             |
|   | Recovery target        | -                             | md1                           | md1                             |
|   | Final action           | -                             | None                          | None                            |

- \*1: You should have a floating IP address to access the WebManager. You can access the WebManager from your Web browser with a floating IP address when an error occurs.
- \*2: To monitor the local disk, specify the file name on the system partition for the file name of the disk RW monitor resource.

**Example of hybrid disk configuration**

| Target                                      | Parameter                              | Value                          |
|---|--|--------------------------------|
| Cluster configuration                       | Cluster name                           | cluster                        |
|   | Number of servers                      | 3                              |
|   | Number of management groups            | 1                              |
|   | Number of failover groups              | 1                              |
|   | Number of monitor resources            | 6                              |
| Heartbeat resources                         | Number of kernel mode LAN heartbeats   | 2                              |
| First server information<br>(Master server) | Server name                            | server1                        |
|   | Interconnect IP address<br>(Dedicated) | 192.168.0.1                    |
|   | Interconnect IP address<br>(Backup)    | 10.0.0.1                       |
|   | Public IP address                      | 10.0.0.1                       |
|   | Mirror connect I/F                     | 192.168.0.1                    |
|   | HBA                                    | HBA connected to a shared disk |
| Second server information                   | Server name                            | server2                        |
|   | Interconnect IP address<br>(Dedicated) | 192.168.0.2                    |
|   | Interconnect IP address<br>(Backup)    | 10.0.0.2                       |
|   | Public IP address                      | 10.0.0.2                       |
|   | Mirror connect I/F                     | 192.168.0.2                    |
|   | HBA                                    | HBA connected to a shared disk |
| Third sever information                     | Server name                            | Server3                        |
|   | Interconnect IP address<br>(Dedicated) | 10.0.0.3                       |
|   | Interconnect IP address<br>(Backup)    | 192.168.0.3                    |
|   | Public IP address                      | 192.168.0.3                    |
|   | Mirror connect I/F                     | 192.168.0.3                    |
|   | HBA                                    | -                              |
| First NP resolution<br>resource             | Type                                   | DISK                           |
|   | Ping target                            | -                              |
|   | Server1                                | E:                             |
|   | Server2                                | E:                             |
|   | Server3                                | Do not use                     |

| Target                                    | Parameter                      | Value                  |
|---|--------------------------------|------------------------|
| Second NP resolution resource             | Type                           | Ping                   |
|   | Ping target                    | 10.0.0.254 (gateway)   |
|   | Server1                        | Use                    |
|   | Server2                        | Use                    |
|   | Server3                        | Use                    |
| Third NP resolution resource*1            | Type                           | Ping                   |
|   | Ping target                    | 10.0.0.254 (gateway)   |
|   | Server1                        | Use                    |
|   | Server2                        | Use                    |
|   | Server3                        | Do not use             |
| First server group                        | Server group name              | svg1                   |
|   | Belonging server               | server1, server2       |
| Second server group                       | Server group name              | svg2                   |
|   | Belonging server               | server3                |
| Group for management (For the WebManager) | Type                           | failover               |
|   | Group name                     | ManagementGroup        |
|   | Startup server                 | All servers            |
|   | Number of group resources      | 1                      |
| Group resource for Management *2          | Type                           | Floating IP resource   |
|   | Group resource name            | ManagementIP           |
|   | IP address                     | 192.168.0.11           |
| Failover group                            | Type                           | failover               |
|   | Group name                     | failover1              |
|   | Server group                   | svg1 → svg2            |
|   | Number of group resources      | 3                      |
| First group resources                     | Type                           | Floating IP            |
|   | Group resource name            | fip1                   |
|   | IP address                     | 192.168.0.12           |
| Second group resources                    | Type                           | hybrid disk resource   |
|   | Group resource name            | hd1                    |
|   | Cluster partition drive letter | F:                     |
|   | Data partition drive letter    | G:                     |
| Third group resources                     | Type                           | Application resource   |
|   | Group resource name            | appli1                 |
|   | Resident type                  | Resident               |
|   | Start path                     | Path of execution file |

| Target   | Parameter                                     | Value                         |
|--|---|-------------------------------|
| First monitor resource   | Type  | Disk RW monitor               |
|  | Monitor resource name                         | diskw1                        |
|  | File name                                     | C:\check.txt *3               |
|  | I/O size                                      | 2000000                       |
|  | Action to be taken when detecting stall error | Intentional stop error occurs |
|  | Action When Diskfull Is Detected              | Recover                       |
|  | Recovery target                               | cluster                       |
|  | Final action                                  | Intentional stop error occurs |
| Second monitor resources<br>(Auto creation after hybrid disk resource is created)  | Type  | Hybrid disk monitor           |
|  | Monitor resource name                         | hdw1                          |
|  | Hybrid disk resource                          | hd1                           |
|  | Recovery target                               | failover1                     |
|  | Final action                                  | None                          |
| Third monitor resources<br>(Auto creation after hybrid disk resource is created)   | Type  | Hybrid disk TUR monitor       |
|  | Monitor resource name                         | hdtw1                         |
|  | Hybrid disk resource                          | hd1                           |
|  | Recovery target                               | failover1                     |
|  | Final action                                  | None                          |
| Fourth monitor resource  | Type  | IP monitor                    |
|  | Monitor resource name                         | ipw1                          |
|  | Monitor IP address                            | 10.0.0.254 (gateway)          |
|  | Recovery target                               | ManagementGroup               |
|  | Reactivation threshold                        | 1                             |
| Fifth monitor resources  | Type  | IP monitor                    |
|  | Monitor resource name                         | ipw2                          |
|  | Monitor IP address                            | 10.0.0.254 (gateway)          |
|  | Recovery target                               | failover1                     |
|  | Reactivation threshold                        | 0                             |
| Sixth monitor resources<br>(Automatically created after the creation of application resources when the application resources are of resident type) | Type  | Application monitor           |
|  | Monitor resource name                         | appliw1                       |
|  | Target resource                               | appli1                        |
|  | Recovery target                               | failover1appli1               |
|  | Reactivation threshold                        | 0                             |

\*1: Only the first and the second server which are connected to the shared disk needs two resources. The one is Ping method NP resolution resource that is used for the whole cluster and the other is Ping method resource that is used for only first and second server. Because the first and the second server use ping + shared disk resolution for network partition resolution.

- \*2: You should have a floating IP address. Even if an error occurs, you can access the WebManager run by the working server from your Web browser with this floating IP address.
- \*3: To monitor a local disk, specify the file name on the system partition for the file name of the disk RW monitor resource.

## Creating the cluster configuration data

Creating the cluster configuration data involves creating a cluster, group resources, and monitor resources. Use the cluster creation wizard to create new configuration data. The procedure is described below.

**Note:**

The created cluster configuration data can be modified later by using the rename function or properties view function.

### 1. Create a cluster

Add a cluster you want to construct.

#### 1-1. Add a cluster

Add a cluster to construct, and enter its name.

#### 1-2. Add a server

Add a server. Make setting such as server name and IP address.

#### 1-3. Set up the network configuration

Set up the network configuration between the servers in the cluster.

#### 1-4. Set up network partition resolution

Set up the network partition resolution resource.

### 2. Create a failover group

Create a failover group that works as a unit when a failover occurs.

#### 2-1. Add a failover group

Add a group that works as a unit when a failover occurs.

#### 2-2. Add a group resource (floating IP address)

Add a resource that constitutes a group.

#### 2-3. Add a group resource (disk resource/mirror disk resource/hybrid disk resource)

Add a resource that constitutes a group.

#### 2-4. Add a group resource (application resource)

Add a resource that constitutes a group.

### 3. Create monitor resources

Create a monitor resource that monitors specified target in a cluster.

#### 3-1. Configure an additional monitor resource (disk RW monitor resource).

Configure an additional monitor resource to use.

#### 3-2. Add a monitor resource (IP monitor resource for the ManagementGroup)

Add a monitor resource to use.

#### 3-3. Add a monitor resource (IP monitor resource for failover group)

Add a monitor resource to use.

### 4. Disabling recovery action triggered by monitor resource error.

Enable or disable the recovery action triggered by the monitor resource error.

# 1. Create a cluster

Create a cluster. Add a server that constitutes a cluster and determine the priorities of the server and heartbeat.

## 1-1. Create a cluster

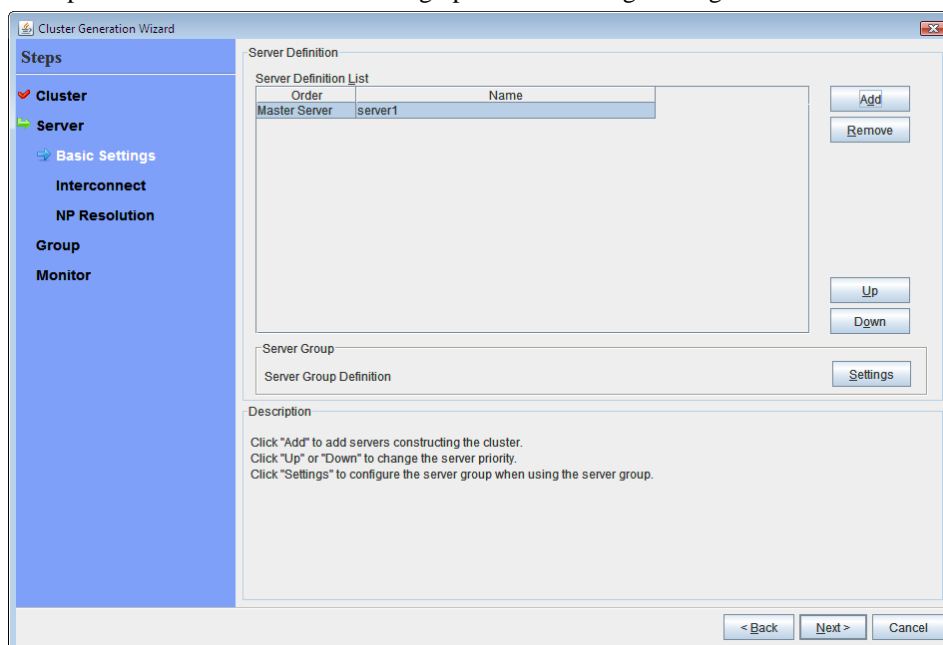
1. On the **Cluster Definition** window in **Cluster Generation Wizard**, click **Language** field to select the language to be used by the OS.

**Note:**

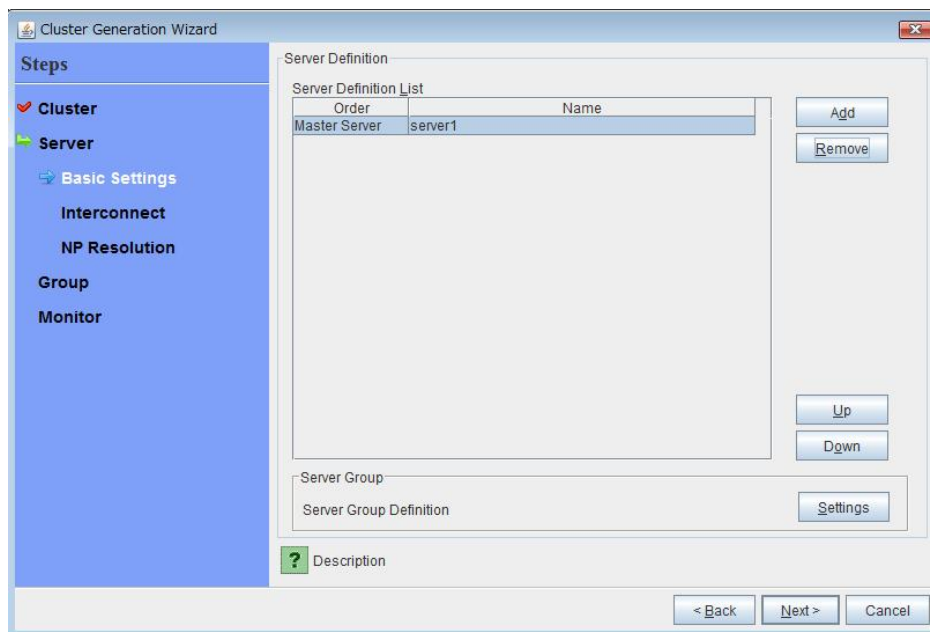
Only one language can be used in the WebManager in one cluster. When the OS with multi languages is used in the WebManager in a cluster, specify “English.”

2. Enter the cluster name in the **Cluster Name** box.
3. Enter the floating IP address (192.168.0.11) used to connect the WebManager in the **Management IP Address** box. Click **Next**.

The **Server Definition** window is displayed. The server (**server1**) for which the IP address was specified as the URL when starting up the WebManager is registered in the list.



If the screen resolution is 800 x 600 pixels or less, the **Description** field will be displayed as a tool tip.



Positioning the mouse cursor to the ? icon displays a tool tip with the full description.

## 1-2. Add a server

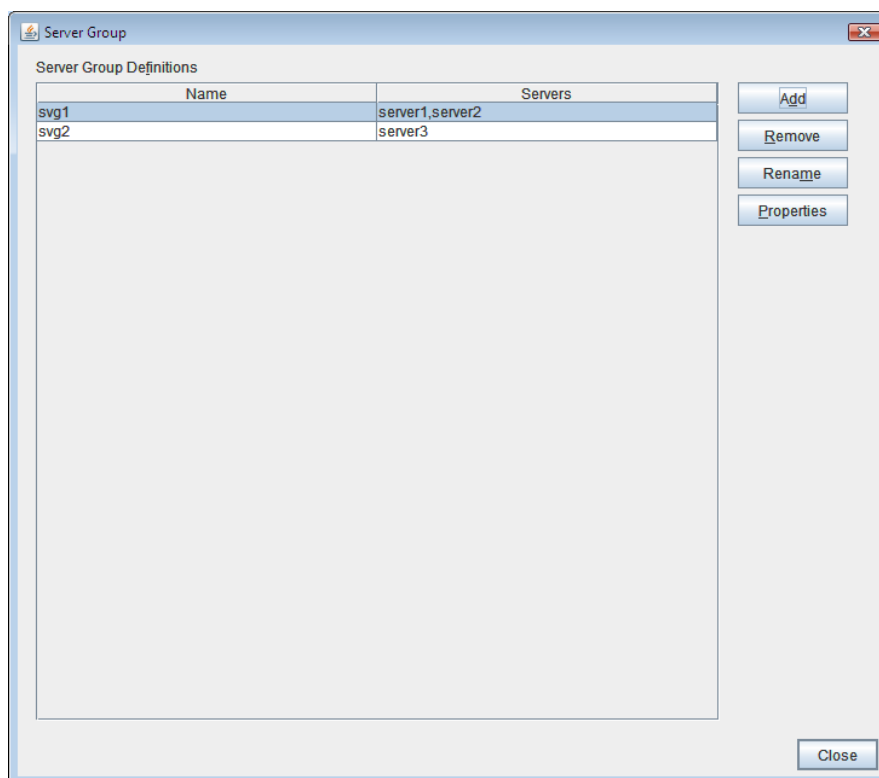
Add the second and subsequent servers to the cluster.

1. In **Server Definition List**, click **Add**.
2. The **Add Server** dialog box is displayed. Enter the server name, FQDN name, or IP address of the second server, and then click **OK**. The second server (**server2**) is added to the **Server Definition List**.
3. For the hybrid disk configuration, add the third server (**server3**) in the same way.
4. For the hybrid disk configuration, click **Settings** in the **Server Group**. **Server Group** dialog box is displayed. Click **Add** to display the **Server Group Definition** dialog box and enter server group name (**svg1**) in the **Name** box. And then click **Next**.
5. Click **Next**.

### 1-3. Create a server group

For the hybrid disk configuration, create a group of servers connected to the disk on each disk to be mirrored before creating a hybrid disk resource.

1. Click **Settings** in **Server Group**.
2. Click **Add** in **Server Group**.
3. The **Server Group Definition** dialog box is displayed. Enter the server group name **svg1** in the **Name** box, and then click **Next**.
4. Click **server1** from **Available Servers**, and then, click **Add**. The **server1** is added in **Servers that can run the Group**.  
Likewise, add **server2**.
5. Click **Finish**. The **svg1** is added in **Server Group Definitions**.
6. Click **Add** to open the **Server Group Definition** dialog box. Enter the server group name **svg2** in the **Name** box, and then click **Next**.
7. Click **server3** from **Available Servers**, and then, click **Add**. The **server3** is added in **Servers that can run the Group**.
8. Click **Finish**. The **svg1** and **svg2** are added in **Server Group Definitions**.



9. Click **Close**.

## 1-4. Set up the network configuration

Set up the network configuration between the servers in the cluster.

| Priority | Type        | MDC        | server1     | server2     |
|----------|-------------|------------|-------------|-------------|
| 1        | Kernel Mode | Do Not Use | 10.0.0.1    | 10.0.0.2    |
| 2        | Kernel Mode | Do Not Use | 192.168.0.1 | 192.168.0.2 |

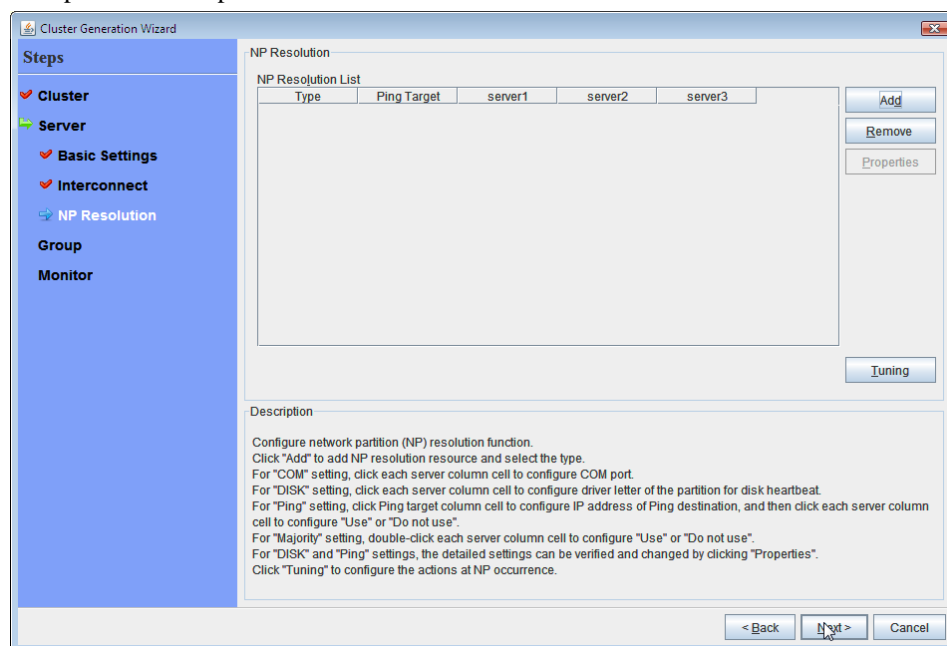
**Description**

Configure the interconnect among the servers constructing the cluster. Click "Add" to add interconnect and select the type. For "Kernel mode" setting, configure the route which is used for heartbeat. For "Mirror Communication Only" setting, configure the route which is used only for data mirroring communication. For "Kernel mode" setting, more than zero routes are necessary to be configured. Configuring more than one routes is recommended. Click each server column cell to configure IP addresses for each communication routes. Click "Up" or "Down" to configure the priority to preferentially use the LAN only for the communication among the cluster servers. For the communication route which is used for data mirroring communication, select the mirror disk connect name to be allocated to the communication route in MDC column.

1. Click **Next** in **Server Definition**. **Interconnect List** is displayed.
2. When the network communication route between the servers in the cluster can be identified using a network address in the IP address format as in the setup example in this chapter, each communication route is automatically registered in **Network Settings**. If the registered communication routes differ from the actual network configuration, add or delete them by using **Add** or **Delete**, click a cell in each server column, and then select or enter the IP address. For a communication route to which some servers are not connected, leave the cells for the unconnected servers blank.
3. For a communication route used for heartbeat transmission (interconnect), click a cell in the **Type** column, and then select **Kernel Mode**. When using only for the data mirroring communication of the mirror disk resource or the hybrid disk resource and not using for the heartbeat, select **Mirror Communication Only**.  
At least one communication route must be specified for the interconnect. Specify as many communication routes for the interconnect as possible.  
If multiple interconnects are set up, the communication route for which the **Priority** column contains the smallest number is used at the highest priority for controlling communication between the cluster and server. To change the priority, change the order of communication routes by using **Up** or **Down**.
4. When using BMC heartbeat, click a cell in the **Type** column, and then select **BMC**. Next, click a cell of each server, and then enter the BMC IP address. For servers that do not use BMC heartbeat, make cells of those servers blank.
5. For a communication route used for data mirroring communication for mirror disk resources or hybrid disk resources, click a cell of the **MDC** column, and then select the mirror disk connect name (mdc1 to mdc16) assigned to the communication route. Select **Do Not Use** for communication routes not used for data mirroring communication.
6. Click **Next**.

## 1-5. Set up network partition resolution

Set up the network partition resolution resource.

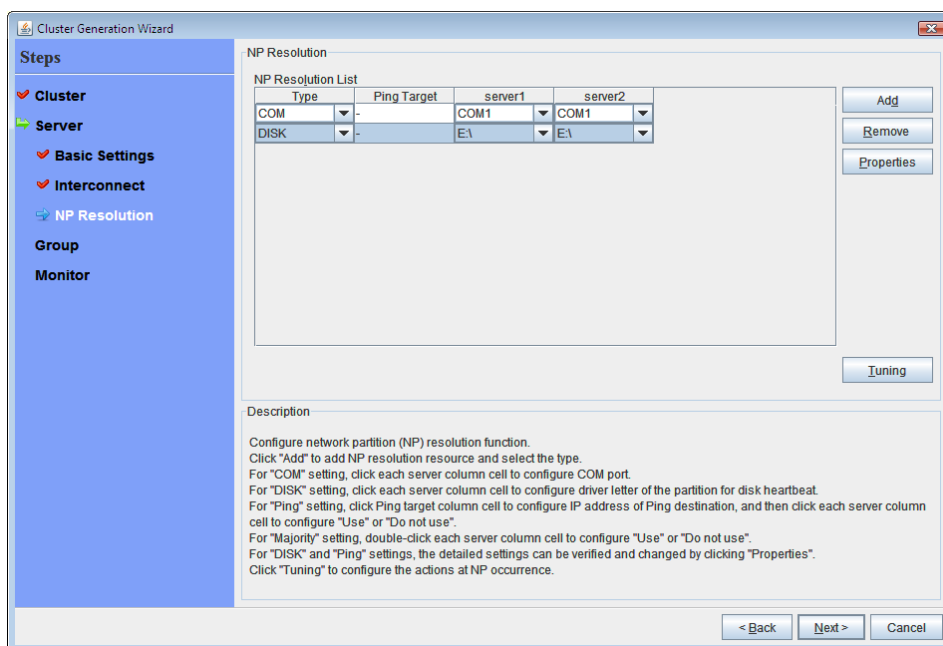


1. To use NP resolution in the COM mode, click **Add** and add a row to **NP Resolution List**, click **Type** and select **COM**, and then, click the cell of each server and select the COM port of each server which is connected with a cross cable. If there are any servers that are not connected, set the cell of the servers to **Do Not Use**.

For the setup example in this chapter, add COM mode row and select **COM1** on the cell of each server to use the shared disk.

2. To use NP resolution in the DISK mode, click **Add** and add a row to **NP Resolution List**, click **Type** and select **DISK**, and then, click the cell of each server and select the disk drive to be used for the partition for disk heartbeat. If there are any servers that are not connected to the shared disk, set the cell of the servers to **Do Not Use**.

For the setup example in this chapter, add a DISK mode row and click the column of each server, and then select the **E: drive** to use the shared disk. To use a hybrid disk, add a DISK mode column, click the cells of **server1** and **server2**, and then select the **E: drive**. Select **Do Not Use** in the **server3** cell.



3. To use NP resolution in the PING mode, click **Add** and add a row to **NP Resolution List**, click **Type** and select **Ping**, click the cell of **Ping Target**, and then click the cell of each server and enter the IP addresses of the ping destination target devices (such as a gateway). When multiple IP addresses separated by commas are entered, they are regarded as isolated from the network if there is no ping response from any of them.

If the PING mode is used only on some servers, set the cell of the server not to be used to **Do Not Use**.

To use a hybrid disk for the setup example in this chapter, add two rows of PING mode, for the first row select **Use** on all servers, for the second row select **Use** on **server1** and **server2** and select **Do Not Use** on **server3**. Specify **192.168.0.254** for **Ping Target** column in all columns.

**NP Resolution**

| Type | Ping Target   | server1 | server2 | server3    |
|------|---------------|---------|---------|------------|
| DISK | -             | E:\     | E:\     |            |
| Ping | 192.168.0.254 | Use     | Use     | Use        |
| Ping | 192.168.0.254 | Use     | Use     | Do Not Use |

**Description**

Configure network partition (NP) resolution function.  
 Click "Add" to add NP resolution resource and select the type.  
 For "COM" setting, click each server column cell to configure COM port.  
 For "DISK" setting, click each server column cell to configure driver letter of the partition for disk heartbeat.  
 For "Ping" setting, click Ping target column cell to configure IP address of Ping destination, and then click each server column cell to configure "Use" or "Do not use".  
 For "Majority" setting, double-click each server column cell to configure "Use" or "Do not use".  
 For "DISK" and "Ping" settings, the detailed settings can be verified and changed by clicking "Properties".  
 Click "Tuning" to configure the actions at NP occurrence.

4. To use the majority method for NP resolution, click **Add** and add a row to **NP Resolution List**, click the cell of **Type** column, and then select **Majority**.  
 For the setup example in this chapter, the majority method is not used.
5. Click **Next**.

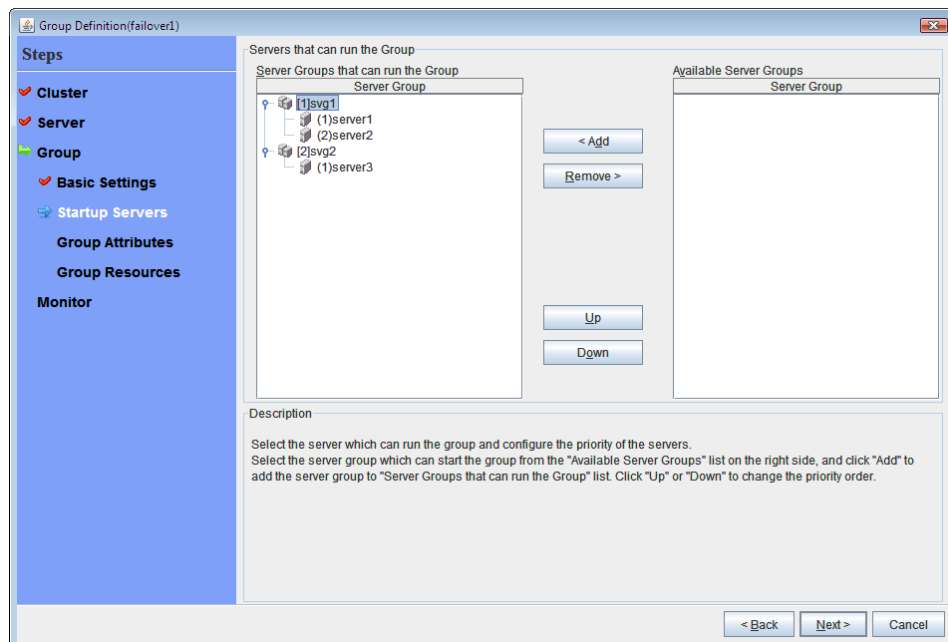
## 2. Create a failover group

Add a failover group that executes an application to the cluster. (Below, failover group is sometimes abbreviated to group.)

### 2-1. Add a failover group

Set up a group that works as a unit of failover at the time an error occurs.

1. Click **Add** in the **Group List** to open the **Group Definition** dialog box.  
For the setup example in this chapter, select **Use Server Group Settings** checkbox to use a hybrid disk. Enter the group name (failover1) in the **Name** box, and click **Next**.
2. Specify a server on which the failover group can start up. For the setup example in this chapter, to use the shared disk or the mirror disk, select the **Failover is possible at all servers** check box or add **server1** and then **server2** from the **Available Servers** and add them to the **Servers that can run the Group**. To use the hybrid disk, add **svg1** and then **svg2** from the **Available Server Groups** to the **Server Groups that can run the Group**



Click **Next**.

3. Specify each attribute value of the failover group. Because all the default values are used for the setup example in this chapter, click **Next**.  
The **Group Resource List** is displayed.

## 2-2. Add a group resource (floating IP resource)

Add a group resource, a configuration element of the group, to the failover group you have created in Step 2-1.

1. Click **Add** in the **Group Resource List**.
2. The **Resource Definition of Group(failover1)** dialog box is displayed. In the **Resource Definition of Group(failover1)** dialog box, select the group resource type **floating ip resource** in the **Type** box, and enter the group resource name **fip1** in the **Name** box. Click **Next**.
3. The **Dependent Resources** page is displayed. Specify nothing. Click **Next**.
4. The **Recovery Operation at Activation Failure Detection** and **Recovery Operation at Deactivation Failure Detection** pages are displayed. Click **Next**.
5. Enter IP address (192.168.0.12 ) to **IP Address** box. Click **Finish**.  
The floating IP resource is added to **Group Resource List**.

## 2-3. Add a group resource (disk resource/mirror disk resource/hybrid disk resource)

### When using a shared disk

Add a shared disk as a group resource.

1. Click **Add** in **Group Resource List**.
2. The **Resource Definition of Group(failover1)** dialog box is displayed. In the **Resource Definition of Group(failover1)** dialog box, select the group resource type **disk resource** in the **Type** box, and enter the group resource name **sd1** in the **Name** box. Click **Next**.
3. The **Dependent Resources** page is displayed. Specify nothing. Click **Next**.
4. The **Recovery Operation at Activation Failure Detection** and **Recovery Operation at Deactivation Failure Detection** pages are displayed. Click **Next**.
5. Select **server1** in the **Servers that can run the Group**. Click **Add**.
6. The **Selection of partition** dialog box is displayed. Select the partition **F:**. Click **OK**.

---

### Important:

For disk resource partition, specify an unformatted partition on the shared disk that is connected to the filtering-configured HBA.

Make sure not to specify the disk resource partition to partition for disk heartbeat partition, or cluster partition or data partition for mirror disk resource. Data on the shared disk may be corrupted.

---

7. Similarly, add **server2** to **Servers that can run the Group**, and click **Finish**.  
The disk resource is added to **Group Resource List**.

**When using a mirror disk**

Add a mirror disk as a group resource.

1. Click **Add** in **Group Resource List**.
2. The **Resource Definition of Group(failover1)** dialog box is displayed. In the **Resource Definition of Group(failover1)** dialog box, select the group resource type **mirror disk resource** in the **Type** box, and enter the group resource name md1 in the **Name** box. Click **Next**.
3. The **Dependent Resources** page is displayed. Specify nothing. Click **Next**.
4. The **Recovery Operation at Activation Failure Detection** and **Recovery Operation at Deactivation Failure Detection** pages are displayed. Click **Next**.
5. Select **server1** in the **Servers that can run the Group**. Click **Add**.
6. The **Selection of partition** dialog box is displayed. In the **Selection of Partition** dialog box, click **Connect**, and then, select a data partition **F:** and cluster partition **E:**. Click **OK**.

---

**Important:**

Specify different partitions for data partition and cluster partition. If the same partition is specified, data on the mirror disk may be corrupted. Make sure not to specify a partition on the shared disk for the data partition and cluster partition of mirror disk resource.

---

7. Similarly, add **server2** to **Servers that can run the Group**, and click **Finish**.  
The mirror disk resource is added to **Group Resource List**.

**When using a hybrid disk**

Add a hybrid disk as a group resource.

1. Click **Add** in **Group Resource List**.
2. The **Resource Definition of Group(failover1)** dialog box is displayed. In the **Resource Definition of Group(failover1)** dialog box, select the group resource type **hybrid disk resource** in the **Type** box, and enter the group resource name hd1 in the **Name** box. Click **Next**.
3. The **Dependent Resources** page is displayed. Specify nothing. Click **Next**.
4. The **Recovery Operation at Activation Failure Detection** and **Recovery Operation at Deactivation Failure Detection** pages are displayed. Click **Next**.
5. Enter the drive letter (G:) of the data partition for mirroring in the **Data Partition Drive Letter** box, the drive letter (F:) of the cluster partition in the **Cluster Partition Drive Letter** box.

---

**Important:**

Specify different partitions for data partition and cluster partition. If the same partition is specified, data on the mirror disk may be corrupted.

---

6. Click **Obtain information**. The GUID information of data and cluster partitions on each server is displayed. Click **Finish**.  
The hybrid disk resource is added to **Group Resource List**.

## 2-4. Add a group resource (application resource)

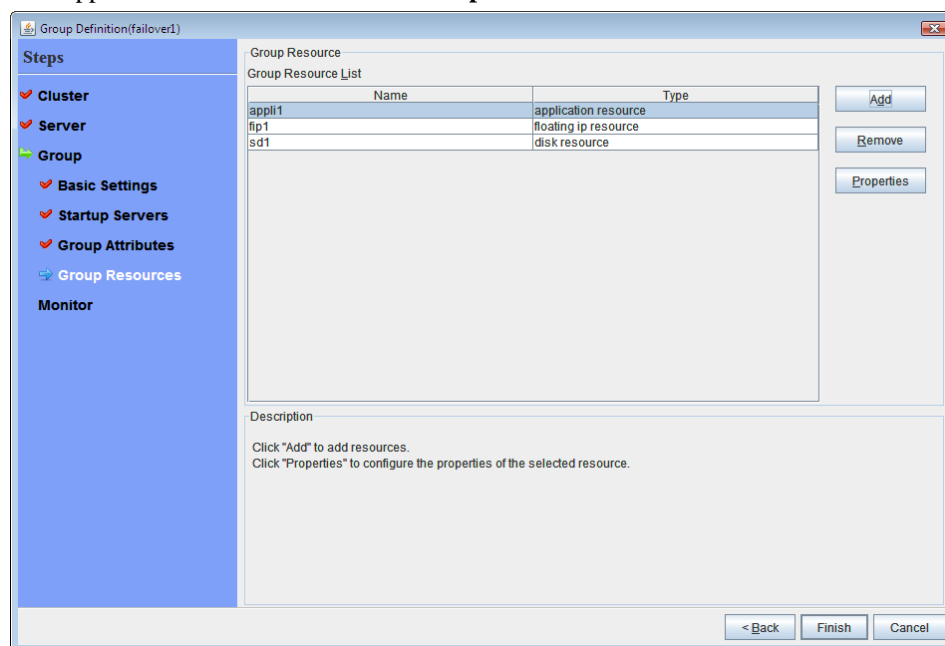
Add an application resource that can start and stop the application.

1. Click **Add** in **Group Resource List**.
2. The **Resource Definition of Group(failover1)** dialog box is displayed. In the **Resource Definition of Group(failover1)** dialog box, select the group resource type **application resource** in the **Type** box, and enter the group resource name appli1 in the **Name** box. Click **Next**.
3. The **Dependent Resources** page is displayed. Specify nothing. Click **Next**.
4. The **Recovery Operation at Activation Failure Detection** and **Recovery Operation at Deactivation Failure Detection** pages are displayed. Click **Next**.
5. Select **Resident** in the **Resident Type**. Specify the path of the execution file for the **Start Path**.

### Note:

For the **Start Path** and **Stop Path**, specify an absolute path of the executable file or the name of the executable file of which the path configured with environment variable is effective. Do not specify a relative path. If it is specified, starting up the application resource may fail.

6. Click **Finish**.  
The application resource is added to **Group Resource List**.



7. Click **Finish**.

## 3. Create monitor resources

Add a monitor resource that monitors a specified target to the cluster.

### 3-1. Add a monitor resource (disk RW monitor resource)

Add RW monitor resource to monitor the local disk.

1. Click **Next** in **Group List**.
2. The **Monitor Resource List** is displayed. In the **Monitor Resource List**, click **Add**. Select the monitor resource type **disk RW monitor** in the **Type** box, and enter the monitor resource name **diskw1** in the **Name** box. Click **Next**.
3. Enter the monitor settings. Select **Always** in the **Monitor Timing** box. Click **Next**.
4. Set the file name **C:/check.txt** and I/O size (**2000000**). Select **Action on Stall (Generate an Intentional Stop Error)** and **Action When Diskfull Is Detected (Recover)**, and click **Next**. For **File Name**, specify the file of the partition where OS is installed.
5. Select **Execute only the final action** in the **Recovery Action** box.
6. Select **Generate an Intentional Stop Error** in the **Final Action** box, and click **Finish**.

The disk RW monitor resource **diskw1** is added to the **Monitor Resource List**.

**Note:**

By specifying a file in the local disk for the monitoring target of the disk RW monitoring resource, monitoring can be performed as the local disk monitoring. In such a case, select **Generate an Intentional Stop Error** for the **Final Action**.

### 3-2. Add a monitor resource (IP monitor resource for the ManagementGroup)

Add monitor resources that monitor IP. IP monitor needs to be created on a failover group basis. Because the example used here has two groups, a group for ManagementGroup and a group for a failover group. An IP monitor is created for each group.

1. Click **Add** in the **Monitor Resource List** dialog box. Select the monitor resource type **ip monitor** in the **Type** box, and enter the monitor resource name **ipw1** in the **Name** box. Click **Next**.
2. Enter the monitor settings. Change nothing from the default values. Click **Next**.
3. Click **Add** in the **IP Addresses**. Enter the IP address to be monitored **192.168.0.254** in the **IP Address** box, and click **OK**.

**Note:**

For monitoring target of the IP monitor resource, specify the IP address of a device (for example, gateway) that is assumed to be always active on the public LAN

4. The IP address you have entered is set in the **IP Addresses**. Click **Next**.
  5. Specify the recovery target. Click **Browse**.
  6. Click ManagementGroup in the tree view and click **OK**. ManagementGroup is set in the **Recovery Target**.
  7. Enter **1** in the **Maximum Reactivation Count** box. Click **Finish**.
- The IP monitor resource **ipw1** is added to the **Monitor Resource List**.

### 3-3. Add a monitor resource (IP monitor resource for failover group)

1. Click **Add** in the **Monitor Resource List** dialog box. Select the monitor resource type **ip monitor** in the **Type** box, and enter the monitor resource name **ipw2** in the **Name** box. Click **Next**.
2. Enter the monitor settings. Change nothing from the default values. Click **Next**.
3. In the IP Addresses, click **Add**. Enter the IP address to be monitored **192.168.0.254** in the **IP Address** box, and click **OK**.

---

**Note:**

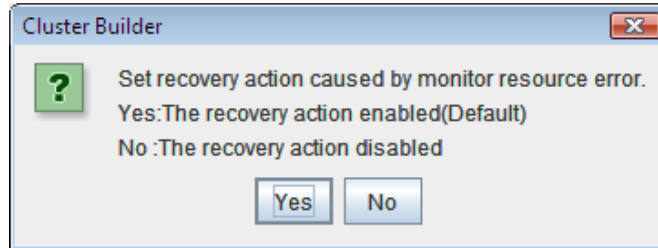
For monitoring target of the IP monitor resource, specify an IP address of the device (i.e. gateway) that is assumed to be always active on public LAN

---

4. The entered IP address is set in the **IP Addresses**. Click **Next**.
5. Specify the recovery target. Click **Browse**.
6. Click failover1 in the displayed tree view. Click **OK**. “failover1” is set in the **Recovery Target**.
7. Set **0** in the **Maximum Reactivation Count** box, and click **Finish**.  
The IP monitor resource **ipw2** is added to the **Monitor Resource List**.

## 4. Disabling recovery action caused by monitor resource error

When you click **Finish** after creating a monitor resource, the following popup message appears:



Clicking **No** disables the recovery action even if a monitor resource error is detected. When you start a cluster for the first time after creating the cluster configuration information, it is recommended that you disable the recovery action to check for errors in the cluster configuration information.

Note that this function can be set up by using the **Disable Recovery Action Caused by Monitor Resource Error** on the **Recovery** tab in the **Cluster Properties** window.

---

**Note:**

When recovery action was disabled, recovery action triggered by monitor resource error is not performed. Even if this function is enabled, recovery from a group resource activation failure and failover upon a server failure will still be performed.

This function is not enabled by the stall detection function of the disk RW monitor resource.

---


Create cluster configuration information is complete. Proceed to the next section, "Starting a cluster".

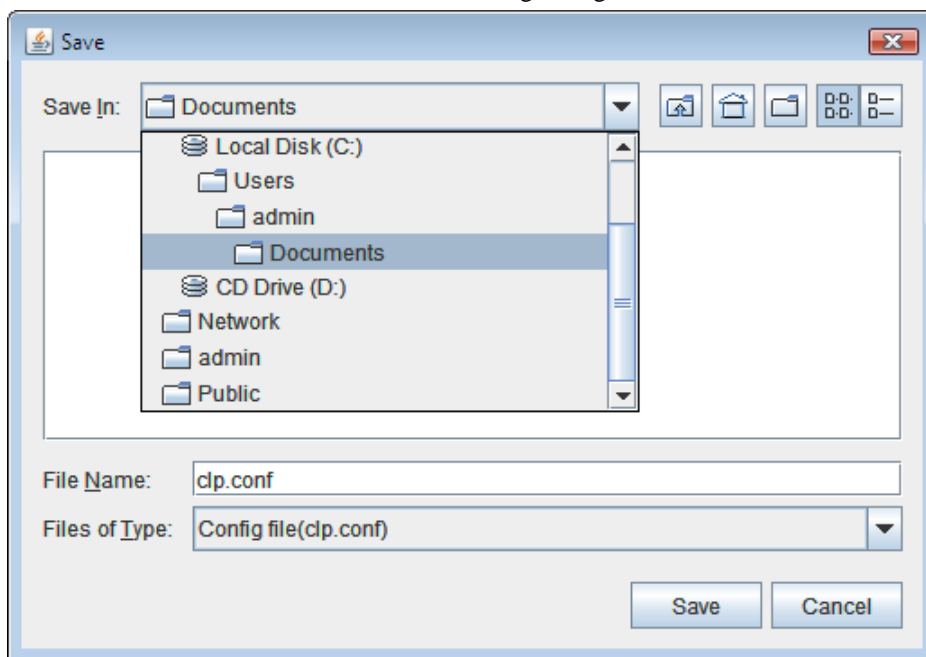
## Saving the cluster configuration data

The cluster configuration data can be saved in a file system or in media such as a floppy disk.

### Saving the cluster configuration data

Follow the procedures below to save the cluster configuration.

1. Select **Export** from the **File** menu of the Builder, or click the icon  on the tool bar.
2. Select a location to save the data in the following dialog box, and click **Save**.



---

**Note:**

One file (`clp.conf`) and one directory (`scripts`) are saved. If any of these are missing, the command to create a cluster does not run successfully. Make sure to treat these two as a set. When new configuration data is edited, `clp.conf.bak` is created in addition to these two.

---

3. Check the file system and verify if the one file (`clp.conf`) and the directory (`scripts`) are located in a directory to be saved.

---

**Note:**

When installing ExpressCluster, if the port number different from the default value is specified in **Port Number**, click **Cluster Properties** and click **Port Number** and specify the same values for **WebManager HTTP Port Number** and **Disk Agent Port Number** specified at the time of installation before saving the cluster configuration data.



---

## Starting a cluster

After creating and/or modifying a cluster configuration data, apply the configuration data on the servers that constitute a cluster and create a cluster system.

### How to create a cluster

After creation and modification of the cluster configuration data are completed, create a cluster in the following procedures.

1. Click **Apply the Configuration File** on the **File** menu or the icon  on the tool bar.  
A popup message asking “Do you want to perform the operations?” is displayed. Click **OK**.  
When the upload ends successfully, a popup message saying "The application finished successfully." is displayed. Click **OK**.  
If the upload fails, perform the operations by following the displayed message.
2. Click **Operation Mode** on the **View** menu of the Builder or select the  **Operation Mode** on the drop down menu of the toolbar to switch to the operation mode.
3. Select **Start Cluster** from **Service** of the WebManager, and click **OK**.

A cluster system starts and the status of the cluster is displayed to the WebManager.

---

**Note:**

When installing ExpressCluster, if the port number different from the default value is specified in **Port Number**, click **Cluster Properties** and click **Port Number** and specify the same values for **WebManager HTTP Port Number** and **Disk Agent Port Number** specified at the time of installation before saving the cluster configuration data.

---



# Chapter 6      Verifying a cluster system

This chapter describes how you verify that the created cluster system runs normally.

This chapter covers:

- Verifying the status using the WebManager ..... 106
- Verifying status using commands ..... 108

## Verifying the status using the WebManager

The cluster system you have set up can be verified by using the WebManager or running the ExpressCluster command from the command prompt. This chapter provides instructions for verifying the cluster system by using the WebManager. The WebManager is installed at the time of the ExpressCluster Server installation. Therefore, it is not necessary to install it separately. The overview of the WebManager is provided. Then how to verify a cluster by accessing the WebManager is described.

---

**Related Information:**

For system requirements of the WebManager, see the *Getting Started Guide*.

---

Follow the steps below to verify the operation of the cluster after creating the cluster and connecting to the WebManager.

---

**Related Information:**

For details on how to use the WebManager, see Chapter 1 “Functions of the WebManager” in the *Reference Guide*. If any error is detected while checking the status, troubleshoot the error referring to Chapter 11 “Troubleshooting” in the *Reference Guide*.

---

**1. Check heartbeat resources**

Check on the WebManager that the each server has been rebooted and that the heartbeat resource status of each server is normal. Check that no alert or error is recorded in the alert view of the WebManager.

**2. Check monitor resources**

Verify that the status of each monitor resource is normal on the WebManager.

**3. Start up a group**

Start a group.

Check on the WebManager that the group has been started and that group resources included in the group have been started.

Check that no alert or error is recorded in the alert view of the WebManager.

**4. Check a disk resource and mirror disk resources/hybrid disk resource**

Check that you can access the resource switching partition or data partition on the server where a disk resource/mirror disk resource/hybrid disk is active. Check that you cannot access the resource switching partition or data partition on the server where any resource described above is not active.

**5. Check a floating IP resource**

Check that you can ping a floating IP address while the floating IP is active.

**6. Check an application resource**

Check that an application is working on the server where an application resource is active.

**7. Check a service resource**

Check that a service is working on the server where a service resource is active.

**8. Stop a group**

Stop a group.

Verify on the WebManager that the group has been stopped and that each group resource included in the group has been stopped. Verify that no alert or error is recorded in the alert view of the WebManager.

**9. Start a group**

Start a group.

Verify on the WebManager that the group has been started.

**10. Move a group**

Move a group to another server.

Check on the WebManager that the group has been started on the moving destination sever. Verify that each group resource has been started successfully and that no alert or error is recorded in the alert view of the WebManager.

Move the group to all servers included in the failover policy to check above mentioned issue.

**11. Perform failover**

Shut down the server where a group is active.

After the heartbeat timeout, check to see the group has failed over. Verify that the status of the group becomes activated on the failover destination server on the WebManager.

**12. Perform failback**

When the automatic failback is set, start the server that you shut down for checking failover. Verify that the group fails back to the original server after it is started. Check on the WebManager that the status of group becomes activated on the failback destination server.

**Note:**

For groups that include mirror disk resource or hybrid disk resource, auto failback cannot be set because mirror recovery is required.

---

**13. Check the alert option**

When the alert option is set, check that an alert mail message is sent after checking a failover.

**14. Shut down the cluster**

Shut down the cluster. Verify that all servers in the cluster are successfully shut down Also, check that all servers start successfully by restarting them. At the same time, check that no alert or error is recorded in the alert view of the WebManager.

## Verifying status using commands

Follow the steps below to verify the status of the cluster from a server constituting the cluster using command lines after the cluster is created.

---

**Related Information:**

For details on how to use commands, see Chapter 3 “ExpressCluster command reference” in the *Reference Guide*. If any error is detected while verifying the status, troubleshoot the error referring to Chapter 11 “Troubleshooting” in the *Reference Guide*.

---

**1. Check heartbeat resources**

Check that the status of each server is activated by using the `clpstat` command.  
Verify that the heartbeat resource status of each server is normal.

**2. Check monitor resources**

Verify that the status of each monitor resource is normal by using the `clpstat` command.

**3. Start groups**

Start the groups with the `clpgrp` command.  
Verify that the status of groups is activated by using the `clpstat` command.

**4. Check a disk resource/mirror disk resource/hybrid disk resource**

Check that you can access the resource switching partition or data partition on the server where a disk resource/mirror disk resource/hybrid disk is active. Check that you cannot access the resource switching partition or data partition on the server where any resource described above is not active.

**5. Check a floating IP resource**

Verify that you can ping a floating IP address while the IP resource is active.

**6. Check an application resource**

Verify that an application is working on the server where the application resource is active.

**7. Check a service resource**

Verify that a service is working on the server where the service resource is active.

**8. Stop a group**

Stop a group by using the `clpgrp` command. Check that the group is stopped by using the `clpstat` command.

**9. Start a group**

Start a group by using the `clpgrp` command. Check that the group is activated by using the `clpstat` command.

**10. Move a group**

Move a group to another server by using the `clpstat` command.  
Verify that the status of the group is activated by using the `clpstat` command.  
Move the group to all servers in the failover policy and verify that the status changes to activated on each server.

**11. Perform failover**

Shut down a server where a group is active.  
After the heartbeat timeout, check to see the group has failed over by using the `clpstat` command. Verify that the status of the group becomes activated on the failover destination server using the `clpstat` command.

**12. Perform failback (When it is set)**

When the automatic failback is set, start the server which you shut down in the previous step, “11. Perform failover.” Verify that the group fails back to the original server after it is started using the `clpstat` command. Verify that the status of the group becomes activated on the failback destination server using the `clpstat` command.

**13. Check the alert option (When it is set)**

When the alert option is set, verify that a mail message is sent at failover.

**14. Shut down the cluster**

Shut down the cluster by using the `clpstdn` command. Verify that all servers in the cluster are successfully shut down.



## **Section III      Evaluation before operating a cluster system**

This section provides information on the evaluation that must be done before starting the operation of ExpressCluster. This section also provides instructions for uninstallation and reinstallation.

- Chapter 7    Verifying operation
- Chapter 8    Preparing to operate a cluster system
- Chapter 9    Uninstalling and reinstalling ExpressCluster



# Chapter 7      Verifying operation

This chapter provides information on how to run dummy-failure tests to see the behaviors of your cluster system and how to adjust parameters.

This chapter covers:

- Operation tests ..... 114
- Backup and restoration ..... 118

## Operation tests

Perform dummy-failure tests, backup, and restoration of the shared disk to verify that the monitor resource can detect errors normally, and that no unexpected errors occur. Also verify that the recovery operations performed when the monitor resource detects an error are performed as intended.

If monitor resources do not detect errors successfully or detect or any stoppage of the server or the OS occurs, the time-out value or other settings need to be adjusted.

**1. Transition of recovery operations due to dummy failure**

When Dummy Failure is enabled, a test must be conducted to check that recovery of the monitor resources in which an error was detected is performed as set.

You can perform this test from WebManager or with the `clpmonctrl` command. For details, see Chapter 1, "Functions of the WebManager" or Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

**2. Dummy-failure of the shared disks**

(When the shared disk is RAID-configured and dummy-failure tests can be run)

The test must include error, replacement, and recovery of RAID for the shared disk.

- Set a dummy-failure to occur on the shared disk.
- Recover RAID from the degenerated state to normal state.

For some shared disk, I/O may temporarily stop or delay when it switches to the degenerated operation or when the RAID is reconfigured.

If any time-out and/or delay occurs in disk rw monitor resource or disk TUR monitor resource, adjust the time-out value of each monitor resource.

**3. Dummy-failure of the paths to shared disks**

(When the path to the shared disk is redundant paths and dummy-failure tests can be run.)

The test must include an error in the paths and switching of one path to another.

- Set a dummy-failure to occur in the primary path.

It takes time for some path-switching software (driver) to switch the failed path to the path normally working. In some cases, the control may not be returned to the operating system (software).

If any time-out and/or delay occurs in disk rw monitor resource or disk TUR monitor resource, adjust the time-out value of each monitor resource.

**4. Backup/Restoration**

If you plan to perform regular backups, run a test backup.

Some backup software and archive commands make CPU and/or disk I/O highly loaded.

If any heartbeat delays, delay in monitor resources, or time-out occur, adjust the heartbeat time-out value and/or time-out value of each monitor resource.

The following describes dummy-failures and what occur by the dummy-failures on a device basis. What occurs varies depending on a system configuration and resource settings. The table in the next page shows the operational examples in the general setting and configuration.

| Device                      | Dummy-failure   | What happens:   |
|-----------------------------|---|---|
| Disk device<br>SCSI/FC path | Unplug the cable on the active server (for redundant disk cable, unplug both cables)                                  | When the shared disk is monitored, an error is detected, and failover to the standby server occurs. When no disk is monitored, the operation stops.<br>Deactivation of a disk resource may fail when performing failover.   |
|                             | Unplug the cable on the standby server (for redundancy, unplug both cables)   | When the disk TUR monitor resource monitors the disk path on the standby server, an error is detected. The operation continues on the active server.  |
|                             | Unplug the cable of the primary path when the disk path is redundant. (When FC Switch is used, power it off as well.) | Switching of the disk path is performed by the path switching software. No error is detected on the ExpressCluster and the operation continues.   |
|                             | In the state of one side path described above, restart the server by moving a group or shutting down the cluster.     | The disk path operates in the same way as it is normal.   |
|                             | Degenerate and/or recover the RAID of the disk device.  | No error is detected on ExpressCluster, and the operation continues.  |
|                             | When the disk device controller is duplicated, stop the one side.   | When the path is duplicated, the disk path is switched by the path switching software. No error is detected on ExpressCluster, and the operation continues.<br>When the path is not duplicated and each server is connected directly to the disk, an error is detected by the disk TUR monitor resource on the server connected to the stopped controller, failover to the standby server is performed. (When the controller on the standby server stops, the operation continues.)   |
| Interconnect LAN            | Unplug the cable dedicated to LAN   | The LAN heartbeat resource on the interconnect becomes offline.<br>A warning is issued to the WebManager alert view.<br>Communication between servers continues by using a public LAN<br>= Operation continues.   |
| Public LAN                  | Unplug the LAN cable or power off the HUB   | Communication with the operational client stops, application stalls or an error occurs.<br>LAN heartbeat resource on the public LAN becomes inactive. A warning is issued to the WebManager alert view.<br>An error is detected when using IP monitor resource and/or NIC Link Up/Down monitor resource. When the cable on the active server is unplugged, a failover occurs. (When HUB is powered off, a failover is repeated up to the largest count configured.<br>When the public LAN is the only communication channel between servers (such as the remote |

| Device                       | Dummy-failure  | What happens:  |
|------------------------------|--|--|
|                              |  | cluster configuration), emergency shutdown due to the network partition resolving in the ping method takes place in the server where LAN cable is unplugged.   |
| Server UPS                   | Unplug the power cable of UPS on the active server from outlet   | The active server shuts down<br>Failover to the standby server occurs  |
| UPS on a shared disk         | When the power of the shared disk is duplicated, unplug one of the power cables from outlet.   | No error is detected on ExpressCluster and the operation continues. When UPS supplies the power to one server, the server shuts down. (If it is the active server, failover to the standby server takes place) |
| LAN for UPS                  | Unplug the LAN cable   | UPS becomes uncontrollable. However, no error is detected on ExpressCluster and operation continues.   |
| COM                          | Unplug the RS-232C cable of the COM network partition resolving.   | A warning is issued to the WebManager alert view.<br>Operation continues.  |
| OS error                     | Run the <code>shutdown</code> command on the active server   | The active server shuts down<br>Failover to a standby server occurs.   |
| Mirror connect               | When more than one LAN cable is set up for the mirror connect and one or more of them are connected<br>Unplug only the LAN cable that is being used as the mirror connect. | Continue the mirroring operation   |
|                              | When only one LAN cable is set up for the mirror connect, or when more than one LAN cable is set up for the mirror connect but none of them are connected                  | A warning is issued to the WebManager alert view I (mirroring stops)<br>Operation continues on the active server but switching to a standby server becomes impossible.   |
|                              | Unplug only the LAN cable that is being used as the mirror connect.  | An error is detected in mirror disk monitor resource/mirror connect disk resource/hybrid disk monitor resource.  |
| Disk resource                | Start up the disk resource on the server where the disk path is unplugged.   | The disk resource does not get activated.<br>Failover to a standby server occurs.  |
| Application resource         | Start up the application resource on the server where the name of the file or folder configured for the start path of the application resource was temporarily changed.    | The application resource does not get activated.<br>Failover to a standby server occurs.   |
| Application monitor resource | Stop a process to be monitored by the task manager.  | An error is detected. The application is restarted or a failover to the standby server occurs.   |
| Service resource             | Start up the service resource on the server where the path or name of the service's execution file was temporarily changed.  | The service resource does not get activated.<br>Failover to a standby server occurs.   |
| Service monitor resource     | Stop a service to be monitored.  | An error is detected. The service is restarted or a failover to a standby server occurs.   |

| Device              | Dummy-failure  | What happens:   |
|---------------------|--|---|
| Floating IP address | Specify the IP address that was set to a floating IP address to a machine in the same segment, and then start up the floating IP address resource. | The floating IP resource does not get activated. Failover to a standby server occurs. (Activation fails at the failover destination. Failover is repeated up to the largest count configured) |
| VM resource         | Disconnect the shared disk containing the virtual machine image.   | The VM resource is not activated.   |
| VM monitor resource | Shut down the virtual machine.   | The virtual machine is started by restarting the resource.  |

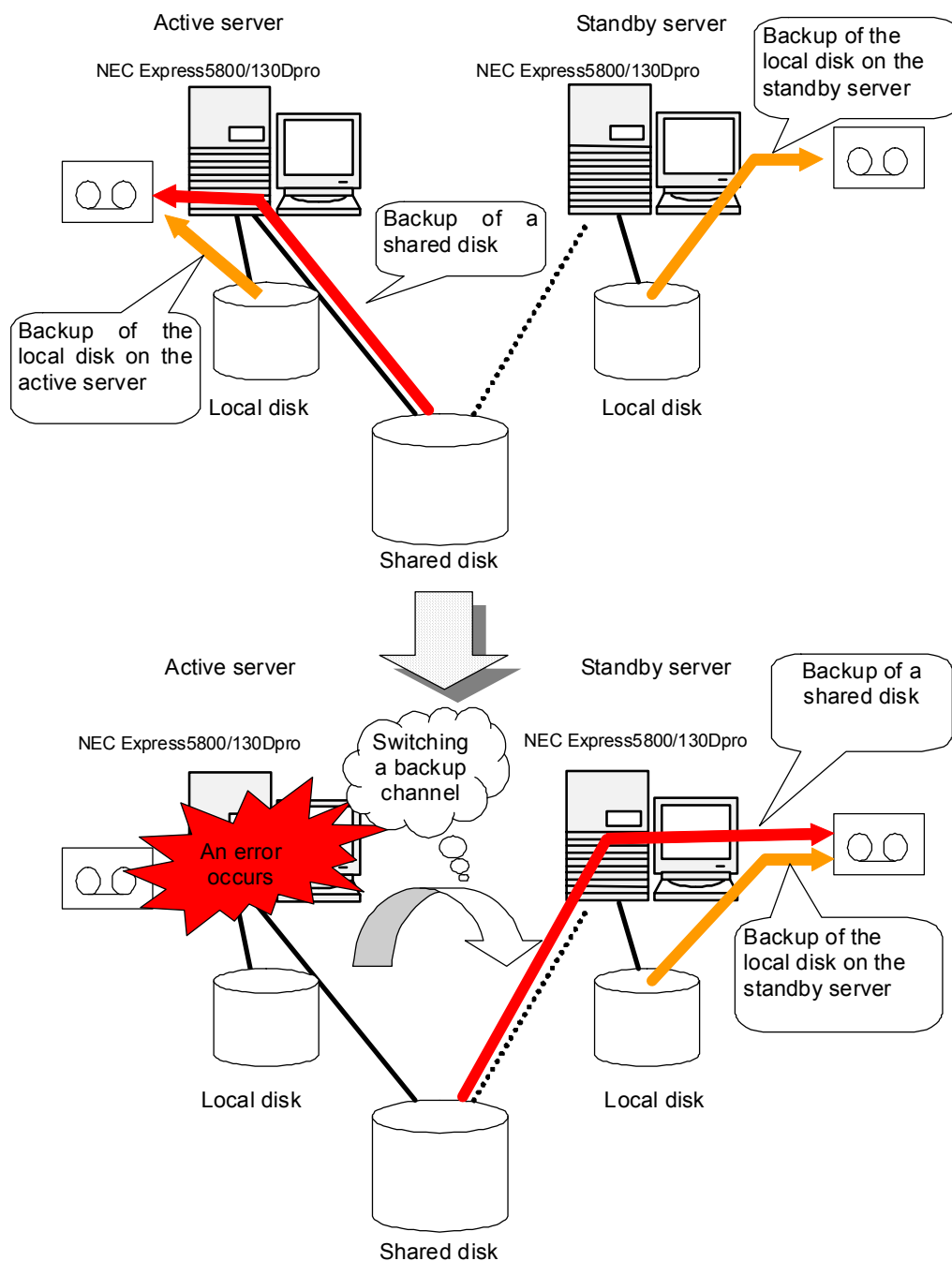
**Related Information:**

For information on how to change each parameter, see the *Reference Guide*.

## Backup and restoration

The following figure illustrates backup and restoration of data. For details on how to back up, see Chapter 10 “The system maintenance information” in the *Reference Guide* and manuals backup software.

The following is an example of the backup on the uni-directional standby server



# Chapter 8      Preparing to operate a cluster system

This chapter describes what you have to do before you start operating ExpressCluster, such as how you perform operation simulation, log collection when an error occurs.

This chapter covers:

- Operating the cluster..... 120
- Suspending ExpressCluster ..... 122
- Modifying the cluster configuration data..... 123
- Checking the log collection procedure ..... 126

## Operating the cluster

Before you start using your cluster system, check to see your cluster system work properly and make sure you can use the system properly. The following describes procedures to start up and shut down a cluster and to shut down a server.

### Activating a cluster

To activate a cluster, follow the instructions below:

1. When you are using any shared or add-in disk, start the disk.
2. Start all the servers in the cluster.

After cluster activation synchronization between the servers has been confirmed, a cluster is activated on each server. After the cluster has been activated, a group is activated on an appropriate server according to the settings.

---

**Note 1:**

When you start all the servers in the cluster, make sure they are started within the duration of time set to **Server Sync Wait Time** on the **Timeout** tab of the **Cluster Properties** in the Builder. Be careful that failover occurs if startup of any server fails to be confirmed within the specified time duration.

**Note 2:**

The shared disk spends a few minutes for initialization after its startup. If a server starts up during the initialization, the shared disk cannot be recognized. Make sure to set servers to start up after the shared disk initialization is completed. For more information, see “1.

Shared disk settings (Required for shared disk)” on page 29.

---

### Shutting down a cluster and server

To shut down a cluster or server, use ExpressCluster commands or shut down through the WebManager.

---

**Note:**

When you are using the Replicator/Replicator DR, mirror break may occur if you do not use any ExpressCluster commands or WebManager to shut down a cluster.

---

### Shutting down the entire cluster

The entire cluster can be shut down by running the `clpstdn` command, executing cluster shutdown from the WebManager or performing cluster shutdown from the **Start** menu. To shut down the entire cluster, wait for all the groups to stop and then terminate each server. By shutting down a cluster, all servers in the cluster can be stopped properly as a cluster system.

---

**Related Information:**

For more information on the `clpstdn` command and the WebManager functions, see the *Reference Guide*.

---

### Shutting down a server

Shut down a server by running the `clpdown` command or executing server shutdown from the WebManager. Failover occurs when you shut down a server. Mirroring performed by mirror disk resources/hybrid disk resources is interrupted when you are using the Replicator/Replicator DR. If you intend to use a standby server while performing hardware maintenance, shut down the active server.

---

**Related Information:**

For more information on the `clpdown` command and the WebManager functions, see Chapter 1 “Functions of the WebManager” in the *Reference Guide*.

---

## Suspending/resuming a cluster

When you want to update the cluster configuration information, you can stop the ExpressCluster service without stopping the current operation. Stopping the ExpressCluster in this way is referred to as “suspending”. Returning from the suspended status to the normal operation status is referred to as “resuming”.

When suspending or resuming a cluster, a request for processing is issued to all the servers in the cluster. Suspending must be executed with the ExpressCluster service on all the servers in the cluster being active.

Use ExpressCluster commands or WebManager to suspend or resume a cluster.

When a cluster is suspended, some functions are disabled as described below because the ExpressCluster service stops while the active resources are kept active.

- All heartbeat resources stop.
- All network partition resolution resources stop.
- All monitor resources stop.
- Groups or group resources are disabled (cannot be started, stopped, or moved).
- The cluster status cannot be displayed or operated by WebManager or the `clpstat` command.
- The following commands cannot be used:
  - `clpstat`
  - `clpcl` command options other than `--resume`
  - `clpdown`
  - `clpstdn`
  - `clpgrp`
  - `clptoratio`
  - `clpmonctrl`
  - `clprsc`
  - `clpcpufreq`

## How to suspend a cluster

You can suspend a cluster by executing the `clpcl` command or by using WebManager.

---

**Related Information:**

For more information on the `clpcl` command and WebManager functions, refer to the *Reference Guide*.

---

## How to resume a cluster

You can resume a cluster by executing the `clpcl` command or by using WebManager.

---

**Related Information:**

For more information on the `clpcl` command and WebManager functions, refer to the *Reference Guide*.

---

## Suspending ExpressCluster

There are two ways to stop running ExpressCluster. One is to stop the service of the ExpressCluster Server, and the other is to set the Server service to be manually started.

### Stopping the ExpressCluster Server service

To stop only the ExpressCluster Server service without shutting down the operating system, use the `clpctl` command or stop the cluster from the WebManager.

---

**Related Information:**

For more information on the `clpctl` command, see Chapter 3 “ExpressCluster command reference” in the *Reference Guide*.

---

### Setting the ExpressCluster Server service to be manually activated

To make the ExpressCluster Server service not start when the OS starts, make the setting by using the OS service manager so that the Server service is manually started. By doing this, the ExpressCluster will not start when the OS is rebooted next time.


### Changing the setting of the ExpressCluster Server service from the manual startup to automatic startup

The OS service manager is also used to set the ExpressCluster Server service to be started automatically. Even you change the settings, the ExpressCluster Server service remains stopped until it is directly started up or the server is restarted.

## Modifying the cluster configuration data

The following describes procedures and precautions for modifying the configuration data after creating a cluster.

### Modifying the cluster configuration data by using the ExpressCluster Builder (online version)

1. Start the ExpressCluster WebManager by using a browser.  
`http://Actual_IP_address_of_server_to_which_ExpressCluster_was_installed:port_number` (Default: 29003)/
2. To start the Builder, click **Config Mode** on the **View** menu of the WebManager or select the **Config Mode** icon  from the drop down menu of the tool bar.
3. Modify the configuration data after the current cluster configuration data is displayed.
4. Upload the modified configuration data. Depending on the data modified, it may become necessary to suspend or stop the cluster and/or to restart by shutting down the cluster. In such a case, uploading is canceled once and the required operation is displayed. Follow the displayed message and do as instructed to perform upload again.

### Modifying the cluster configuration data by using the ExpressCluster Builder (offline version)

1. Start the ExpressCluster X Builder by using the Web browser.  
`Installation_path/CLUSTERPRO/clpbuilder-w/clptrek.htm`
2. Open the saved cluster configuration data.
3. When the cluster configuration data is displayed, modify it.
4. Save the modified configuration data.
5. Upload the configuration data from the server where ExpressCluster is saved by using the command prompt.  
`clpcfctrl --push -x  
path_to_directory_where_configuration_data_is_saved`  
Depending on the data modified, it may become necessary to suspend or stop the cluster, or to restart by shutting down the cluster. In such a case, uploading is canceled once and the required operation is displayed. Follow the displayed message and do as instructed to perform upload again.

---

#### Note:

When using the offline version, the disk configuration data cannot be obtained. To add and/or change the setting related to a disk and/or HBA, use the online version.

---

## Applying the modified cluster configuration data

To upload the modified cluster configuration data by the online ExpressCluster Builder or the `clpcfctrl` command, select the operation from the following depending on the modification. For the operation required to apply the modified data, refer to Chapter 2 “Functions of the Builder” in the *Reference Guide*.

The way you apply the changed data may affect the applications on the system and the behavior of the ExpressCluster Server. For details, see the table below:

| # | The way to apply changes                                       | Effect   |
|---|--|--|
| 1 | Upload only  | The operation of the ExpressCluster Server is not affected. Heartbeat resources, group resources and monitor resource do not stop.   |
| 2 | Restart the WebManager after uploading                         |  |
| 3 | Upload after stopping the group whose setting has been changed | Group resources are stopped. Because of this, the applications on the system that are controlled by the group are stopped until the group is started after uploading.  |
| 4 | Upload after suspending the cluster                            | The ExpressCluster is partly stopped. During the period when the ExpressCluster Server service is suspended, heartbeat resources and monitor resources are stopped. Because group resources do not stop, the applications on the system continue to operate. |
| 5 | Upload after stopping the cluster                              | The ExpressCluster totally stops. Groups stop as well. Therefore, the applications used on the system are stopped until data is uploaded and the cluster is started.   |
| 6 | Shut down and restart the cluster after uploading the data     | The applications used on the system are stopped until the cluster restarts and the group is started.   |

---

### Note:

If the cluster needs to be suspended or stopped to apply the modified data, ensure suspension or stopping is complete before applying the data.

Check if the message on the WebManager alert view shows “Module type: pm, Event type: information, Event ID: 2”. For more information on messages, see Section III in the *Reference Guide*.

When the WebManager is not available, check the syslog to see if “Module type: pm, Event type: information, Event ID: 2” is displayed on the event viewer.

After checking the message stated above, apply the cluster configuration data on the ExpressCluster environment.

---

## Only uploading the data

1. Start the ExpressCluster X Builder, and modify the cluster configuration data.
2. Upload the cluster configuration data by the ExpressCluster X Builder.
3. The following message is displayed if the data has successfully been distributed.  
The application finished successfully.

## Restarting the ExpressCluster X WebManager

For information on how to restart ExpressCluster X WebManager, refer to Chapter 1, “Functions of the WebManager” in the *Reference Guide*.

## Uploading the data by suspending the cluster

The following explains how to suspend the cluster when changing the configuration such as adding and/or deleting a server.

1. Start the ExpressCluster Builder and change the cluster configuration data.
2. Execute **Stop Cluster** by clicking the **Service** menu of the WebManager.
3. Upload the cluster configuration data by the ExpressCluster X Builder.
4. The following message is displayed if the data has successfully been distributed.  
Changes applied successfully.
5. Execute **Resume Cluster** by clicking the **Service** menu of the WebManager.

## Uploading the data by stopping the cluster

1. Start the ExpressCluster Builder and change the cluster configuration data.
2. Execute **Stop Cluster** by clicking the **Service** menu of the WebManager.
3. Upload the cluster configuration data by the ExpressCluster X Builder.
4. The following message is displayed if the data has successfully been distributed.  
Changes applied successfully.
5. Execute **Start Cluster** by clicking the **Service** menu of the WebManager.


## Shutting down and restarting a cluster after uploading the data

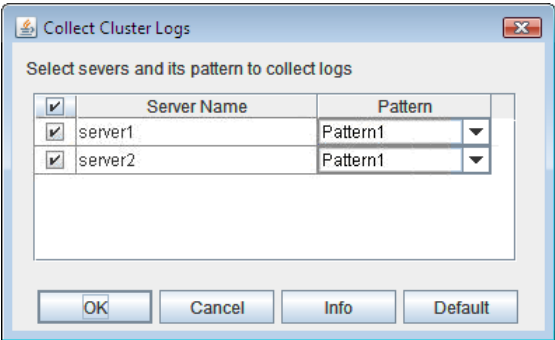
1. Start the ExpressCluster Builder and change the cluster configuration data.
2. Execute **Stop Cluster** by clicking the **Service** menu of the WebManager.
3. Upload the cluster configuration data by the ExpressCluster X Builder.
4. The following message is displayed if the data has successfully been distributed.  
Changes applied successfully.
5. Restart all servers from the **Start** menu.

# Checking the log collection procedure

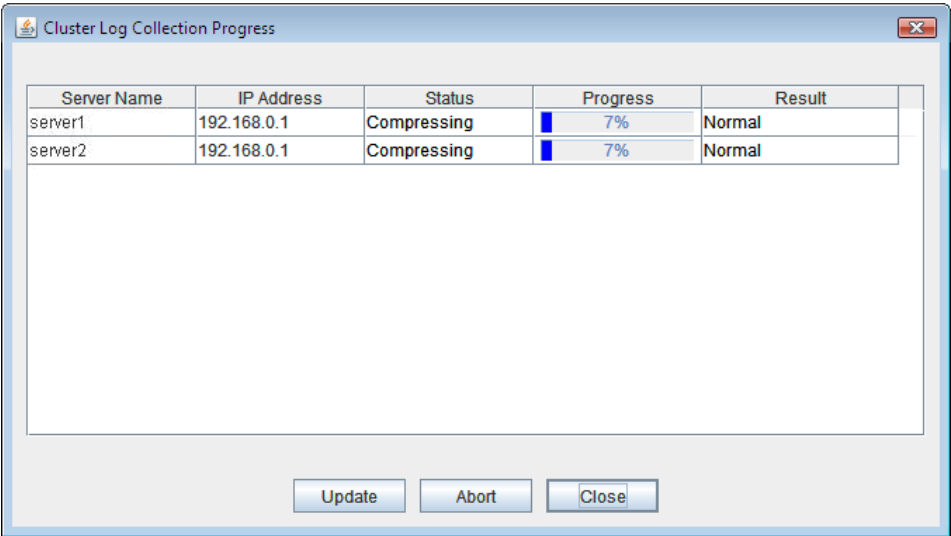
The following describes how to collect logs by using the WebManager.

## Collecting logs by using the WebManager

- 1. Start the WebManager.  
`http://IP_address_for_the_management_group or actual_IP_address_of_the_server_to_which_ExpressCluster_was_installed:port_number(Default: 29003)>`
- 2. Click **Collect Logs** on the **Tools** menu or click  on the toolbar. The **log collection** dialog box will open.

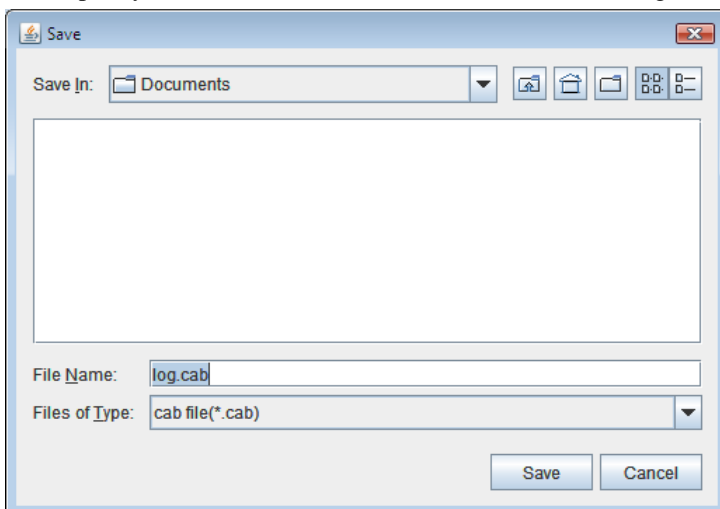


- 3. Select the check box of the servers for collecting log and select a log collection pattern. To view details about the pattern, click **Info**. To restore the default settings, click **Default**.
- 4. Click **OK**. Log collection will start and the dialog box that shows the progress of log collection will open.



The progress is displayed in the **Progress** column. To view the latest status, click **Update**.

5. When log collection is completed, a file saving dialog box of the browser is displayed. Specify a location to store the file and download the logs.



---

**Note:**

If you are using Internet Explorer 6.0 SP1 or later, the window described above may not be displayed. If the window is not displayed, enable the setting **Automatic prompting for file downloads** in the security settings, and collect logs again. Logs may not be downloaded properly when the window shown above is left without any action for more than 10 minutes.

---



Chapter 9

Uninstalling and reinstalling  
ExpressCluster

This chapter provides instructions for uninstalling and reinstalling ExpressCluster.  
This chapter covers:

- Uninstallation ..... 130
- Reinstallation ..... 132

# Uninstallation

## Uninstalling the ExpressCluster Server

---

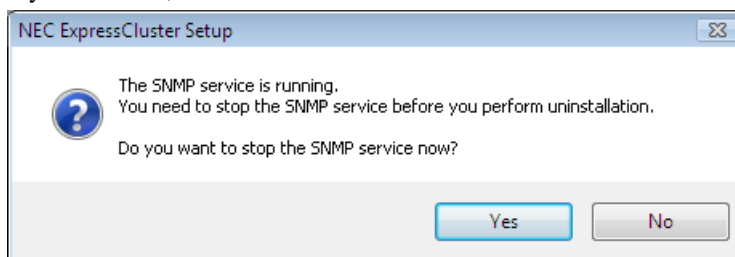
**Note:**

You must log on as Administrator when uninstalling the ExpressCluster Server. It is recommended to extract configuration information before performing uninstallation. For details, refer to Chapter 3, “ExpressCluster command reference” in the *Reference Guide*.

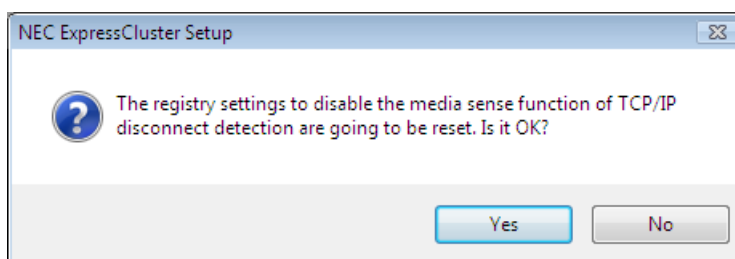
---

Follow the procedures below to uninstall the ExpressCluster Server:

1. Select **Service** in **Administrative Tool** in OS, and set following service **Startup Type** to **Manual**.
  - ExpressCluster
  - ExpressCluster Event
  - ExpressCluster Manager
  - ExpressCluster Old API Support
  - ExpressCluster Server
  - ExpressCluster Transaction
  - ExpressCluster Web Alert
2. Shutdown the server.
3. If the shared disk is used, please unplug all disk cables connected to the server because disk filtering will be disabled after uninstallation.
4. Turn on the server.
5. In **Control Panel** in OS, click **Add or Remove Programs**.
6. Select ExpressCluster Server and remove it.
7. The **ExpressCluster Server Setup** dialog box is displayed.
8. Click **Yes** in the uninstallation confirmation dialog box. If you click **No**, uninstallation will be canceled.
9. If the SNMP service is started, the message to confirm to stop the SNMP service is displayed. Click **Yes**. If you click **No**, uninstallation will be canceled.



10. The message asking whether to return the media sense function (TCP/IP disconnection detection) to the state before installing the ExpressCluster Server is displayed. Click **Yes** to return to the state before installing the ExpressCluster Server. If you click **No**, ExpressCluster will be uninstalled while media sense function is not effective.



11. The completion message is displayed when uninstallation is completed in the **ExpressCluster Server Setup** dialog box. Click **Finish**.
12. The confirmation message whether to restart the computer is displayed. Select whether to restart the PC and click **Finish**. Uninstallation of the ExpressCluster Server is completed.

---

**Important:**

If the shared disk is used, make sure not to start the OS while the shared disk is connected after uninstalling ExpressCluster. Data on the shared disk may be corrupted.

---

---

**Note:**

If you uninstall ExpressCluster with CPU frequency changed by using CPU Frequency Control of ExpressCluster, the CPU frequency does not return to the state before changing. In this case, return the CPU frequency to the defined value by the following way.

Windows Server 2003:

Execute the following command at a command prompt.

```
# powercfg /X "Always On" /processor-throttle-ac none
```

The character string to be specified with /X option is the name selected in the current setting of **Power Options** -> **Power Schemes** in **Control Panel**.

Windows Server 2008, Windows Server 2012:

Select **Balanced** in **Power Options** -> **Select a power plan** in **Control Panel**.

---

## Uninstalling the offline version ExpressCluster X Builder

To uninstall the ExpressCluster X Builder, follow the procedures below:

1. Exit from all Web browsers (confirm that the JavaVM icon is no longer in the task tray).
2. Delete the ExpressCluster X Builder installation folder from Windows Explorer.

## Reinstallation

### Reinstalling the ExpressCluster Server

To reinstall the ExpressCluster Server, you have to prepare the cluster configuration data (or the latest data if you reconfigured the cluster) created by the Builder.

After changing the configuration data, make sure to save the latest cluster configuration data. The configuration data backup can be created by the `clpcfctrl` command as well as it can be saved in the Builder when being created. For details, refer to “Creating a cluster and backing up configuration data (`clpcfctrl` command)” in Chapter 3, “ExpressCluster command reference” in the *Reference Guide*.

#### To reinstall ExpressCluster Server on the entire cluster

To reinstall the ExpressCluster Server, follow the procedures below:

1. Unplug disk all cables connected to all servers because access restriction does not function until reinstallation of the ExpressCluster Server is completed.
2. Uninstall the ExpressCluster Server in all servers that configure a cluster system. When reinstalling OS, it is not necessary to uninstall ExpressCluster. However, if ExpressCluster will be reinstalled to the folder where it was installed before, all files in the installation folder need to be deleted.

For details on the uninstallation procedures, refer to "Uninstalling the ExpressCluster Server" in this chapter.

3. Shut down OS after uninstalling the ExpressCluster Server is completed.

---

**Important:**

When a shared disk is used, make sure not to start the server connected to the shared disk while ExpressCluster is uninstalled. Data on the shared disk may be corrupted.

---

4. Install the ExpressCluster Server and register the license as necessary. Shut down the OS after installing the ExpressCluster Server is completed. If the shared disk is used, connect the shared disk and then start the OS. If the shared disk is not used, simply start the OS.

For details on how to install the ExpressCluster Server, refer to Chapter 3, "Installing ExpressCluster" in this guide. For how to register the license, refer to Chapter 4, "Registering the license" in this guide.

---

**Important:**

When a shared disk is used, make sure not to connect the shared disk to HBA without filtering settings or SCSI controller. Data on the shared disk may be corrupted.

---

5. Create the cluster configuration data and a cluster.  
For details on how to create the cluster configuration data and a cluster, refer to Chapter 5, "Creating the cluster configuration data" in this guide.

### To reinstall ExpressCluster Server on some servers in the cluster

To reinstall the ExpressCluster Server, follow the procedures below:

1. When a shared disk is used, unplug all disk cables connected to the servers on which you want to reinstall the ExpressCluster Server. This is because the access control does not work until the reinstallation is completed.
2. Uninstall the ExpressCluster Server. If you are reinstalling the OS, it is not necessary to uninstall the ExpressCluster. However, when reinstalling in the folder on which ExpressCluster was installed, the files in the installation folder must be deleted.  
For details on uninstallation procedures, refer to "Uninstalling the ExpressCluster Server" in this chapter.
3. Shut down the OS when uninstalling the ExpressCluster Server is completed.

---

#### Important:

When a shared disk is used, make sure not to start the server connected to the shared disk while ExpressCluster is uninstalled. Data on the shared disk may be corrupted.

---

4. Install the ExpressCluster Server to the server where it was uninstalled, and register the license as necessary. Shut down the OS when installing ExpressCluster Server is completed. When a shared disk is used, connect the shared disk and then start the OS. If a shared disk is not used, simply start the OS.  
For details on how to install the ExpressCluster Server, refer to Chapter 5, "Installing ExpressCluster" in this guide. For how to register the license, refer to Chapter 4, "Registering the license" in this guide.

---

#### Important:

When a shared disk is used, make sure not to connect the shared disk to HBA without filtering settings or SCSI controller. Data on the shared disk may be corrupted.

---

5. Connect to the WebManager in other servers in a cluster and switch to the **Config mode** (the Builder).
6. If a shared disk is used and the OS is reinstalled, or if you modify HBA to connect the shared disk, update the filtering information in **HBA** tab in **Server Properties** of the server where the OS is reinstalled.

---

#### Important:

To configure the filtering settings, click **Server Properties** of the server where the ExpressCluster Server is installed, click **HBA** tab, and then click **Connect**. If the filtering setting is configured without clicking **Connect**, data on the shared disk may be corrupted.

---

7. From the server where the web browser of the Builder is connected, run `clpctl -suspend --force` from the command prompt and suspend the cluster.
8. Apply the changes by the ExpressCluster X Builder.
9. The following message is displayed if the changes has successfully been applied.  
The application finished successfully.
10. Change the WebManager to **Operation** mode and resume the cluster from the **Service** menu.

---

#### Note:

When resuming the cluster from the WebManager, the message "Failed to resume the cluster. Click the Reload button, or try again later." is displayed, but ignore this message.

---

11. In the WebManager, right-click the server where ExpressCluster Server is reinstalled and select **Start in Service**.
12. When **Off** is selected in **Auto Return** in **Cluster Properties**, right-click the server where the ExpressCluster Server is reinstalled by using the WebManager and select **Recover**.
13. If necessary, move the group.



# Appendix A.

# Troubleshooting

## Error messages when installing the ExpressCluster Server

| Behavior and Message   | Cause   | Action   |
|--|---|--|
| failed to set up<br>Error code: %x<br>%x: error code   | Refer to the given error code.                            | Refer to the action for the error code.  |
| Less than 9.0 has been installed. After uninstalling, reinstall it again.                                    | The old version of the ExpressCluster has been installed. | Uninstall the old version of the ExpressCluster and install the current version. |
| Failed to set up (%d)<br>Error code: %x<br>After restart, install it.<br>%d: internal code<br>%x: error code | Refer to the explanation of the given error code.         | Refer to the action for the given error code.                                    |

## Troubleshooting for licensing

| Behavior and Message   | Cause   | Action   |
|--|---|--|
| When the cluster was shut down and rebooted after distribution of the configuration data created by the Builder to all servers, the following message was displayed on the WebManager's alert view, and the cluster stopped.<br>"The license is not registered. Product ID: %1"<br>%1: Product ID  | The cluster has been shut down and rebooted without its license being registered. | Register the license from one of the servers in the cluster.   |
| When the cluster was shut down and rebooted after distribution of the configuration data created by the Builder to all servers, the following message appeared on WebManager's alert view, but the cluster is working properly.<br>"The license is insufficient. The number of registered licenses is %1. The number of insufficient license is %2. The product ID is %3."<br>%1: The number of registered licenses<br>%2: The number of licenses in short of supply<br>%3: Product ID | Not enough license  | Obtain a license and register it.  |
| While the cluster was operated on the trial license, the following message is displayed and the cluster stopped.<br>"The license of trial expired by %1, %2 and %3. Product ID: %4"<br>%1: Trial end year<br>%2: Trial end ,month<br>%3: Trial end day<br>%4: Product ID   | The license has already expired.  | Ask your sales agent for extension of the trial version license, or obtain and register the product version license. |



## Appendix B.

## Glossary

|                                 |   |
|---------------------------------|---|
| <b>Active server</b>            | A server that is running for an application set.<br>(Related term: Standby server)  |
| <b>Cluster partition</b>        | A partition on a mirror disk. Used for managing mirror disks.<br>(Related term: Disk heartbeat partition)   |
| <b>Cluster shutdown</b>         | To shut down an entire cluster system (all servers that configure a cluster system).  |
| <b>Cluster system</b>           | Multiple computers are connected via a LAN (or other network) and behave as if it were a single system.   |
| <b>Data partition</b>           | A local disk that can be used as a shared disk for switchable partition. Data partition for mirror disks.<br>(Related term: Cluster partition)  |
| <b>Disk heartbeat partition</b> | A partition used for heartbeat communication in a shared disk type cluster.   |
| <b>Failback</b>                 | A process of returning an application back to an active server after an application fails over to another server.   |
| <b>Failover</b>                 | The process of a standby server taking over the group of resources that the active server previously was handling due to error detection.   |
| <b>Failover group</b>           | A group of cluster resources and attributes required to execute an application.   |
| <b>Failover policy</b>          | A priority list of servers that a group can fail over to.   |
| <b>Floating IP address</b>      | Clients can transparently switch one server from another when a failover occurs.<br>Any unassigned IP address that has the same network address that a cluster server belongs to can be used as a floating address. |
| <b>Heartbeat</b>                | Signals that servers in a cluster send to each other to detect a failure in a cluster.<br>(Related terms: Interconnect, Network partition)  |
| <b>Interconnect</b>             | A dedicated communication path for server-to-server communication in a cluster.<br>(Related terms: Private LAN, Public LAN)   |

|                                 |   |
|---------------------------------|---|
| <b>Management client</b>        | Any machine that uses the WebManager to access and manage a cluster system.   |
| <b>Master server</b>            | The server displayed at the top of <b>Master Server</b> in <b>Server Common Properties</b> of the Builder   |
| <b>Mirror connect</b>           | LAN used for data mirroring in a data mirror type cluster. Mirror connect can be used with primary interconnect.  |
| <b>Mirror disk type cluster</b> | A cluster system that does not use a shared disk. Local disks of the servers are mirrored.  |
| <b>Moving failover group</b>    | Moving an application from an active server to a standby server by a user.  |
| <b>Network partition</b>        | All heartbeat is lost and the network between servers is partitioned.<br>(Related terms: Interconnect, Heartbeat)   |
| <b>Node</b>                     | A server that is part of a cluster in a cluster system. In networking terminology, it refers to devices, including computers and routers, that can transmit, receive, or process signals. |
| <b>Primary (server)</b>         | A server that is the main server for a failover group.<br>(Related term: Secondary server)  |
| <b>Private LAN</b>              | LAN in which only servers configured in a clustered system are connected.<br>(Related terms: Interconnect, Public LAN)  |
| <b>Public LAN</b>               | A communication channel between clients and servers.<br>(Related terms: Interconnect, Private LAN)  |
| <b>Secondary server</b>         | A destination server where a failover group fails over to during normal operations.<br>(Related term: Primary server)   |
| <b>Server Group</b>             | A group of servers connected to the same network or the shared disk device  |
| <b>Shared disk</b>              | A disk that multiple servers can access.  |
| <b>Shared disk type cluster</b> | A cluster system that uses one or more shared disks.  |
| <b>Standby server</b>           | A server that is not an active server.<br>(Related term: Active server)   |

---

**Startup attribute**

A failover group attribute that determines whether a failover group should be started up automatically or manually when a cluster is started.

**Switchable partition**

A disk partition connected to multiple computers and is switchable among computers.  
(Related terms: Disk heartbeat partition)

**Virtual IP address**

IP address used to configure a remote cluster.



# Appendix C.

## A

- Activating a cluster, 120
- Add a cluster, 88
- Add a failover group, 95
- Add a group for management, 87
- Add a group resource, 96
- Add a group resource (application resource), 98
- Add a group resource (disk resource/mirror disk resource/hybrid disk resource), 96
- Add a monitor resource (disk RW monitor resource), 99
- Add a monitor resource (IP monitor resource for failover group), 100
- Add a monitor resource (IP monitor resource for the ManagementGroup), 99
- Add a server, 89
- Add monitor resources, 99
- Adjustment of the operating system startup time, 32
- applications to be duplicated, 40
- applying the modified cluster configuration data, 124

## B

- Backup and restoration, 118
- Browsers supported, 76

## C

- Changing the setting of the ExpressCluster Server service from the manual startup to automatic startup, 122
- Checking system requirements for each ExpressCluster module, 29
- Checking the values to be configured, 77
- cluster topology, 37
- Configuring a cluster system, 36
- Create a cluster, 88
- Creating a cluster, 103
- Creating the cluster configuration data, 74, 87

## D

- Disabling recovery action caused by monitor resource error, 101

## E

- ExpressCluster X WebManager, 75

## F

- Failover in multi-directional standby cluster, 39
- Failover in uni-directional standby cluster, 38

# Index

## G

- group resources, 45

## H

- hardware configuration, 29
- heartbeat resources, 48
- How to create a cluster, 103

## I

- Installing ExpressCluster Server, 57
- Installing the ExpressCluster Builder (offline version), 64
- Installing the ExpressCluster Server for the first time, 58

## L

- log collection procedure, 126

## M

- mirror disk type, 20
- Mirror partition settings, 31
- Modifying the cluster configuration data, 123
- modules, 19
- monitor resources, 46

## O

- Operation tests, 114

## P

- Planning a failover group, 44

## R

- Referring and/or deleting the license, 71
- Registering the license, 68
- Registering the license by entering the license information, 69
- Registering the license by specifying the license file, 68, 70
- Reinstallation, 132
- Reinstalling the ExpressCluster Server, 132
- Restarting the ExpressCluster X WebManager, 125
- resuming a cluster, 121

## S

- Sample cluster environment, 77

- Saving the cluster configuration data, 102
- Server applications, 40
- Server clock synchronization, 33
- Set up the network configuration, 91
- Setting the ExpressCluster Server service to be manually activated, 122
- Setting Up JAVA runtime environment, 76
- Setting up the SNMP linkage function manually, 58, 65
- Settings after configuring hardware, 29
- Setup of BMC and ipmiutil, 34
- Setup of SNMP service, 33
- Setup of Subsystem for UNIX Application (SUA), 34
- Shared disk settings, 30, 120
- Shared disk type, 20
- Shutting down a cluster and server, 120
- Starting the WebManager, 76
- Starting up the ExpressCluster X WebManager, 75
- Stopping the ExpressCluster Server service, 122
- Suspending, 119, 122
- Suspending a cluster, 121
- system configuration, 20
- system requirements, 29

## T

- Troubleshooting, 135
- Turning off power saving function, 33

## U

- Understanding network partition resolution resources, 49
- Uninstallation, 130
- Uninstalling, 130, 132, 133
- Uninstalling the offline version ExpressCluster X Builder, 131
- uploading, 124

## V

- Verification of the firewall settings, 33
- Verification of the network settings, 32
- Verifying status using commands, 108
- Verifying the cluster using the WebManager, 106

## W

- What is ExpressCluster, 15, 18