ExpressCluster® X 1.0 *for Windows*

Installation and Configuration Guide

06/22/2007
Third Edition

Revision History

Edition	Revised Date	Description
First	09/08/2006	New manual
Second	12/28/2006	Reflected the logo change Modified misdescriptions and formats
Third	06/22/2007	Added the descriptions of CIFS and NAS resource.

© Copyright NEC Corporation 2006. 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® X is a registered trademark of NEC Corporation.
Intel, Pentium and Xeon are registered trademarks and trademarks of Intel Corporation.
Microsoft and Windows are registered trademarks of Microsoft Corporation in the United State and other countries.
Other product names and slogans written in this manual are trademarks and registered trademarks of their respective companies.

Table of Contents

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

Section I **Configuring a cluster system**
Determines cluster hardware configuration required before installing ExpressCluster and how to create the cluster configuration data with the ExpressCluster X Builder before installing ExpressCluster.

Chapter 1 **Determining a system configuration**
Provides instructions for how to verify system requirements and determine the system configuration.

Chapter 2 **Configuring a cluster system**
Helps you understand how to configure a cluster system.

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

Chapter 3 **Installing ExpressCluster**
Provides instructions for how to install ExpressCluster.

Chapter 4 **Registering the license**
Provides instructions for how to register the license.

Chapter 5 **Creating the cluster configuration data**
Provides instructions for how to create the cluster configuration data with the ExpressCluster X Builder.

Chapter 6 **Verifying a cluster system**
Verify that the cluster system you have configured operates successfully.

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

Chapter 7 **Verifying operation**
Run the dummy-failure test and adjust the parameters.

Chapter 8 **Preparing to operate a cluster system**
Provides information on what you need to consider before starting to operate ExpressCluster.

Chapter 9 **Uninstalling and reinstalling ExpressCluster**
Provides instructions for how to uninstall and reinstall ExpressCluster.

Appendix A **Troubleshooting**
Appendix B **Glossary**
Appendix C **Index**

ExpressCluster X Documentation Set

The ExpressCluster X manuals consist of the following four 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*.

Alert Service Administrator's Guide
This guide is intended for system administrators who install ExpressCluster X Alert Service, operate and maintain a cluster system. The guide provides instructions for installing a cluster system that uses ExpressCluster X Alert Service.

Conventions

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

Contacting NEC

For the latest product information, visit our website below:

http://www.ace.comp.nec.co.jp/CLUSTERPRO/clp/global-link.html

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

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

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:

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.

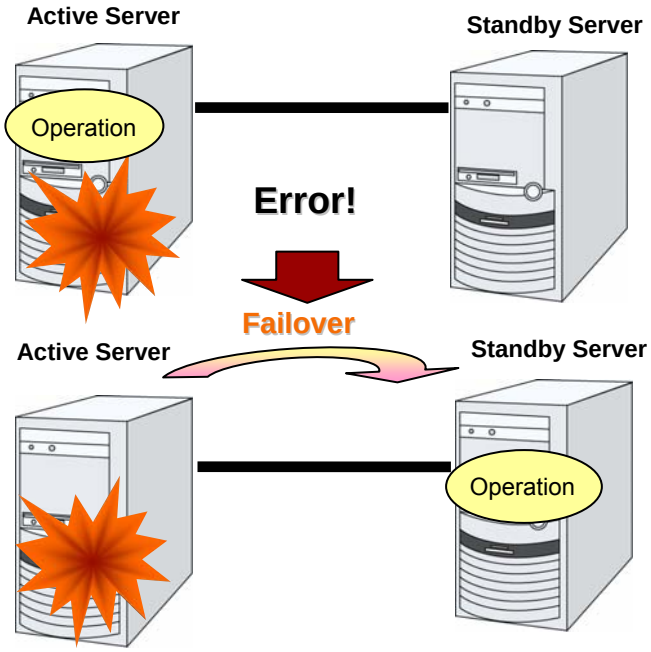
Step 9 Uninstalling and reinstalling ExpressCluster (Chapter 9)

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

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 in Section I "Using ExpressCluster" in the *Getting Started Guide.*

ExpressCluster modules

ExpressCluster X consists of following three modules:

- **ExpressCluster Server**

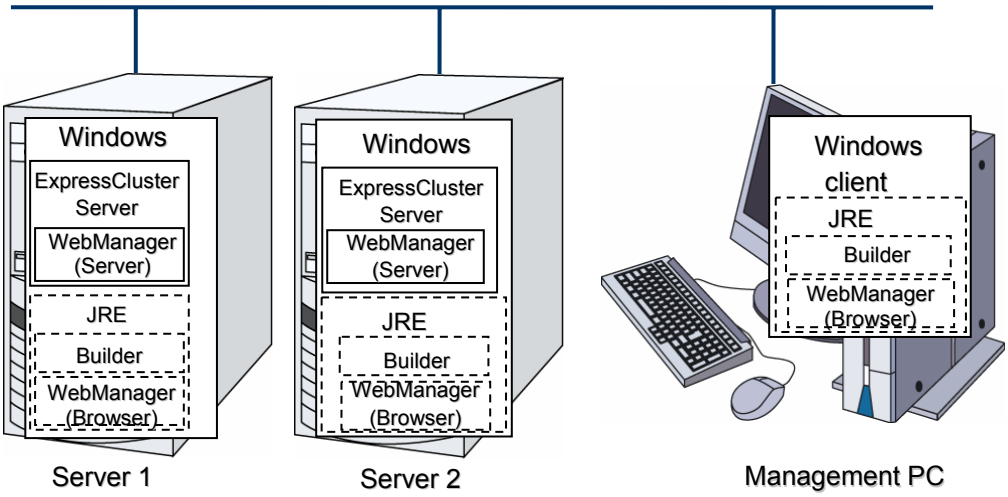
  The main module of ExpressCluster and has all high availability functions of the server. Install this module on each server constituting the cluster.

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



The ExpressCluster X Builder and the WebManager 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 Builder and the WebManager 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 two types of system configurations: shared disk type and mirror 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.

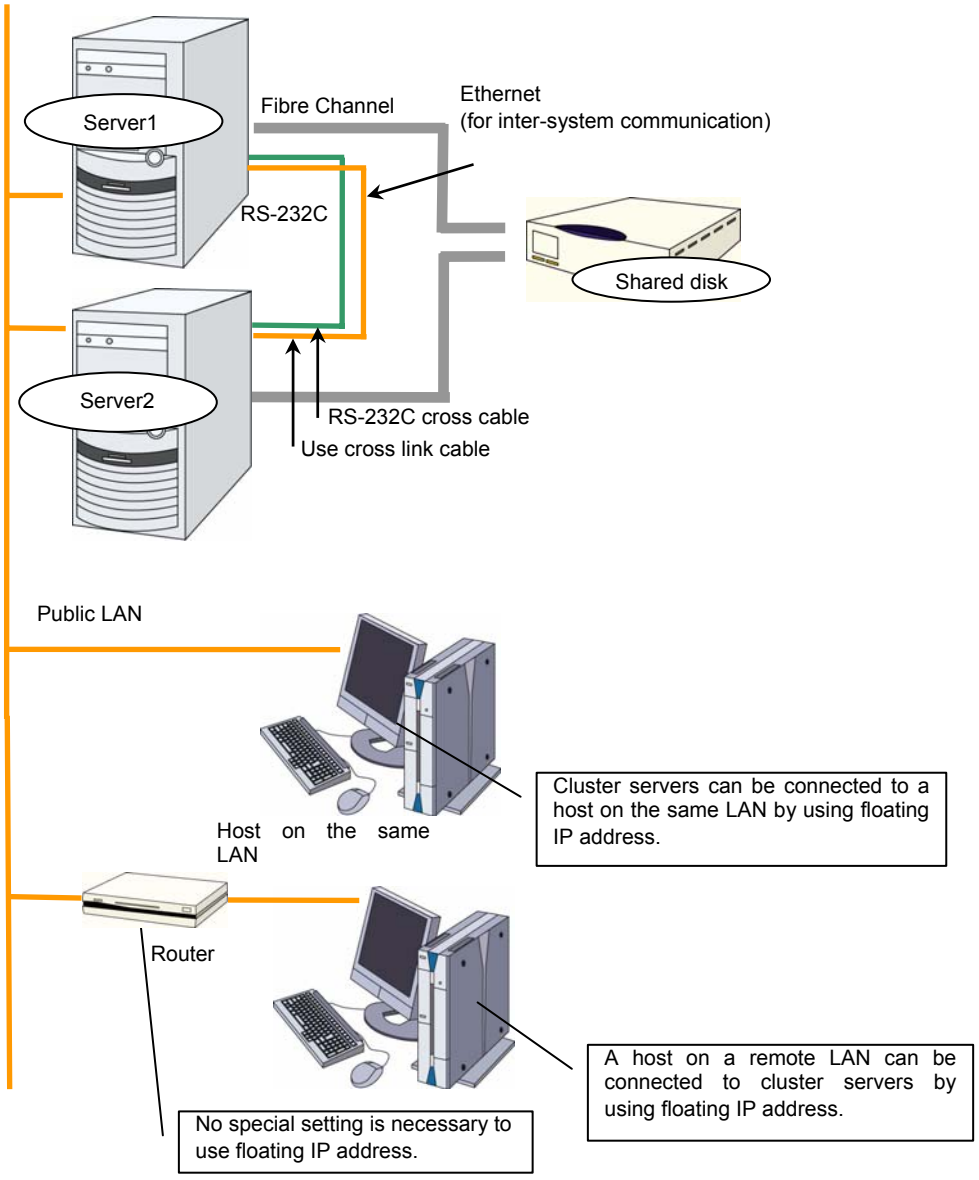
  When configuring a remote cluster by placing the standby server in a remote site for disaster control, a shared disk cannot be used. Thus the mirror disk type is used.

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

Example 1: configuration using a shared disk with 2 nodes

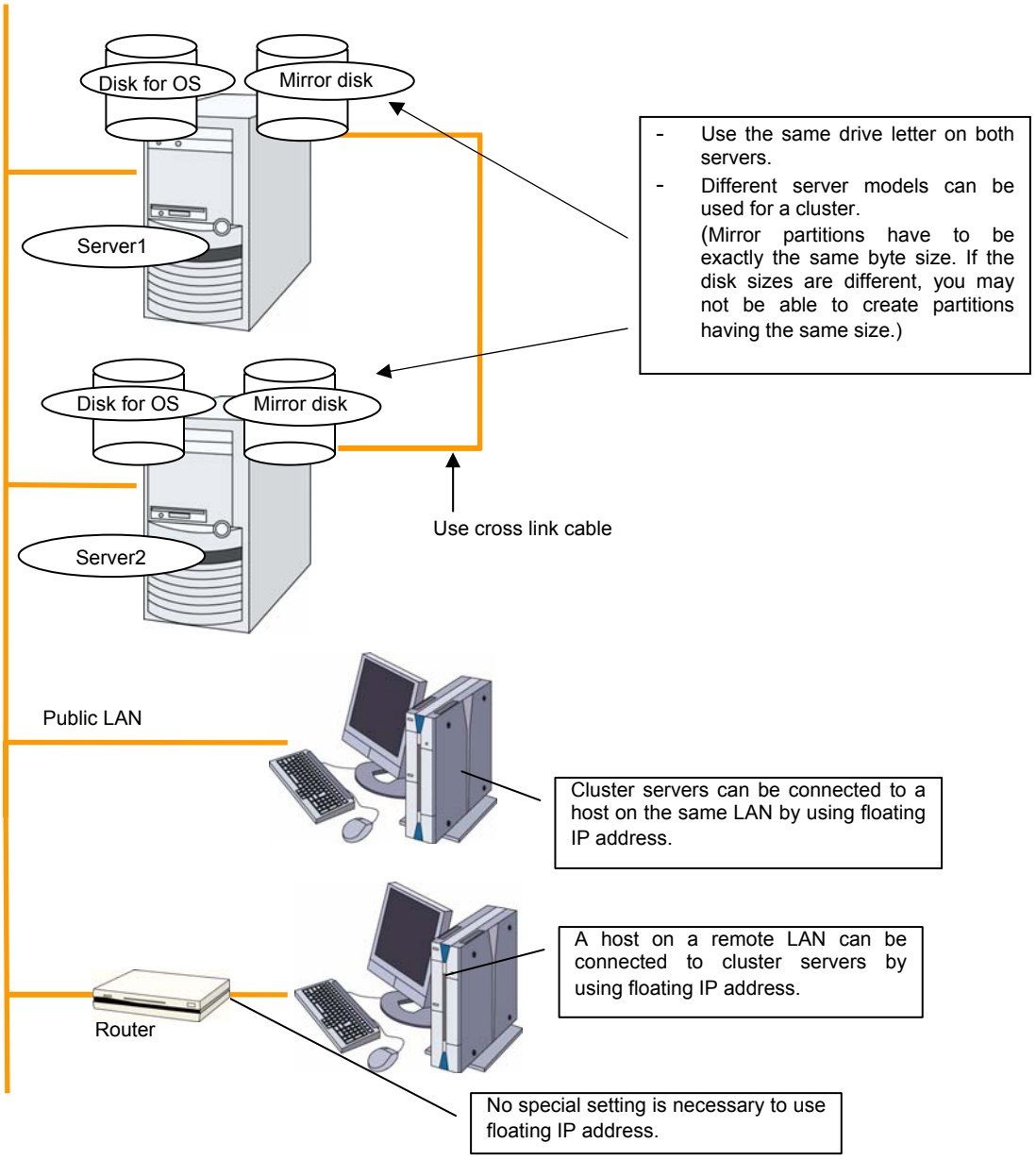
This is the most commonly used system configuration:

- 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 4-nodes configuration.
- Connect COM (RS-232C) ports using a cross cable.



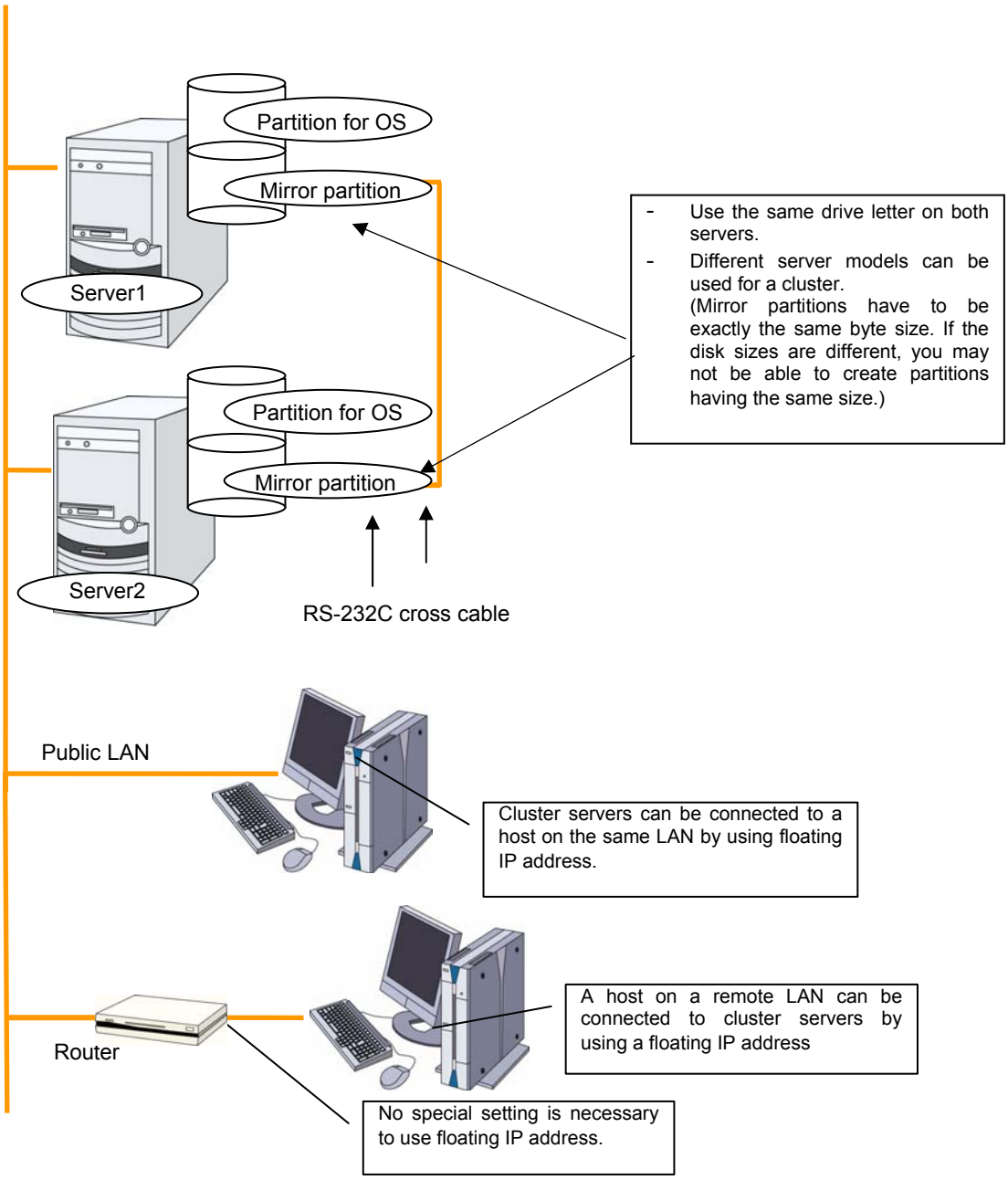
Example 2: configuration using mirror disks with 2 nodes

- Different models can be used for servers. However, the mirrors 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

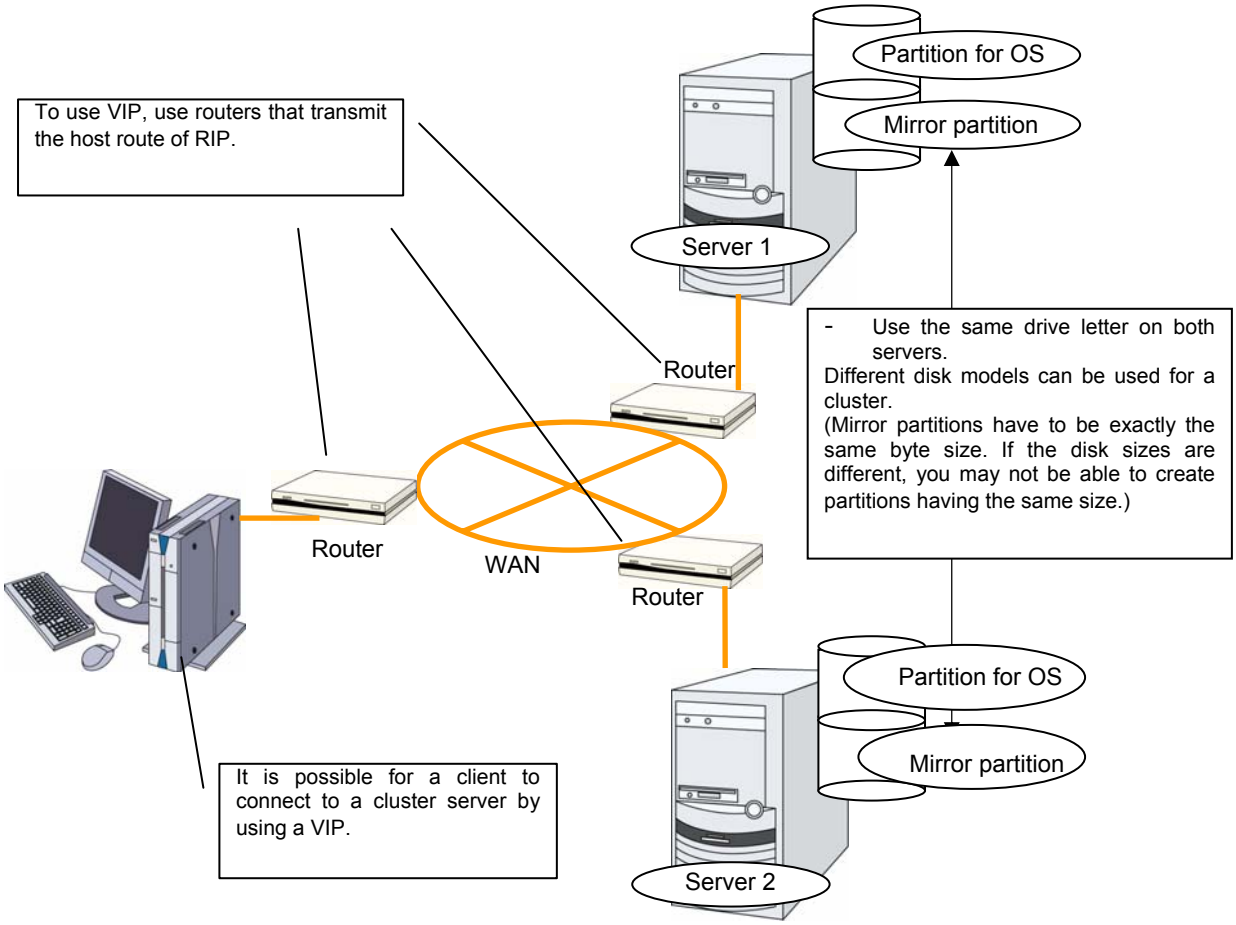
- A mirroring partition can be created on the disk used for the OS.



Related Information:
For mirror partition settings, refer to Chapter 6, “Group resources” and “Understanding mirror disk resource” in the *Reference Guide.*

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

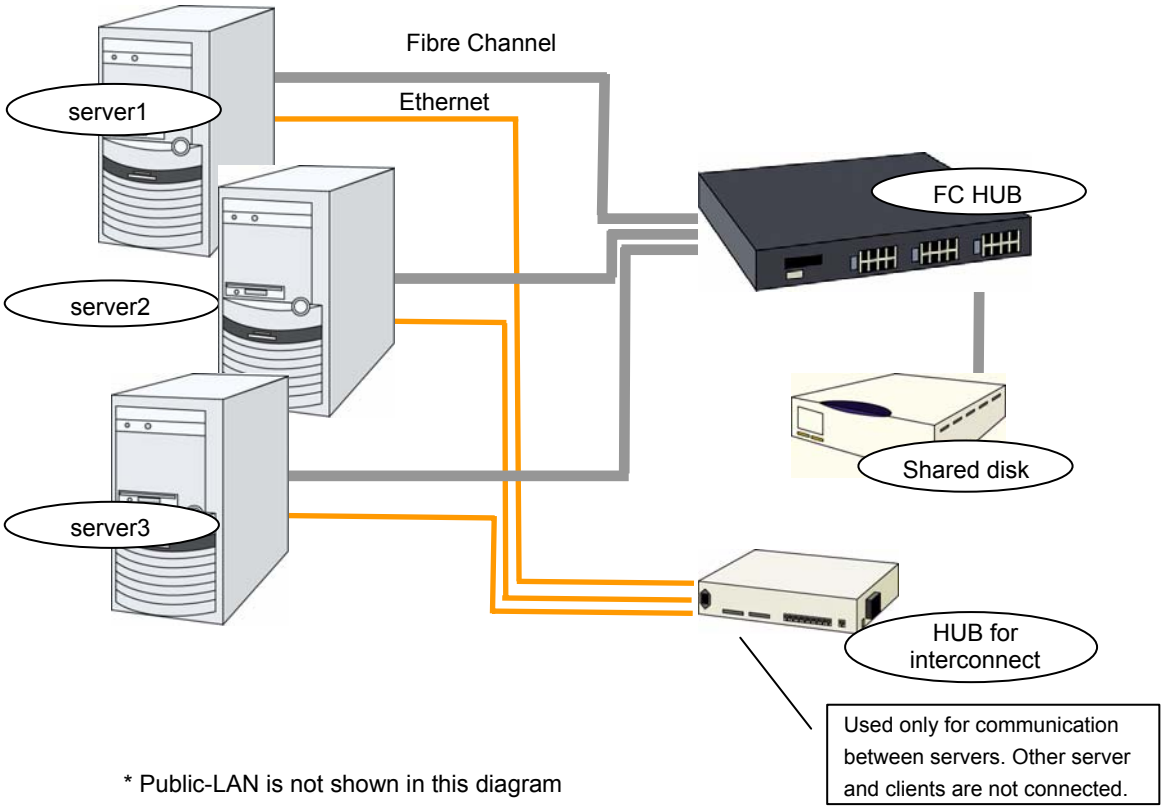
- Configuring a cluster between servers in remote sites by using WAN, as shown below, is a solution for disaster control.
- Because there is one communication path (interconnect) between servers, the chance of network partition due to network failures is high. Ping must be used to address network partition 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 6, “Group resource details” and Chapter 9, “Details on network partition resolution resources” in the *Reference Guide*.

Example 5: Configuration using a shared disk with 3 nodes

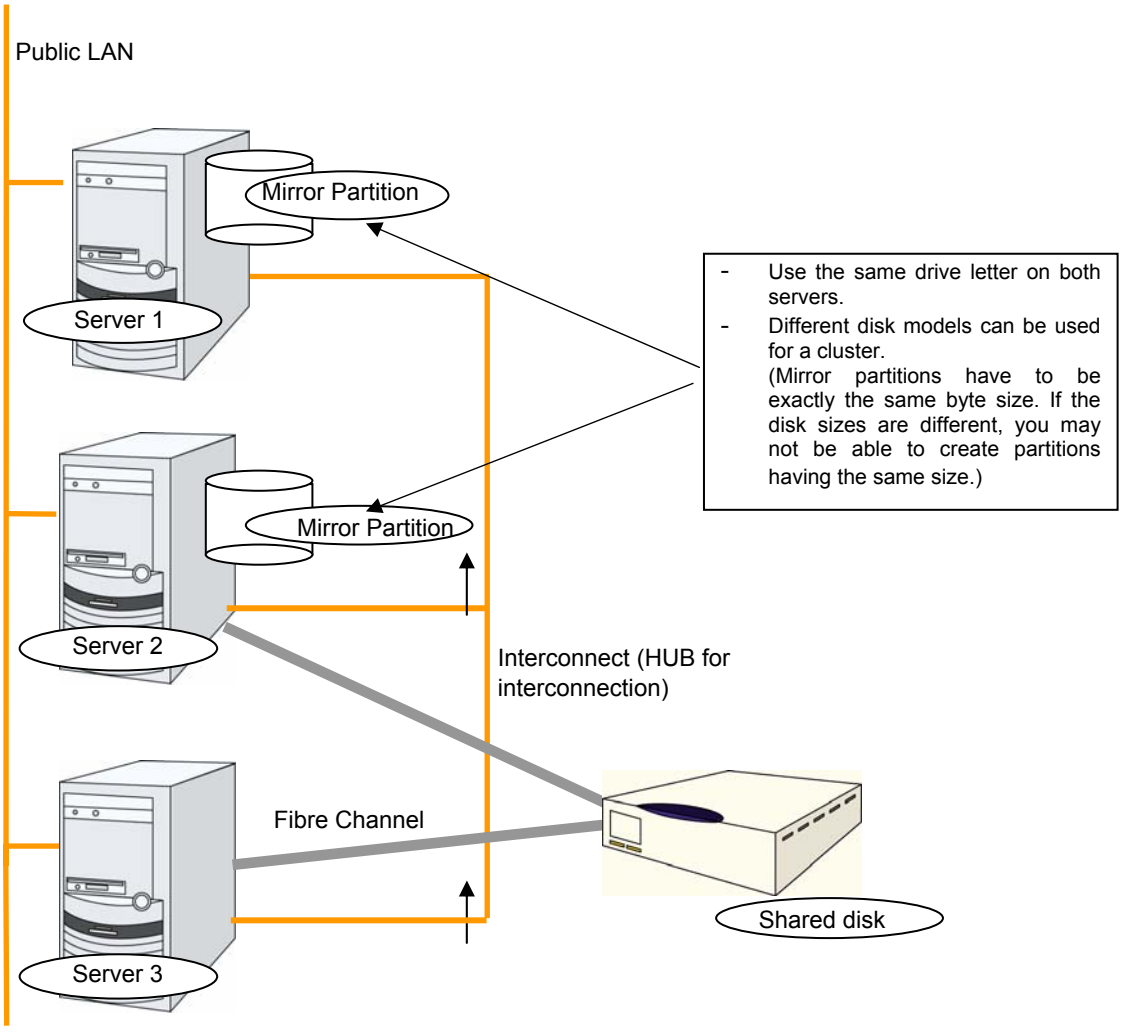
- The same way as 2 nodes-configuration, connect servers to a shared disk. The shared disk should have the same drive letter on all servers.
- Install a dedicated HUB for interconnection.
- It is not necessary to establish connectivity between servers using the connect COM (RS-232C).



* Public-LAN is not shown in this diagram

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).



Checking system requirements for each ExpressCluster module

ExpressCluster X consists of three modules: ExpressCluster Server, ExpressCluster X WebManager, and ExpressCluster X Builder. Check configuration and operation requirements of each machine where these modules will be used. The following is the basic system requirements for ExpressCluster X 1.0 for Windows:

- The operating system that supports ExpressCluster Server

Following is the system requirements for each module:

ExpressCluster Server	
Machine on which ExpressCluster Server can be installed	PC that supports one of the following operating systems.
Supported operating systems	**IA-32 version** Microsoft Windows Server 2003, Standard Edition SP1 or later Microsoft Windows Server 2003, Enterprise Edition SP1 or later Microsoft Windows Server 2003, Standard Edition R2 Microsoft Windows Server 2003, Enterprise Edition R2 **EM6-4T version** Microsoft Windows Server 2003, Standard x64 Edition SP1 or later Microsoft Windows Server 2003, Enterprise x64 Edition SP1 or later Microsoft Windows Server 2003, Standard x64 Edition R2 Microsoft Windows Server 2003, Enterprise x64 Edition R2

ExpressCluster X Builder	
Machine on which the Builder can be installed	PC that supports one of the following operating systems.
Supported operating systems	Microsoft Windows XP SP2 (IA-32) Microsoft Windows Vista™ (IA-32) Microsoft Windows Server 2003 SP1 (IA-32)
Supported browsers	Browsers supporting Java 2 Windows XP: Microsoft internet Explorer 6.0 SP2 or later Windows Vista™: Microsoft internet Explorer 7.0 Windows Server 2003: Microsoft internet Explorer 6.0 SP1 or later
Java runtime environment	Sun Microsystems Java(TM) 2 Runtime Environment Version 5.0 Update 6 (1.5.0_06) or later ∗ Java runtime environment is necessary to use the Builder.

ExpressCluster X WebManager	
Machine on which the WebManager can be installed	PC that supports one of the following operating systems.
Supported operating systems	Microsoft Windows XP SP2 (IA-32) Microsoft Windows Vista™ (IA-32) Windows Server 2003 SP1 (IA-32, x86-64)
Supported browsers	Browsers supporting Java 2 Windows XP: Microsoft internet Explorer 6.0 SP2 or later Windows Vista™: Microsoft internet Explorer 7.0 Windows Server 2003: Microsoft internet Explorer 6.0 SP1 or later
Java runtime environment	Sun Microsystems Java(TM) 2 Runtime Environment Version 5.0 Update 6 (1.5.0_06) or later ∗ Java runtime environment is necessary to use WebManager

Related Information:
For details on supported hardware and the latest information on system requirements, refer to the *Getting Started Guide*.

Example of ExpressCluster Server (main module) hardware configuration

The ExpressCluster Server is a core component of ExpressCluster. Install it on each server that constitutes a cluster. The ExpressCluster X WebManager and Builder are included in the ExpressCluster Server and it is automatically installed once the ExpressCluster Server is installed. (The Builder can be separately installed on a PC where ExpressCluster Server is not installed.)

General requirements

The following is the recommended specification for ExpressCluster Server:

- RS-232C port: 1 port (not necessary when configuring a cluster with more than 3 nodes)
- Ethernet port: 2 or more ports
- Shared disk, mirroring disks, or free partition space for mirroring (when mirroring disk is used)
- Floppy disk drive or USB port
- CD-ROM drive

Related Information:
For information on system requirements for supported hardware and OS, refer to Chapter 3, “Installation requirements for ExpressCluster” in the *Getting Started Guide*. Configure and connect the peripheral devices and networks as described in “Planning system configuration” in this chapter.

Checking system requirements for the Builder

The ExpressCluster X Builder accesses a cluster from a management PC via a Web browser to create configuration data of the cluster system that uses ExpressCluster. Thus the PC for the management should be able to access the cluster via a network. (You can use the Builder by installing it separately on the PC.)

Supported operating systems and browsers

Visit the website, *http://www.ace.comp.nec.co.jp/CLUSTERPRO/clp/global-link.html*, for the latest information. Currently supported operating systems and browsers are the following:

Operating system	Browser	Language
Windows XP SP2	IE6 SP2	English/Japanese
Microsoft Windows Vista™	IE7	English/Japanese
Microsoft Windows Server 2003 SP1	IE6 SP1	English/Japanese
Microsoft Windows Server 2003 R2	IE6 SP1	English/Japanese

Note:
The Builder cannot be operated on 64-bit and x86_64 machines. When constructing or changing a cluster system, prepare the 32-bit machine.

Java runtime environment

To use the Builder, you need to have Java runtime environment.

- Sun Microsystems Java(TM) 2 Runtime Environment, Version 5.0 Update 6 (1.5.0_06) or later

Required memory/disk space

- Required memory size: 32MB or more
- Required disk size: 2MB (excluding space required for Java runtime environment)

Related Information:
For information on system requirements for supported hardware and OS, refer to Chapter 3, “Installation requirements for ExpressCluster” in the *Getting Started Guide*.

Checking system requirements for the WebManager

To monitor a cluster system that uses ExpressCluster, use WebManager, which accesses from a management PC via a Web browser. Therefore, a management PC should be able to make access to the cluster via network.

Supported operating systems and browsers

Currently the following operating systems and browsers are supported:

Operating system	Browser	Language
Windows XP SP2	IE6 SP2	English/Japanese
Microsoft Windows Vista™	IE7	English/Japanese
Microsoft Windows Server 2003 SP1	IE6 SP1	English/Japanese
Microsoft Windows Server 2003 R2	IE6 SP1	English/Japanese

Note:
The WebManager cannot be operated on 64-bit and x86_64 machines. P When constructing or changing a cluster system, prepare the 32-bit machine. For the latest information, refer to ExpressCluster website, *http://www.ace.comp.nec.co.jp/CLUSTERPRO/clp/global-link.html*.

Java runtime environment

To use WebManager, you should have Java runtime environment.

- Sun Microsystems Java(TM) 2 Runtime Environment, Version 5.0 Update 6 (1.5.0_06) or later

Required memory and disk space

- Required memory size: 40 MB or more
- Required disk size: 300KB (excluding space required for Java runtime environment)

Related Information:
For information on system requirements for supported hardware and OS, refer to Chapter 3, “Installation requirements for ExpressCluster” in the *Getting Started Guide*.

Note:
To operate ExpressCluster for Linux using the Integrated WebManager, make sure to use Linux supported OS and browser.

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:

- Configuration of the shared disk settings (Required for shared disk)
- Configuration of the mirror partition settings (Required for the Replicator)
- Adjustment of the operating system startup time (Required)
- Verification of the network settings (Required)
- Verification of the firewall settings (Required)
- Synchronization of the server clock (Recommended)
- Power saving function – OFF (Required)
- Setup of SNMP service (Required if ESMPRO/SM is to be used cooperated with EXPRESSCLUSTER)

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.

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 17MB (16*786*432 bytes) or larger Leave the disk heartbeat partitions as RAW partition without formatting.

2. Allocate a partition for disk resources.

Create a partition to be used for disk resources on the shared disk by using “Disk Management” function of OS. Set a drive letter and format with NTFS. Perform this operation on one of the servers to which the shared disk is connected. 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/format a partition. The access to the shared disk is not controlled until the ExpressCluster setup is completed. If more than one server is rebooted while they are connected to the shared disk, a file and folder on the shared disk may be corrupted. Therefore, do not start more than one server connected to the shared disk simultaneously until a partition for disk resources is formatted and ExpressCluster is installed and rebooted.

Important:
Make sure not to start more than one server connected to the shared disk. Data on the shared disk may be corrupted.

Mirror partition settings (Required for the Replicator)

Set up partitions for mirror disk resources by following the steps below:

Note:
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.

1. Allocate partitions for cluster partitions.

Create partitions to be used by the mirror resources. The partitions are used for managing the status of mirror 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:
A cluster partition should be 17 MB (17*1024*1024 byte) or larger. (The size will be actually larger than 17 MB even if you specify exactly 17 MB because of the disk size difference. This will cause no problem.) You do not need to create a file system on this partition.

2. Allocate partitions for mirror disk resource

Create partitions for mirroring by mirror resources. Create 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. Partitions for mirror disk resources of both servers need to be exactly of the same size. The same drive letter needs to be configured on both servers.

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 below.

Set the time to display the operating system list, which is shown by clicking the **My Computer** icon, selecting **Properties,** clicking the **Details** tab, and then selecting **Startup and Recovery,** longer than the measured time.[1]

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.

[1] When there is only one OS to be selected at booting, the settings of the start wait time may be ignored. In such a case, edit the boot.ini file and add the second entry to the **Operating System** section. The second entry can be the copy of the first entry.

Verification of the firewall settings (Required)

ExpressCluster uses several port numbers. Change the firewall settings so that ExpressCluster can use some port numbers. The following is the list of port numbers used by default in ExpressCluster:

Server to Server					
From			**To**		**Used for**
Server	Automatic allocation[2]	→	Server	29001/TCP	Internal communication
Server	Automatic allocation	→	Server	29002/TCP	Data transfer
Server	Automatic allocation	→	Server	29003/UDP	Alert synchronization
Server	Automatic allocation	→	Server	29004/TCP	Communication between disk agents
Server	Automatic allocation	→	Server	29005/TCP	Communication between mirror drivers
Server	29106/UDP	→	Server	29106/UDP	Heartbeat (kernel mode)

Server to Client					
From			**To**		**Used for**
Client	Automatic allocation	→	Server	29007/TCP 29007/UDP	Client service communication

Server to the WebManager					
From			**To**		**Used for**
WebManager	Automatic allocation	→	Server	29003/TCP	http communication

Server connected to the Integrated WebManager to target server[3]					
From			**To**		**Used for**
Server connected to the Integrated WebManager	Automatic allocation	→	Server	29003/TCP	http communication

If mirror connect monitor resources are going to be used, you need to let icmp packets through because EXPRESSCLUSTER checks if ping reaches between servers. If mirror connect monitor resources are going to be used, modify firewall settings so that ping reaches between servers.

[2] In automatic allocation, a port number not being used at a given time is allocated.

[3] If other clusters are managed by using the integrated WebManager, http communication is established between the server that is connected when the Web browser opens the integrated WebManager and the other cluster servers to be the managed.

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:
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.

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

Setup of SNMP service (Required if ESMPRO/SM is to be used cooperated with EXPRESSCLUSTER)

SNMP service is required if ESMPRO/SM is to be used cooperated with EXPRESSCLUSTER. Set up SNMP service first before installing EXPERSSCLUSTER.

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.

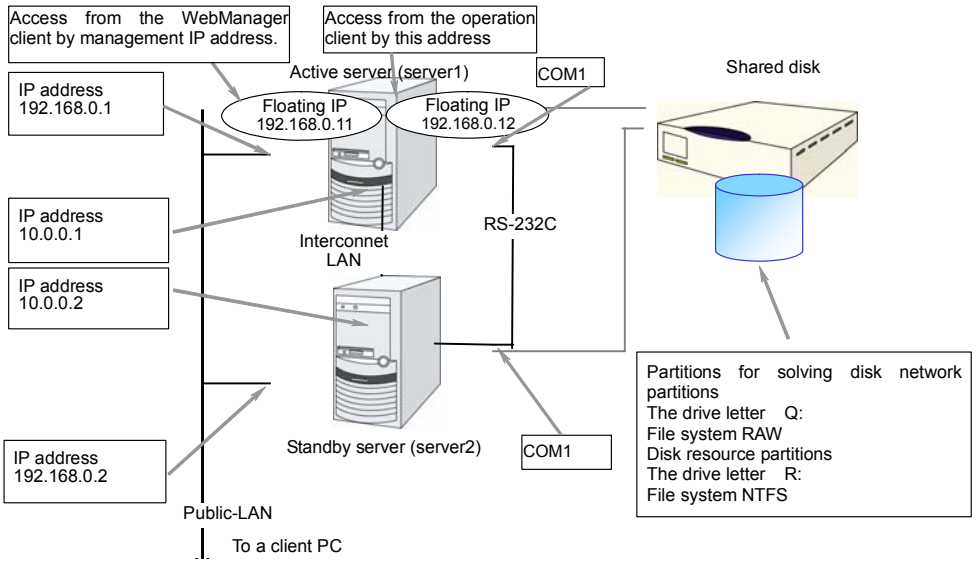
This chapter covers:

Configuring a cluster system

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

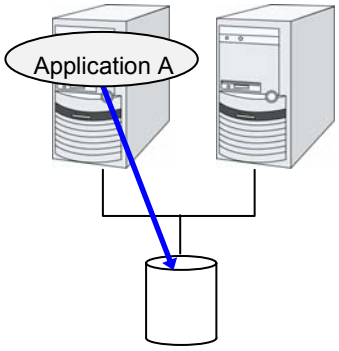
The following is a typical example of cluster environment with 2 nodes where standby is uni-directional.



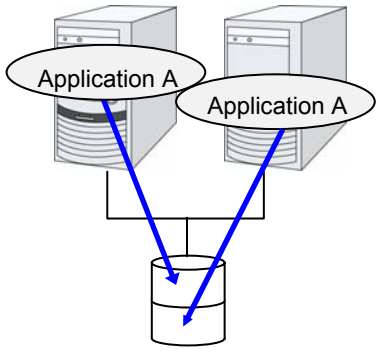
Determining a cluster topology

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.

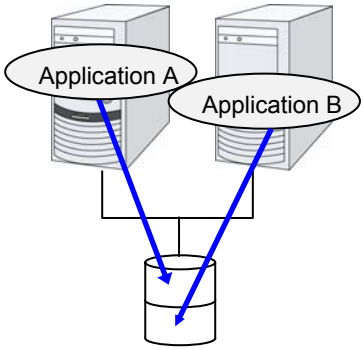
- **Uni-directional standby cluster system**
  In this operation, only one application runs on an entire cluster system. There is no performance deterioration even when a failover occurs. However, resources in a standby server will be wasted.



- **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.

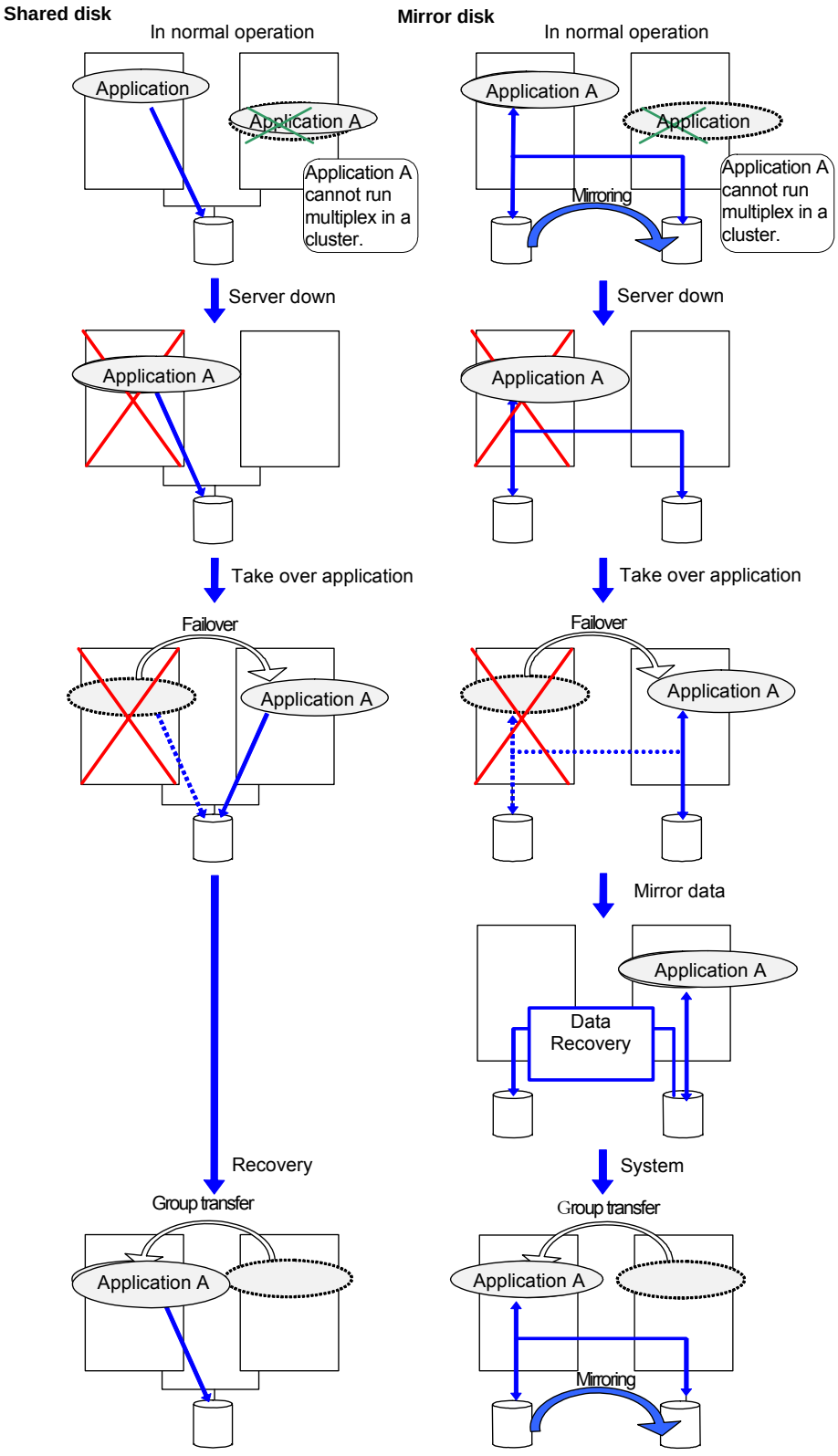


- **Different applications multi-directional standby cluster system**
  In this operation, different applications run on different servers and standby each other. Resources will not be wasted during normal operation; however, two applications run on one server after failing over and system performance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



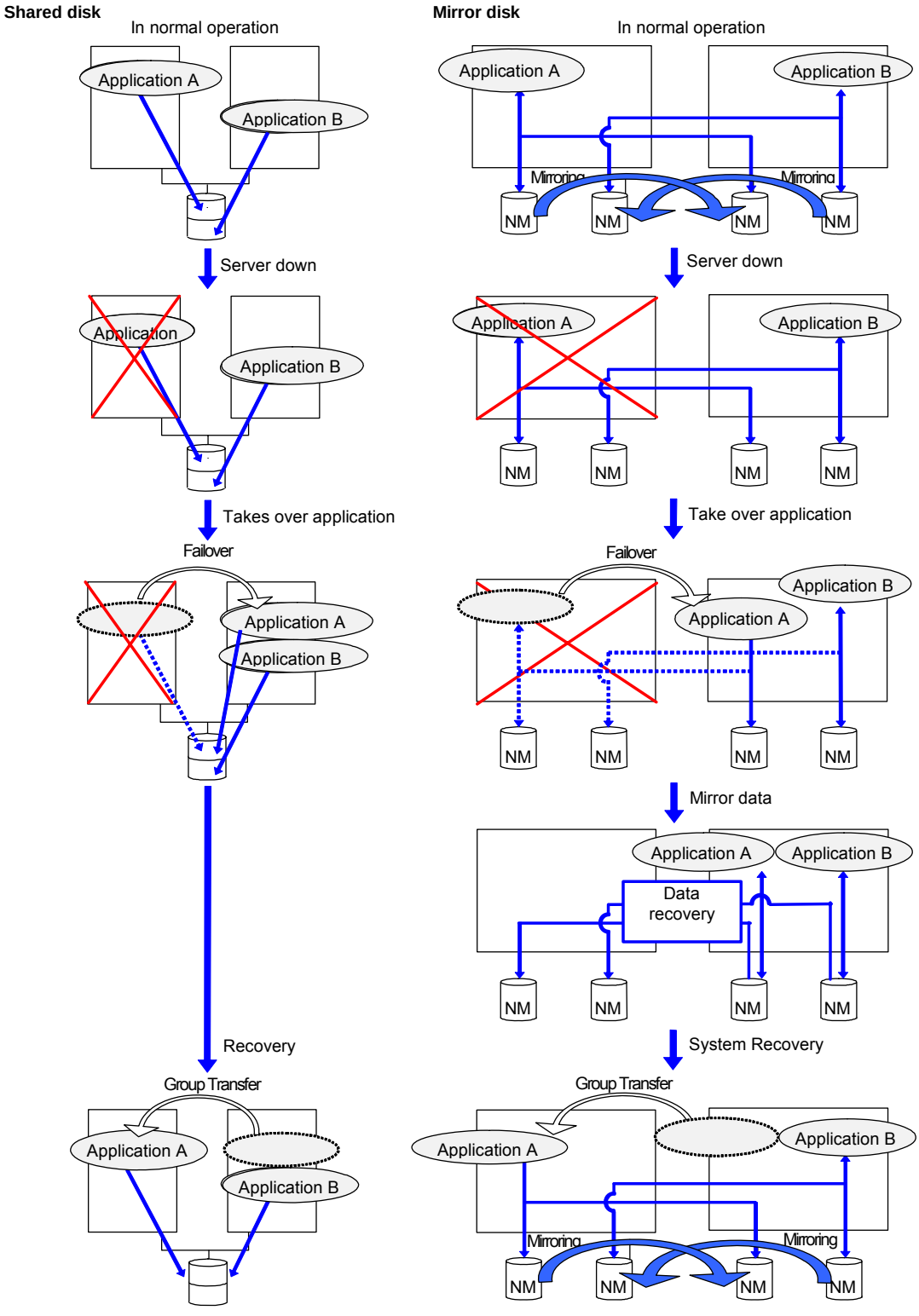
Failover in uni-directional standby cluster

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 sever, 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.



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.

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.)

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 severs:

- Data on shared disk or mirror disks
- 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 data should be saved separately. .

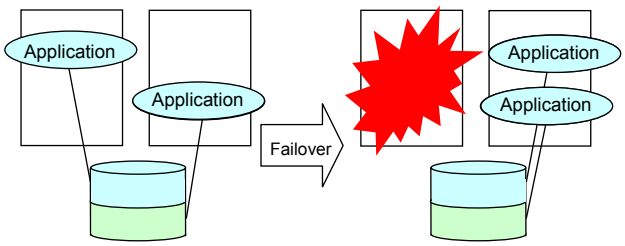
Data type	Example	Where to store
Data to be shared among servers	User data, etc.	On shared disk or mirror disks
Data specific to a server	Programs, configuration data	On server's local disks

Note 4: Multiple application service groups

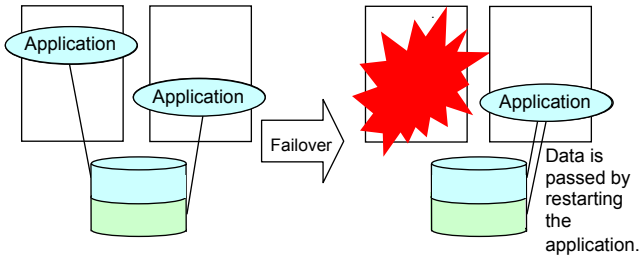
When you run the same application service in the multi-directional standby operation, you have to assume (in case of degeneration due to a failure) that multiple application groups are run by the same application on a server.

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.

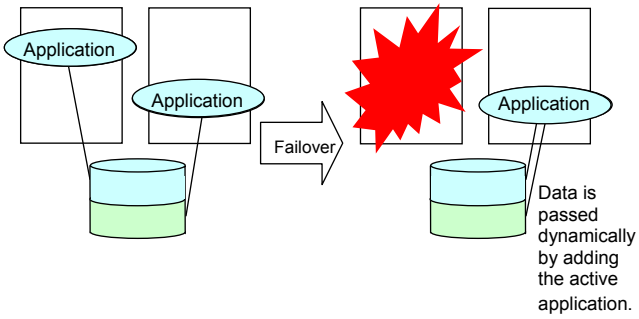
- **Starting up multiple instances**
  This method invokes a new process. More than one application should co-exist and run.



- **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 mirror partitions mirrored by a mirror 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 n 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.

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 sleep 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

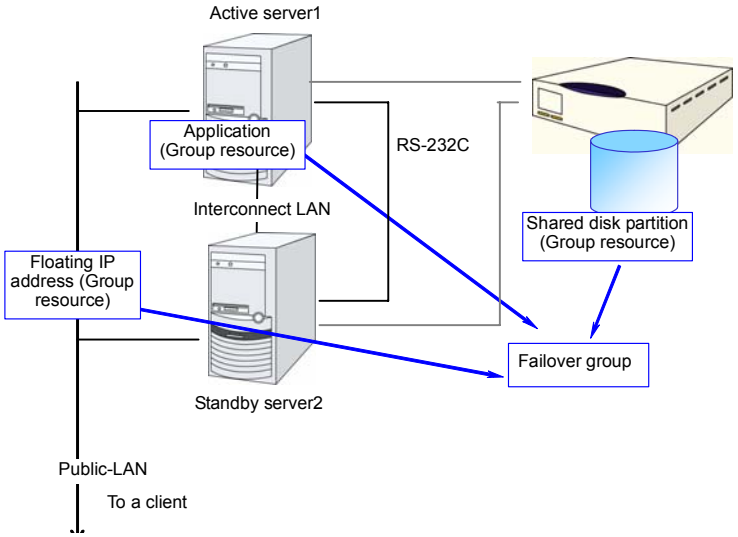
How to determine a cluster topology

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 shared disks or mirror disks

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 group name, group resources, and attributes.



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 6, "Group resource details" in the *Reference Guide*.

The following are currently supported group resources:

Group Resource Name	Abbreviation
Application resource	appli
Floating IP resource	fip
Mirror disk resource	md
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
CIFS resource	cifs
NAS resource	nas

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 times when monitor resources monitor: always monitor and monitor when active.

Related Information:
For the details of each resource, see Chapter 7, "Monitor resource details" in the *Reference Guide*.

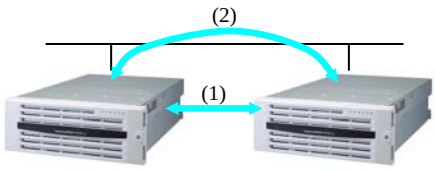
The following are currently supported monitor resources:

Monitor Resource Name	Abbreviation
Application monitor resource	appliw
CIFS monitor resource	cifsw
DB2 monitor resource	db2w
Disk RW monitor resource	diskw
Floating IP monitor resource	fipw
FTP monitor resource	ftpw
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
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	wlsw

- Always monitor (From cluster startup to cluster stop)
  - Disk RW monitor resources
  - IP monitor resources
  - Mirror disk monitor resources
  - Mirror connect monitor resources
  - NIC Link Up/Down monitor resources
  - Multi-target monitor resources
  - Disk TUR monitor resources
- Monitor when active (From group activation to group deactivation)
  - Application monitor resources
  - CIFS monitor resource
  - DB2 monitor resources
  - Floating IP monitor resources
  - FTP monitor resources
  - HTTP monitor resources
  - IMAP4 monitor resources
  - NAS monitor resource
  - ODBC monitor resources
  - Oracle monitor resources
  - POP3 monitor resources
  - PostgreSQL monitor resources
  - Registry synchronization monitor resource
  - Service monitor resources
  - SMTP monitor resources
  - Print spooler monitor resources
  - SQL Server monitor resources
  - Tuxedo monitor resources
  - Virtual computer name monitor resources
  - Virtual IP monitor resources
  - Websphere monitor resources
  - Weblogic monitor resources

Understanding heartbeat resources

Servers in a cluster system monitor whether or not other servers in the cluster are active. The following are the heartbeat resources being used:



(1) LAN heartbeat resource dedicated to interconnect (kernel mode)

(2) Public LAN heartbeat (kernel mode)

Heartbeat Resource Name	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.

- At least one kernel mode LAN heartbeat resource needs to be set. Setting up more than two is recommended. Setting both LAN heartbeat resources dedicated to interconnection and Public LAN heartbeat resource simultaneously 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 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.

Shared 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+ Shared disk method

- This is a method that combines the COM method and the shared 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 + shared disk method

- This is a method that the ping method and the shared 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 does not return continues, due to a failure of the ping device before the heartbeat is lost, the method is switched to the shared disk method.
- 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.
- The ping method is recommended for a cluster with three or more nodes but without a shared disk.
- The COM + shared disk method or the ping+ shared 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
Shared disk	No limit	Shared disk	Disk error	The master server survives	None	Time calculated by the heartbeat timeout and disk IO wait time is needed.
Ping	No limit	Device to receive the ping command and return a response	None	Server that responses to the ping command survives	All networks are disconnected after the ping command timeouts the specified times consecutively.	0
COM+ shared disk	2	Serial cables shared disk	COM error and disk error	The master server survives	None	0
ping+ shared disk	No limit	Device to receive the ping command and return response 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
Mirror disk	2	None	None	Both server fail over	All networks are disconnected	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

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

The following describes the steps from installing ExpressCluster to creating a cluster system, registering a license and verifying the installation.

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 6**,** “Verifying a cluster system.”)

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 Alert	Alert option
ExpressCluster Disk Agent	Shared disk, mirror disk control
ExpressCluster Event	Event log output
ExpressCluster Manager	WebManager Server
ExpressCluster Old API Support	Compatible API process
ExpressCluster Server	ExpressCluster Server
ExpressCluster Transaction	Communication process
ExpressCluster Web Alert	Alert synchronization

Installing the ExpressCluster Server

Install the ExpressCluster X RPM 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.

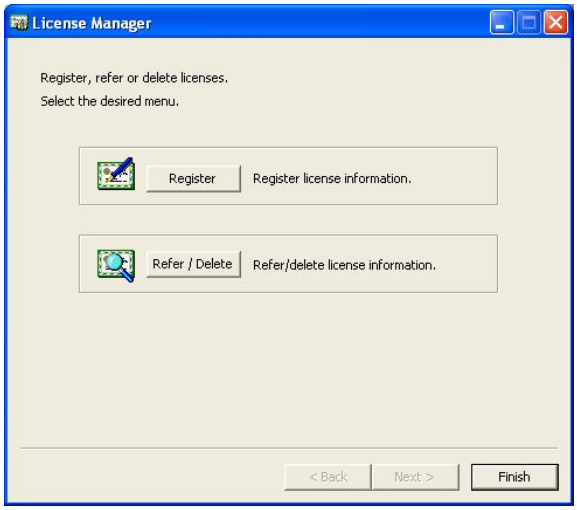
Note:
Install the ExpressCluster Server with the administrator privilege.

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 the ExpressCluster® X 1.0 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 3 “Function of the Builder” in the *Reference Guide*.
8. In **Filter Settings of Shared Disk**, right-click the **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.
9. The window that shows the completion of setting is displayed. Click **Yes**.
10. **License Manager** is displayed. Click **Register**.



11. The window to select a method to register a license is displayed. Click **Register with License File**.
12. In the **License File Specification** dialog box, specify a license file and click **Open**.
13. The message confirming the license registration is displayed. Click **OK**.
14. Click **Finish** to close the **License Manager** dialog box.
15. The **Complete InstallShiled 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.

Installing the ExpressCluster Builder (offline version)

It is not necessary to install the ExpressCluster Builder (offline version) to the servers that make up a cluster. Install it on a PC only when modifying the cluster configuration data without ExpressCluster server. Follow the procedures below to install the ExpressCluster 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 the **ExpressCluster® Accessories**.
4. Select the **ExpressCluster® Builder**.
5. Select where to install in the **Cluster Builder self-extracting dialog** and click **Extract**.
6. Click **OK** in the ZIP self-extract dialog box. Installation is completed.

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

Among servers that constitute the cluster, use the master server to register the CPU license. The registration of a node license is performed on a server that uses an optional product. Registering a node license is needed to operate the cluster system implementing ExpressCluster X 1.0 Replicator, ExpressCluster X Agent product group and ExpressCluster X 1.0 Alert Service (hereafter described as optional products).

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

- Specifying the license file to register the license. Refer to page .50 “Registering the license by specifying the license file ”
- Entering the license information attached to the license product to register the license. (Refer to “Registering the license by entering the license information.”

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:

When registering the CPU license

- 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.

When registering a node 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.

To make the license registration effective and start using the cluster, shut down all servers by using the shutdown command of the OS, and then reboot.

Proceed to Chapter 5, “Creating the cluster configuration data.”

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:

When registering the CPU license

- 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.

When registering a node 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** .
5. If a CPU license product is selected for Product information in the step 4, the **License Unit Selection** dialog box is displayed. 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.

For the license registration to take effect, before using the cluster, shut down all of the servers by using the shutdown command and reboot.

Proceed to Chapter 5, “Creating the cluster configuration data” after the reboot.

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

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 reflected in the cluster system by the Builder.

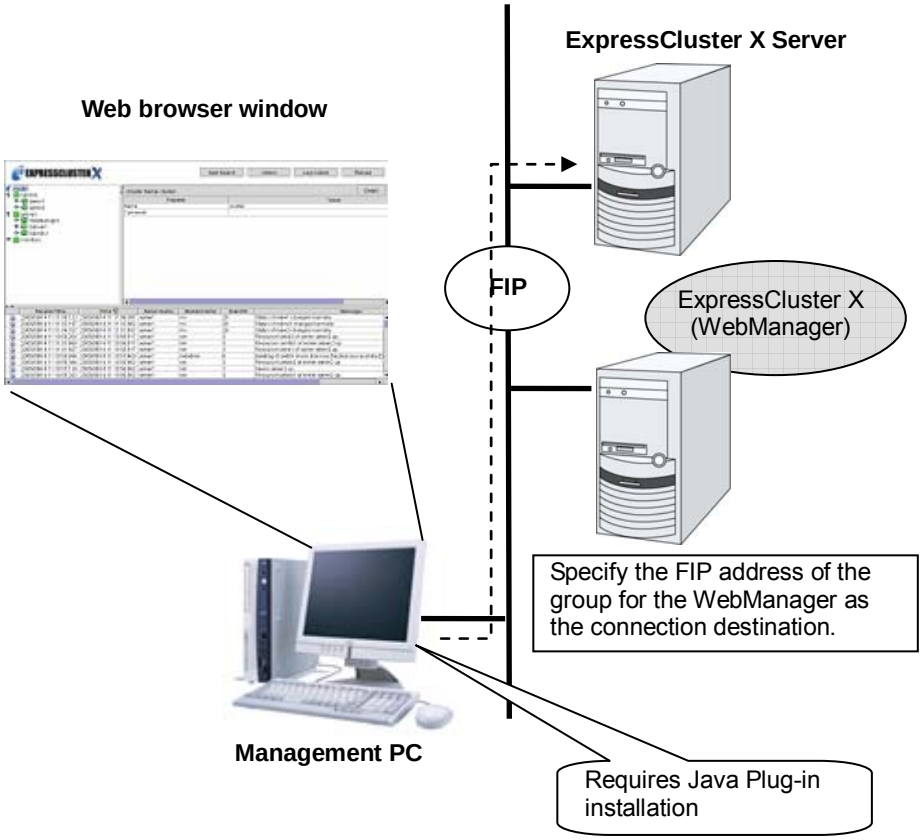
Starting up the ExpressCluster X WebManager

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, 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.

Browsers supported by the WebManager

Use the following browsers to access the WebManager:

- For Windows® XP, Microsoft® Internet Explorer 6.0 SP2 or later
- For Windows® 2003 Server, Microsoft® Internet Explorer 6.0 SP1 or later

Related Information:
For information on combinations of a browser and operating system that have been tested and verified, refer to Chapter 3, “Installation requirements for ExpressCluster” in the *Getting Started Guide*.

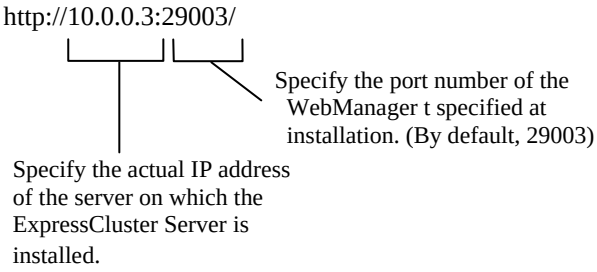
Setting up JAVA runtime environment

In order to access the WebManager, a Java Plug-in (Java™ 2 Runtime Environment Standard Edition Version 5.0 Update 6 1.5.0_06 or later) must be installed on a browser on a management PC.

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

Access to the WebManager

When accessing the WebManager from the server on which the ExpressCluster Server is installed, specify the following as the URL. .



Starting the WebManager

Start the WebManager to use the Builder.

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.

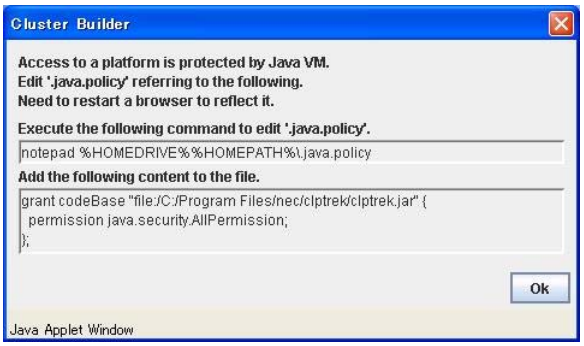
   http://10.0.0.11:29003/

   Make sure to enter the same port number that you have specified when installing the WebManager Server. The default value is 29003.

Starting the Builder

Note:
If you click **Settings** on the title bar of the WebManager several times while the pointer of the WebManager is displayed as an hourglass, the Builder may freeze. Make sure not to operate anything while the pointer of the WebManager appears as an hourglass.

1. On the title bar of the WebManager, click **Settings** to start up the Builder. If you start up the Builder for the first time, the following window is displayed.



2. Configure the user policy file of Java to grant the Builder (Java applet) a right to access outside the platform OS (outside Java VM).

   On the **Start** menu, click **Run** and run the command `notepad %HOMEDRIVE%%HOMEPATH%\.java.policy`, shown in the window above. The `.java.policy` file in the home directory is displayed. If the `.java.policy` file does not exist in the home directory, a message asking whether or not to create a new file is displayed. Click **Yes**.

   Note:
   When the OS is installed in the C drive and you are logging in by *USERNAME*, the home directory is `C:\Documents and Settings\`*USERNAME*. In some environments, this varies.

3. Copy the character string displayed below [Add the following content to the file.] shown in the window above to the `.java.policy` file, and then save it.

4. Close all the Web browsers.

5. Connect to the WebManager again and click **Settings** to start up the Builder.

   Note:
   If the Builder does not start up successfully, check that
   JRE is installed on the computer.
   JRE is enabled on the browser.
   The .Java.policy file exists in the home directory, and Builder installation path is specified.

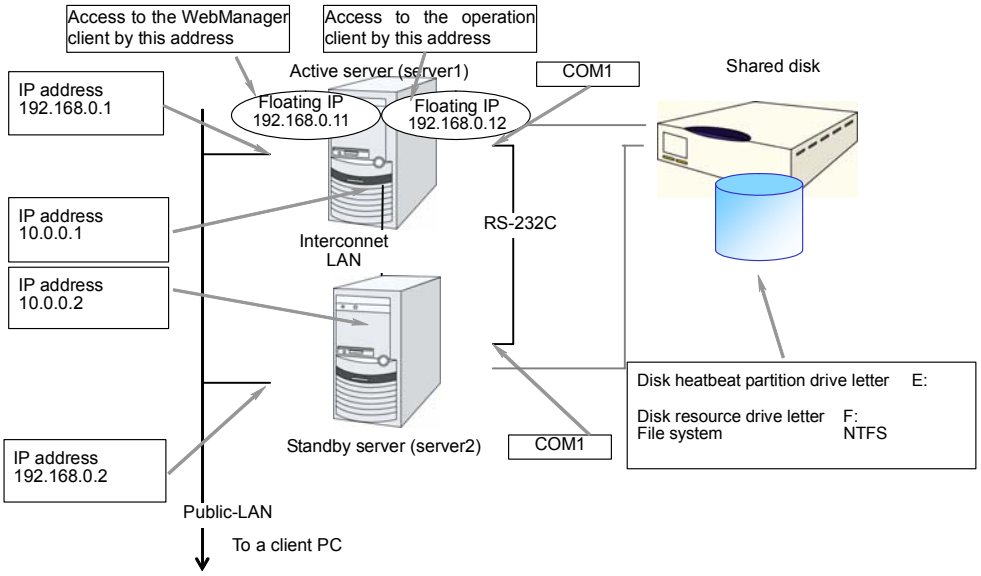
Checking the values to be configured

Before you create the cluster configuration data using the Builder, 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.

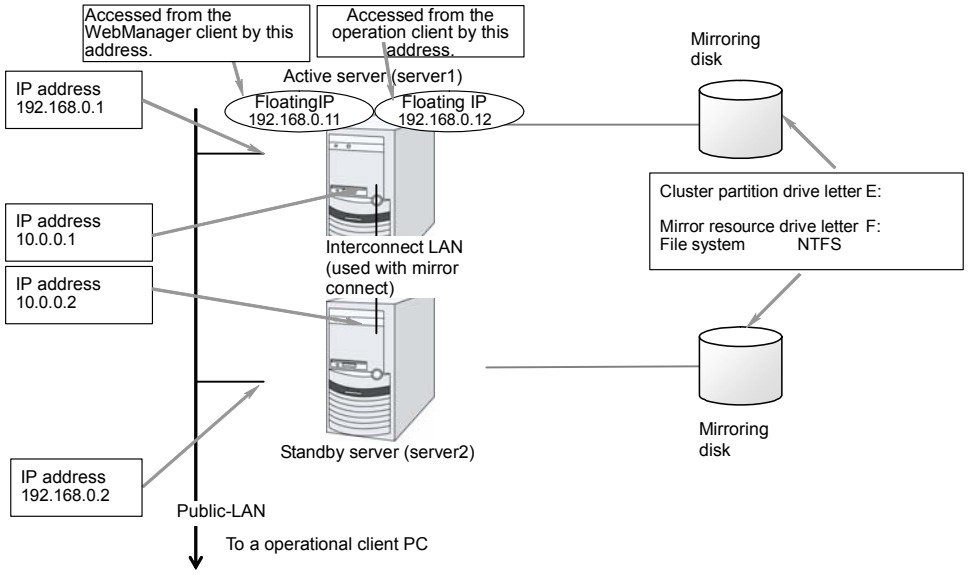
Sample cluster environment

As shown in the below, this chapter uses a typical configuration with two nodes as a cluster example.

When a shared disk is used:



When mirroring disks 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 mirroring disk)
Cluster configuration	Cluster name	Cluster	Cluster
	Number of servers	2	2
	Number of management groups	1	1
	Number of failover groups	1	1
	Number of monitor resources	5	6
Heartbeat resources	Number of kernel mode LAN heartbeats	2	2
First server information (Master server)	Server name	server1	server1
	Interconnect IP address (Dedicated)	10.0.0.1	10.0.0.1
	Interconnect IP address (Backup)	192.168.0.1	192.168.0.1
	Public IP address	192.168.0.1	192.168.0.1
	COM I/F heartbeat	COM1	-
	Disk I/F heartbeat	E:	-
	Ping I/F	-	-
	Majority I/F	-	-
	Mirror connect I/F	-	10.0.0.1
	HBA	HBA connected to a shared disk	-
Second server information	Server name	server2	server2
	Interconnect IP address (Dedicated)	10.0.0.2	10.0.0.2
	Interconnect IP address (Backup)	192.168.0.2	192.168.0.2
	Public IP address	192.168.0.2	192.168.0.2
	COM I/F heartbeat	COM1	-
	Disk I/F heartbeat	E:	-
	Ping I/F	-	-
	Majority I/F	-	-
	Mirror connect I/F	-	10.0.0.2
	HBA	HBA connected to a shared disk	-
Group for management (For the WebManager)	Type	failover	failover
	Group name	ManagementGroup	ManagementGroup
	Startup server	server1 → server2	server1 → server2
	Number of group resources	1	1
Group resources	Type	floating IP resource	floating IP resource

Target	Parameter	Value (For shared disk)	Value (For mirroring disk)
for management *1	Group resource name	ManagementIP	ManagemmentIP
	IP address	192.168.0.11	192.168.0.11
Failover group	Type	failover	failover
	Group name	failover1	failover1
	Startup server	server1 → server2	server1 → server2
	Number of group resources	3	3
First group resources	Type	floating IP	floating IP
	Group resource name	fip1	fip1
	IP address	192.168.0.12	192.168.0.12
Second group resources	Type	disk resource	Mirror disk resource
	Group resource name	sd1	md1
	Disk resource drive letter	F:	-
	Mirror disk resource cluster partition drive letter	-	E:
	Mirror disk resource data partition drive letter	-	F:
Third group resources	Type	Application resource	Application resource
	Group resource name	appli1	appli1
	Resident type	Resident	Resident
	Start path	Path of execution file	Path of execution file
First monitor resources	Type	Disk RW monitor	Disk RW monitor
	Monitor resource name	diskw1	diskw1
	File name	C:\check.txt*2	C:\check.txt*2
	I/O size	2000000	2000000
	Action to be taken when detecting stall error	Intentional stop error occurs	Intentional stop error occurs
	Recovery target	cluster	cluster
	Final action	Intentional stop error occurs	Intentional stop error occurs
Second monitor resources	Type	Disk TUR monitor	-
	Monitor resource name	sdw1	-
	Disk resource	sd1	-
	Recovery target	failover1	-
	Final action	None	-

Target	Parameter	Value (For shared disk)	Value (For mirroring disk)
Third monitor resources	Type	IP monitor	IP monitor
	Monitor resource name	ipw1	ipw1
	Monitored IP address	192.168.0.254 (Gateway)	192.168.0.254 (Gateway)
	Recovery target	ManagementGroup	ManagementGroup
	Reactivation Threshold	1	1
Fourth monitor resources	Type	IP monitor	IP monitor
	Monitor resource name	lpw2	lpw2
	Monitor IP address	192.168.0.254 (Gateway)	192.168.0.254 (Gateway)
	Recovery target	failover1	failover1
	Reactivation Threshold	0	0
Fifth monitor resource	Type	Application monitoring	Application monitoring
	Monitor resource name	appliw1	appliw1
	Target resource	appli1	appli1
	Recovery target	failover1	failover1
	Reactivation Threshold	0	0
Sixth monitor resource (Automatically created after creation of mirror disk resource)	Type	-	mirror connect monitoring
	Monitor resource name	-	mdnw1
	Mirror disk resource	-	md1
	Recovery target	-	md1
	Final action	-	None
Seventh monitor resource (Automatically created after creation of mirror disk resource)	Type	-	Mirror disk monitor
	Monitor resource name	-	mdw1
	Mirror disk resource	-	md1
	Recovery target	-	md1
	Final action	-	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.

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:
Most of 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. Make setting such as floating IP address to the management IP.

1-2. Add the first server

Add a server that constitutes the cluster. Make setting such as server name and IP address.

1-3. Add the second server

Add a server that constitutes the cluster. Make setting such as server name and IP address.

1-4. Set a server priority

Specify the server that serves as an active server and the server that serves as a standby server.

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 or mirror 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. Add a monitor resource (disk RW monitor)

Add a monitor resource to use.

3-2. Add a monitor resource (disk TUR monitor)

Add a monitor resource to use (shared disk configuration only.)

3-3. Add a monitor resource (ip monitor for management group)

Add a monitor resource to use.

3-4. Add a monitor resource (ip monitor for failover group)

Add a monitor resource to use.

3-5. Add a monitor resource (application monitor)

Add a monitor resource to use.

1. Creating a cluster

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

1-1. Add a cluster

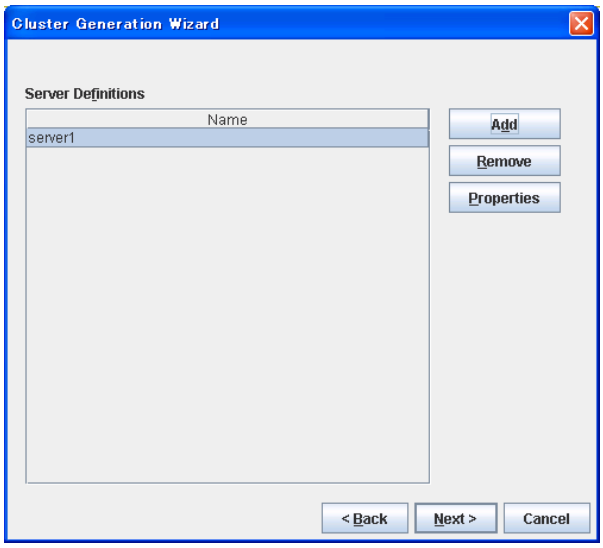
1. On the **File** menu, click **Cluster Generation Wizard**. In the **Cluster Generation Wizard** dialog box, select the language to be used by the OS for the **Language** field.

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. Type the cluster name (cluster) in the **Name** box, and then click **OK**.
3. Select the type of the management IP (floating IP) in the window to enter the management IP. Enter the management IP address **192.168.0.11** in the **IP Address**, and click **Next**.

Note:
For the details of the floating IP and the virtual IP, refer to Chapter 6, “Group resource details” in the *Refernce Guide*.

Server Definitions is displayed.



1-2. Add the first server

Add information of each server that constitutes a cluster.

1. Click **Add** on the Server Definitions.
2. In the **Server Definition** dialog box, enter the data of the first server. Enter the server name **server1** in the **Name** box, and then click **Next**.

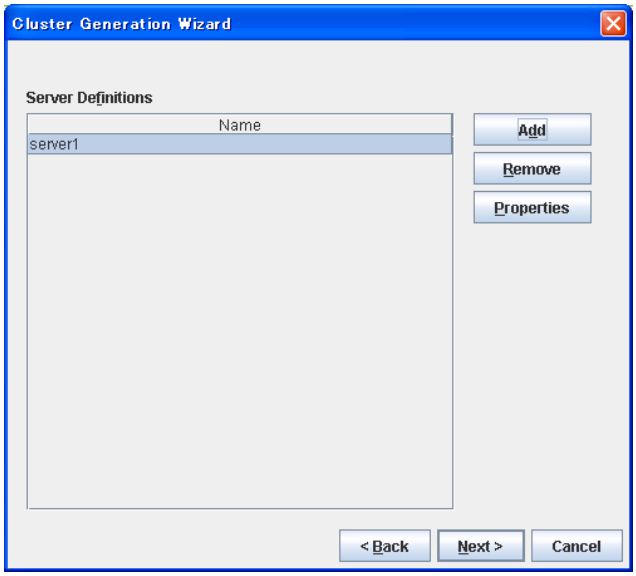
Note:
Enter the host name of the actual server.

3. Set up an interconnect LAN. Click **Add** and enter the interconnect IP address (dedicated) **10.0.0.1** in the **IP Address** box. Click **OK**.
4. The IP address you have entered is displayed in **Interconnect LAN I/F**. Enter the interconnect LAN IP address (backup) **192.168.0.1**. Click **Next**.
5. **Public LAN I/F** is displayed. Check if the IP address **192.168.0.1** set as back up is displayed to **Interconnect LAN I/F**, and click **Next**.
6. **COM I/F** is displayed. To send the heartbeats using RS-232C, click **Add** and select COM1 in the **Port Name** box . Click **OK**. For the mirror disk configuration, click **Next** without setting anything.
7. The device name you have entered is set in the **COM I/F.** Click **Next**.
8. **Disk I/F** is displayed. Click **Add** and the window to select a partition is displayed. Click **Connect**, and select the drive you have specified as a disk heartbeat partition on the shared disk. Click **OK**. For the mirror disk configuration, click **Next** without setting anything.

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

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

9. The entered partition is set in the **Disk I/F**. Click **Next**.
10. Click **Next** without setting anything in the **Ping I/F**.
11. Click **Next** without setting anything in the **Majority I/F**.
12. In the case of the mirror disk configuration, click **Add** and enter the IP address **10.0.0.1** in the **Mirror Connect I/F**. In the case of the shared disk configuration, click **Next** without setting anything.
13. On **HBAs to be managed by the cluster system**, select an HBA connecting to the shared disk, and then, check if the necessary partition is selected in the **Partitions to be managed by the cluster system** and click **Finish**. For the mirror disk configuration, click **Finish** without setting anything. server1 is displayed in the **Server Definitions**.



1-3. Add the second server

Enter the second server information so that it corresponds with the first server information. Only **server1** is displayed in the **Server Definitions**.

1. Click **Add** in the **Server Definitions**.
2. The **Server Definition** dialog box is displayed.
   Enter the server name **server2** in the **Name** box, and then click **Next**.

   Note:
   Enter the actual host name of the server.
3. When you define the second server and rest of servers, you will see I/Fs in definition as many as you find in the master server. The IP address is blank by default. Set the IP address corresponding to the I/F number registered in other servers.

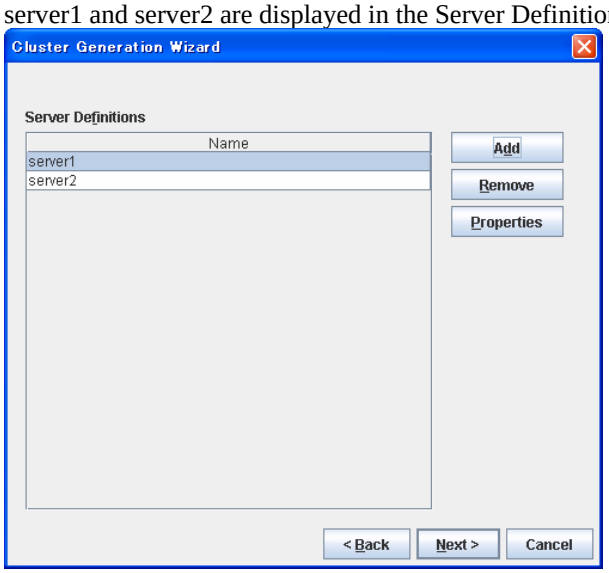
   Click **Edit** and enter the interconnect LAN IP address (dedicated) **10.0.0.2** in the **IP Address** box. Click **OK**.
4. The IP address you have entered is set in **Interconnect LAN I/F**. Likewise, select **[2]** of **I/F No.**, click **Edit**, and enter the LAN IP address (backup) **192.168.0.2.** Click **Next**.
5. **Public LAN I/F** is displayed. Check if the IP address (backup) **192.168.0.2** is displayed in the **Interconnect LAN I/F**, and click **Next**.
6. When the heartbeat using RS-232C is sent, the device name is displayed in **COM I/F**. The number of interfaces as many as you see in the master server is displayed. The COM heartbeat device name of the master server is set by default. Click **Next** without changing the settings. For the mirror disk configuration, click **Next** without setting anything.
7. The **Disk I/F** is displayed. Click **Edit** to display the window to select a partition. Click **Connect**, select the drive specified as a disk heartbeat partition on the shared disk, and click **OK**. For the mirror disk configuration, click **Next** without setting anything.

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

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

8. The device you entered is displayed in the **Disk I/F**. Click **Next**.
9. Click **Next** without setting anything in the **Ping I/F**.
10. Click **Next** without setting anything in the **Majority I/F**.
11. Click **Edit** and enter the IP address **10.0.0.2** in the **Mirror Connect I/F**. For the shared disk configuration, click **Next** without setting anything.
12. On **HBAs to be managed by the cluster system**, select an HBA connecting to the shared disk, and then, check to see the necessary partition is selected in the **Partitions to be managed by the cluster system**, and click **Finish**. For the mirror disk configuration, click **Finish** without setting anything.

server1 and server2 are displayed in the Server Definitions.



1-4. Set a server priority

Specify a priority to the servers that constitute the cluster.

1. Click **Next** in the **Server Definitions**. Make sure that **Master Server** is set to **server1** in the **Server Priority**. If not, make the setting by clicking **Up** and **Down** buttons, and click **Next**.
2. **Group Definitions** is displayed.

2. Add a failover group

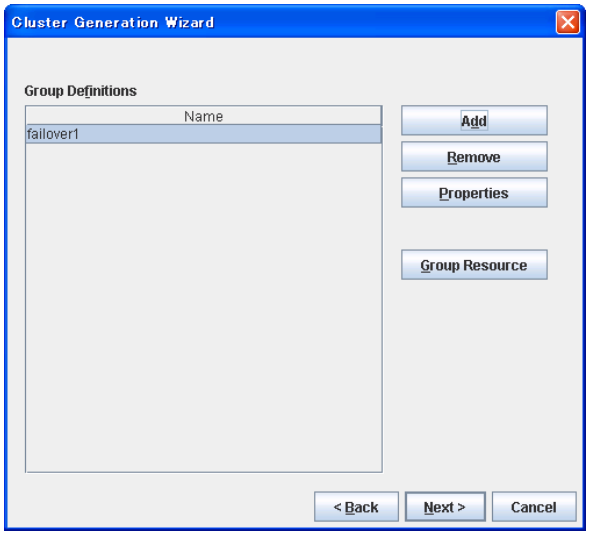
Add a failover group to (hereafter a failover group may be abbreviated as a group) the cluster.

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 Definitions** to open the **Group Definition** dialog box. Enter the group name (failover1) in the **Name** box, and click **Next**.
2. Click **server1** in the **Available Servers** and click **Add**. **server1** is added to the **Servers that can run the Group**. Add **server2** in the same way.
3. Verify that **server1** and **server2** are set in this order to the **Servers that can run the Group**. It they are not set, configure by clicking **Up** and/or **Down**. Click **Finish**.

A failover group is added to the **Group Definitions.**



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

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

1. Click **Group Resource** in the **Group Definitions**.
2. Click **Add** in the **Group Resource Definitions**.
3. In the **Resource Definition** 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**.
4. Enter the IP Address **192.168.0.12** in the **IP Address** box. Click **Next**.
5. **Recovery Operation at Activation Failure Detection** and **Recovery Operation at Deactivation Failure Detection** are displayed. Click **Next**.
6. A page for setting up a dependency is displayed. Click **Finish**.

2-3. Add a group resource (disk resource or mirror disk resource)

When using a shared disk

Add a shared disk as a group resource.

1. Click Add in Group Resource Definitions.
2. In the **Resource Definition** dialog box, select the group resource type **disk resource** in the **Type** box, and enter the group name **sd1** in the **Name** box. Click **Next**.
3. In the .**Servers that can run the Group,** select the **server1**, and click **Add**.
4. Select the partition **F:** and click **OK** in the **Selection of Partition** dialog box.

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.

5. Similarly, add **server2** to **Servers that can run the Group**, and click **Next**.
6. **Recovery Operation at Deactivation Failure Detection** and a **Recovery Operation at Activation Failure Detection** are displayed. Click **Next**.
7. A page for setting up a dependency is displayed. Click **Finish** without specifying anything. The disk resource is added to the **Group Resource Definitions.**

When using a mirror disk

Add a mirror disk as a group resource.

1. Click Add in Group Resource Definitions.
2. **Resource Definition** dialog box is opened. Select the group resource type (mirror disk resource) in the **Type** box and enter a group name **md1**.Click **Next**.
3. In the **Servers that can run the Group**, select **server1** and click **Add**.
4. In the **Selection of Partition** dialog box, select a data partition **F:** and cluster partition **E:** and 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 the partition on the shared disk for the data partition and cluster partition.

5. Similarly, add **server2** to **Servers that can run the Group**, and click **Next**.
6. **Recovery Operation at Activation Failure Detection** and **Recovery Operation at Deactivation Failure Detection** are displayed. Click **Next**.
7. A page for setting up a dependency is displayed. Click **Finish** without specifying anything. The mirror disk resource is added to the **Group Resource Definitions**.

2-4. Add a group resource (Application resource)

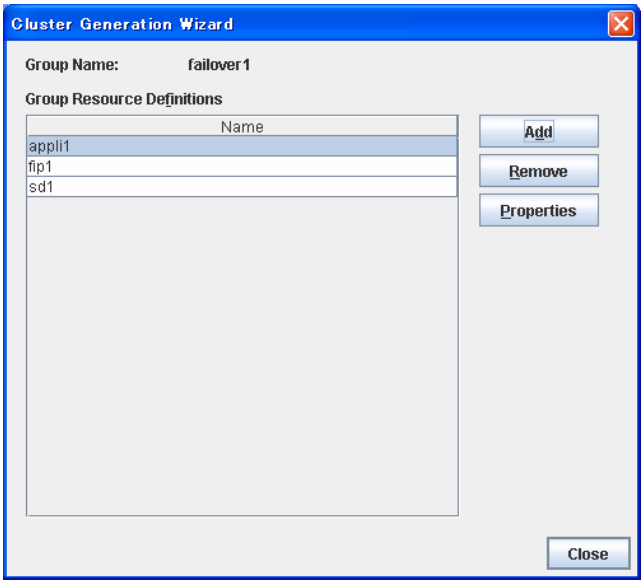
Add an application resource that can start and stop the application.

1. Click **Add** in **Group Resource Definitions**.
2. In the **Resource Definition** dialog box, select the group resource, **application resource,** in the **Type** box, and enter the group name **appli1** in the **Name** box. Click **Next**.
3. Select **Resident** in the **Resident Type**. Specify the path of the execution file for the **Start Path**. Click **Next**.

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.

4. **Recovery Operation at Activation Failure Detection** and **Recovery Operation at Deactivation Failure Detection** are displayed. Click **Next**.
5. A page for setting up a dependency is displayed. Click **Finish**.

   An application resource is added to the **Group Resource Definitions**.



6. Click **Close**.

3. Add 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 Definitions**.
2. In the **Monitor Resource Definition** dialog box, 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. Set the file name **C:/check.txt** and I/O size (**2000000**). Select **Action on Stall** (**Generate an Intentional Stop Error**), and click **Next**. For **File Name**, specify the file of the partition where OS is installed.
4. Configure the monitor settings. Set the monitor timing to **Resident** and click **Next**.
5. Specify the recovery target. Click **Browse**.
6. Click **cluster** in the tree view shown. Click **OK**. **cluster** is set to the **Recovery Target**.
7. 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 Definitions.**

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 (disk TUR monitor resource)

For a shared disk configuration, add TUR monitor resource to monitor disk resource.

1. In the **Monitor Resource Definition** dialog box, click **Add**. Select the monitor resource type **disk TUR monitor** in the **Type** box. Enter the monitor resource name **sdw1** in the **Name** box. Click **Next**.
2. To set a disk resource, click **Browse**.
3. Select **sd1** in the tree view, and click **OK**. Check that **sd1** is set to the **Disk Resource** and click **Next**.
4. Enter the monitoring setting. Click **Next** without changing the default value. Click **Next**.
5. Set the recovery target. Click **Browse**.
6. Click **failover1** in the tree view and click **OK**. Check that **failover1** is set to **Recovery Target**, and click **Finish**.
7. The disk TUR monitor resource (**sdw1**) is added to the **Monitor Resource Definitions**.

3-3. 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 Definition** 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. 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
3. The IP address you have entered is set in the **IP Addresses**. Click **Next**.
4. Configure the monitor settings. Do not change the default value. 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. Set **1** in the **Reactivation Threshold** box. Click **Finish**. The IP monitor resource **ipw1** is added to the **Monitor Resource Definitions**.

3-4. Add a monitor resource (IP monitor resource for failover group)

1. Click **Add** in the **Monitor Resource Definition** 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. 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**.

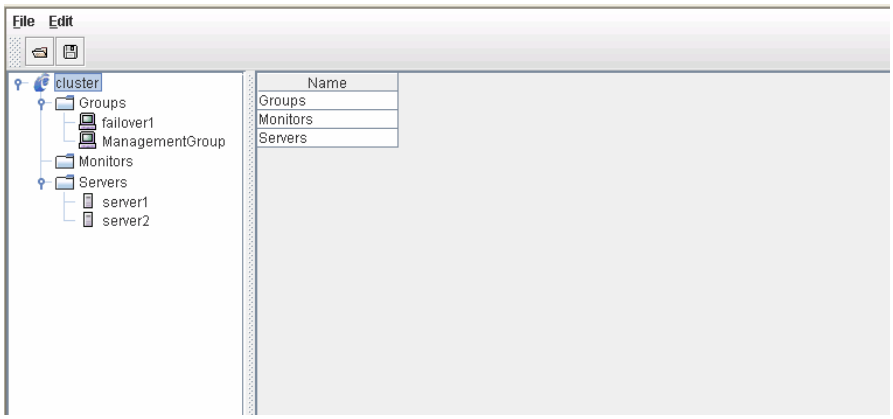
   Note:
   For monitoring target of the IP monitor resource, specify an IP address of the device (i.e. gateway) that is assumed to be always active on public LAN

3. The entered IP address is set in the **IP Addresses**. Click **Next**.
4. Configure the monitor settings. Click **Next** without changing the default value.
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 **Reactivation Threshold** box, and click **Finish**.
   The IP monitor resource **ipw2** is added to the **Monitor Resource Definitions**.

3-5 Add a monitor resource (application monitor resource)

1. Click **Add** in the **Monitor Resource Definition** dialog box. Select the monitor resource type **ap monitor** in the **Type** box, and enter the monitor resource name **appliw1** in the **Name** box. Click **Next**.
2. Enter the monitoring settings. Click **Browse**.
3. Click **appli1** in the displayed tree view and click **OK**. **appli1** is set to the **Target Resource**. Click **Next**.
4. Set the recovery target. Click **Browse**.
5. Click **failover1** in the displayed tree view, and click **OK**. **failover1** is set to the **Recovery Target**.
6. Set 0 in the **Reactivation Threshold** box, and click **Finish**.
   The IP monitor resource appliw1 is added to the **Monitor Resource Definition**. Click **Finish**.

The table view will look similar to the following.



Creating the cluster configuration data is completed. Proceed to the next section “Saving the cluster configuration data.”

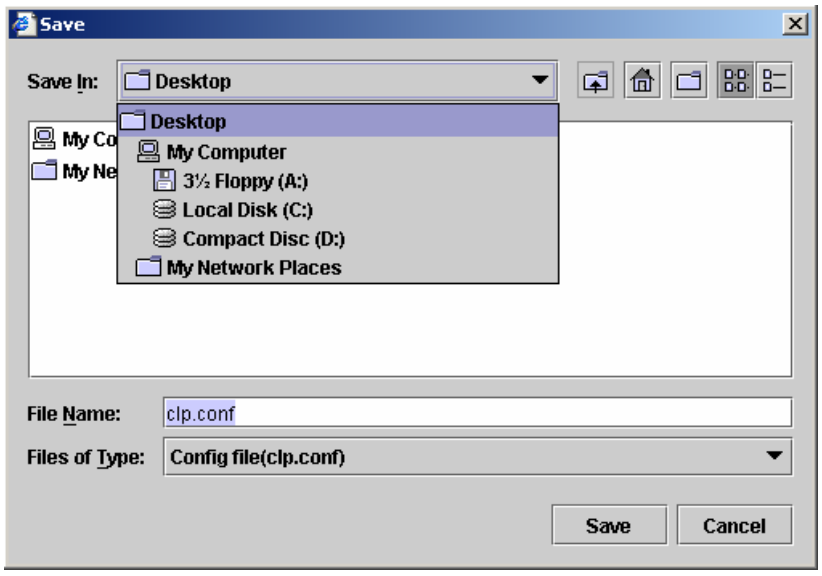
Saving the cluster configuration data

The cluster configuration data can be saved in a file system or in media such as a floppy disk. In an environment where the Builder is activated by using the WebManager, the saved cluster information can be reflected to server machines on which the ExpressCluster Server is installed via the WebManager.

Saving the cluster configuration data

Follow the procedures below to save the cluster configuration.

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



Note:
Two files (clp.conf and clp.conf.rep) 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 three as a set. When new configuration data is edited, clp.conf.bak is created in addition to these three.

3. Check the file system and verify if the two files (clp.conf and clp.conf.rep) 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.

Creating a cluster

After creating and/or modifying a cluster configuration data, reflect 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 **Upload the Configuration File** on the **File** menu.

If the upload succeeds, the message “The upload is completed successfully. To apply the changes you made, from the Service menu, restart the WebManager and then start the cluster.” is displayed. If the upload fails, perform the operations by following the displayed message.

2. Terminate the Builder.
3. Select **Restart Manager** from **Service** of the WebManager, and click **OK**.
4. 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 cluster using the WebManager

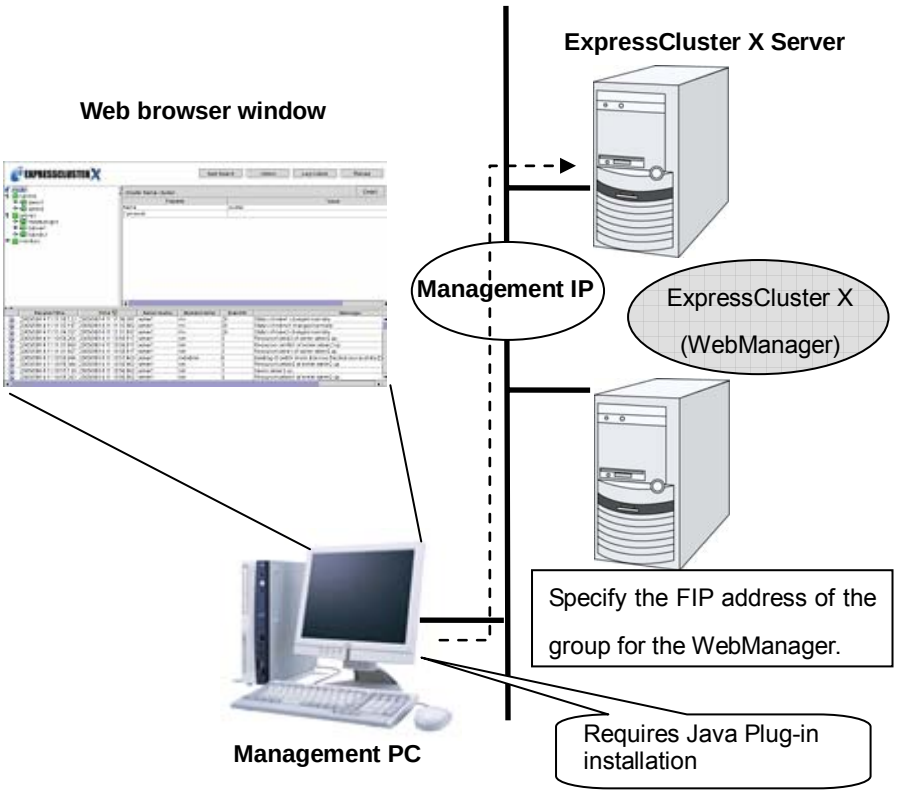
The cluster system you have set up can be verified by using the WebManager or running the ExpressCluster command from the command prompt. This chapter provides instructions for verifying the cluster system by using the WebManager. The WebManager is installed at the time of the ExpressCluster Server installation. 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 Chapter 3 “System requirements for the WebManager” in *Getting Started Guide*.

What is ExpressCluster X WebManager?

The following provides the overview of the ExpressCluster X WebManager (hereafter the WebManager).

Using the WebManager allows you to monitor the cluster status and startup and stop of servers and groups, and collect cluster operation logs from a management PC. A commonly used Web browser (hereafter a browser) is used to access the WebManager from a management PC. The following figure shows the overview of the WebManager.



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

Related Information:
You can make settings to manually start WebManager by using the Builder. After creating a cluster, click **Settings** from the WebManager and start the **Builder**. In the Builder, select **Cluster Properties** and clear the **Enable WebManager Server** check box in the **WebManager tab**.

Browsers supported by the WebManager

You can use the following browsers to access the WebManager:

- For Windows® XP, Microsoft® Internet Explorer 6.0 SP2 or later
- For Windows® 2003 Server, Microsoft® Internet Explorer 6.0 SP1 or later

Note that a browser must have Java™ 2 Runtime Environment, Version 5.0 Update 6 (1.5.0_06) or later in it.

Related Information:
For information on combinations of a browser and operating system that have been tested and verified, see Chapter 3 “Installation requirements for ExpressCluster” in the *Getting Started*.

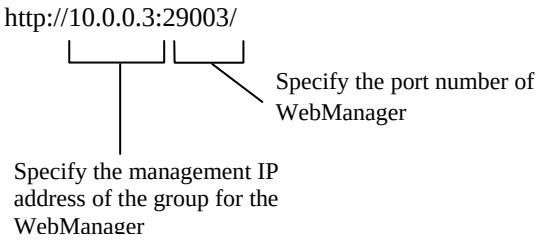
Setting Up JAVA runtime environment

In order to access the WebManager, a Java Plug-in must be installed on a browser on a management PC.

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

Starting up the WebManager

Enter the following URL in the browser on your management PC.



In general, specify the management IP address of a group (ManagementGroup) for the WebManager.

A connection will switch from the original access destination server to other active server when the server goes down if a management IP address is specified.

Specify the port number that has been configured in **WebManager HTTP Port Number**. To configure a port number, select **Cluster Properties** in **ExpressCluster X Builder**, and then click **Port No.**

Verifying the status by using the WebManager

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**

   Check that you can access the resource switching partition or data partition on the server where a disk resource or mirror disk resource is 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, 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 by 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 4 “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**

   Check that you can access a disk partition on the server where the disk resource is 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

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

This chapter covers:

Operation tests

Verify that monitor resources detect errors successfully and no unexpected error occurs by performing dummy-failure tests and/or backup restoration of the shared disk.

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. **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.

2. **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.

3. **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 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. 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-HUB 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. 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. A warning is issued to the WebManager alert view. Communication between servers continues by using a public LAN = 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. LAN heartbeat resource on the public LAN becomes inactive. A warning is issued to the WebManager alert view. 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. When the public LAN is the only communication channel between servers (such as the remote cluster configuration), emergency shutdown due to the network partition resolving in the ping

Device	Dummy-failure	What happens:
		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 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. Operation continues.
OS error	Run the shutdown command on the active server	The active server shuts down Failover to a standby server occurs.
Mirror connect	Unplug the LAN cable	A warning is issued to the WebManager alert view l (mirroring stops) Operation continues on the active server but switching to a standby server becomes impossible.
		An error is detected in mirror disk monitor resource and/or mirror connect monitor resource.
Disk resource	Start up the group on the server where the disk path is unplugged.	The disk resource does not get activated. Failover to a standby server occurs.
Application resource	Temporarily change the name of the file or folder configured for the start path of the application resource, and then start a group.	The application resource does not get activated. 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	Temporarily change the path or file name of the service's execution file, and then start a group.	The service resource does not get activated. Failover to a standby server occurs.

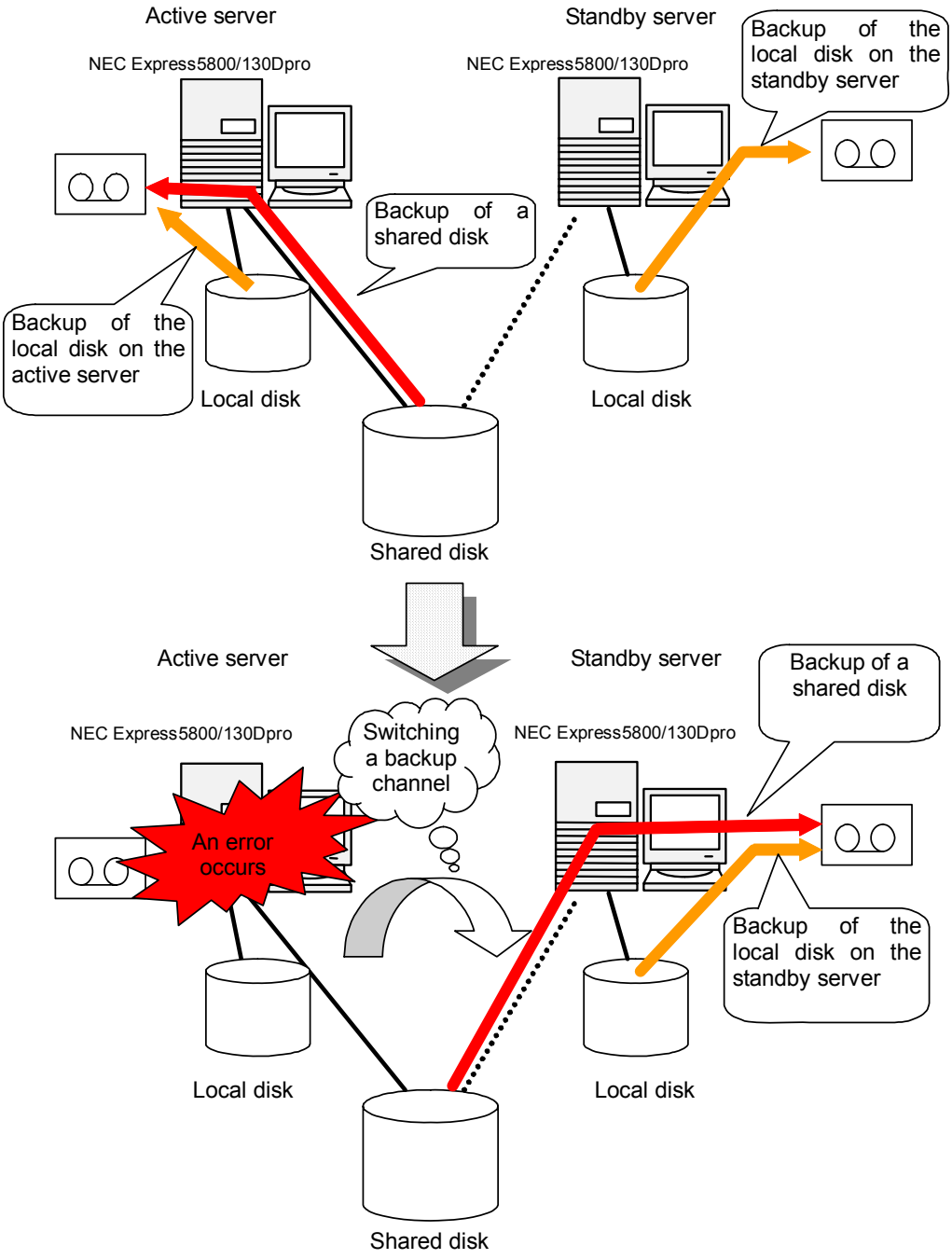
Resource	Dummy-failure	What happens:
Service monitor resource	Stop a service to be monitored.	An error is detected. The service is restarted or a failover to a standby server occurs.
Floating IP address	Specify the same IP address (the one that is used for server) to make it overlapped, and start a group.	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)

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, backup, data restoration and log collection when an error occurs.

This chapter covers:

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.
3. The cluster starts.

Note:
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.

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 "

Shared disk settings (Required for shared disk)" on page 19.

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, 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. 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 is interrupted when you are using the Replicator. If you intend to use a standby server while performing hardware maintenance, shut down the active server.

Related Information:
For more information on the clpstdn command and the WebManager functions, see Chapter 1 "Functions of the WebManager" in 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 clpcl command or **Stop Cluster** from the WebManager.

Related Information:
For more information on the clpcl command, see Chapter 4 “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 of changing the configuration data after creating a cluster.

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

1. Start the ExpressCluster Builder by using a browser.

   http:// *Management address for the WebManager group: port number* (default value 29003)/StartTrekking Tool.js

2. Modify the configuration data after the current cluster configuration data is displayed.
3. 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 cancelled 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.

   (The path for installation) /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 <The path 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 cancelled 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.

Reflecting 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 reflect the modified data, refer to Chapter 3 “Functions of the Builder” in the *Reference Guide.*

The way you reflect 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 reflect 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 reflect the modified data, ensure suspension on stopping is complete before reflecting 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 “Source: ExpressCluster X, Event type: information, Event ID: 2” are displayed on the event viewer.
After checking the message stated above, reflect 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 upload is completed successfully.

Restarting the ExpressCluster X WebManager

For information on how to restart ExpressCluster X WebManager, see Chapter 3 “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 **Service** 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.

   The upload is completed successfully.
5. Execute **Resume Cluster** by clicking **Service** 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 **Service** 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.

   The upload is completed successfully.
5. Execute **Start Cluster** by clicking the **Service** button 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** button 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.

   The upload is completed successfully.
5. Restart all servers from the **Start** menu.

Checking the log collection procedure

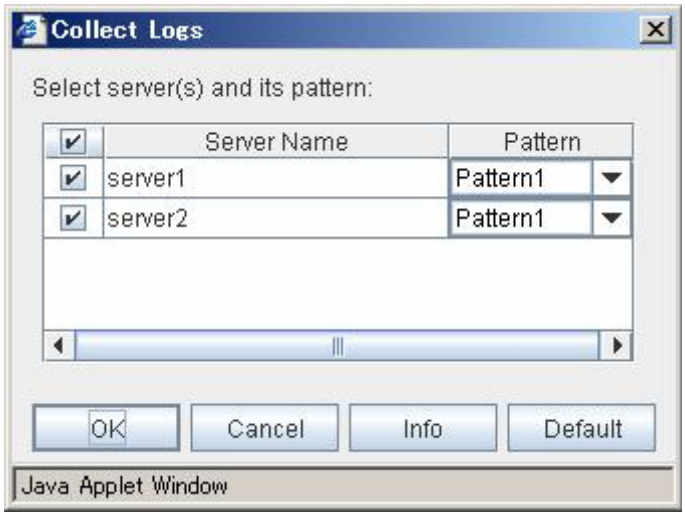
The following describes how to collect logs by using the WebManager.

Collecting logs by using the WebManager

1. Start the WebManager.

   (*http://IP_address_for_the WebManager_group*: *port_number* (the default value is 29003).

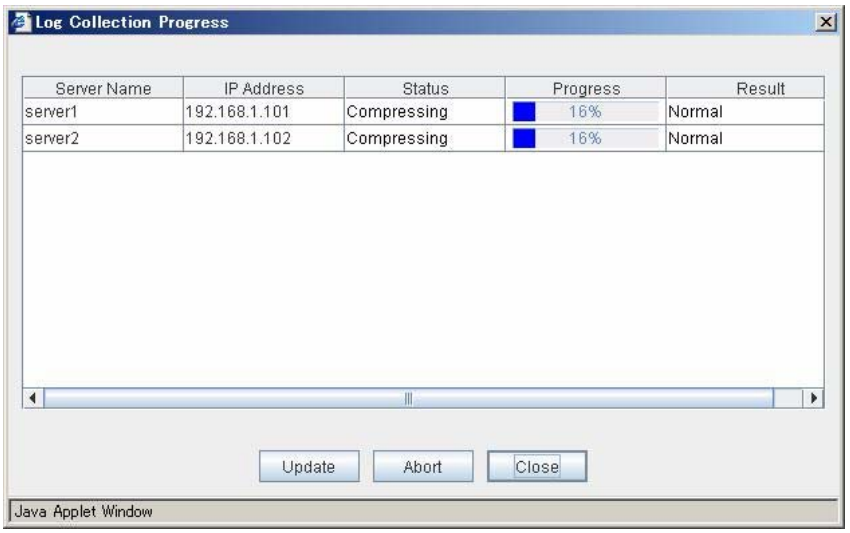
2. In the title view, click **Collect Logs**. The log collection dialog box will open.



3. Select the check box of the servers for collecting log and select a log collection pattern.

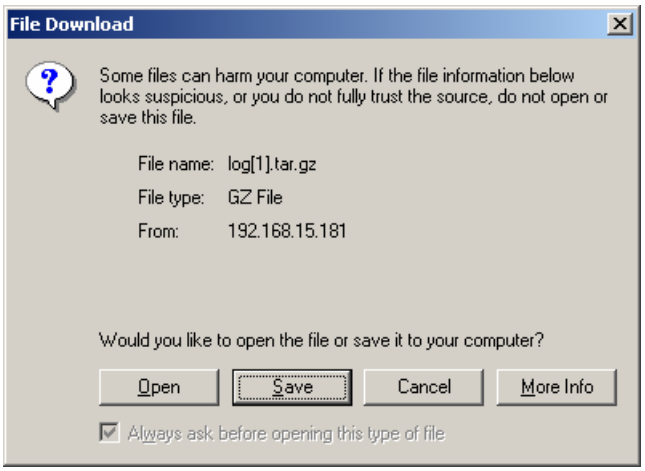
   To view details of the pattern, click the **Info** button. To reset the settings, click the **Default** button.

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 the **Update** button.

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



(* For Internet Explorer 6.0 SP1)

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

Uninstalling the ExpressCluster Server

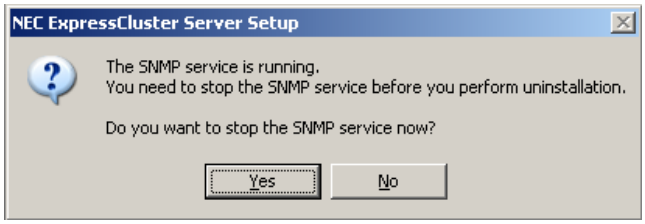
Note:
You must log on as root user when uninstalling the ExpressCluster Server.

Follow the procedures below to uninstall the ExpressCluster Server:

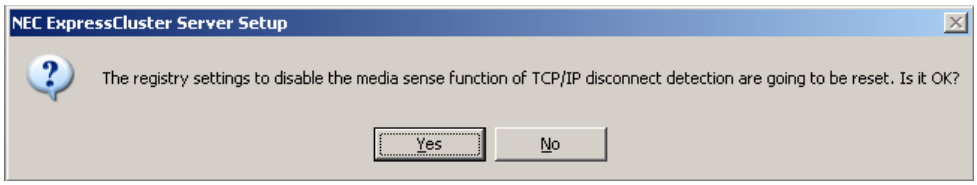
1. If the shared disk is used, unplug all disk cables connected to the server after uninstallation is completed. This is because access restriction becomes disabled after the ininstallation.
2. Select **Service** in **Administrative Tool** in OS, and stop the following services from the service manager.
   - EXPRESSCLUSTER
   - EXPRESSCLUSTER Alert
   - EXPRESSCLUSTER Disk Agent
   - EXPRESSCLUSTER Event
   - EXPRESSCLUSTER Manager
   - EXPRESSCLUSTER Old API Support
   - EXPRESSCLUSTER Server
   - EXPRESSCLUSTER Transaction
   - EXPRESSCLUSTER Web Alert

Note:
All services except EXPRESSCLUSTER Event service depend on EXPRESSCLUSTER Event service. By stopping EXPRESSCLUSTER Event service, all services will be stopped.

3. In **Control Panel** in OS, click **Add or Remove Programs**.
4. Select ExpressCluster Server and then, click **Change/Remove**.
5. The **ExpressCluster Server Setup** dialog box is displayed.
6. Click **Yes** in the uninstallation confirmation dialog box. If you click **No**, uninstallation will be canceled.
7. 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.



8. 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.



9. The completion message is displayed when uninstallation is completed in the **ExpressCluster Server Setup** dialog box. Click **Finish**.

10. 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.

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.
3. Delete Java user policy file settings.
   Delete ExpressCluster X Builder settings, which were added at installation, from the .java.policy file in the home directory. For details on ExpressCluster X Builder settings, see Chapter 3, “Functions of the Builder” in the *Reference Guide*.

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 4, "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 uninstallation procedures, refer to "Reinstalling the ExpressCluster Server."
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 ExpressCluster Server, refer to Chapter 3, "Installing ExpressCluster." For details on how to register the license, refer to Chapter 4 "Registering the license."

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."

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, see "Uninstalling the ExpressCluster Server."

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 ExpressCluster Server, refer to Chapter 3, “Installing ExpressCluster.” For details on how to register the license, refer to Chapter 4 “Registering the license.”

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 start up the Builder.
6. If OS is reinstalled or partition used for mirror disk resource is recreated, update the partition information of the server for which Step 1 to 4 is performed through **Details** tab in **Mirror Disk Resource Properties**. If mirror disk resource is not used, no update is necessary.

Note:
In **Mirror Disk Resource Properties**, click **Details** tab, and select the server where the ExpressCluster Server is reinstalled. In the **Selection of Partition** dialog box, click **Connect** and select **Data Partition** or **Cluster Partition**.

7. If a shared disk is used and the OS is reinstalled, click **Details** tab in **Disk Resource Tuning Properties** to update the partition information of the server where the OS is reinstalled. Update the partition information and filtering information in **HBA** tab or **Disk I/F** tab in **Server Properties** of the server where the OS is reinstalled.

Note:
In **Disk Resource Tuning Properties**, click **Details** tab, select the server where the ExpressCluster Server is reinstalled, and click **Edit**. In the **Selection of Partition** dialog box, click **Connect** and select the **Partition**.
In **Server Properties** of the server where the OS is installed, click **Disk I/F** tab and click **Edit**. In the **Selection of Partition** dialog box, click **Connect** and select **Partition**. If more than one partition is registered with **Disk I/F**, update all partition information.

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.

8. From the server where the Builder is started up, run clpcl –suspend --force from the command prompt and suspend the cluster.
9. Upload the configuration data by the ExpressCluster X Builder. The following message is displayed if the data has successfully been distributed.

   The upload is completed successfully.

10. Resume the cluster from the WebManager.

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 Error code: %x %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) Error code: %x After restart, install it. %d: internal code %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. "The license is not registered. Product ID: %1" %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. "The license is insufficient. The number of registered licenses is %1. The number of insufficient license is %2. The product ID is %3." %1: The number of registered licenses %2: The number of licenses in short of supply %3: Product ID		Obtain a license and register it.
While the cluster was operated on the trial license, the following message is displayed and the cluster stopped. "The license of trial expired by %1, %2 and %3. Product ID: %4" %1: Trial end year %2: Trial end ,month %3: Trial end day %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

Cluster partition	A partition on a mirror disk. Used for managing mirror disks. (Related term: Disk heartbeat partition)
Interconnect	A dedicated communication path for server-to-server communication in a cluster. (Related terms: Private LAN, Public LAN)
Virtual IP address[4]	IP address used to configure a remote cluster.
Management client	Any machine that uses the WebManager to access and manage a cluster system.
Startup attribute	A failover group attribute that determines whether a failover group should be started up automatically or manually when a cluster is started.
Shared disk	A disk that multiple servers can access.
Shared disk type cluster	A cluster system that uses one or more shared disks.
Switchable partition	A disk partition connected to multiple computers and is switchable among computers. (Related terms: Disk heartbeat partition)
Cluster system	Multiple computers are connected via a LAN (or other network) and behave as if it were a single system.
Cluster shutdown	To shut down an entire cluster system (all servers that configure a cluster system).
Active server	A server that is running for an application set. (Related term: Standby server)
Secondary server	A destination server where a failover group fails over to during normal operations. (Related term: Primary server)
Standby server	A server that is not an active server. (Related term: Active server)
Disk heartbeat partition	A partition used for heartbeat communication in a shared disk type cluster.
Data partition	A local disk that can be used as a shared disk for switchable partition. Data partition for mirror disks. (Related term: Cluster partition)
Network partition	All heartbeat is lost and the network between servers is partitioned. (Related terms: Interconnect, Heartbeat)

[4] This applies only for Windows version.

Node	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.
Heartbeat	Signals that servers in a cluster send to each other to detect a failure in a cluster. (Related terms: Interconnect, Network partition)
Public LAN	A communication channel between clients and servers. (Related terms: Interconnect, Private LAN)
Failover	The process of a standby server taking over the group of resources that the active server previously was handling due to error detection.
Failback	A process of returning an application back to an active server after an application fails over to another server.
Failover group	A group of cluster resources and attributes required to execute an application.
Moving failover group	Moving an application from an active server to a standby server by a user.
Failover policy	A priority list of servers that a group can fail over to.
Private LAN	LAN in which only servers configured in a clustered system are connected. (Related terms: Interconnect, Public LAN)
Primary (server)	A server that is the main server for a failover group. (Related term: Secondary server)
Floating IP address	Clients can transparently switch one server from another when a failover occurs. Any unassigned IP address that has the same network address that a cluster server belongs to can be used as a floating address.
Master server	The server displayed on top of the **Master Server** in **Cluster Properties** in the Builder.
Mirror connect	LAN used for data mirroring in a data mirror type cluster. Mirror connect can be used with primary interconnect.
Mirror disk type cluster	A cluster system that does not use a shared disk. Local disks of the servers are mirrored.

Appendix C. Index

T

U

V

W