ExpressCluster® X 3.1 *for Solaris*

Installation and Configuration Guide

Revision History

Edition	Revised Date	Description
First	10/11/2011	New manual

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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. This guide describes necessary instructions for designing, installing, and configuring a cluster system with ExpressCluster.

This guide shows how to design, install and configure a cluster system using ExpressCluster by step-by-step in the order of actual procedure.

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**
Installs ExpressCluster to the server machine and configure a cluster system using the cluster configuration data that you have created in Section I. Then run the operation tests and verify if 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**
Verifies if the cluster system that you have configured operates successfully.

Chapter 7 **Modifying the cluster configuration data**
Provides instructions for how to modify the cluster configuration data.

Section III **Evaluation before operating a cluster system**
Evaluates the system before start operating the cluster. Verify the required settings after checking the behavior of the cluster system. Instruction on how to uninstall and reinstall ExpressCluster is provided as well.

Chapter 8 **Verifying operation**
Runs the pseudo-failure test and adjust the parameters.

Chapter 9 **Preparing to operate a cluster system**
Provides notice or caution on starting operation of actual ExpressCluster.

Chapter 10 **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 five guides. The title and purpose of each guide is described below:

Getting Started Guide
This guide is intended for all users. The guide covers topics such as product overview, system requirements, update information 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*.

ExpressCluster X Integrated WebManager Administrator's Guide
This guide is intended for system administrators who manage the cluster system using ExpressCluster with ExpressCluster Integrated WebManager and for system engineers who are introducing Integrated WebManager. The details on the required items at the time of introducing the cluster system is explained in accordance with actual procedures.

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

Conventions

The following is examples of what is explained in **Note**, **Important** and **Related Information** in this guide.:

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]`
#	Prompt to indicate that a Solaris user has logged on as root user.	`# clpcl -s -a`
Monospace (courier)	Indicates path names, commands, system output (message, prompt, etc), directory, file names, functions and parameters.	`/Solaris/3.0/eng/server/`
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.	`pkgadd –NECexpresscls -<version_number>-<release_number>.x86.pkg`

Contacting NEC

For the latest product information, visit our website below:

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

Section I   Configuring a cluster system

Before installing ExpressCluster, it is important to plan your cluster system considering the hardware configuration and the operation requirements and needs. This section describes how to determine the hardware configuration required before installing ExpressCluster and how to create the cluster configuration data with the ExpressCluster X Builder.

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

Chapter 1 Determining a system configuration

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

This chapter covers:

Steps from configuring a cluster system to installing ExpressCluster

Before you set up a cluster system that uses ExpressCluster, you should carefully plan the cluster system after carefully considering factors such as hardware requirements, software to be used, and the way the system is used. After 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 to take from designing the cluster system to operating ExpressCluster:

The following is the procedure for configuring a cluster system to run an operation test:

Configuring a cluster system (Section I)

This section describes preparation for installing ExpressCluster. Determine the hardware configuration and the setting information of a cluster system to be constructed.

Step 1   Determining a system configuration (Chapter 1)

Step 2   Configuring a cluster system (Chapter 2)

Installing and configuring ExpressCluster X (Section II)

This section describes the installation of ExpressCluster. Install ExpressCluster to server machines, create a configuration data file by using setting information created on section I, and construct a cluster. After that, verify that a cluster system operates normally.

Step 3   Installing ExpressCluster (Chapter 3)

Step 4   Registering the license (Chapter 4)

Step 5   Creating the cluster configuration data   (Chapter 5)

Step 6   Verifying a cluster system (Chapter 6)

Step 7   Modifying the cluster configuration data (Chapter 7)

Evaluation before operating a cluster system (Section III)

This section describes about the evaluation required before starting the ExpressCluster operation. Test the operations of a constructed cluster system, and then check what should be checked before starting the ExpressCluster operation. On the last part of this section, how to uninstall and reinstall ExpressCluster is described.

Step 8   Verifying operation (Chapter 8)

Step 9   Preparing to operate a cluster system (Chapter 9)

Step 10   Uninstalling and reinstalling ExpressCluster (Chapter 10)

Related Information:
Refer to the *Reference Guide* as you need when you operate ExpressCluster in accordance with the procedures in this guide. See the *Getting Started Guide* for installation requirements.

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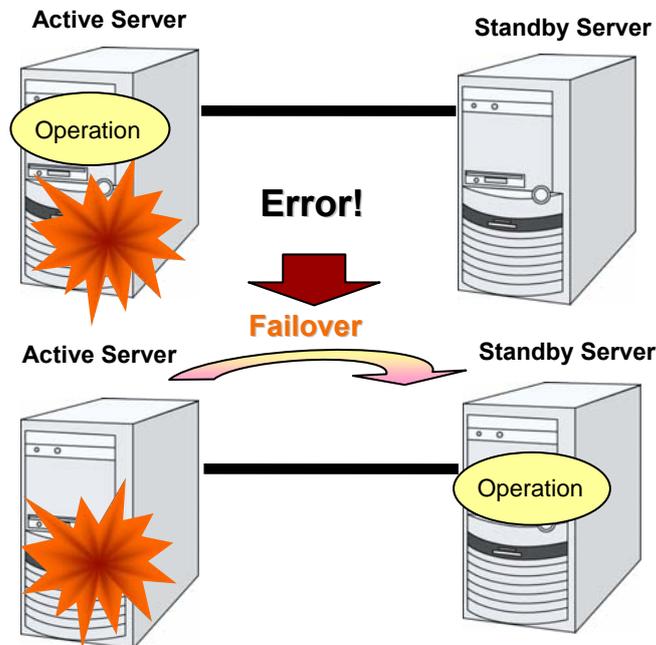
The following can be achieved by introducing a cluster system that uses ExpressCluster.

● 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

An expandable database platform can be provided by supporting a parallel database up to 32 servers.

Related Information:
For details on ExpressCluster, refer to Section I "Introducing ExpressCluster" in the *Getting Started Guide*.

ExpressCluster modules

ExpressCluster 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 configuring the cluster.

◆ **ExpressCluster X WebManager**

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

◆ **ExpressCluster X Builder**

A tool for editing the cluster configuration data.
The following two versions of Builder are provided: an online version that operates as the setup mode of WebManager, and an offline version that is individually installed on the management PC. The online version is incorporated into WebManager.
The Builder needs to be installed separately from the ExpressCluster Server on the machine where you use the Builder.
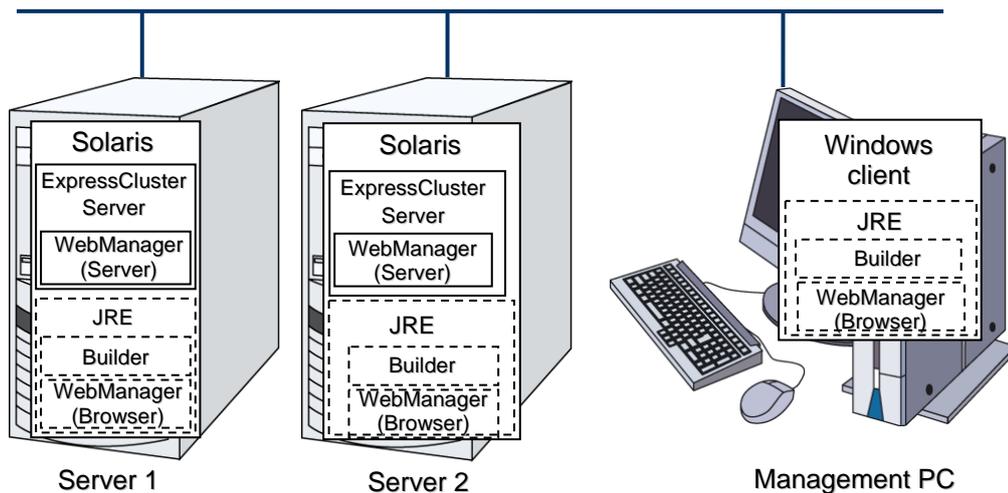
The WebManager and the Builder are Java applets that run on Java VMs. The ExpressCluster X Builder and WebManager can run on any Windows machines as long as Java Runtime Environment (JRE) is installed. This is because the WebManager and the Builder are Java applets that run on Java VM.

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 the latest information on system requirements, refer to the *Getting Started Guide.*

Shared disk type

There is one type of system configuration: shared 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 restrict the access from a server to the shared disk when the other 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 the performance does not degrade in writing data.

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

Example 1: configuration using a shared disk with 2 nodes

The most commonly used system configuration:

◆ Different models can be used for servers.

◆ Use cross cables for interconnection. (A dedicated HUB can be used for connection as in the case with the 4-node configuration)

◆ Connect COM (RS-232C) ports using a cross cable.

ExpressCluster X 3.1 for Solaris Installation and Configuration Guide
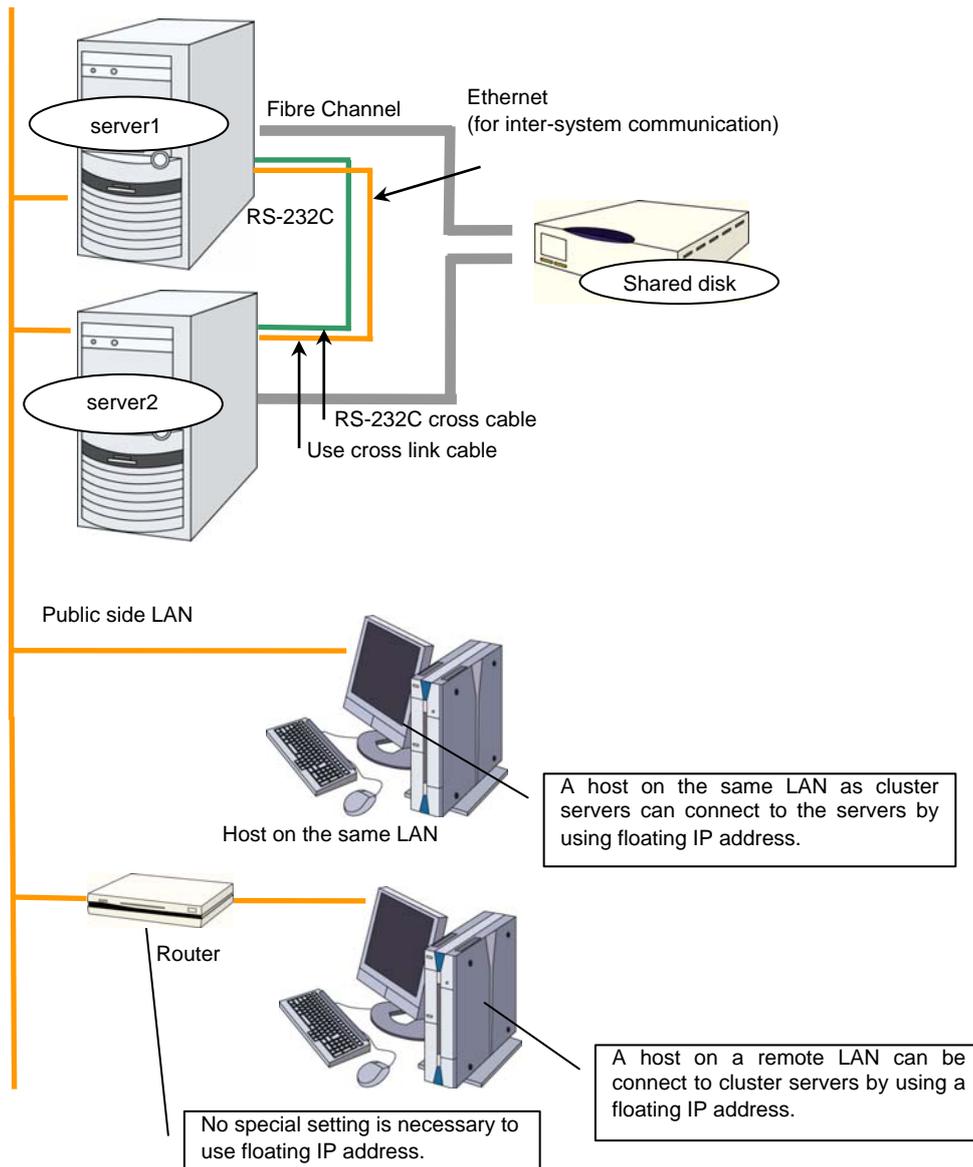
Example 2: configuration with 4 nodes

◆ As is the case with 2 nodes, connect a shared disk.

◆ Install a dedicated HUB for interconnection.

◆ It is not necessary to establish connectivity between servers using the connect COM (RS-232C).

Fibre Channel

Ethernet

server1

server2

server3

server4

FC Switch

Shared disk

HUB for interconnection

Used only for communication between servers. Other servers and client are not connected.

* Public-LAN is not shown in this diagram
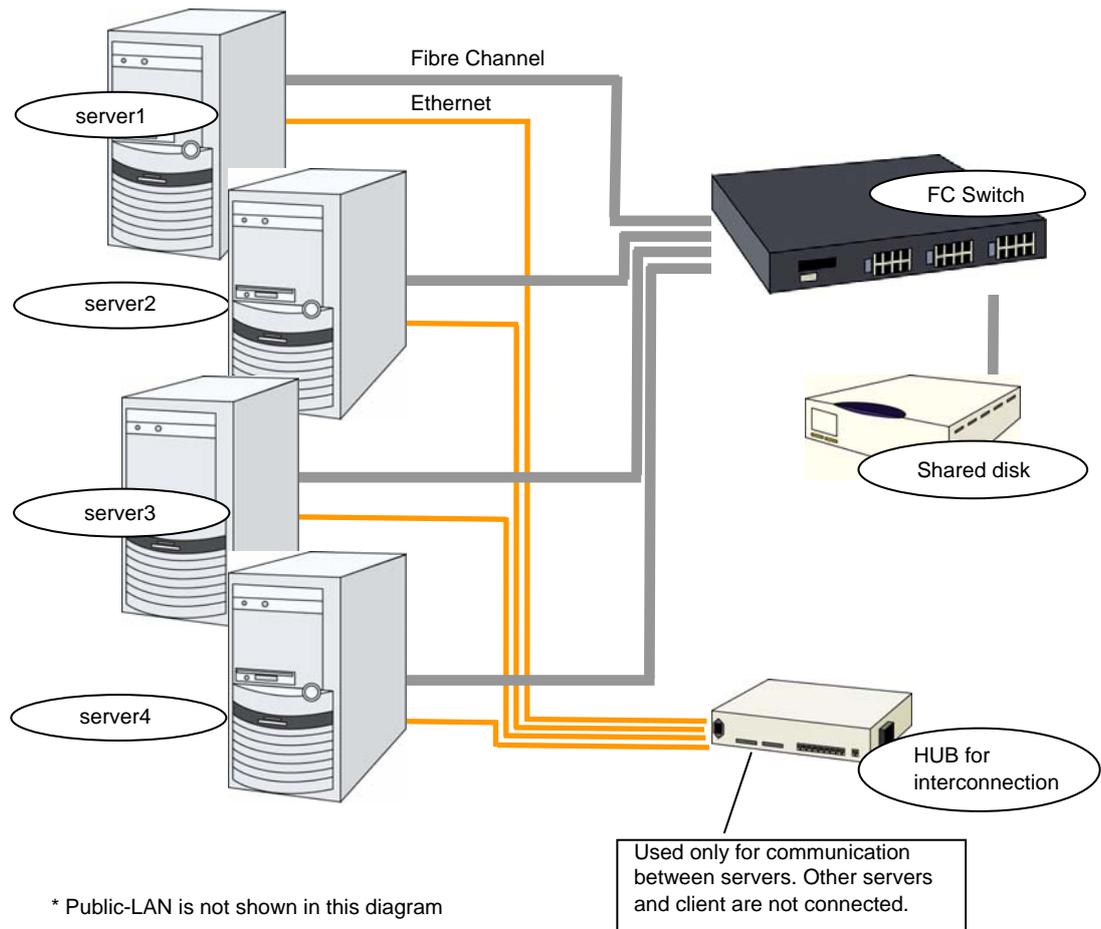
Example 3: Configuration for using BMC-related functions with two nodes

This is an example of 2-node cluster configuration for using chassis identify function.

◆ Different models of server can be used together, but each server must support the use of BMC linkage functions.

◆ Connect the interconnect LAN and BMC management LAN via a dedicated HUB.

◆ Use as fast a HUB as is available.
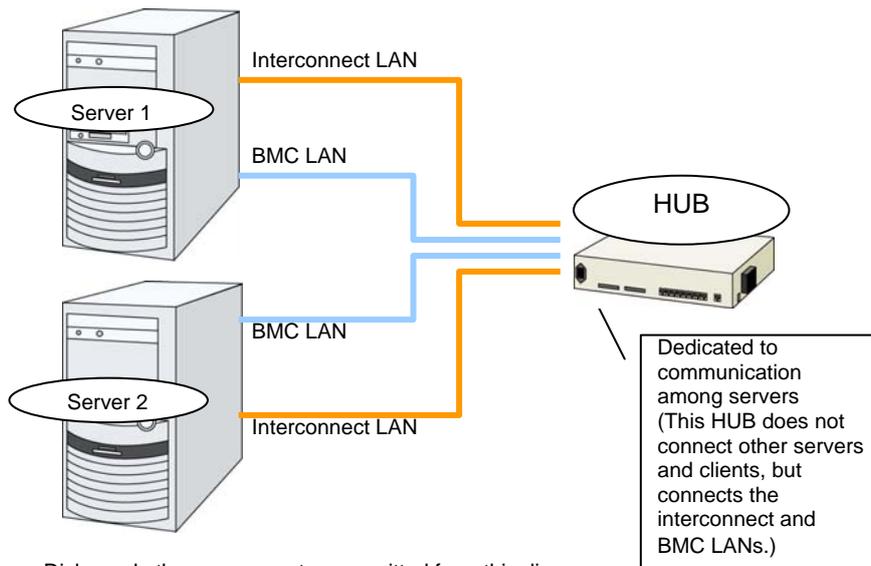
Disks and other components are omitted from this diagram.

Checking system requirements for each ExpressCluster module

ExpressCluster consists of three modules: ExpressCluster Server (main module), ExpressCluster X WebManager, and ExpressCluster X Builder. Check configuration and operation requirements of each machine where these modules will be installed. The following is the basic system requirements for ExpressCluster X 3.1 for Solaris:

- Details on operating system supporting ExpressCluster Server.

- It is recommended to use a file system that is capable of journaling for the root file system in the operating system. If a file system that is not capable of journaling is used, you need to run an interactive command (fsck the root file system) when rebooting from server or OS stop (i.e. normal shutdown could not be done.)

The following is the system requirements for each module:

ExpressCluster Server	
Machine on which ExpressCluster Server can be installed	Server that supports one of the following operating systems.
Supported operating systems	**i86pc(x86/x86_64) version** Solaris10

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 Microsoft Windows Vista™ Microsoft Windows Server 2003 SP1 or later Microsoft Windows Server 2008 * For Microsoft Windows Vista™, only Microsoft Internet Explorer 7.0 is supported.
Supported browsers	Browsers supporting Java 2: Firefox 1.0.6 or later Microsoft internet Explorer 6.0 SP1 or later Microsoft Internet Explorer 7.0
Java runtime environment	Java(TM) Runtime Environment Version 6.0 Update 21 (1.6.0_21) or later * Java runtime environment is necessary to use the Builder. * For Microsoft Windows Vista™, Version 6.0 (1.6.0) or later is required.

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 Microsoft Windows Vista™ Microsoft Windows Server 2003 SP1 or later Microsoft Windows Server 2008 * For Microsoft Windows Vista™, only Microsoft Internet Explorer 7.0 is supported.
Supported browsers	Browsers supporting Java 2: Firefox 1.0.6 or later Microsoft Internet Explorer 6.0 SP1 or later Microsoft Internet Explorer 7.0
Java runtime environment	Java(TM) Runtime Environment Version 6.0 Update 21 (1.6.0_21) or later * Java runtime environment is necessary to use WebManager. * For Microsoft Windows Vista™, Version 6.0 (1.6.0) or later is required.

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

Example of ExpressCluster (main module) hardware configuration

The ExpressCluster Server is a core component of ExpressCluster. Install it on each server that constitutes a cluster. ExpressCluster X WebManager is included in the ExpressCluster Server and it is automatically installed once the ExpressCluster Server is installed.

General requirements

Following is the recommended specification for the 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 (For disk resource)

◆ USB port (When using offline Builder)

◆ CD-ROM drive

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

Verifying system requirements for the WebManager

To monitor a cluster system that uses ExpressCluster, WebManager accesses to the system from a management PC via a Web browser. Therefore, a management PC should be able to access to the cluster via network. Windows is available for the operating system for the management PC.

For information of the latest system requirements of the WebManager (supported operating systems and browsers, Java runtime environment, required memory and disk size) see the *Getting Started Guide*.

Determining a hardware configuration

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

Settings after configuring hardware

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

1. Configuration of the shared disk for disk resource (Required when using disk resource)
2. Adjustment of the operating system startup time (Required)
3. Verification of the network settings (Required)
4. Verification of the root file system (Required)
5. Verification of the firewall settings (Required)
6. Synchronization of the server clock (Recommended)

1. Set shared disk for volume manger resource and disk resource (Required when using volume manager resource and disk resource)

Set up the shared disk by following the steps below.

Note:

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

1-a. Allocate partitions for disk heartbeat resource.

Allocate a partition on a shared disk to be used by the disk heartbeat resource in ExpressCluster. Create a partition on one of the servers in the cluster that uses the shared disk. Use the format command to create partitions.

Note 1:
* Typically, only one partition is used for heartbeat resources. However, in addition to the LUN used for heartbeat, you should create another partition used for the disk heartbeat resources in each disk as a spare dummy partition. This is because heartbeat needs to be done in other LUN when the file system gets corrupted and the device name is changed by disk error or other errors. Use the same partition number for partitions for disk heartbeat in all the LUNs.

Note 2:
* It is recommended to use up to two disk heartbeat resources in the cluster even when multiple LUNs are used. When you set the disk heartbeat resource, set it considering how heavily the disk is loaded because it executes read/write to the disk per heartbeat interval.

Note 3:
* A disk heartbeat partition should be 10MB (10*1024*1024 bytes) or larger. It is not necessary to construct any file system for disk heartbeat partitions.

1-b. Allocate a partition for volume manager resources/disk resources

Create partitions to be used for volume manager resources/disk resources on the shared disk. Create the partitions on a server in the cluster that uses the shared disk. Use the format command to create partitions.

2. Create a file system.

Configure a file system on a partition for the volume manager resources/disk resources on the shared disk. Configure the file system on a server in the cluster that uses the shared disks as you usually do in Solaris. The configuration procedure differs depending on the file system to be created.

[Creating with ZFS]

1. Create a ZFS storage pool
   Specify the whole disk or a disk partition for the disk to be used for ZFS storage pool. Create a ZFS storage pool from one server within a cluster that uses the shared disk.
   (Example) Device name c1t0d0 , ZFS storage pool name tank
   ```
   zpool create tank c1t0d0
   ```

2. Create a ZFS file system
   ZFS file system can be additionally created in ZFS storage pool if necessary. Create ZFS file system from one server within a cluster that uses the shared disk.

(Example) File system name data , mountpoint /tank/data

```
zfs create tank/data
```

3. Export ZFS storage pool
   When ZFS file system creation and configuration is completed, ZFS storage pool must be exported. ZFS storage pool must be exported before ExpressCluster starts up, since ExpressCluster controls import/export of ZFS storage pool
   (Example) ZFS storage pool name tank

```
zpool export tank
```

[Creating with UFS]

1. Create a UFS
   Specify a disk partition for the disk to be used for UFS.
   (Example) Device name c1t0d0

```
newfs /dev/rdsk/c1t0d0
```

Note 1:
- It is not necessary to configure the file system for a partition for the disk heartbeat resource.

Note 2:
- The ExpressCluster controls the file systems on shared disks. Do not enter the file systems on the shared disks into /etc/fstab in the operating system.

- In principle, the file system used on shared disk does not depend on others. However, an error may occur depending on fsck on file system.

- It is recommended to use a file system that is capable of journaling to avoid system failure.

- It is recommended to use a file system that is capable of journaling to avoid system failure.

  - ufs

  - zfs

3. Create a mount point.

   Create a directory to mount the partition for disk resources.
   Create these directories on all the servers in the cluster that use disk resources.

2. Adjustment of the operating system startup time (Required)

The period to the startup of the server operating system from power-on of servers of a cluster system should be longer than the below:

◆ The time from power-on of the shared disk to the point they become available.

◆ Heartbeat timeout time (90 seconds by default in the Builder.)

The adjustment of the startup time is necessary due to the following reasons:

◆ Activating disk resources fails if the cluster system is started by powering on the shared disk and servers.

◆ 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 heartbeat is continuing.

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

When GRUB is used for the operating system loader

Edit /boot/grub/menu.lst.

Specify the time-out <*Startup_time* (in seconds)> option. In the following example, change only the underlined part.

```
---(Example: Startup time: 90 seconds)---
default 0
timeout 90

title Solaris 10
   findroot (rootfs0,0,a)
   kernel /platform/i86pc/multiboot
   module /platform/i86pc/boot_archivekernel
```

Note:
When you are using an operating system loader other than GRUB is used, see the setup guide of the operating system loader.

3. Verification of the network settings (Required)

On all servers in the cluster, verify the status of the following networks using the ifconfig or ping command. Verify if network devices (e1000g0, e1000g1, etc) are assigned to appropriate roles, such as public LAN and interconnect-dedicated LAN. Check the following network status.

◆ 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 or virtual IP resources used in the cluster in the operating system.

4. Verification of the root file system (Required)

It is recommended to use a file system which is capable of journaling for the root file system in the operating system

Important:
If a file system that is not capable of journaling is used, you must run an interactive command (fsck the root file system) when rebooting from server or OS stop (for example, normal shutdown could not be done.) This is not limited to cluster system and the same is true for a single server.

5. Verification of the firewall settings (Required)

ExpressCluster uses several port numbers. Change the firewall settings so that some port numbers are available for ExpressCluster.

The following is the list of port numbers used for ExpressCluster:

Server to Server (Loopback in Server)					
From			**To**		**Used for**
Server	Automatic allocation	→	Server	29001/TCP	Internal communication
Server	Automatic allocation	→	Server	29002/TCP	Data transfer
Server	Automatic allocation	→	Server	29002/UDP	Heartbeat
Server	Automatic allocation	→	Server	29003/UDP	Alert synchronization
Server	Automatic allocation	→	Server	icmp	Duplication check of FIP/VIP resource
Server	Automatic allocation	→	Server	XXXX[5]/UDP	Communication or internal log

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

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

Others					
From			**To**		**Used for**
Server	Automatic allocation	→	Network warning light	514/TCP	Network warning light control
Server	Automatic allocation	→	BMC Management LAN of the server	623/UDP	BMC control (Forced stop/chassis identify)
Server	Automatic allocation	→	Monitoring target	icmp	IP monitor
Server	Automatic allocation	→	NFS Server	icmp	Monitoring if NFS server of NAS resource is active
Server	Automatic allocation	→	Monitoring target	icmp	Monitoring target of PING method of network partition resolution resource

1. In automatic allocation, an available port number is allocated.

2. In the **Port Number** (log) tab in **Cluster Properties**, select **UDP** for log communication, and use the port number configured at **Port Number**. The default log communication method, **UNIX Domain**, does not use a communication port.

6. Server clock synchronization (Required)

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

Note:

If the clock in each server is not synchronized, it may take time to analyze the problem when an error occurs.

Chapter 2   Configuring a cluster system

This chapter provides information on applications to be duplicated, cluster topology, and explanation on cluster configuration data that are required to configure a cluster system.

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

In this guide, explanations are given using a 2-node and uni-directional standby cluster environment as an example.
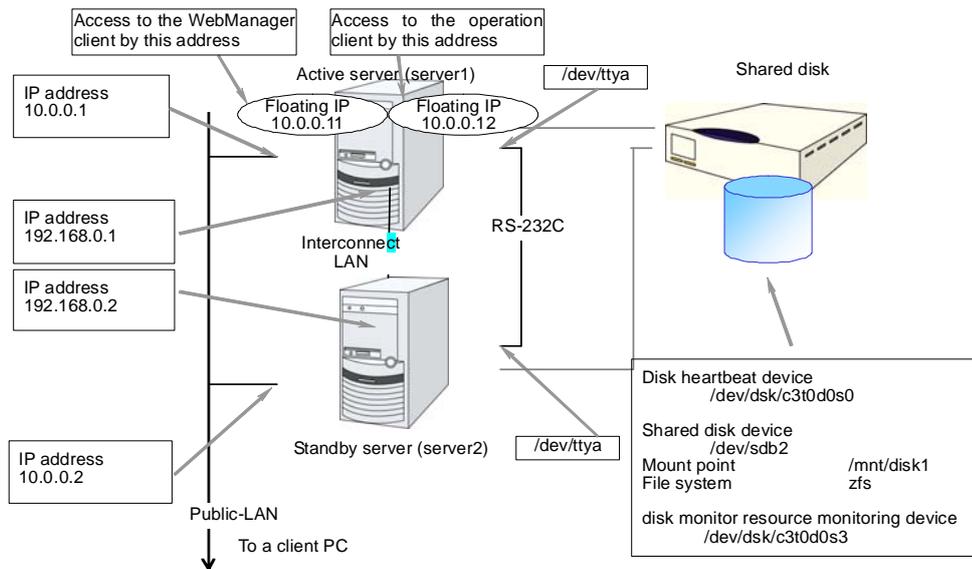
Determining a cluster topology

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.
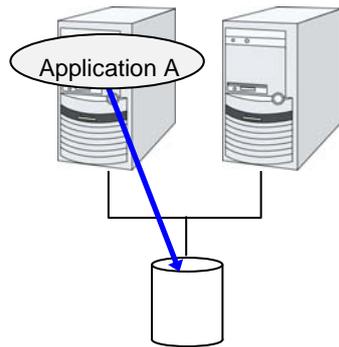
◆ **The same applications – multi-directional standby cluster system**
In this operation, the same applications run simultaneously on an entire cluster system. Applications used in this system must support multi-directional standby operations.
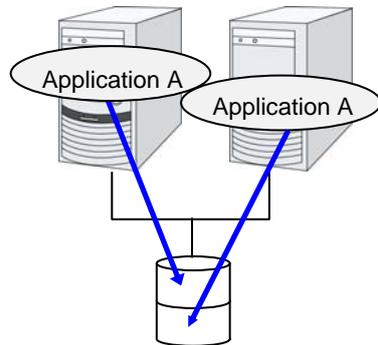
◆ **Different applications multi-directional standby cluster system**
In this operation, different applications run on different servers and standby each other. Resources will not be wasted during normal operation; however, two applications run on one server after failing over and the system performance deteriorates.
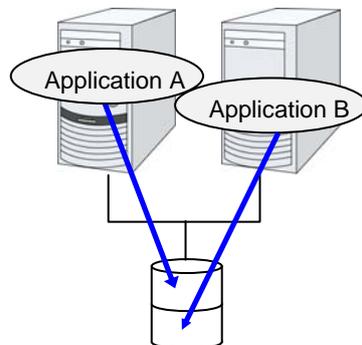
Failover in uni-directional standby cluster

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:

Shared disk

In normal operation

Application

Application A

Application A cannot run multiplex in a cluster.

Server down

Application A

Take over application

Failover

Application A

Recovery

Group transfer
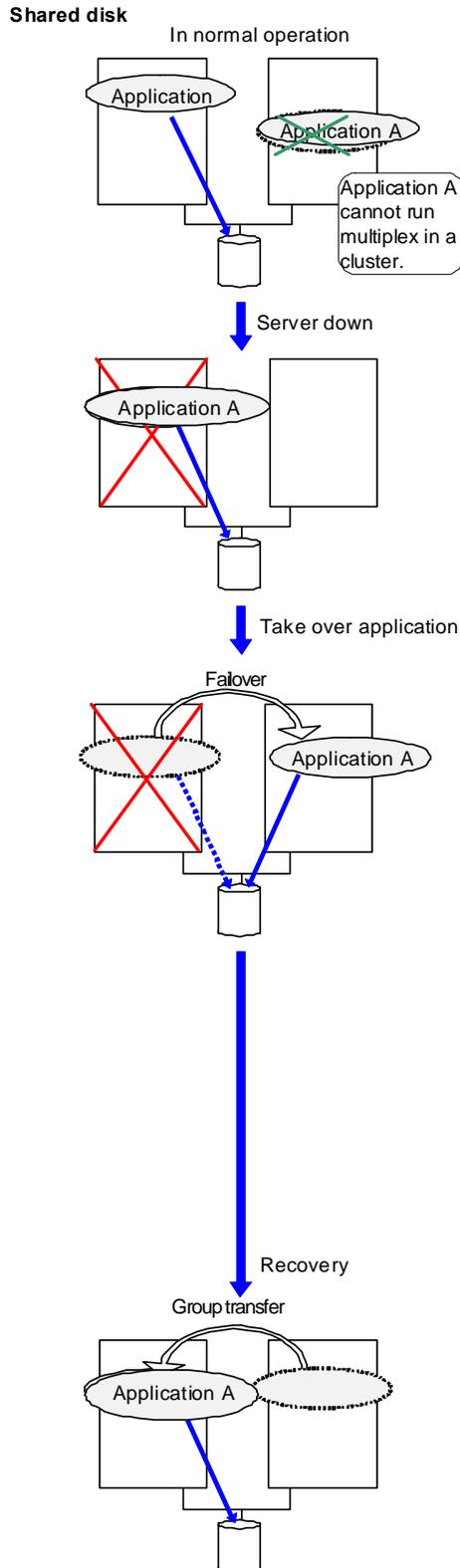
Application A

Failover in multi-directional standby cluster

On a multi-directional standby cluster system, an application can simultaneously run on multiple servers. However, the active server gets heavily loaded when a failover occurs as described in the diagram below:
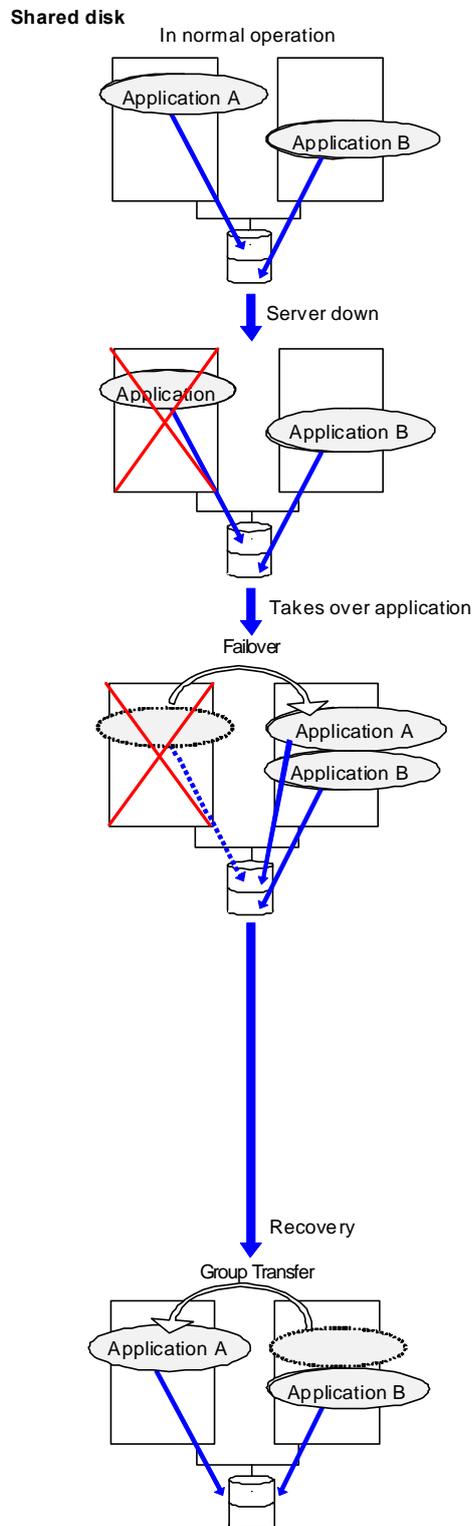
Determining applications to be duplicated

When you determine applications to be duplicated, study candidate applications considering the points described below to see whether 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 correspond to the numbers of notes (1 through 5) described above:

◆ 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.)

Note on 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).

ExpressCluster executes fsck if the file system on a shared disk requires fsck.

Note 2: Application termination

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

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

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

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

Note 4: Multiple application service groups

For 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.

Starting up multiple instances
This method invokes a new process. more than one application should co-exist and run.
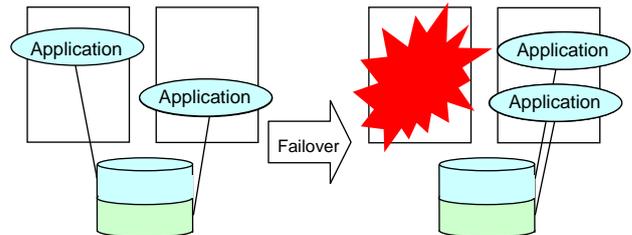
Restarting the application
This method stops the application which was originally running added resources become available by restarting it.

Data is passed by restarting the application.
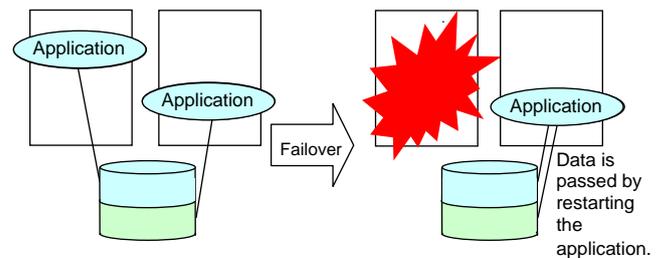
Adding dynamically
This method adds resources in running applications automatically or by instructions from script.

Data is passed dynamically by adding the active application.
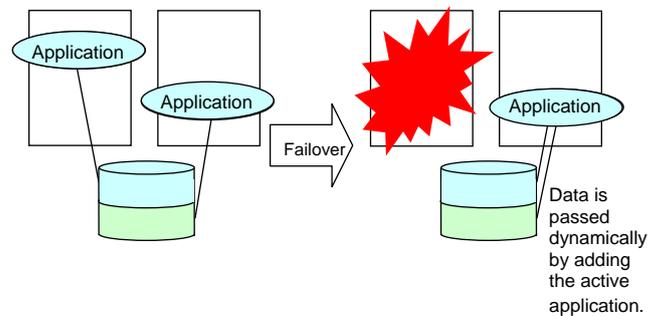
Note 5: Mutual interference and compatibility with applications

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.

◆ Multi-home environment and transfer of IP addresses
In a cluster system, a server usually has multiple IP addresses, and an IP address (such as floating IP address) moves between servers.

◆ Access to shared disks from applications
The stopping of application groups is not notified to co-existing applications. Therefore, if such an application is accessing a disk resource used by an application group at the time when the application group stops, unmount 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.

Solution 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	Note 1: Data recovery after an error
The application keeps accessing a disk or file system for a certain period of time even after stopping the application.	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 disk resources.

Planning a cluster configuration

A 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.
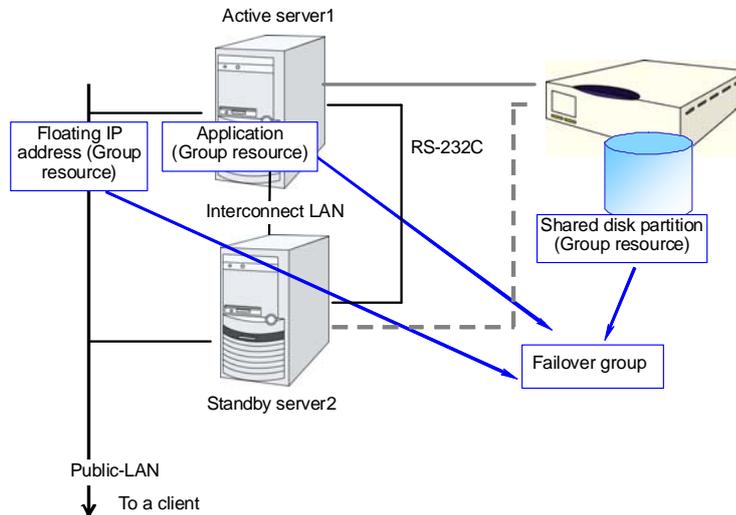
Resources in each group are handled by the unit of the group. If a failover occurs in the group1 that has disk resource1 and floating IP address1, a failover of the disk resource1 and a failover of the floating IP address1 are concurrent (failover of the disk resource 1 never takes place without that of the floating IP address 1).

Likewise, disk resources1 is never contained in other groups, such as group2.

Understanding 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 the *Reference Guide*.

Following is the currently supported group resources:

Group Resource Name	Abbreviation
EXEC resource	exec
Disk resource	disk
Floating IP resource	fip
Virtual IP resource	vip
NAS resource	nas
Volume manager resource	volmgr
VM resource	vm
Dynamic DNS resource	ddns

Understanding monitor resources

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

There are two types of timing for monitor resource monitoring:

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

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

Following is the currently supported monitor resource:

Monitor Resource Name	Abbreviation	Always monitors	Monitors While activated
Disk monitor resource	diskw	Yes	
IP monitor resource	ipw	Yes	
NIC Link Up/Down monitor resource	miiw	Yes	
PID monitor resource	pidw		Yes
User space monitor resource	userw	Yes	
Custom monitor resource	genw	Yes	
Multi-target monitor resource	mtw	Yes	
Virtual IP monitor resource	vipw		Yes
Volume manager monitoring resource	volmgrw	Yes	
MySQL monitor resource	mysqlw		Yes
NFS monitor resource	nfsw		Yes
Oracle monitor resource	oraclew		Yes
PostgreSQL monitor resource	psqlw		Yes
Samba monitor resource	sambaw		Yes
VM monitor resource	vmw	Yes	
Message receive monitor resource	mrw	Yes	
Dynamic DNS monitor resource	ddnsw		Yes
Process name monitor resource	psw	Yes	Yes

Understanding heartbeat resources

Servers in a cluster system monitor if other servers in the cluster are active. For this, heartbeat resources are used. Following is the heartbeat device types:
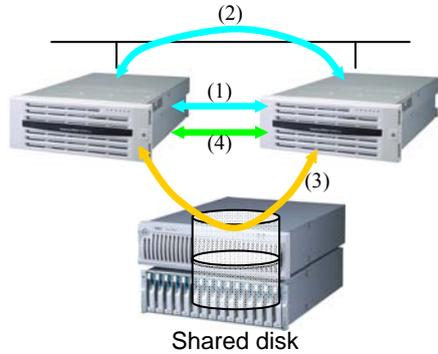
(1) LAN heartbeat resource dedicated to interconnect

(2) Public LAN heartbeat

(3) Disk heartbeat

(4) COM heartbeat

Shared disk

Heartbeat Resource Name	Abbreviation	Functional Overview
LAN heartbeat resource (1)(2)	lanhb	Uses a LAN to monitor if servers are active. Used for communication within the cluster as well.
Disk heartbeat resource (3)	diskhb	Uses a dedicated partition in the shared disk to monitor if servers are active.
COM heartbeat resource (4)	comhb	Uses a COM cable to connect two servers to monitor if servers are active.

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

◆ Follow the specifications below to set the interface for disk heartbeat resource and COM heartbeat resource:

When a shared disk is used:	Up to two servers: In principle, COM interface and disk interface Three or more servers: Disk interface
When a shared disk is not used:	Up to two servers: COM interface

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 ExpressCluster determines lack of heartbeat is be caused by the server failure, the system performs a failover by activating each resource and rebooting applications on a server running normally. When ExpressCluster determines the lack of heartbeat is 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:

◆ **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.

◆ **Not solving the network partition**

- If a failure occurs on all the network channels between servers in a cluster, all the servers fail over.

The following are the recommended methods to resolve the network partition:

- The ping method is recommended for a remote cluster.

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
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
None	No limit	None	None	All servers fail over	All the networks are disconnected	0

Section II   Installing and configuring ExpressCluster X

This section describes procedures to install ExpressCluster. Configure a cluster system by installing ExpressCluster to server machines and using the cluster configuration data that you have created in Section I. After that, run the operation tests and verify if the system operates successfully.

Chapter 3   Installing ExpressCluster
Chapter 4   Registering the license
Chapter 5   Creating the cluster configuration data
Chapter 6   Verifying a cluster system
Chapter 7   Modifying the cluster configuration data

Chapter 3   Installing ExpressCluster

This chapter provides instructions for installing ExpressCluster. For ExpressCluster installation, install ExpressCluster Server which is the core component of ExpressCluster. 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 and Builder separately.

This chapter covers:

Related Information:
Refer to Chapter 6, "Upgrading ExpressCluster" in the *Getting Started Guide* for how to upgrade ExpressCluster from older version.

Steps from Installing ExpressCluster to creating a cluster

The following describes the steps of installing ExpressCluster, registering the license, creating a cluster and verifying the installed cluster system.

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. (See Chapter 3, "Installing ExpressCluster.")

Reboot the server

2. Register the license

Register the license by running the clplcnsc command. (See Chapter 4, "Registering the license.")

Reboot the server

3. Create the cluster configuration data using the Builder

Create the cluster configuration data using the Builder. (See Chapter 5, "Creating the cluster configuration data .")

4. Create a cluster

Create a cluster using the configuration data created with the Builder. (See Chapter 5, "Creating the cluster configuration data .")

5. 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:
Refer to the *Reference Guide* as you need when you operate ExpressCluster in accordance with the procedures in this guide. See the *Getting Started Guide* for installation requirements.

Setting up the ExpressCluster Server

The ExpressCluster Server, which is the core component of ExpressCluster, consists of the following system services. It is set up by installing the ExpressCluster Server package.

System Service Name	Description
clusterpro	ExpressCluster daemon: A service of ExpressCluster itself.
clusterpro_evt	ExpressCluster event: A service to control syslog and logs being output from ExpressCluster.
clusterpro_trn	ExpressCluster data transfer: A service to control license synchronization and configuration data transfer in a cluster.
clusterpro_alertsync	ExpressCluster alert synchronization: A service to synchronize alerts among servers in the cluster.
clusterpro_webmgr	ExpressCluster WebManager: A WebManager service.

Installing the ExpressCluster Package

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

Note:
Log in as root user when installing the ExpressCluster Server Package.

1. Mount the installation CD-ROM.

2. Run the pkgadd command to install the package file.
   .

   Navigate to the folder, /Solaris/3.1/en/server, in the CD-ROM and run the following:

   ```
   pkgadd –d NECexpresscls-[version].[architecture].pkg
   ```

   The installation starts.

   Note:
   ExpressCluster will be installed in the following directory. You will not be able to uninstall the ExpressCluster if you change this directory.
   Installation Directory: /opt/nec/clusterpro

3. When the installation is completed, unmount the installation CD-ROM.

4. Remove the installation CD-ROM.
   When you do not use the ExpressCluster Builder (offline version), proceed to a license registration procedure.

Related Information:
The use of the SNMP linkage function requires additional settings.
For how to set up the SNMP linkage function, refer to "Setting up the SNMP linkage function."

Installing the Builder (Offline version)

It is not necessary to install the ExpressCluster X Builder (offline version) to the server where configure a cluster. Install it only when modifying the cluster configuration data on a PC excluding the servers that configure a cluster.

Follow the procedures below to install the ExpressCluster X Builder (offline version).

Installing the Builder on a Windows machine (Offline version)

When you install the ExpressCluster X Builder on Windows machine, install it in a directory where you can access (read/write) by the security right granted to you.

1. Set the Installation CD-ROM in the CD-ROM drive.

2. Navigate to the \Solaris\3.1\en\builder\ in the CD-ROM and execute the following:

   NECexpressclsbuilder-[version #].solaris.x86.exe

3. The following dialog box is displayed.
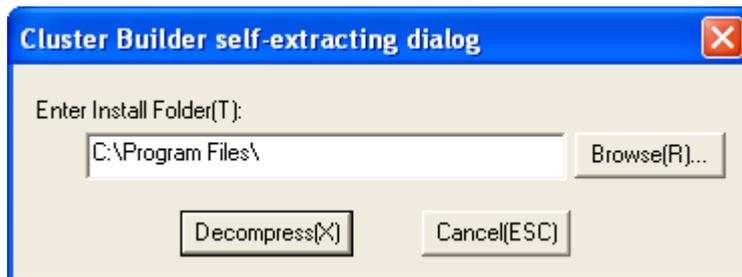
Specify an install folder and click **Decompress**. The default install folder is "Program Files". In the folder specified here, "ExpressCluster\clpbuilder-s" directory is created. The Builder is installed in this directory.

When the installation is successfully completed, the following dialog box is displayed.

Note:
To change the location where the Builder is installed, move all files in your installation folder without changing the structure of the "clpbuilder-s" directory.

Starting the Builder

1. Load the following html file by a Web browser and start the Builder.

   file:///*Installation_path*/clptrek.htm

Note:
If the Builder does not start up successfully, check that
- JRE is installed on the computer.
- JRE is enabled on the browser.

Setting up the SNMP linkage function

To handle information acquisition requests on SNMP, Solaris System Management Agent must be installed separately and the SNMP linkage function must be registered separately.

Follow the procedure below to set up the SNMP linkage function.

Note:
To set up the SNMP linkage function, you must log in as the root user.

1. Install Solaris System Management Agent.

2. Stop the snmpd daemon.

   ```
   svcadm disable -t sma
   ```

3. Register the SNMP linkage function in the configuration file for the snmpd daemon, Open the following configuration file with a text editor:

   ```
   /etc/sma/snmp/snmpd.conf
   ```

   Add the following description at the end of the file:

   ```
   dlmod clusterManagementMIB
   /opt/nec/clusterpro/lib/libclpmgtmib.so
   ```

   Note:
   Add the OID of ExpressCluster in the MIB view (view definition by snmpd.conf) permitted by the snmpd daemon.

   The OID of ExpressCluster is ".1.3.6.1.4.1.119.2.3.207".

4. Start the snmpd daemon.

   ```
   svcadm enable -t sma
   ```

Related Information:
You must cancel the settings of the SNMP function when uninstalling the ExpressCluster Server.
For how to cancel the setting of the SNMP linkage function, refer to "Cancelling the SNMP linkage function settings."

Note:
The settings required for SNMP communication are to be made by the snmpd daemon of Solaris System Management Agent.

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 CPU license

It is required to register the CPU license to run the cluster system you create.

Related Information: When the virtual server exists in the cluster system to be constructed, VM node license can be used not CPU license for the virtual server.
CPU license and VM node license cannot be mixed.
For the details on registration of VM node license, see page 62, "Registering the VM node license."

Among servers that constitute the cluster, use the master server to register the CPU license. There are two ways of license registration; using the information on the license sheet and specifying the license file. These two ways are described for both the product and trial versions.

Product version

◆ Specify the license file as the parameter of the license management command. Refer to page 59, "Registering the license by specifying the license file (for both product version and trial version)."

◆ Register the license by running the license management command and interactively entering the license information that comes with the licensed product. Refer to page 60, "Registering the license interactively from the command line (Product version)."

Trial version

◆ Specify the license file as the parameter of the license management command. Refer to page 59, "Registering the license by specifying the license file (for both product version and trial version)."

Before registering the license, make sure that the procedures described in Chapter 5, "Creating the cluster configuration data " in are executed on all servers.

Registering the license by specifying the license file (for both product version and trial version)

The following describes how to register the license by specifying the license file when you have a license for the product version or trial version.

Check the following before executing these steps.

◆ Allow logon as a root user to the server that will be set as a master server among servers that configures a cluster system.

◆ Store the license file in the server that will be set as a master server among servers that constitute the cluster system.

1. Log on to the master server as a root user and run the following command.

   ```
   # clplcnsc –i <filepath> –p <PRODUCT-ID>
   ```

   Specify the path to the license file for *filepath* specified by the -i option. Specify the product ID for **PRODUCT-ID** specified by the -p option. Enter the product ID that corresponds to the version you are using. The product ID is listed below:

Licensed Product Name	Product ID
ExpressCluster X 3.1 for Solaris	BASE31

   When the command is successfully executed, the message "Command succeeded." is displayed in the console. When a message other than this is displayed, refer to Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

2. Run the following command to verify the licenses registered. In PRODUCT-ID, enter the product ID. For *PRODUCT-ID*, enter the product ID specified on step 1 of this procedure.

   ```
   # clplcnsc –l –p <PRODUCT-ID>
   ```

3. When an optional product is used, refer to page 66, "Registering the node license" in this chapter.

4. When an optional product is not used, run the OS shutdown command to reboot all servers. By doing this, the license registration becomes effective and you can start using the cluster. After rebooting all servers, proceed to Chapter 5, "Creating the cluster configuration data" on page 71 and follow the steps.

Registering the license interactively from the command line (Product version)

The following describes how you register a license for the product version interactively from the command line.

Before you register the license, make sure to:

◆ Have the official license sheet that comes with the product. The license sheet is sent to you when you purchase the product. You will enter the values on the license sheet.

◆ Allow logon as root user to the server that will be set as a mater server among servers that constitute the cluster system.

Related Information:
The clplcnsc command is used in the following procedures. For more information on how to use the clplcnsc command, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

1. Have the license sheet.

The instruction here is given using the values in the following license sheet as an example. When actually entering the values, modify the value according to the information on your license sheet.

Product name:	**ExpressCluster X 3.1 for Solaris**
License information:	
Type	Product Version
License Key	A1234567- B1234567- C1234567- D1234567
Serial Number	AAA0000000
Number of Licensed CPUs	2

2. Log on to the master server as root user and run the following command.

```
# clplcnsc –i –p PRODUCT-ID
```

Specify the product ID for **PRODUCT-ID** specified by the -p option. Enter the product ID that corresponds to the version you are using. The product ID is listed below:

Licensed Product Name	Product ID
ExpressCluster X 3.1 for Solaris	BASE31

3. The text that prompts you to enter the product division is displayed. Enter **1** to select "product version" for license version:

```
Selection of License Version.
1. Product version
2. Trial version
Select License Version. [1 or 2 ] ...1
```

4. The text that prompts you to enter the number of licenses is displayed. The default value 2 is set for the number of licenses. If the number written in your license sheet is 2, simply press ENTER without entering any value. When the value written in your license sheet is other than 2, enter the correct value and press ENTER.

```
Enter the number of license [1 to 99 (default:2)] ... 2
```

5. The text that prompts you to enter the serial number is displayed. Enter the serial number written in your license sheet. Note this is case sensitive.

```
Enter serial number [Ex. XXX0000000] ... AAA0000000
```

6. The text that prompts you to enter the license key is displayed. Enter the license key written in your license sheet. Note this is case sensitive.

```
Enter license key
  [XXXXXXXX- XXXXXXXX- XXXXXXXX- XXXXXXXX] ...
A1234567-B1234567-C1234567-D1234567
```

When the command is successfully executed, the message "Command succeeded" is displayed in the console. When a message other than this is displayed, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

7. Run the following command to verify the licenses registered. In PRODUCT-ID, enter the product ID specified in Step 2.

```
# clplcnsc –l –p PRODUCT-ID
```

8. When an optional product is used, refer to page 66, "Registering the node license" in this chapter.

9. When an optional product is not used, run the OS shutdown command to reboot all servers. By doing this, the license registration becomes effective and you can start using the cluster. After rebooting all servers, proceed to Chapter 5, "Creating the cluster configuration data " and follow the steps.

Registering the VM node license

When the virtual server exists in the cluster system to be constructed, VM node license can be used not CPU license for the virtual server.

CPU license and VM node license cannot be mixed.

Registering the VM node license is done on all the virtual servers of the servers constructing the cluster. Of servers constituting the cluster, register the VM node license on all the virtual servers. There are two ways of license registration; using the information on the license sheet and specifying the license file.

Product version

- Specify the license file as the parameter of the license management command. Refer to page 63, "Registering the VM node license by specifying the license file (for both product version and trial version)."

- Register the license by running the license management command and interactively entering the license information that comes with the licensed product. Refer to page 64, "Registering the VM node license interactively from the command line (Product version)."

Registering the VM node license by specifying the license file (for both product version and trial version)

The following describes how you register the license by specifying the license file when you have a license for the product version.

- Among virtual servers of which you intend to construct a cluster, log on to the server as root user and run the following command.

  ```
  # clplcnsc -i filepath -p PRODUCT-ID
  ```

  Specify the path to the license file for filepath specified by the –i option.

  Specify the product ID for PRODUCT-ID specified by the -p option. The following is the product ID list.

License Product Name	Product ID
ExpressCluster X3.1 for Solaris VM	BASE31

  When the command is successfully executed, the message "Command succeeded" is displayed on the console. When a message other than this is displayed, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

- Run the following command to verify the licenses registered. In PRODUCT-ID, enter the product ID specified in Step 1 of this procedure.

  ```
  # clplcnsc -l -p PRODUCT-ID
  ```

- If there are other virtual servers in a cluster system, register the VM node license by following the same procedures.

- When using option products, refer to page 66 , "Registering the node license."

- When not using option products, run the OS shutdown command to reboot all the servers. By doing this, the license registration becomes effective and you can start using the cluster. After rebooting all servers, proceed to Chapter 5, "Creating the cluster configuration data " and follow the steps.

Note:
You can ignore that clusterpro_md fails at the time the operating system is starting up. It is because the cluster is yet to be created.

Registering the VM node license interactively from the command line (Product version)

The following describes how you register the license for the product version interactively from the command line.

Before you register the license, make sure to:

● Have the official license sheet that comes with the product. The license sheet is sent to you when you purchase the product. You will enter the values on the license sheet.

● Be allowed to logon as root user to the virtual servers of servers constituting the cluster system.

Related Information: The clplcnsc command is used in the following procedures. For more information on how to use the clplcnsc command, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

• Have the license sheet.

The instruction here is given using the values in the following license sheet as an example. When actually entering the values, modify them according to the information on your license sheet.

Product name:	**ExpressCluster X 3.1 for Solaris VM**
License information:	
Type	Product Version
License Key	A1234567- B1234567- C1234567- D1234567
Serial Number	AAA0000000
Number of License Server	1

• Among virtual servers of which you intend to construct a cluster, log on to the server as root user and run the following command.

```
# clplcnsc -i -p PRODUCT-ID
```

Specify the product ID for PRODUCT-ID specified by the -p option. The following is the product ID list. Enter the product ID corresponding to the edition you are using.

Licensed Product Name	Product ID
ExpressCluster X 3.1 for Solaris VM	BASE31

• The text that prompts you to enter the license version is displayed. Enter 1 since it is a product version:
```
Selection of License Version.
   1   Product version
   2   Trial version
Select License Version. [1 or 2]...1
```

- The text that prompts you to enter the number of licenses is displayed. The default value 2 is being displayed. For VM license, enter 0 and press Enter.

```
Enter the number of license [0(Virtual OS) or 1 to 99
(default:2)]... 0
```

- The text that prompts you to enter the serial number is displayed. Enter the serial number written in your license sheet. Note this is case sensitive.

```
Enter serial number [Ex. XXX0000000]... AAA0000000
```

- The text that prompts you to enter the license key is displayed. Enter the license key written in your license sheet. Note this is case sensitive.

```
Enter license key
  [XXXXXXXX- XXXXXXXX- XXXXXXXX- XXXXXXXX]...
A1234567-B1234567-C1234567-D1234567
```

When the command is successfully executed, the message "Command succeeded" is displayed on the console. When a message other than this is displayed, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

- Run the following command to verify the licenses registered. In PRODUCT-ID, enter the product ID specified in the Step 2.

```
# clplcnsc -l -p PRODUCT-ID
```

- If there is any other virtual server in the cluster, register the VM license by repeating the same steps.

- When using option products, refer to page 66 , "Registering the node license."

- When not using option products, run the OS shutdown command to reboot all the servers. After rebooting all servers, proceed to next Chapter 5, "Creating the cluster configuration data" and follow the steps.

Note:
You can ignore that clusterpro_md fails at the time the operating system is starting up. It is because the cluster is yet to be created.

Registering the node license

It is required to register the node license for the X 3.1 Agent products, and X 3.1 Alert Service (hereafter referred to as "optional product") to operate the cluster system where those products are constituted.

Among servers constituting the cluster, register the node license on the server that uses an optional product. There are two ways of license registration; using the information on the license sheet and specifying the license file. These two ways are described for both the product and trial versions.

Product version

◆ Register the license by running the license management command and interactively entering the license information that comes with the licensed product. Refer to page 68, "Registering the node license interactively from the command line (Product version)."

◆ Specify the license file as the parameter of the license management command. Refer to page 67, "Registering the node license by specifying the license file (for both product version and trial version)."

Trial version

◆ Specify the license file as the parameter of the license management command. Refer to page 67, "Registering the node license by specifying the license file (for both product version and trial version)."

Registering the node license by specifying the license file (for both product version and trial version)

The following describes how you register the license by specifying the license file when you have a license for the product version or trial version.

Before you register the license, make sure to:

◆ Allow log on as root user to the server for which you use an optional product.

1. Among servers of which you intend to construct a cluster and use the optional product, log on to the server you plan to use as a master server as root user and run the following command.

   ```
   # clplcnsc –i filepath –p PRODUCT-ID
   ```

   Specify the path to the license file for **filepath** specified by the –i option. Specify the product ID for **PRODUCT-ID** specified by the -p option. For details on product ID, refer to the *Reference Guide*.

   For *PRODUCT-ID* specified by the –p option, specify the production ID. The product ID is listed below.

License Product Name	Product ID
ExpressCluster X Database Agent 3.1 for Solaris	DBAG31
ExpressCluster X File Server Agent 3.1 for Solaris	FSAG31
ExpressCluster X Alert Service 3.1 for Solaris	ALRT31

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

   When the command is successfully executed, the message "Command succeeded" is displayed in the console. When a message other than this is displayed, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

2. Run the following command to verify the licenses registered. In **PRODUCT-ID**, enter the product ID specified in Step 1 of this procedure.

   ```
   # clplcnsc –l –p PRODUCT-ID
   ```

3. If there is other server in a cluster system that uses the optional product, register the node license by following the same procedures.

4. Run the OS shutdown command to reboot all the servers. By doing this, the license registration becomes effective and you can start using the cluster. After rebooting all servers, proceed to Chapter 5, "Creating the cluster configuration data " and follow the steps.

   When the license for the Replicator is registered after you have started using the cluster, shut down and reboot the cluster. The Replicator becomes available after rebooting the cluster.

Registering the node license interactively from the command line (Product version)

The following describes how you register the license for the product version interactively from the command line.

Before you register the license, make sure to:

◆ Have the official license sheet that comes with the product. The license sheet is sent to you when you purchase the product. The number of license sheets required is the number of servers for which you use the optional product. You will enter the values on the license sheet.

◆ Allow logon as a root user to the server for which you plan to use the option product among servers constituting the cluster system.

Related Information:
The clplcnsc command is used in the following procedures. For more information on how to use the clplcnsc command, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

---

1. Have the license sheet.

The instruction here is given using the values in the following license sheet (Database Agent) as an example. When actually entering the values, modify them according to the information on your license sheet.

Product name:	**ExpressCluster X Database Agent 3.1 for Solaris**
License information:	
Type	Product Version
License Key	A1234567- B1234567- C1234567- D1234567
Serial Number	AAA0000000
Number of Nodes	1

2. Among servers that constitute the cluster, log on as root user to the server for which you are intending to use the option product as root, and then run the following command:

```
# clplcnsc –i –p PRODUCT-ID
```

Specify the product ID for **PRODUCT-ID** specified by the -p option. Enter the product ID that corresponds to the version you are using. The product ID is listed below:

Licensed Product Name	Product ID
ExpressCluster X Database Agent 3.1 for Solaris	DBAG31
ExpressCluster X File Server Agent 3.1 for Solaris	FSAG31
ExpressCluster X Alert Service 3.1 for Solaris	ALRT31

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

---

3. The text that prompts you to enter the license version is displayed. Enter **1** since it is a product version:

```
Selection of License Version.
1. Product Version
2. Trial Version
Select License Version. [1 or 2 ] ...1
```

4. The text that prompts you to enter the serial number is displayed. Enter the serial number written in your license sheet. Note this is case sensitive.

```
Enter serial number [Ex. XXX0000000]... AAA0000000
```

5. The text that prompts you to enter the license key is displayed. Enter the license key written in your license sheet. Note this is case sensitive.

```
Enter license key
 [XXXXXXXX- XXXXXXXX- XXXXXXXX- XXXXXXXX]...
A1234567-B1234567-C1234567-D1234567
```

When the command is successfully executed, the message "Command succeeded" is displayed in the console. When a message other than this is displayed, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

6. Run the following command to verify the licenses registered. In ***PRODUCT-ID***, enter the product ID specified in the Step 2.

```
# clplcnsc –l –p PRODUCT-ID
```

7. If there is any other server in the cluster that uses an optional product, register the node license by repeating the same steps
Run the OS shutdown command to reboot all the servers. By doing this, the license registration becomes effective and you can start using the cluster. After rebooting all servers, proceed to Chapter 5, "Creating the cluster configuration data " and follow the steps.

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." Generally, this data is created using the Builder which is started on the WebManager. This chapter provides the procedures to start up the WebManager and 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. This section describes the overview of the WebManager, the access to the WebManager, and how to create cluster configuration data.

Related Information:
For the system requirements of the WebManager, refer to Chapter 3, "Installation requirements for ExpressCluster" in the *Getting Started Guide*.

What is ExpressCluster X WebManager?

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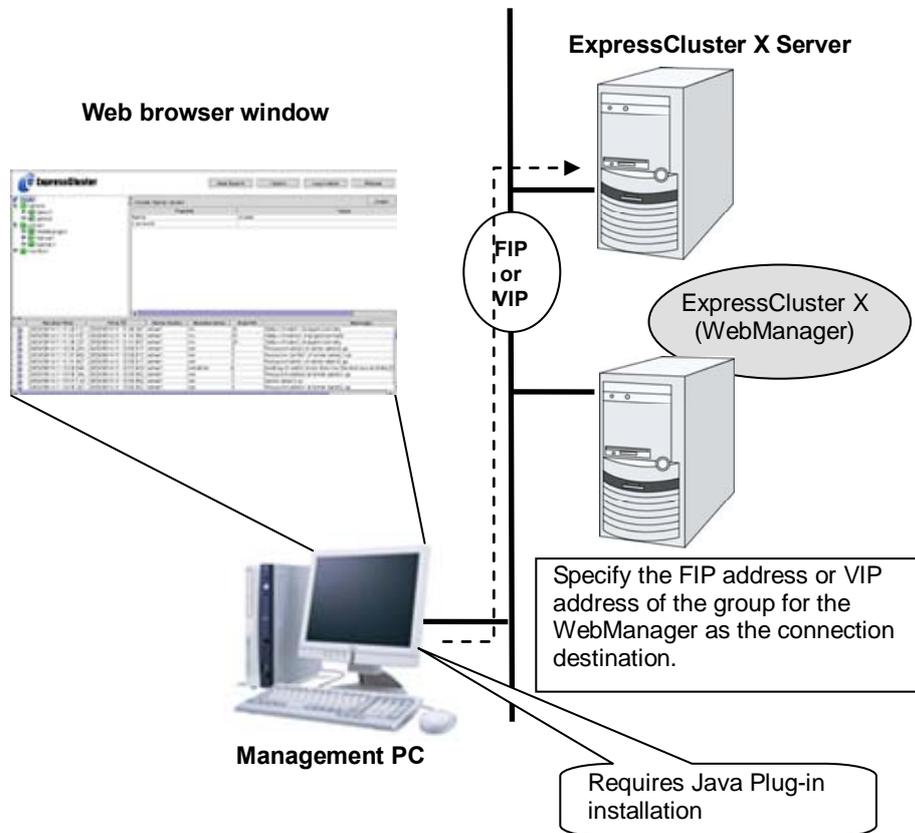
The WebManager in ExpressCluster Server is configured to start up at the time when the operating system starts up.

Browsers supported by the WebManager

For information of the latest system requirements of the WebManager (supported operating systems and browsers, Java runtime environment, required memory and disk size), see the *Getting Started Guide*.

Setting up JAVA runtime environment to a management PC

To access the WebManager, a Java Plug-in (Java™ Runtime Environment Version 6.0 Update 21 (1.6.0_21) or later) must be installed in a browser on a management PC.

When the version of Java Plug-in is older than the version written above, the browser might prompt you to install Java. In this case, install the Java Plug-in of the version of which the operation is verified on ExpressCluster WebManager.

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

Starting the WebManager

Start the WebManager.
To start the WebManager:

1. Start your Web browser.

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

   http://10.0.0.11:29003/

   Specify the port number of the
   WebManager   (By default, 29003)
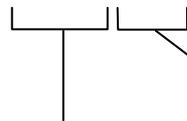
   Specify the actual IP address
   of the server on which the
   ExpressCluster Server is
   installed.

3. WebManager starts up.

4. Click **Setup Mode** on the **View** menu or click the button on the toolbar to switch to the setup mode (Builder (online version)).

Checking the values to be configured in the cluster environment with 2 nodes

Before you create the cluster configuration data using the Builder (in the WebManager setup mode), 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 diagram below, this chapter uses a typical configuration with two nodes as a cluster example.

When a disk resource is used:
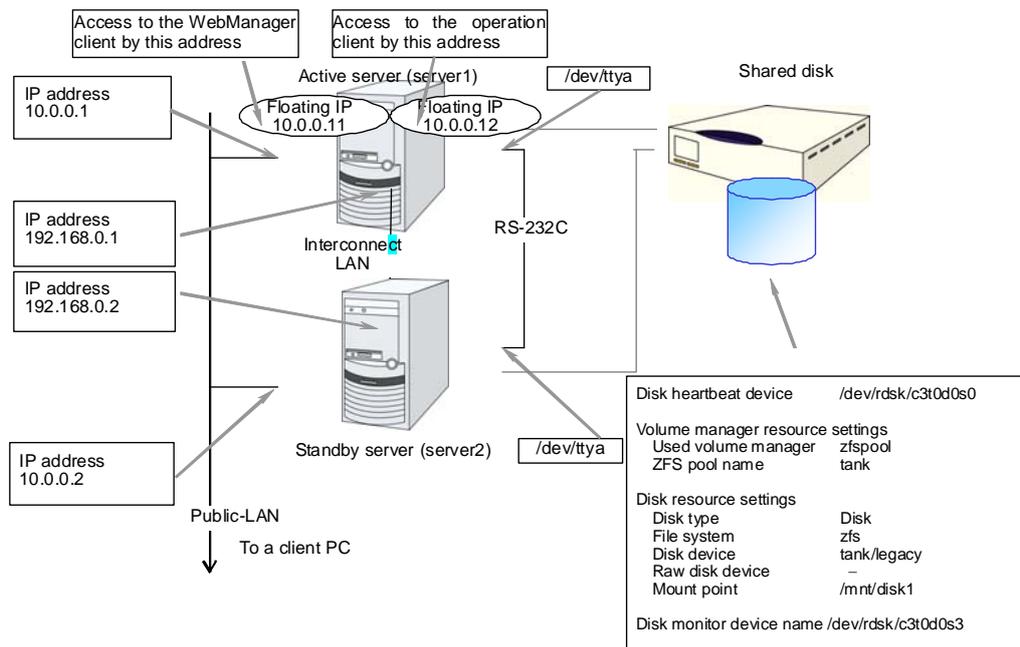
Check the values to be configured before creating the cluster configuration data. The following table lists sample values of the cluster configuration data to achieve the cluster system shown above. These values and configuration are applied hereafter in the step-by-step instruction to create the cluster configuration data. 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 disk resource)
Cluster configuration	Cluster name	cluster
	Number of servers	2
	Number of failover groups	2
	Number of monitor resources	4
Heartbeat resources	Number of LAN heartbeats	2
	Number of COM heartbeats	1
	Number of disk heartbeats	1
First server information	Server name*1	server1
(Master server)	Interconnect IP address (Dedicated)	192.168.0.1
	Interconnect IP address (Backup)	10.0.0.1
	Public IP address	10.0.0.1
	COM heartbeat device	/dev/ttya
	Disk heartbeat device	/dev/rdsk/c3t0d0s0
Second server information	Server name*1	server2
	Interconnect IP address (Dedicated)	192.168.0.2
	Interconnect IP address (Backup)	10.0.0.2
	Public IP address	10.0.0.2
	COM heartbeat device	/dev/ttya
	Disk heartbeat device	/dev/rdsk/ c3t0d0s0
Group resources for management (For the WebManager)	Type	failover
	Group name	ManagementGroup
	Startup server	All servers
	Number of group resources	1
Group resources for management *2	Type	floating IP resource
	Group resource name	WebManager FIP1
	IP address	10.0.0.11
Group resources for operation	Type	failover
	Group name	failover1
	Startup server	All the servers
	Number of group resources	3
First group resources	Type	floating IP resource
	Group resource name	fip1
	IP address	10.0.0.12
Second group resources	Type	disk resource
	Group resource name	volmgr1

Target	Parameter	Value (For disk resource)
	Volume manager	zfspool
	Pool name	tank
Third group resources	Type	Disk resource
	Group resource name	Disk 1
	Device name	tank/legacy
	Mount point	/mnt/disk1
	File system	zfs
	Disk type	disk
Forth group resource	Type	execute resource
	Group resource name	exec1
	Script	Standard script
First monitor resources (Created by default)	Type	user mode monitor
	Monitor resource name	userw
Second monitor resources (Automatically created after creating volume manager resource)	Type	volume manager monitor
	Monitor resource name	volmgrw1
	Volume manager	zfspool
	Pool name	tank
	When error is detected	Stop the cluster service and shut down OS
Third monitor resources	Type	NIC Link Up/Down monitor
	Monitor resource name	miiw1
	Monitored target	e1000g0 (Public LAN interface)
	When error is detected	"ManagementGroup" group's failover *3
Fourth monitor resources	Type	NIC Link Up/Down monitor
	Monitor resource name	miiw2
	Monitored target	e1000g0 (Public LAN interface)
	When error is detected	"failover1" group's Failover *3

*1: "Host name" represents the short name that excludes the domain name from a frequently qualified domain name (FQDN).

*2: 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.

*3: For the settings to execute a failover when all interconnect LANs are disconnected, see Chapter 5, "Monitor resource details" in the *Reference Guide*.

Creating the configuration data of a 2-node cluster

Creating the cluster configuration data involves creating a cluster, group resources, and monitor resources. The steps you need to take to create the data are described in this section.

Note:
The following instruction can be repeated as many times as necessary. Most of the settings can be modified later by using the rename function or properties view function.

1. Create a cluster

Add a cluster you want to construct and enter its name.

1-1. Add a cluster

Add a cluster you want to construct and enter its name.

1-2. Add a server

Add a server. Make settings such as IP addresses.

1-3. Set up the network configuration

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

1-4 Set up network partition resolution

Set up the network partition resolution resource.

2. Create a failover group

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

2-1 Add a failover group

Add a resource that constitutes a group.

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

Add a resource that constitutes a group.

2-3. Add a group resource (volume manager resource)

Add a resource that constitutes a group.

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

Add a resource that constitutes a group when the disk resource is used.

2-5. Add a group resource (EXEC resource)

Add a resource that constitutes a group when the mirror disk resource is used.

3. Create monitor resources

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

3.1. Configure a monitor resource (volmgrw monitor resource)

Configure a monitor resource to use.

3-2. Add a monitor resource (NIC Link Up/Down monitor resource for a management group)

Add a monitor resource to use.

3-3. Add a monitor resource (NIC Link Up/Down monitor resource for a failover group)

Add a monitor resource to use.

1. Creating a cluster

Create a cluster. Add a server that constitute a cluster and determine a heartbeat priority.

1-1. Add a cluster

1. Click **Languages** field in **Cluster Definition** window of **Cluster Generation Wizard**, select a language that is used on the machine that the WebManager works.

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. In the **Cluster Definition** dialog box, type the cluster name (cluster) in the **Name** box.

3. Enter the floating IP address (**10.0.0.11**) used to connect the WebManager in the **Management IP Address** box. Click **Next**.
The **Servers list** is displayed. The server (**server1**) for which the IP address was specified as the URL when starting up the WebManager is registered in the list.
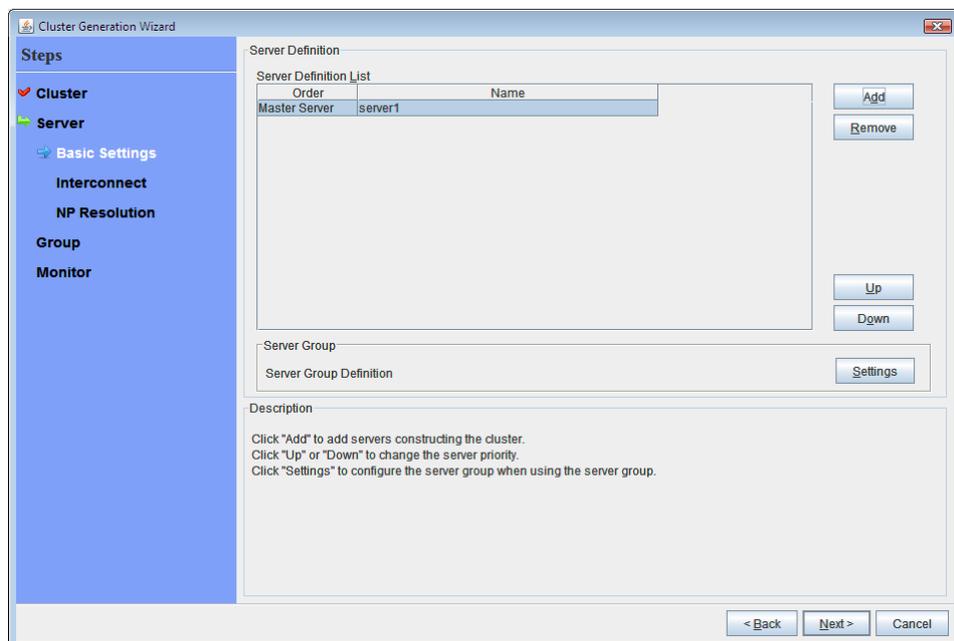
If the screen resolution is 800 x 600 pixels or less, the **Description** field will be displayed as a tool tip.
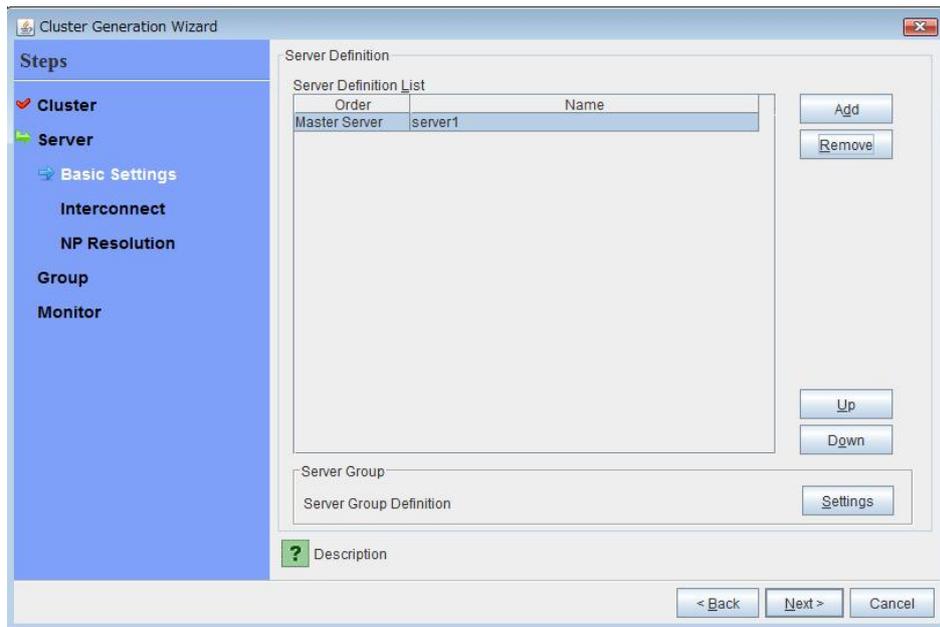
Positioning the mouse cursor to the **?** icon displays a tool tip with the full description.

1-2. Add a server

Add the second server to the cluster.

1. In the **Servers list**, click **Add**.

2. The **Server Addition** dialog box is displayed. Enter the server name, FQDN name, or IP address of the second server, and then click **OK**. The second server (**server2**) is added to the **Servers list**.

3. Click **Next**.

1-3. Set up the network configuration

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

1. When the network communication route between the servers in the cluster can be identified using a network address in the IP address format as in the setup example in thi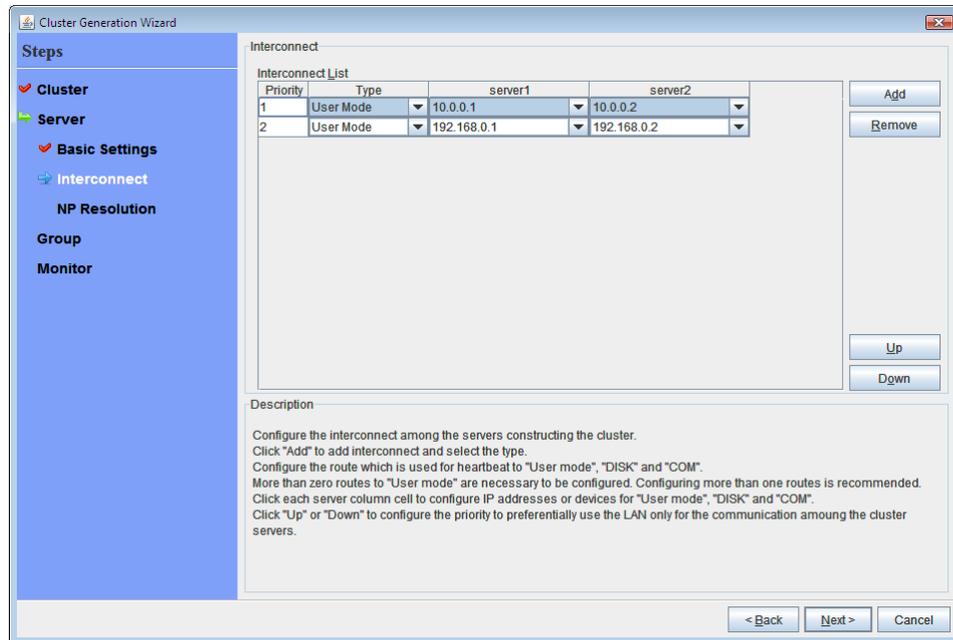s chapter, each communication route is automatically registered in **Interconnect List**. If the registered communication routes differ from the actual network configuration, add or delete them by using **Add** or **Delete**, click a cell in each server column, and then select or enter the IP address. For a communication route to which some servers are not connected, leave the cells for the unconnected servers blank.

2. For a communication route used for heartbeat transmission (interconnect), click a cell in the **Type** column, and then select **Kernel Mode**.
    At least one communication route must be specified for the interconnect. Specify as many communication routes for the interconnect as possible.
    If multiple interconnects are set up, the communication route for which the **Priority** column contains the smallest number is used at the highest priority for controlling communication between the cluster and server. To change the priority, change the order of communication routes by using **Up** or **Down**.

3. When using COM heartbeat, click **Type** column cell and select **COM**. Click **Server name** column cell and select or enter COM device. For the server not using COM heartbeat, set blank to **Server name** column cell.

4. When using DISK heartbeat, click **Type** column cell and select **DISK**. Click **Server name** column cell and select or enter disk device. For the server not using DISK heartbeat, set blank to **Server name** column cell.

5. Click **Next**.

1-4. Set up network partition resolution

Set up the network partition resolution resource.
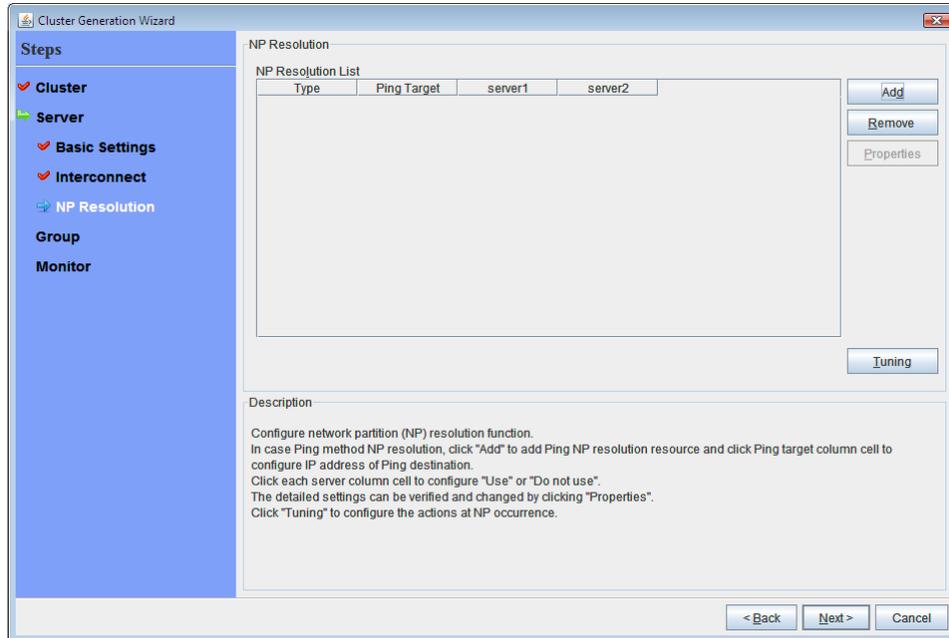
1. To use NP resolution in the PING mode, select the **PING Mode** check box, select **Simple Settings** in **PING Settings**, and then enter the IP address of the ping destination device (such as a gateway). When multiple IP addresses separated by commas are entered, they are regarded as isolated from the network if there is no ping response from any of them. If the PING mode is used only on some servers, multiple PING mode NP resolution resources must be specified, or some ping-related parameters must be changed from their default values, select **Detailed Settings**, and then specify the settings in the **PING Mode NP Resolution Settings** dialog box.

For the setup example in this chapter, 192.168.0.254 is specified for **Ping Target**.
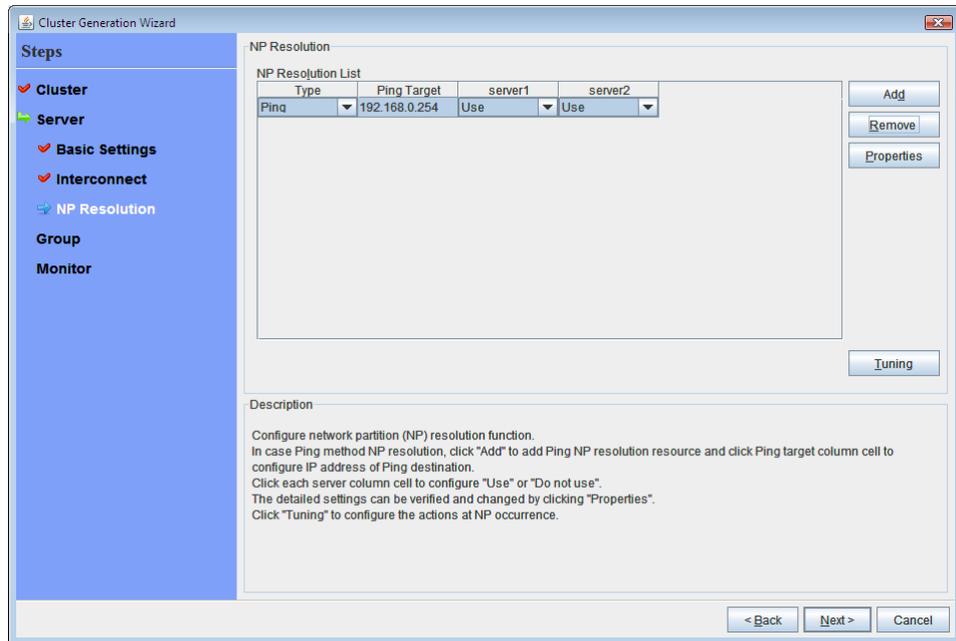
2. Specify the operation to perform when a network partition is detected. Select **Stop the cluster service** or **Stop the cluster service and shut down OS,** and then click **OK**.

   To use the mirror disk, **Stop the cluster service** is selected.

3. Click **Next**.

2. Creating a failover group

Add a fail over group (may be abbreviated as "group" below) to the cluster. First, create a fail over group for management and then add a fail over group to execute applications for operation.

2-1. Add a failover group

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

1. In the **Group**, click **Add**.

2. The **Group Definition** dialog box is displayed. Enter the group name (**failover1**) in the **Name** box, and click **Next**.

3. Specify the server on which the failover group is permitted to start up. In the setup example in this chapter, the **Failover is possible at all servers** check box is checked.

4. Specify each attribute value of the failover group. Because all the default values are used for the setup example in this chapter, click **Next**.

   The **Group Resource** is displayed.
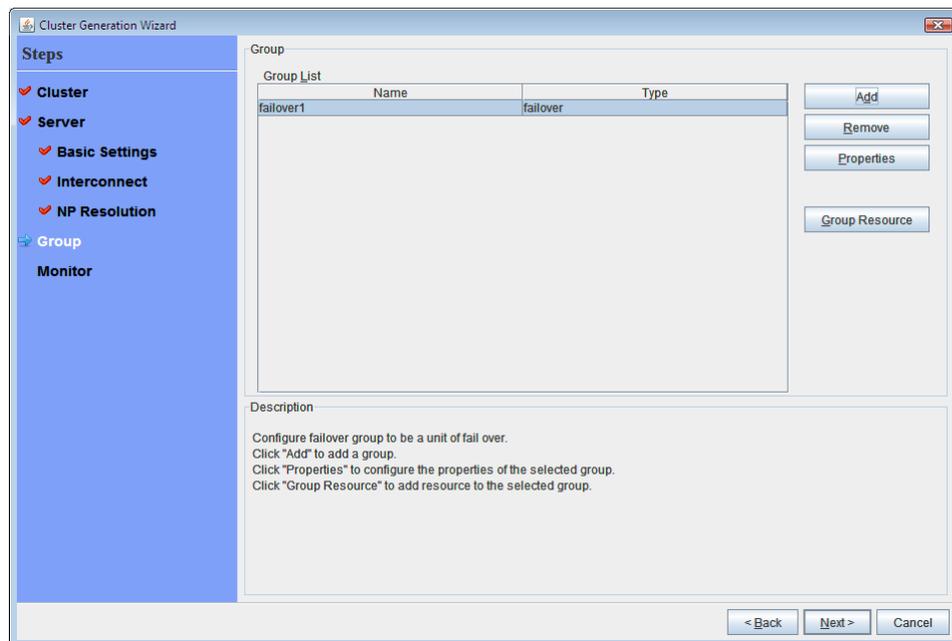
2-2. Add a group resource (floating IP address)

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

1. In the **Group Resource**, click **Add**.

2. The **Resource Definition** dialog box is displayed. In this dialog box, select the group resource type **floating ip resource** in the **Type** box, and enter the group name **fip1** in the **Name** box. Click **Next**.

3. The **Dependent Resources** page is displayed. Specify nothing. Click **Next**.

4. The Recovery Operation at Activation Failure Detection and Recovery Operation at Deactivation Failure Detection pages are displayed. Click Next.

5. Enter IP address (192.168.0.12) to **IP Address** box. Click **Finish**.

2-3. Add a group resource (volume manager resource)

Add a ZFS storage pool as a group resource.

1. In the **Group Resource,** click **Add**

2. The **Resource Definition** dialog box is displayed. In this dialog box, select the group resource type **volume manager resource** in the **Type** box, and enter the group resource name **volmgr1** in the **Name** box. Click **Next**.

3. The **Dependent Resources** page is displayed. Specify nothing. Click **Next**.

4. The Recovery Operation at Activation Failure Detection and Recovery Operation at Deactivation Failure Detection pages are displayed. Click Next.

5. Select volume manager name to be used (lvm1) and enter the target name (vg1) in the box. Click **Finish**.

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

Add ZFS data set as a group resource.

1. In the **Group Resource** , click **Add**.

2. In the **Resource Definition**, select the group resource type **disk resource** in the **Type** box, and enter the group resource name **disk1** in the **Name** box. Click **Next**.

3. The **Dependent Resources** page is displayed. Specify nothing. Click **Next**.

4. The **Recovery Operation at Activation Failure Detection** and **Recovery Operation at Deactivation Failure Detection** pages are displayed. Click **Next**.

5. Select disk type (disk) in the **Disk Type** box and file system (ext3) in the **File System** box, and enter device name (/dev/sdb2) and mount point (/mnt/sdb2) to each box. Click **Finish**.

2-5. Add a group resource (exec resource)

Add an exec resource that can start and stop the application from a script.

1. In the **Group Resource** , click **Add**.

2. In the **Resource Definition**, select the group resource **execute resource** in the **Type** box, and enter the group resource name **exec1** in the **Name** box. Click **Next**.

3. The **Dependent Resources** page is displayed. Specify nothing. Click **Next**.

4. The Recovery Operation at Activation Failure Detection and Recovery Operation at Deactivation Failure Detection pages are displayed. Click Next.

5. Check **Script created with this product**. Describe start or stop procedures of the application by editing this script. When the application to be used by ExpressCluster is decided, edit the script here. Click **Finish**.

When a shared disk is used in a cluster system, the **Group Resource Definitions** list of the failover1 should look similar to the following:
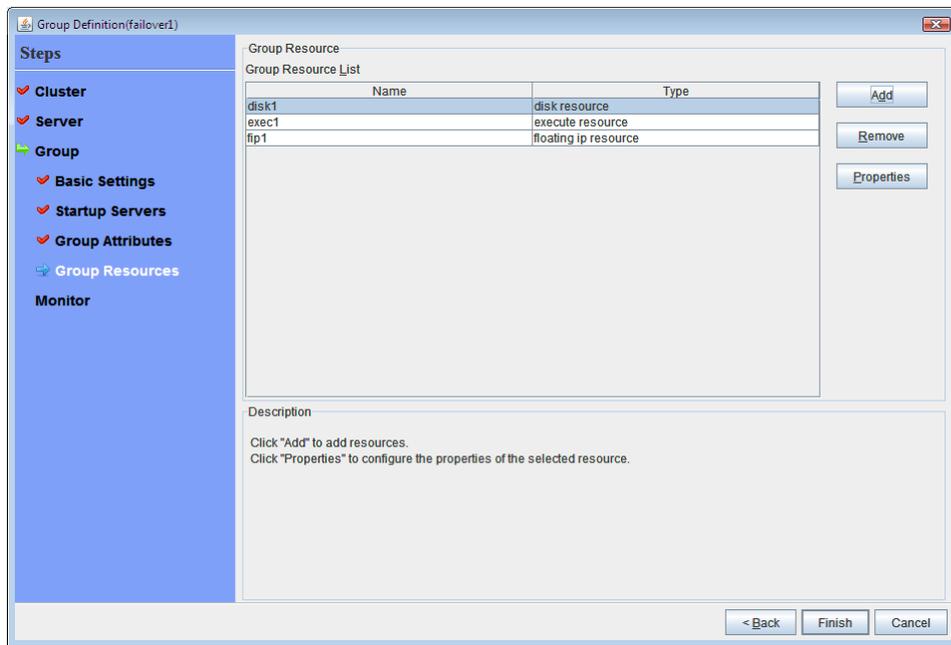
6. Click **Finish**.

3. Creating monitor resources

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

3.1. Configure a monitor resource (volmgrw monitor resource)

Add monitor resources to monitor ZFS storage pool.

1. In the **Group**, click **Next**.

2. The **Monitor Resource Definition** is displayed.

3. The first monitor resource information is created by default when the cluster name is defined. Select a volume manager monitor resource (volmgrw1), and click **Properties**.

4. On the **Recovery Action** tab, check that the recovery target and final action are appropriate, and click **OK**..

3-2. Add a monitor resource (NIC Link Up/Down monitor resource for a management group)

Add monitor resources that monitor NIC. NIC Link Up/Down monitor needs to be created on a failover group basis. Because the example used here has two groups, a group for management and a group for an application. A NIC Link Up/Down monitor is created for each group.

1. In the **Monitor Resource**, click **Add**.

2. In the **Monitor Resource**, select the monitor resource type **NIC Link Up/Down monitor** in the **Type** box, and enter the monitor resource name **miiw1** in the **Name** box. Click **Next**.

3. Configure the monitor settings. Do not change the default value. Click **Next**.

4. Enter the NIC (e1000g0) to be monitored in the **Monitor Target** box, and 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. Click **Finish**.

3-3. Add a monitor resource (NIC Link Up/Down monitor resource for a failover group)

1. In the **Monitor Resource**, click **Add**.

2. In the **Monitor Resource**, select the monitor resource type **NIC Link Up/Down monitor** in the **Type** box, and enter the monitor resource name **miiw2** in the **Name** box. Click **Next**.

3. Configure the monitor settings. Do not change the default value. Click **Next**.

4. Enter the NIC (e1000g0) to be monitored in the **Monitor Target** box, and click **Next**

5. Specify the recovery target. Click **Browse**.

6. Click **failover1** in the tree view. Click **OK**. "failover1" is set in the **Recovery Target**.

7. Click **Finish**.

The **Monitor Resource Definitions** list should look similar to the following.   :
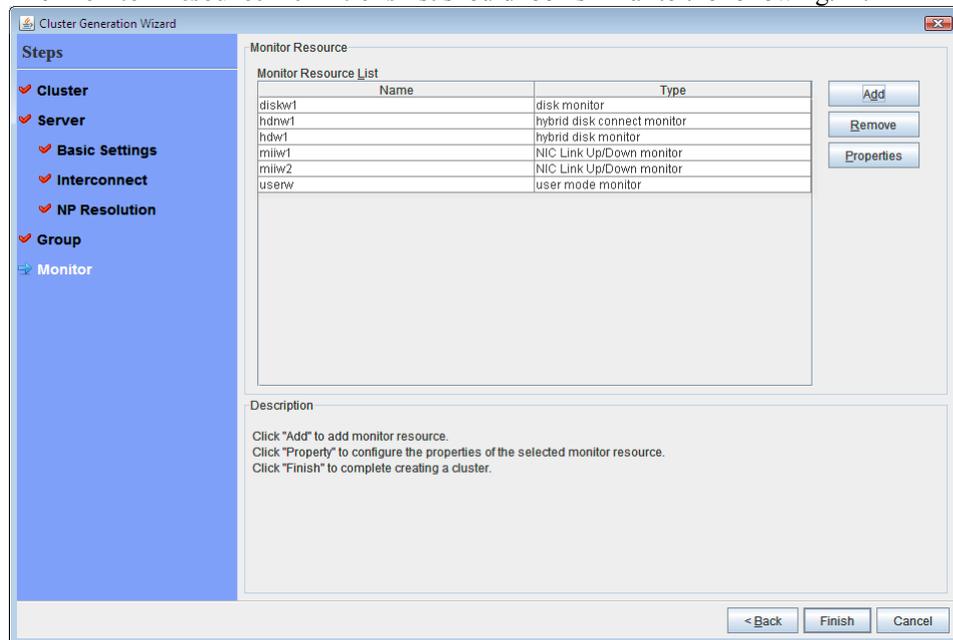
4. Disabling recovery action caused by monitor resource error

When you click **Finish** after creating a monitor resource, the following popup message appears:
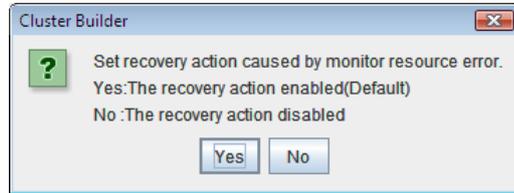
Clicking **Yes** disables the recovery operation even if a monitor resource error is detected. When you start a cluster for the first time after creating the cluster configuration information, it is recommended that you enable the recovery function to check for setting errors in the cluster configuration information.

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

Note:

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

---

Creating the cluster configuration data is completed. Proceed to "Creating a cluster" on page 91.

Saving the cluster configuration data

The cluster configuration data can be saved in a file system or in media such as a floppy disk. When starting the Builder on the WebManager, you can reflect the saved cluster information to the server machine with the ExpressCluster Server installed via the WebManager.

Saving the cluster configuration data in the file system (Windows)

Follow the procedures below to save the cluster configuration data in file system when using a Windows machine.

1. Select **Export** on the **File** menu of the Builder.

2. Select a location to save the data in the following dialog box, and click **Save**.
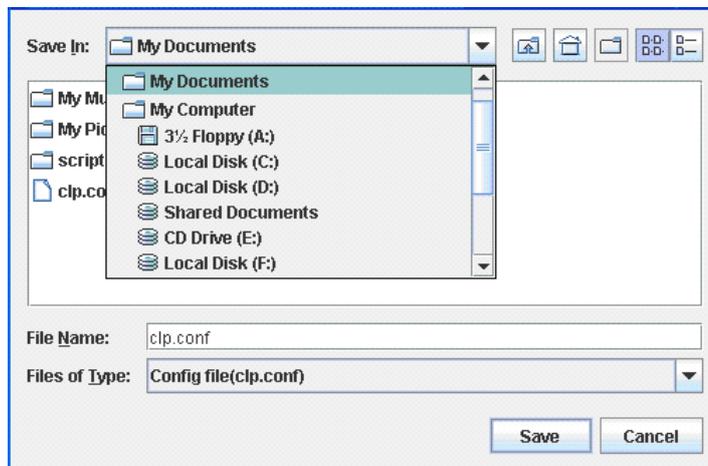
3. Select a location to save the data in the following dialog box, and click **Save**. Specify this directory when executing the creation command later.

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

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

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 **Apply the Configuration File** on the File menu.

   If the upload succeeds, the message saying "The upload is completed successfully.

   The upload finished successfully.

   If the upload fails, perform the operations as prompted by messages.

2. Terminate the Builder.

3. Execute the procedure below.
   - **(1)** Execute **Restart Manager** from the **Service** menu of WebManager.
   - **(2)** Execute **Start clustering** from the **Service** menu of WebManager. Clustering starts and the status of clustering is displayed on WebManager.

Chapter 6   Verifying a cluster system

This chapter describes how you change the cluster configuration.

This chapter covers:

Verifying operations using the WebManager

The cluster system you have set up can be verified by using the WebManager or the command line. This chapter provides instructions for verifying the cluster system 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 WebManager can be accessed from a management PC. The following describes how to access to the WebManager.

Related Information:
For system requirements of the WebManager, refer to Chapter 3, "System requirements for the WebManager" in the *Getting Started Guide*.

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

Related Information:
For details on how to use the WebManager, see Chapter 1, "Functions of the WebManager" in the *Reference Guide*. If any error is detected while verifying the operation, troubleshoot the error referring to Chapter 10, "Troubleshooting" in the *Reference Guide*.

1. **Check heartbeat resources**

   Verify that the status of each server is online on the WebManager.
   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 on the WebManager.

3. **Start up a group**

   Start a group.
   Verify that the status of the group is online on the WebManager.

4. **Volume manager resource**

   Verify that pool is imported on the server where the group having a volume manager resource is operating.

5. **Disk resource**

   Verify that you can access a disk mount point on the server where the group having disk resources is active.

6. **Check a floating IP resource**

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

7. **Check an exec resource**

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

8. **Stop a group**

   Stop a group.
   Verify that the status of the group is offline on the WebManager.

9. **Move a group**

   Move a group to another server.
   Verify that the status of the group is online on the WebManager.
   Move the group to all servers in the failover policy and verify that the status changes to online on each server.

10. **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 online on the failover destination server on the WebManager.

11. **Perform failback**

   When the automatic failback is set, start the server that you shut down in the previous step, "9. Failover." Verify that the group fail back to the original server after it is started using the clpstat command. Verify that the status of group becomes online on the failback destination server on the WebManager.

12. **Shut down the cluster**

   Shut down the cluster. Verify that all servers in the cluster are successfully shut down using the clpstat command.

Verifying operation by using commands

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

Related Information:
For details on how to use commands, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*. If any error is detected while verifying the operation, troubleshoot the error referring to Chapter 10, "Troubleshooting" in the *Reference Guide*.

---

1. **Check heartbeat resources**

   Verify that the status of each server is online 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 online by using the clpstat command.

4. **Stop a group**

   Stop a group with the clpgrp command.
   Verify that the status of the group is offline by using the clpstat command.

5. **Volume manager resource**

   Verify that pool is imported on the server where the group having a volume manager resource is operating.

6. **Disk resource**

   Verify that you can access a disk mount point on the server where the group having disk resources is active.

7. **Check a floating IP resource**

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

8. **Check an exec resource**

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

9. **Move a group**

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

10. **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 online on the failover destination server using the clpstat command.

11. Perform failback

When the automatic failback is set, start the server which you shut down in the previous step, "9. 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 online on the failback destination server using the clpstat command.

12. Shut down the cluster

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

Chapter 7   Modifying the cluster configuration data

This chapter describes how you modify the cluster configuration data.

This chapter covers:

Modifying the cluster configuration data

Before you reconfigure the ExpressCluster Server or change its parameters, you must back up the cluster configuration data. Backing up can be done with the clpcfctrl command. For details, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

Modify the cluster configuration data by using the ExpressCluster X Builder. For details of the ExpressCluster X Builder, see Chapter 2, "Functions of the Builder" in the *Reference Guide*.

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

Add the server

Add a server that constitutes a cluster.

1. Click **Servers** on the tree view, and click **Add** on the **Edit** menu.

2. The **Server Definition** dialog box is displayed. Click Add.

3. The **Add Server** dialog box is displayed. Enter the server name to the **Server Name or IP Address**, and click **OK**.

   Note:
   Enter the actual host name of the server. Make sure to type it correctly because the information you enter here is case sensitive.

4. Click **Next**.

5. Configure the interconnect. After configuring, click **Next**.

6. Configure NPresolution. After configuring, click **Finish**

Add a group

Add a group by which a failover is performed.

1. Click **Groups** in the tree view, and click **Add** on the **Edit** menu.

2. The **Group Definition** dialog box is displayed. Select the checkbox when you use Sever **Group Settings**. Enter the group name (failover1) in the **Name** box, and click **Next**.

3. **Servers that can run the Group** is displayed. Configure the settings, and then click **Next**.

4. The **Group Attribute Settings** is displayed. Configure the group and click **Next**.

5. The **Group Resource** is displayed. Configure the group and click **Finish**.

Add a group resource

Add a group resource. In this example, a floating IP resource is added.

1. Click the group to which a resource to be added belongs in the tree view. Click **Add Resource** on the **Edit** menu.

2. In the **Resource Definition** dialog box, select the group resource type **floating ip resource** in the **Type** box, and enter the group name **fip1** in the **Name** box. Click **Next**.

3. A page for setting up a dependency is displayed. Configure the settings, and click **Next**.

4. **Recovery Operation at Activation Failure Detection** and **Recovery Operation at Deactivation Failure Detection** are displayed. Configure the settings, and click **Next**.

5. Enter the IP address in the **IP Address** box, and then click **Finish**

Add a monitor resource

Add monitor resources that monitor IP. In this example, an IP monitor resource is added.

1. Click **Monitors** in the tree view, and click **Add** on the **Edit** menu.

2. In the **Monitor** 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**.

3. The monitor settings is displayed. Configure the monitor resource and click **Next.**

4. Click **Add**. Enter the IP address to be monitored in the **IP Address** box, and click **OK**.

5. Entered IP address is set in the **IP address list**, and click **OK.**

6. Recovery action is displayed. Configure the setting and click Finish.

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)/

2. Start the Builder by selecting **Config Mode** from **View** menu of the WebManager.

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

4. Upload the modified configuration data from **Apply the Configuration File** on **File** menu. Depending on the modified data, it may become necessary to suspend or stop the cluster and/or to restart by shutting down the cluster.

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) /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 -w –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.

Reflecting the cluster configuration data

Reflect the cluster configuration data on the ExpressCluster Server environment. The way to reflect them varies depending on the nature of the changes. For details on how to change parameters and how to reflect them, refer to the *Reference Guide*.

The way you reflect changed parameters may affect behavior of the ExpressCluster X. For details, see the table below:

The way to reflect changes	Effect
Upload Only	The operation of the applications and ExpressCluster Server is not affected. Heartbeat resources, group resources or resource monitor does not stop.
Uploading data and restarting the WebManager	
Uploading data after suspending the monitor	The monitor resource stops. The application continues to run because the group resource does not stop.
Uploading data after suspending the cluster	The operation of the ExpressCluster Server partly stops. While the ExpressCluster daemon is suspended, heartbeat resources and monitor resources stop. Applications continue operations since group resources do not stop.
Uploading data after stopping the monitor	The group resource stops. The application stops until the resource is started.
Uploading data after suspending the group	The group stops. The application stops until the group is started.
Uploading data after stopping the cluster	All the operations of the ExpressCluster Server stop. Since groups are also stopped, applications are stopped until a cluster and groups are started after uploading data.
Shutting down and restarting a cluster after uploading data	Applications are stopped until a cluster is restarted and groups are started.

Note:

If the ExpressCluster daemon needs to be suspended or stopped to reflect the modified data, ensure it is suspended or stopped before reflecting the cluster configuration 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 to use, check the syslog to see if "Module type: pm, Event type: information, Event ID: 2" are reported.

After checking the message above, reflect the cluster configuration data to the ExpressCluster environment.

Online version Builder

Uploading data only

1. Start the ExpressCluster Builder, and change the cluster configuration data.

2. Upload the cluster configuration data with the ExpressCluster Builder from **Apply the Configuration File** on **File** menu.

3. The following message is displayed if the data has successfully been distributed.

   ```
   The upload is completed successfully.
   ```

Uploading data and restarting the WebManager

For details on how to restart the ExpressCluster WebManager, see Chapter 1 "Functions of the WebManager" in the *Reference Guide*.

1. Start the ExpressCluster Builder, and change the cluster configuration data.

2. Upload the cluster configuration data with the ExpressCluster Builder from **Apply the Configuration File** on **File** menu.

3. The following message is displayed if the data has successfully been distributed.

   ```
   The upload is completed successfully.
   ```

4. Restart the WebManager.

Uploading data after suspending a cluster

The following explains how to suspend a cluster such as when changing a configuration (adding or deleting a server).

1. Start the ExpressCluster Builder, and change the cluster configuration data.

2. On **Service** of the WebManager, click **Suspend Cluster**.

3. Upload the cluster configuration data with the ExpressCluster Builder from **Apply the Configuration File** on **File** menu.

4. The following message is displayed if the data has been successfully distributed.

   ```
   The upload is completed successfully.
   ```

5. On **Service** of the WebManager, click **Resume Cluster**.

Uploading data after stopping a cluster

1. Start the ExpressCluster Builder, and change the cluster configuration data.

2. On **Service** of the WebManager, click **Stop Cluster**.

3. Upload the cluster configuration data with the ExpressCluster Builder from **Apply the Configuration File** on **File** menu.

4. The following message is displayed if the data has successfully been distributed.

   ```
   The upload is completed successfully.
   ```

5. Execute **Stop Cluster** by clicking **Service** of the WebManager.

Shutting down and restarting a cluster after uploading data

1. Start the ExpressCluster Builder, and change the cluster configuration data.

2. On **Service** of the WebManager, click **Stop Cluster**.

3. Upload the cluster configuration data with the ExpressCluster Builder from **Apply the Configuration File** on **File** menu.

4. The following message is displayed if the data has successfully been distributed.

   ```
   The upload is completed successfully.
   To apply the changes you made, restart the WebManager from the
   Service menu.
   ```

5. Restart all servers.

Using the data saved in a file

Uploading data only

1. Prepare the configuration data for the server specified as the master server by the Builder.

2. Distribute the configuration data to all the servers registered in the cluster configuration information:

   (A) If you created the configuration data on a Windows computer (on 1.44-MB formatted floppy disk), run the following command with the –w option:

   ```
   clpcfctrl --push –w -x <The path where configuration data is
   saved>
   ```

3. The following message is displayed if the data has successfully been distributed.

   ```
   The upload is completed successfully.(cfmgr:0)
   Command succeeded.(code:0)
   ```

   For troubleshooting while running clpcfctrl, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

Uploading data and restarting the WebManager

1. Prepare the configuration data for the server specified as the master server by the Builder.

2. Distribute the configuration data to all the servers registered in the cluster configuration information:

   (A) If you created the configuration data on a Windows computer, run the following command with the –w option:

   clpcfctrl --push –w -x <The path where configuration data is saved>

3. The following message is displayed if the data has successfully been distributed.

   ```
   The upload is completed successfully.(cfmgr:0)
   ```

   ```
   To apply the changes you made, restart the WebManager.
   ```

   ```
   Command succeeded.(code:0)
   ```

   For troubleshooting while running clpcfctrl, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

4. Restart the WebManager.

Uploading data after suspending a cluster

If you want to reconfigure the cluster by adding or deleting a server, follow the steps below and suspend the ExpressCluster daemon.

1. Run `clpcl -suspend` to suspend the ExpressCluster daemon.

2. Prepare configuration data for the server specified as the master server by the Builder.

3. Distribute the configuration data to all the servers registered in the cluster configuration information:

   (A) If you created the configuration data on a Windows computer, run the following command with the –w option:

   ```
   clpcfctrl --push –w -x <The path where configuration data is saved>
   ```

4. After clicking the **RETURN** key, the following message is displayed if the data has successfully been distributed.

   ```
   The upload is completed successfully.(cfmgr:0)
   Command succeeded.(code:0)
   ```

   For troubleshooting while running clpcfctrl, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

5. Run the `clpcl -resume` to resume the ExpressCluster daemon.

Uploading data after stopping a cluster

1. Run the `clpcl -t -a` to stop the ExpressCluster daemon.

2. Prepare configuration data for the server specified as the master server by the Builder.

3. Distribute the configuration data to all the servers registered in the cluster configuration information:

   (A) If you created the configuration data on a Windows computer, or created the configuration data as a Windows file on Linux, run the following command with the –w option:

   ```
   clpcfctrl --push –w -x <The path where configuration data is saved>
   ```

   The following message is displayed if the data has successfully been distributed.

   ```
   The upload is completed successfully.(cfmgr:0)
   Command succeeded.(code:0)
   ```

   For troubleshooting while running clpcfctrl, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

4. Run the `clpcl -s -a` to restart the ExpressCluster daemon.

Shutting down and restarting a cluster after uploading data

1. Run **`clpcl -t -a`** to stop the ExpressCluster daemon.

2. Prepare configuration data for the server specified as the master server when you created the configuration data by using the Builder.

3. Distribute the configuration data to all the servers registered in the cluster configuration information:

   (A) If you created the configuration data on a Windows computer, run the following command with the –w option:

      `clpcfctrl --push –w -x <The path where configuration data is saved>`

   The following message is displayed if the data has successfully been distributed.

   `The upload is completed successfully.(cfmgr:0)`

   `To apply the changes you made, shutdown and reboot the cluster.`

   `Command succeeded.(code:0)`

   For troubleshooting while running clpcfctrl, refer to Chapter 3, "Function of the Builder" in the *Reference Guide*.

4. Restart all servers.

Notes on using data saved in a file

The following describes notes on using data saved in a file.

Uploading the cluster configuration data

You can access the cluster configuration data saved on the file system from the server you are uploading data. Access the cluster configuration data from the master server by using FTP.

Do either (1) or (2) depending on the operating system on which you use the Builder. The following example assumes that the cluster configuration data is in the /tmp/upload directory.

1. If you use the cluster configuration data saved by the Builder on Windows, run the following command:

```
clpcfctrl --push -w -x /tmp/upload
```

Related Information:
For details on the clpcfctrl command options, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

Backing up the cluster configuration data

Do either (1) or (2) depending on the operating system on which you use the Builder. The following example assumes that data is backed up in the /tmp/backup directory.

1. To back up the cluster configuration data for the Builder working on Windows Web browser, run the following command:

```
clpcfctrl --pull -w -x /tmp/backup
```

Related Information:
For details on the clpcfctrl command options, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

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. After you have verified the constructed system, check what you need to do before you start operating a cluster system. This section also provides instructions for uninstallation and reinstallation.

Chapter 8   Verifying operation
Chapter 9   Preparing to operate a cluster system
Chapter 10   Uninstalling and reinstalling ExpressCluster

Chapter 8   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 how your cluster behaves by performing dummy-failure tests and/or backup restoration of the shared disk. Check for errors in monitor resources or stoppage of the server and OS.

If any error is detected in monitor resources or any stoppage of the server or the OS occurs, the time-out value or other settings need to be adjusted.

1. Transition of recovery operation due to dummy failure

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

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

2. **Dummy-failure of the shared disks**
(When the shared disks are RAID-configured and dummy-failure tests can be run)

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

- Set a dummy-failure to occur on a shared disk.

- Recover RAID from the degenerated state to normal state.

For some shared disks, I/O may temporarily stop or delay when they switch to the degenerated operation or when RAID is reconfigured.

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

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

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

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

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

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

4. **Backup/Restoration**

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

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

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

Different types of dummy-failure tests for each device and what happen after the tests are described below:

Device/Resource	Dummy-failure	What happens
Shared disk device SCSI/FC path	Unplug the cable on the server side (for a redundant server, unplug both cables)	When a disk is monitored, failover to the standby server occurs. When no disk is monitored, the operation stops.
		Disk heartbeat resource becomes offline. A warning is issued to the WebManager terminal. = Operation continues.
		Disk monitor resources detect an error
	For FC, power off the FC Switch	When a disk is monitored, failover to the standby server occurs. When no disk is monitored, the operation stops.
		Disk heartbeat resources become offline.
		Disk monitor resources detect an error
Interconnect LAN	Unplug the LAN cable	Communication between servers continues using a public LAN Operation continues
		The LAN heartbeat resource on the interconnect becomes offline. A warning is issued to the WebManager terminal. = Operation continues.
		An error is detected in an IP monitor resource Failover to the standby server occurs.
		An error is detected in a NIC Link Up/Down monitor resource Failover to the standby server occurs.
Public LAN	Unplug the LAN cable or power off the HUB	Communication stops, application stalls or an error occurs. =These do not result in failover.
		LAN heartbeat resource on the public LAN becomes inactive. A warning is issued to the WebManager terminal. = Operation continues.
		An error is detected in an IP monitor resource Failover to the standby server occurs.
		An error is detected in a NIC Link Up/Down monitor resource. Failover to the standby server occurs
UPS	Unplug the UPS from outlet	The active server shuts down Failover to the standby server occurs
Array UPS	Unplug the UPS from outlet	Both servers shut down Operation stops
LAN for UPS	Unplug the LAN cable	UPS becomes uncontrollable. Operation continues

Section III Evaluation before operating a cluster system

Device/Resource	Dummy-failure	What happens
COM	Unplug the RS-232C cable of the COM heartbeat	COM heartbeat resource becomes offline. A warning is issued to the WebManager terminal. Operation continues.
OS error	Run the shutdown command on the active server	The active server shuts down Failover to a standby server occurs.
Disk resource	Start up the group after mounting the disk (Example) # mount /dev/dsk/c3t0d0s1 /mnt/disk	A disk resource does not get activated. Failover to a standby server occurs.
Exec resource	Write an invalid command in exec resource script Change "EXIT 0" in the end of script to "EXIT 1"	An exec resource does not get activated. Failover to a standby server occurs.
Floating IP address	Specify the already-used address (the one that is used for server) to make it overlapped	A floating IP resource does not get activated.
Virtual IP resource	Specify the already-used address (the one that is used for server) to make it overlapped	A virtual IP resource does not get activated.
NAS resource	Start up the group after mounting the disk (Example) # mount -F nfs server name:/share name /mnt/nas1	A NAS resource does not get activated.
PID monitor resource	Terminate resident process of monitored exec resource (Example) # kill process ID	Failover to a standby server occurs.
Volume manager monitor resource	When **Volume Manager** is zfspool Manually export the volume group.	An error is detected in the monitor resource.
VM resource	Disconnect the shared disk containing the virtual machine image.	The VM resource is not activated.
	Start the virtual machine while the VM resource is stopped.	The VM resource is activated.
VM monitor resource	Shut down the virtual machine.	The virtual machine is started by restarting the resource.
Dynamic DNS resource	Start the Dynamic DNS resource while the name resolution service on the DNS server is not running.	The Dynamic DNS resource is not activated.
Dynamic DNS monitor resource	Shut down a normally operating DNS server or stop the running name resolution service.	The VHOSTW monitor resource detects an error and takes action for it. The VHOST resource fails to stop when there is resource reactivation or a failover.

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Device/Resource	Dummy-failure	What happens
	Use the nsupdate command to delete the virtual host name that is registered in the Dynamic DNS resource from the DNS server.	The Dynamic DNS monitor resource registers the virtual host name on the DNS server again within the monitor interval.

Note:

For changing each parameter, refer to the *Reference Guide*.

Backup procedures

This section explains how to back up and restore the file system. Before you start using your cluster system, make sure to simulate a backup operation.
To back up the file system, follow the procedures below.

Backing up while ExpressCluster is active

To back up the file system while the ExpressCluster daemon is active, follow the procedures below.

1. Make sure the cluster is working normally.

2. To prevent the heartbeat time-out caused by highly loaded user space from occurring, change the time-out ratio of ExpressCluster by using the time-out temporary adjustment command.

If you want to triple the current time-out and make this temporary setting valid for one hour, run the following command:

```
# clptoratio -r 3 -t 1h
```

3. Back up the shared disk.

For backing up a shared disk, the disk resource in group resources needs to be activated on the server for backup.

4. Set the time-out ratio adjusted with the time-out temporary adjustment command back to the original:

```
# clptoratio -i
```

For details on the command that adjusts time-out temporarily, refer to the *Reference Guide*.

Backing up while ExpressCluster is inactive

To back up the file system while the ExpressCluster daemon is inactive, follow the procedures below.

1. Make sure the cluster is working normally.

2. Stop the ExpressCluster daemon.

```
# clpcl -t -a
```

3. Back up the file system and shared disk.

For the shared disk, manually mount the file system on the shared disk you want to back up. Make sure to unmount the file system after you have completed the backup.

4. Start the ExpressCluster daemon.

```
# clpcl -s –a
```

Restoration procedures

You also need to simulate restoration operation before starting to use your cluster system. To restore the file system, follow the procedures below.

Restoring the file system containing the /opt/nec/clusterpro directory

1. Back up the cluster configuration data on a server normally running in the cluster.

    ```
    # clpcfctrl --pull –w –x <The path where configuration data is saved>
    ```

    Note:
    Perform the subsequent procedure on the server to be restored.

2. Run **svccadm disable** *name* in the following order to disable services on the server to be restored.

    -   clusterpro_alertsync

    -   clusterpro_webmgr

    -   clusterpro

    -   clusterpro_trn

    -   clusterpro_evn

3. Restart the server with reboot command or other method.

4. Restore the file system on the server to be recovered (there is no cluster-dependent work).

5. Verify if the ExpressCluster Server is installed on the restored file system with the following command:

    ```
    pkginfo -l NECclusterpro
    ```

    When the ExpressCluster Server is installed, proceed to Step (6).
    When the ExpressCluster Server is not installed, proceed to Step (7).

6. If the ExpressCluster Server is installed, run the following command to uninstall it:

    ```
    pkgrm NECclusterpro
    ```

    For troubleshooting a problem that occurs when you uninstall the ExpressCluster Server, see page 128, "Uninstalling the ExpressCluster Server."

7. Install the ExpressCluster Server.

    For details, see page 53, "Setting up the ExpressCluster Server" in Chapter 3.
    If there is any server in the cluster on which an update of the ExpressCluster Server is applied, apply the same update to this server. Make sure that the same version of the ExpressCluster Server is installed on all servers in the cluster.

8. Insert the cluster configuration data floppy disk in the server where the ExpressCluster Server was reinstalled.

    Note:
    You have to restart the server where the ExpressCluster Server was reinstalled after reinstallation.

9. .Register the cluster configuration data which was backed up in Step 1 with the server by running the cluster creation command:

```
# clpcfctrl --push –w –x <The path where configuration data is saved>

  Command succeeded.(code:0)
```

Verify if the command is successfully displayed and completed.

Related Information:
For details on the cluster creation command, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

10. Eject the information FD and restart the server.

Restoring the data on the shared disk

The following describes how to restore the data in the disk resource on the shared disk.

Restoring while ExpressCluster is active

1. Make sure that the cluster is working normally.

2. To prevent the heartbeat time-out caused by heavily loaded user space from occurring, change the time-out ratio of ExpressCluster with the time-out temporary adjustment command.

If you want to triple the current time-out and make this temporary setting valid for one hour, run the following command:

```
# clptoratio -r 3 -t 1h
```

3. Restore the shared disk.

The disk resource of the group resource should be active on the server to be restored.

4. Set the time-out ratio adjusted with the timeout temporary adjustment command back to the original ratio:

```
# clptoratio –i
```

Related- Information:
For details on the command for adjusting time-out temporarily, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

Restoring while ExpressCluster is inactive

1. Make sure that the cluster is working normally.

2. Stop the ExpressCluster daemon.

```
# clpcl -t -a
```

3. Manually mount the file system on the shared disk to be restored. Make sure to unmount the file system when you have completed restoration.

4. Start the ExpressCluster daemon.

```
# clpcl -s -a
```

Related Information:
For details on the command for operating a cluster, see Chapter 3, "ExpressCluster command reference" in the *Reference Guide*.

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Chapter 9 Preparing to operate a cluster system

This chapter describes what you have to do before you start operating a cluster system, such as how you perform operation simulation, backup, data restoration and log collection.

This chapter covers:

Operating the cluster system

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, start the disk.

2. Start all the servers in the cluster.

> **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. Note 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 "1. Set shared disk for volume manger resource and disk resource   (Required when using volume manager resource and disk resource)" on page 29.

Shutting down a cluster and server

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

Shutting down the entire cluster

The entire cluster can be shut down by running the clpstdn command or executing cluster shutdown from the WebManager. 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, refer to 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.

If you intend to use a standby server while performing hardware maintenance, shut down the active server.

> **Related Information:**
> For more information on the clpdown command and the WebManager functions, refer to the *Reference Guide*.

Suspending/resuming a cluster

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

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

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

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

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

How to suspend a cluster

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

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

How to resume a cluster

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

Related Information:
For details on the clpcl command and WebManager functions, refer to the *Reference Guide*.

Suspending ExpressCluster

There are two ways to stop running ExpressCluster. One is to stop the ExpressCluster daemon, and the other is to disable the ExpressCluster daemon.

Stopping the ExpressCluster daemon

To stop only the ExpressCluster daemon without shutting down the operating system, use the clpcl command.

Related Information:
For more information on the clpcl command, refer to the *Reference Guide*.

Disabling the ExpressCluster daemon

To make the ExpressCluster daemon not start at the time the operating system is started up, you can disable it with the svcadm command. The following describes how to disable the ExpressCluster daemon. To disable the ExpressCluster daemon, you also have to disable the ExpressCluster X WebManager.

Follow the procedures below to disable the ExpressCluster daemon by executing `svcadm disable` *name*.

1. Run **chkconfig --del** *name* in the following order to disable services on the server where you want to disable the ExpressCluster daemon.

   - `clusterpro_alertsync`

   - `clusterpro_webmgr`

   - `clusterpro`

2. Restart the server with reboot command or other method.

Enabling the disabled ExpressCluster daemon

Follow the procedures below to enable the disabled ExpressCluster daemon again:

1. On the server where the ExpressCluster daemon is disabled, run **svcadm** in the following order to enable services.

   svcadm enable *name*

   - `clusterpro`

   - `clusterpro_webmgr`

   - `clusterproclusterpro_alertsync`

Checking the log collecting procedure

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

Collecting logs by using the WebManager

1. Start the WebManager.

2. Click **Collect Cluster Logs** on the **Tools** menu or click on the toolbar. The collect Cluster Logs dialog box will open.
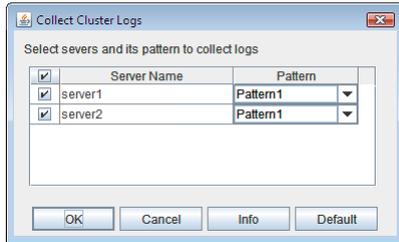
3. Select the check box of the servers for collecting log and select a log collection pattern.

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

4. Click **OK**. Log collection will start and the dialog box that shows the progress of log collection will open.
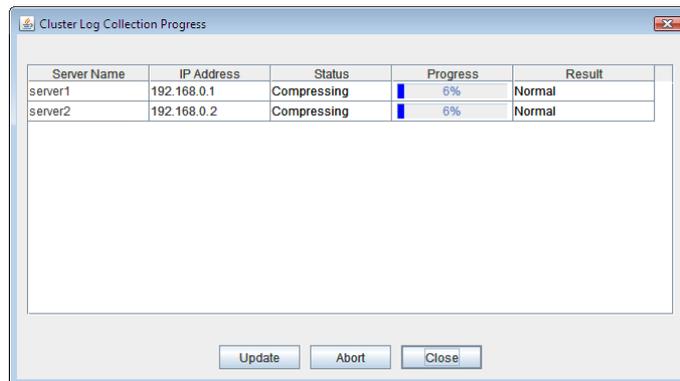
The progress is displayed in the **Progress** column. To view the latest status, click the **Update** button.

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.
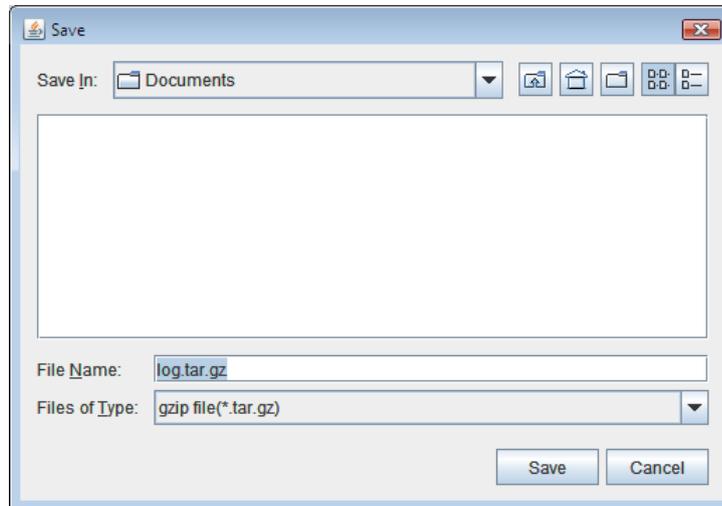
(In the case of * Internet Explorer 7.0, above dialog appears)

Note:

Logs may not be downloaded properly if nothing is changed for more than 10 minutes.

Note:

If other modal dialog is displayed while collecting logs, the file saving dialog box for the log collection will not be displayed. To display the file saving dialog box, terminate the modal dialog.

Chapter 10   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 the root user when uninstalling the ExpressCluster Server. It is recommended to extract the cluster configuration before uninstalling the ExpressCluster Server. See Chapter 3, "ExpressCluster command reference" in the *Reference Guide* for details.

Follow the procedures below to uninstall the ExpressCluster Server:

1. If the SNMP linkage function has been used, you must cancel the linkage before uninstalling ExpressCluster Server. For how to cancel the settings of the SNMP linkage function, refer to "Cancelling the SNMP linkage function settings."

2. Run the **svcadm disable** *name* to disable the following services in this order.

- clusterpro_alertsync
- clusterpro_webmgr
- clusterpro
- clusterpro_trn
- clusterpro_evt

3. Run **pkgrm NECclusterpro**.

4. Restart the server with reboot command or other method.

Uninstalling the ExpressCluster X Builder (Offline version)

.

For Windows

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.

Cancelling the SNMP linkage function settings

You must cancel the SNMP function settings before uninstalling the ExpressCluster Server.

Follow the procedure below to cancel the SNMP linkage function settings.

Note:
To cancel the SNMP linkage function settings, you must log in as the root user.

---

1. Stop the Net-SNMP snmpd daemon.

   `svcadm disable -t sma`

2. Cancel registration of the SNMP linkage function in the configuration file for the snmpd daemon.
   Open the following configuration file with a text editor:

   `/etc/sma/snmp/snmpd.conf`

   Delete the following line:

   `dlmod clusterManagementMIB`
   `/opt/nec/clusterpro/lib/libclpmgtmib.so`

   Note:
   Delete the OID of ExpressCluster from the MIB view (view definition by snmpd.conf) permitted by the snmpd daemon.

   The OID of ExpressCluster is ".1.3.6.1.4.1.119.2.3.207".

   ---

3. Start the snmpd daemon.

   `svcadm enable -t sma`

Reinstallation Procedure

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.

If you do not have the cluster configuration data (or the latest data if you reconfigured the cluster) created by the Builder at hand, you can back up the data with the clpcfctrl command. For details, see Chapter 2, "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. Uninstall the ExpressCluster Server.
   For details, refer to page 128, "Uninstalling the ExpressCluster Server."

2. Install the ExpressCluster Server and recreate the cluster.
   For details, refer to page 53, "Setting up the ExpressCluster Server."

To reinstall ExpressCluster Server on some servers in the cluster

To reinstall the ExpressCluster X, follow the procedures below:

1. Uninstall the ExpressCluster Server.
   For details, refer to page 128, "Uninstalling the ExpressCluster Server."

2. Install the ExpressCluster Server package.
   For details, refer to page 54, "Installing the ExpressCluster Package."

   | **Note:** |
   | You have to restart the server on which you reinstalled the ExpressCluster Server. |

3. Distribute the configuration data to servers of which the ExpressCluster Server has been reinstalled from the server where it has not been reinstalled. Log on to one of the server where the ExpressCluster Server has not been reinstalled. Run one of the following commands:

   clpcfctrl --push –h
   <Host_name_of_a_server_where_the_ExpressCluster_Server_was_reinstalled>

   clpcfctrl --push –h
   <IP_address_of_a_server_where_the_ExpressCluster_Server_was_reinstalled>

   The following message is displayed if the data has successfully been distributed.
   ```
   Command succeeded.(code:0)
   ```

   | **Note:** |
   | For troubleshooting problems that occur while you are running clpcfctrl, refer to the *Reference Guide*. |

4. Register the license only if the option of the node license will be used on the server where the ExpressCluster Server is reinstalled.
   For details, refer to page 66, "Registering the node license."

5. Restart the server on which you reinstalled the ExpressCluster Server.

Appendix A   Troubleshooting

Error messages when installing the ExpressCluster Server

	Error message	Cause	Action
1	pkgrm: ERROR: You must be "root" for pkgrm to execute properly.	The user logged on is not root user.	Log on as root user.

Error messages when uninstalling the ExpressCluster Server

	Error messages	Cause	Action
1	failed to open //var/lib/rpm/packages.rpm error: cannot open //var/lib/rpm/packages.rpm	The user logged on is not root user.	Log on as root user.
2	error: EXPRESSCLUSTER is running	The ExpressCluster is active.	Disable services by using the svcadm command, restart the server, and uninstall the ExpressCluster again.

Troubleshooting for licensing

Behavior and Message	Cause	Action
When the command was executed, the following message appeared in the console: "Log in as root."	The command was executed by a general user.	Log on as root user or log on again after changing to root user with su -.
When the command was executed at the license registration, the following message appeared in the console: "Command succeeded. But the license was not applied to all the servers in the cluster because there are one or more servers that are not started up."	The transaction server may not be active, or the cluster configuration data may be yet to be distributed.	Check again whether the transaction server is activated and the cluster configuration data is distributed on all servers. If either of them is not done yet, complete the task and register the license again.
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. (%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 insufficient is %1. (%2)" %1: The number of licenses in short of supply %2: Product ID	The number of licenses is insufficient.	Obtain a license and register it.
While the cluster was operated on the trial license, the following message appeared and the cluster stopped. "The license of trial expired by %1. (%2)" %1: Trial end date %2: 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

Interconnect	A dedicated communication path for server-to-server communication in a cluster. (Related terms: Private LAN, Public LAN)
Virtual IP address	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.
Network partition	All heartbeat is lost and the network between servers is partitioned. (Related terms: Interconnect, Heartbeat)
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 at the top of **Master Server** in **Server Common Properties** of the Builder

Appendix C   Index