

# **ExpressCluster for Linux Version 3**

## **ExpressCluster WAN Installation Guide**

Revision 5us



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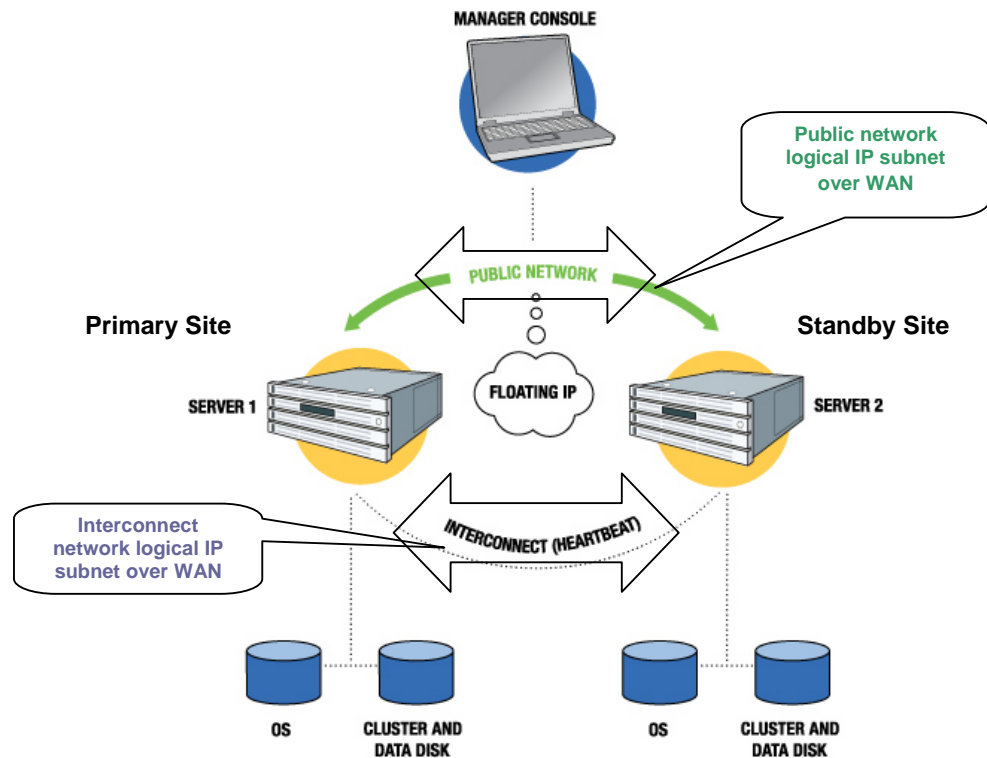
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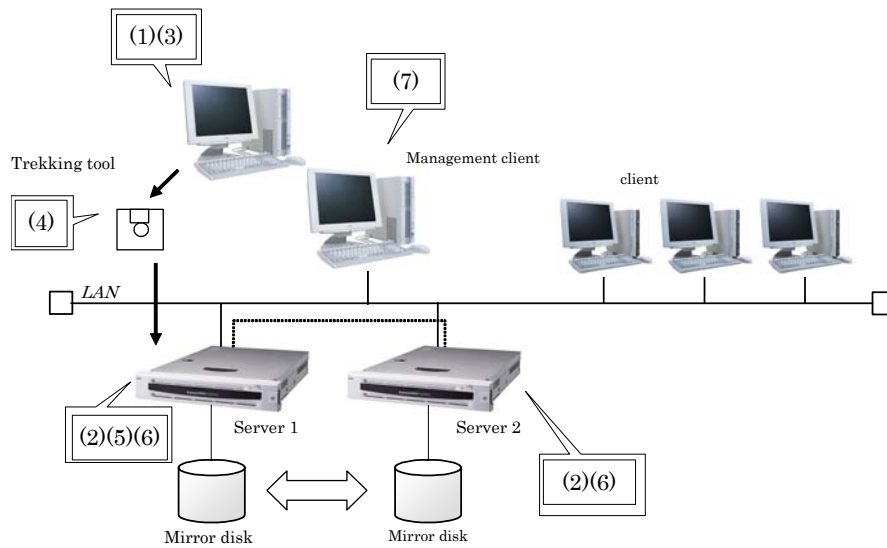
# 1 OVERVIEW OF INSTALLATION PROCEDURE











The following is an overview of the ExpressCluster WAN deployment procedure.

- ❑ Primary Site: Assembled hardware for both servers and made sure basic hardware is fully functional.
- ❑ Primary Site: Verified availability of network IP addresses and hostnames at Primary site & Standby site subnets and virtual subnets
- ❑ Primary Site: Reconfigured IP addresses and hostnames for all systems as needed.
- ❑ The “Public LAN” network for the two servers are connected to the production network. The “Interconnect” is connected using a cross-over cable or HUB.
- ❑ Primary Site: Installed target application software on both servers
- ❑ Primary Site: Installed ExpressCluster WAN (including licensing) on both servers and completed the mirror build by performing the following tasks:
  - Setting up Configuration Tool  
Set up Configuration Tool.
  - Setting up ExpressCluster Servers  
Set up ExpressCluster Server on all servers that form a cluster.
  - Creating Cluster Configuration data  
Create Cluster Configuration data by using Configuration Tool and store it in floppy disk.

- Hand-carrying the floppy disk  
Insert the floppy disk created by Configuration Tool in the master server.
- Executing a cluster generation command  
Run the cluster generation command on the server where the floppy disk was inserted. After executing a cluster generation command, register license.
- Rebooting Server  
Restart servers that form a cluster.
- Access ExpressCluster Web Manager  
Access ExpressCluster Server through your browser.



If you shut down or restart a server running as a part of cluster, do it with an appropriate ExpressCluster command or from Web Manager.  
If you work with servers with the shutdown command or reboot command, a mirror break may occur.

Installing ExpressCluster Configuration Tool.	→ See 2.
You install ExpressCluster Configuration Tool.	
	
Installing ExpressCluster Server.	→ See 3.
You install ExpressCluster Server.	
	
Restarting the operating system.	→ See 3.
You reboot Linux.	
	
Post-installation setup.	→ See 3.2.
Reserve partitions and create a mount point.	
You tune the time from power-on until the OS startup.	
You confirm the interconnection and Public-LAN.	
You make settings for the clock synchronization.	
You make settings for the root file system.	
You change settings for your firewall.	
	
Creating the cluster configuration data.	→ See 4.
You create a cluster configuration data floppy disk by Configuration	
	
Creating the cluster	→ See 5.
You cluster servers with the clpcfgctrl command.	
	
Registering the license.	→ See 6.
You register the license with the clplnsc command.	
	
Restarting the operating system.	→ See 5.
You reboot Linux.	
	
Accessing ExpressCluster Web Manager.	→ See 7.
You access ExpressCluster Web Manager from your server.	

- ❑ Primary Site: Verified full application and data recovery functionality (manual and automatic failover) using the ExpressCluster Manager installed on the client PC at the Primary site.
- ❑ Primary Site: Verified Application client connectivity to a test database during manual and automatic failover.

- Primary Site: Verify WAN connectivity to production routers at Standby site from test laptop connected to local subnet.
- Primary Site: Make sure primary is active then isolate and shutdown Standby server from cluster
- Primary Site: Connect the interconnect cable from Primary server to production network router and verify network connectivity to Standby site router.
- Primary Site/ Standby Site: Pack and move Standby server, test laptop, to Standby site
- Standby Site: Verify WAN connectivity to production routers at Primary site from test laptop connected to local subnet.
- Standby Site: Verify WAN connectivity to server at Primary site from production routers.
- Standby Site: Install and power up Standby server connected to production routers
- Standby Site: Verify WAN connectivity to server at Primary site from Standby server
- Standby Site: Verify basic cluster management functionality from a client system running ExpressCluster Manager
- Standby Site: Return Standby server to cluster to restore normal cluster condition
- Standby Site: Verify full application and data recovery functionality over WAN



## 2 SETTING UP CONFIGURATION TOOL

### 2.1 Before Installation

Confirm the followings before installing Configuration Tool (also known as Trekking Tool) on the management client.

\* Is the operating environment in place?

Configuration Tool can work on the following environment. It only creates information. It can work on clients which cannot communicate with clustered servers, if installed.

Hardware	Models where Java virtual machine (hereinafter referred to as Java VM) can work
OS	Linux Windows®
Java VM	Sun Microsystems Java™ 2 Runtime Environment, Standard Edition Version 1.4.1_02 or newer
Web browser	Java 2 supporting browser

For details about operating systems and browsers where behaviors have been confirmed, see a separate guide, "Operational Environment".

- + To use Configuration Tool on Linux, see Section 2.2 "Installation on Linux".
- + To use Configuration Tool on Windows, see Section 2.3 "Installation on Windows".

## 2.2 Installation on Linux

To install ExpressCluster Configuration Tool on Linux, do as a root user.

- (1) Mount the installation CD-ROM.
- (2) Run the rpm command to install the package file.  
Move to the folder, /configtool, in the CD-ROM.  
Run the following;

```
rpm -i eccfg-[version #]-[release #].i386.rpm
```

Then, installation starts.

The Configuration Tool will be installed in the following place. Note that if you change this directory, you will not be able to uninstall this tool.

**Installation directory: /opt/nec/clptrek**

- (3) When you have installed the package, umount the CD-ROM.
- (4) Set the Java user policy file.  
Give Configuration Tool (Java applet) the right to access the platform OS (outside of Java VM).

See a separate guide, "Configuration Tool" for how to set the Java user policy file.

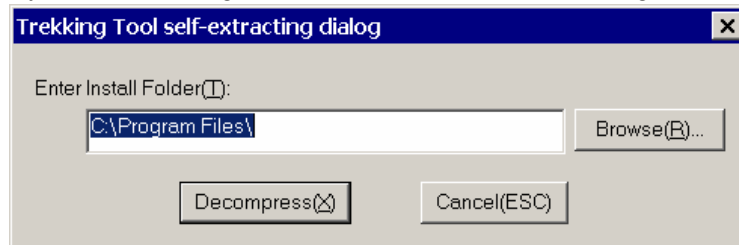
[Troubleshooting]

	Error messages	Cause	Action
1	failed to open //var/lib/rpm/packages.rpm error: cannot open //var/lib/rpm/packages.rpm	You are not a root user.	Log in as a root user.
2	error: package eccfg-* is already installed	ExpressCluster Configuration Tool is already installed.	First, uninstall. Then install it again.

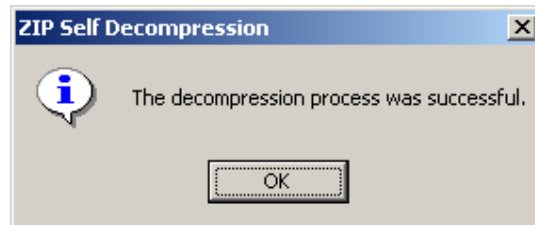
## 2.3 Installation on Windows

To install ExpressCluster Configuration Tool on Windows, install it in a place where you can access (read/write) with the security right given to you.

- (1) Run the exe file to install the package file.  
Run the \configtool\eccfg-[version #]-[release #].i386.exe in the CD-ROM. You will see the following dialog.  
Specify the Installation folder, and click [Decompress] button.  
The default installation folder is "Program Files". In the folder specified here, "nec\clptrek" directory is created for installation.
- (2) When the installation is successfully completed, you will see the following dialog.  
If you want to change the installation folder, do not change the folder structure



in "clptrek" folder. Move all files in your installation folder.



- (3) Set Java user policy file.  
Give Configuration Tool (Java applet) the right to access the platform OS (outside of Java VM).

See a separate guide, "Configuration Tool" for how to set the Java user policy file.

## 3 SETTING UP EXPRESSCLUSTER SERVER

ExpressCluster Server consists of the following system services;  
You can set it up by installing ExpressCluster Server RPM.

System service name	Description
clusterpro	ExpressCluster daemon A service of ExpressCluster itself
clusterpro_md	ExpressCluster data mirroring daemon A service for data mirroring
clusterpro_evt	ExpressCluster event A service to control syslog and logs which come 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 a cluster
clusterpro_webmgr	ExpressCluster Web Manager Web Manager service

## 3.1 Installation of ExpressCluster Server RPM

To install ExpressCluster Server RPM, you should be a root user.  
Install Server RPM on all servers as follows;

- (1) Mount the installation CD-ROM.
- (2) Run the rpm command to install the package file.  
Move to the folder, /server, in the CD-ROM.  
Run the following;  
**rpm -i ecwan-svr-[version #]-[release #].i386.rpm**

Then, installation starts.

ExpressCluster will be installed in the following place. Note that if you change this directory, you will not be able to uninstall ExpressCluster.

**Installation directory: /opt/nec/clusterpro**

- (3) When you have installed, umount the Installation CD-ROM.
- (4) Remove the Installation CD-ROM. Then, reboot servers.

[Trouble shooting]

	Error messages	Cause	Countermeasures
1	failed to open //var/lib/rpm/packages.rpm error: cannot open //var/lib/rpm/packages.rpm	You are not a root user.	Log in as a root user.
2	error: package ecwan-* is already installed	ExpressCluster have been installed.	First, uninstall. Then install it again.

## 3.2 Post-Installation Settings

After installation steps, you need to do the followings;

	Disk resources to be used	
	With mirror disk	No mirror disk
Mirror disk settings	Required	Not Required
Tuning the OS Boot Time	Required	Required
Network Settings	Required	Required
Clock synchronization settings	Required	Required
Root file system settings	Required	Required
Firewall settings	Required	Required
Loadable module verification	Required	Required

### 3.2.1 Mirror disk settings

Follow the steps below to make mirror disk settings. You set two types of partitions. One is called "cluster partition". This is to manage mirror disk resources. The other is called "data partition". This is used by the mirror disk resources. Set the partition for managing mirror disk resources (cluster partition) and the one used for them (data partition).

These steps should be performed in both servers.

- (1) If you plan to reuse a disk that you have used as a mirror disk, it is necessary to initialize it, because previous data remains in the cluster partitions. See "Reuse of Mirror Disks" section in a separate guide, "Maintenance" for initialization of cluster partitions.

- (2) Reserve cluster partitions  
Create a partition that is used only by ExpressCluster on a mirror disk. Reserve this partition on both servers.  
Use the fdisk command to reserve the partition. Use 83 (Linux) to reserve a partition ID.

Reserve one cluster partition for each mirror disk resource.

A cluster partition should have a minimum of 10MB (10\*1024\*1024 bytes) space.

The size may be larger than 10MB depending on disk geometry but this will not cause any problem.

For more information on cluster partition, refer to a separate guide "Resource Details".

- (3) Reserve a data partition  
Create a data partition that is used for mirror disk resources on a mirror disk. Reserve this partition on both servers.  
Use the fdisk command to reserve the partition. Use 83 (Linux) to reserve a partition ID.

A data partition should have 1GB or larger space. The partition size should be a multiple of 4096 bytes. The number of blocks will be a multiple of 4.

For more information on data partition, refer to a separate guide "Resource Details".

- (4) Creating file system of data partitions  
If "Perform First mkfs" is the default setting, ExpressCluster will automatically construct file system. If you have to select "Perform First mkfs" when you are creating the cluster configuration information with Configuration Tool, the system will not create file system in ExpressCluster.  
See a separate guide "Resource Details" for more information on the "Perform First mkfs" setting.

- (5) Synchronizing data partitions  
If "First Mirror Construction" is the default setting, initialization of data partitions will occur when the system is first started after it has been constructed. If you do not select "First Mirror Construction" when creating the cluster configuration information by Configuration Tool, initializing mirror configuration will not be performed in ExpressCluster.  
See a separate guide "Resource Details" for more information on the "First Mirror Construction" setting.

- (6) Create a mount point  
Create a directory to mount mirror disk resource.  
Create this mount point on both servers.

**Notes**

**The file system on a mirror disk is controlled by ExpressCluster.  
Do not enter the file system of a mirror disk in /etc/fstab in OS.**

**A cluster partition and a data partition should be created on the same disk.**



### 3.2.2 Tuning the OS startup time

Tune the OS startup time (from power-on until the OS startup). It should take longer than the followings.

- + Heartbeat timeout time

If the lilo or GRUB is used for the OS loader, tune the OS startup time as follows; Otherwise, see the setup manuals of your OS loader.

A. If the lilo is used.

1. Edit /etc/lilo.conf.

Specify the prompt option and timeout=<Startup time (in 1/10 seconds)> option. Or, specify delay=<Startup time (in 1/10 seconds)> option without specifying the prompt option. Change only the underlined parts in the following example.

```
---(Sample 1: You will be prompted. Startup time: 30 seconds)---
boot=/dev/sda
map=/boot/map
install=/boot/boot.b
prompt
linear
timeout=300
image=/boot/vmlinuz-2.4.22
    label=linux
    root=/dev/sda1
    initrd=/boot/initrd-2.4.22.img
    read-only

---(Sample 2: You will not be prompted. Startup time: 30
seconds)---
boot=/dev/sda
map=/boot/map
install=/boot/boot.b
#prompt
linear
delay=300
image=/boot/vmlinuz-2.4.22
    label=linux
    root=/dev/sda1
    initrd=/boot/initrd-2.4.22.img
    read-only
```

2. Run the /sbin/lilo command, and reflect the changes of settings.

B. If GRUB is used.

1. Edit the /boot/grub/menu.lst.

Specify the timeout <Startup time (in seconds)> option. Change only the underlined part in the following example.

```
---(Sample: Startup time: 30 seconds)---  
default 0  
timeout 30  
  
title linux  
    kernel (hd0,1)/boot/vmlinuz  
    root=/dev/sda2 vga=785  
    initrd (hd0,1)/boot/initrd  
  
title floppy  
    root (fd0)  
    chainloader +1
```

### 3.2.3 Verifying the network

Verify the network to be used for interconnects and mirror disk connect on all servers in the cluster. Use the ifconfig and ping command to proper communication and routing over the wide area network (WAN).

- public network: check for proper IP network communication to/from systems at primary and standby sites across a logical subnet over the WAN via IP addresses and host names.

- interconnect network: check for proper IP network communication between servers across a logical subnet over the WAN via IP addresses, make sure round-trip latency between servers is less than 70ms and available network bandwidth is at least 3 times the required target application I/O throughput.

**Note:**

**You do not need to specify the IP address on the OS side for FIP Resources to be used in a cluster.**

### 3.2.4 Clock synchronization

It is recommended for cluster systems to synchronize clocks of servers on regular basis with ntp or by other means.

If forced mirror recovery is necessary, it is recommended to synchronize times on all servers because a server having the latest data needs to be determined according to the mirror break time.

### 3.2.5 Root file system

The file system which is capable of journaling is recommended for the OS root file system.

### 3.2.6 Firewall

ExpressCluster uses several port numbers. You need to change your firewall settings so that ExpressCluster can use some port numbers.

For details of port numbers to be used by ExpressCluster, see a separate guide, "Maintenance".

### 3.2.7 Verifying loadable module

Check that loadable modules are properly configured by using the ls command. Run the following command to see that liscal.o exists.

```
ls -l /opt/nec/clusterpro/drivers/md
```

If there is no liscal.o, there is a possibility that a distribution or kernel not supported by ExpressCluster is being used.

For information on supported distributions and kernels, see a separate guide, "Operational Environment".

# 4 HOW TO CREATE CLUSTER CONFIGURATION DATA

## 4.1 Cluster Environment Sample

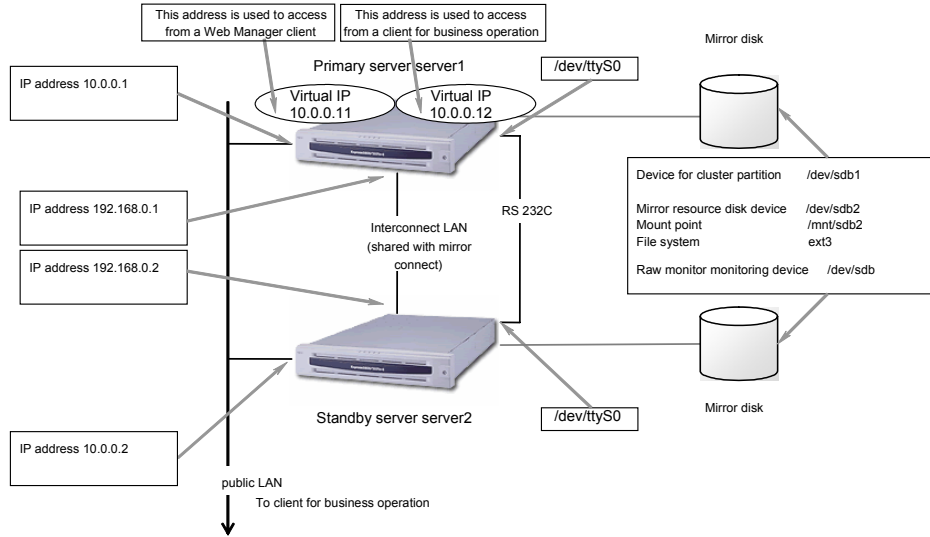
The table below shows typical settings to create a 2-node cluster environment. This section describes how to create a cluster configuration data on this condition step by step.

	Parameters	Values
Cluster configuration	Cluster name	cluster
	Number of servers	2
	Number of failover groups	2
	Number of monitor resources	6
	Heartbeat resource	Number of LAN heartbeats
Number of COM heartbeats		1
1st server information (master server)	Server name	server1
	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 devices	/dev/ttyS0
	Mirror disk connect	192.168.0.1
2nd server information	Server name	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/ttyS0
Mirror disk connect	192.168.0.2	
1st group (for Web Manager)	Type	Failover
	Group name	Web Manager
	Startup server	server1→server2
	Number of group resources	1
1st group resource *1	Type	floating ip resource
	Group resource name	WebManagerFIP1
	IP address	10.0.0.11
2nd group (for business operation use)	Type	Failover
	Group name	failover1
	Startup server	server1→server2
	Number of group resources	3
1st group resource	Type	floating ip resource
	Group resource name	fip1
	IP address	10.0.0.12
2nd group resource	Type	mirror disk resource
	Group resource name	md1
	Mirror partition device name	/dev/NMP1
	Mirror mount point	/mnt/sdb2
	Data partition device name	/dev/sdb2
	Cluster partition device name	/dev/sdb1
	Disk device name	/dev/sdb
File system	ext3	
Mirror data port number	29051	

	Parameters	Values
3rd group resource	Type	execute resource
	Group resource name	exec1
	Script	Standard script
1st monitor resource (created by default)	Type	user mode monitor
	Monitor resource name	userw
2nd monitor resource (automatically created after a mirror disk resource is created)	Type	mirror disk connect monitor
	Monitor resource name	mdnw1
	Monitoring mirror disk connect	No.1
	When an error is detected	Take no action
3rd monitor resource (automatically created after a mirror disk resource is created)	Type	mirror disk monitor
	Monitor resource name	mdw1
	Monitoring mirror disk resource	md1
	When an error is detected	Take no action
4th monitor resource	Type	raw monitor
	Monitor resource name	raww1
	Monitoring target raw device	/dev/raw/raw2
	Device name	/dev/sdb *2
	When an error is detected	Stop Cluster daemon and OS Shutdown
5th monitor resource	Type	ip monitor
	Monitor resource name	ipw1
	Monitoring IP address	10.0.0.254 (gateway)
	When an error is detected	Failover of the "WebManager" group *3
6th monitor resource	Type	ip monitor
	Monitor resource name	ipw2
	Monitoring IP address	10.0.0.254 (gateway)
	When an error is detected	Failover of the "failover1" group *3

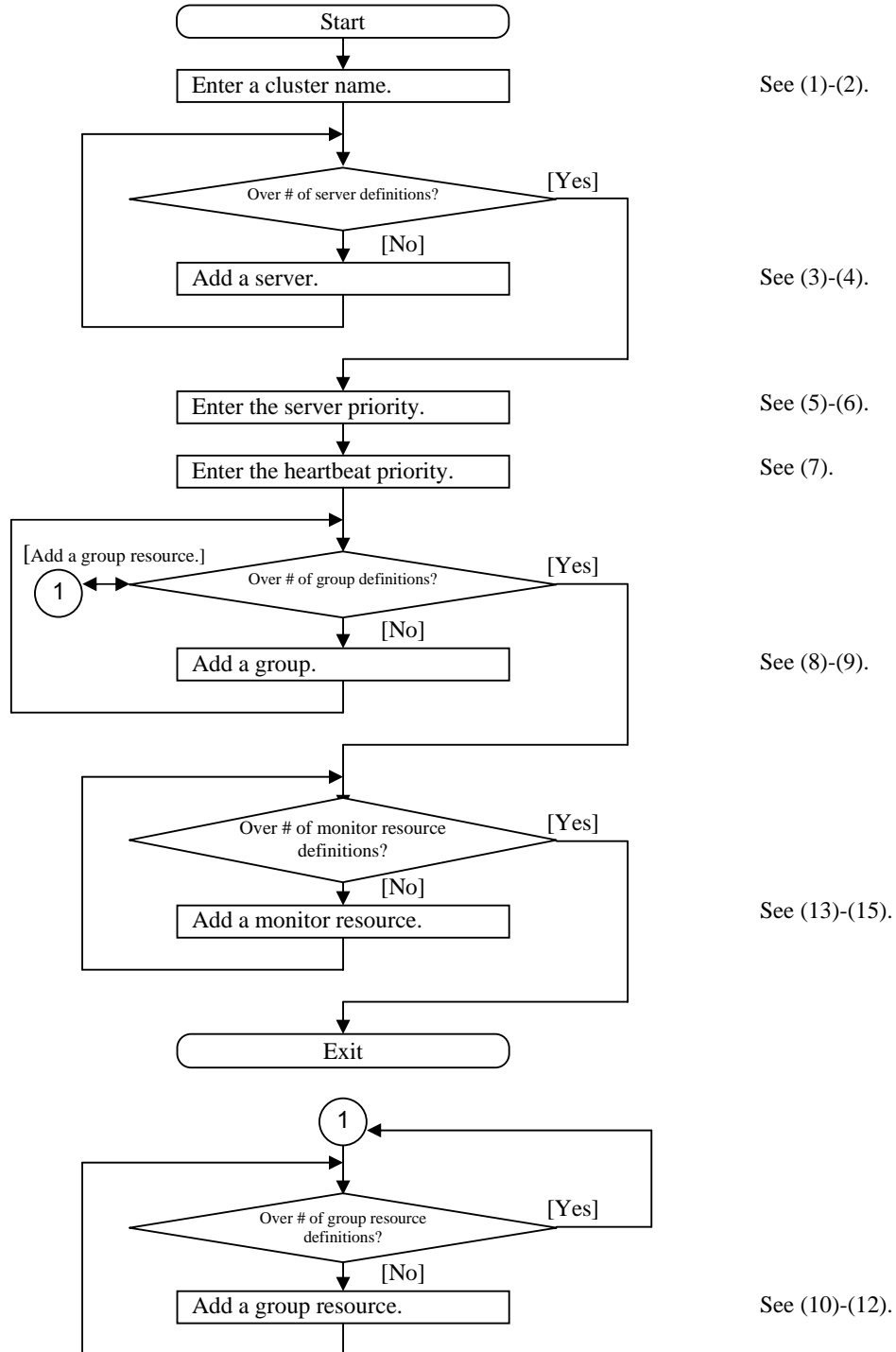
- = \*1: Prepare a floating IP address for starting Web Manager. Add it to the dedicated group. Unless Web Manager dedicated group does not stop, you can access it from Web browser without being aware of the server's real IP.
- = \*2: \*2: This setting sample is for 2.4 kernels. For 2.6 kernel setting samples, see Section 2.3 "RAW monitor resource" in a separate guide, "Resource Details."
- = \*3: For detailed settings for trying failover when all Interconnect LANs are disconnected, see "Monitor Resources" section in a separate guide, "Configuration Tool".

This cluster configuration is illustrated below.



## 4.2 Steps To Create Cluster Configuration Data

Cluster configuration data is created as follows;



- (1) Start Configuration Tool.  
Load Configuration Tool's html file on your Web browser.

For Linux:

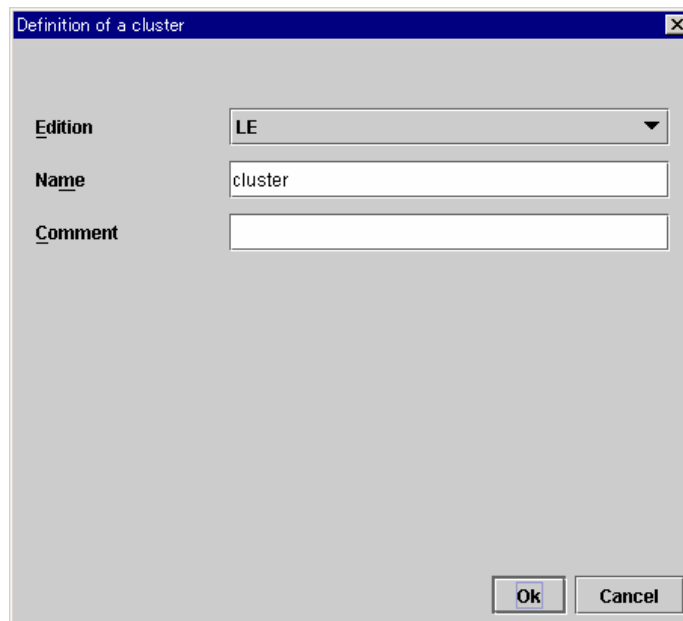
file:///opt/nec/clptrek/clptrek.html

For Windows:

file:///<Installation path>/clptrek.html

Menu bar means Configuration Tool's menu bar in the following explanations. You can repeat the following steps as many times as you need. You can change almost all settings you specify here by the rename function or properties view function. Dialog boxes in the following explanation are the same as corresponding tab pages of properties view function. See a separate guide, "Configuration Tool" for details.

- (2) Select [Edit | Add] from the menu bar.  
Select "LE" for the Edition in the dialog box below. Enter the cluster name.  
Click [Ok].  
Cluster name: cluster



Definition of a cluster

**E**dition LE

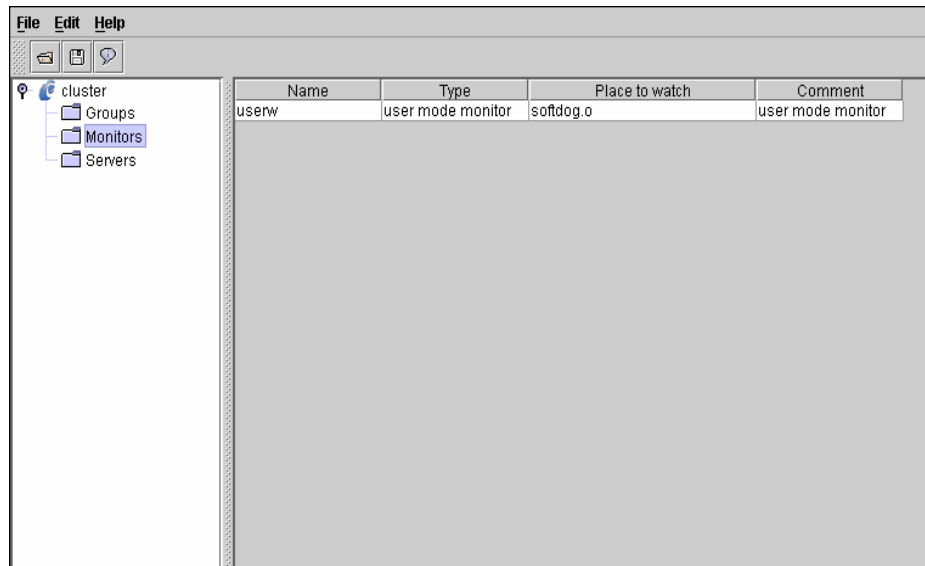
**N**ame cluster

**C**omment

Ok Cancel



The tree view looks like as follows;



When the cluster name is defined, "user mode monitor" is defined.

- (3) Select "Servers" on the tree view.  
Select [Edit | Add] from the menu bar.  
The server's definition dialog box is displayed. Enter data for the 1st server.

Server name	server1
LAN heartbeat IP address (Dedicated)	192.168.0.1
LAN heartbeat IP address (Backup)	10.0.0.1
Public IP address	10.0.0.1
COM heartbeat device	/dev/ttyS0
Mirror disk connect	192.168.0.1

- A. Enter the server name in the following dialog box. Click [Next].

Definition of a server

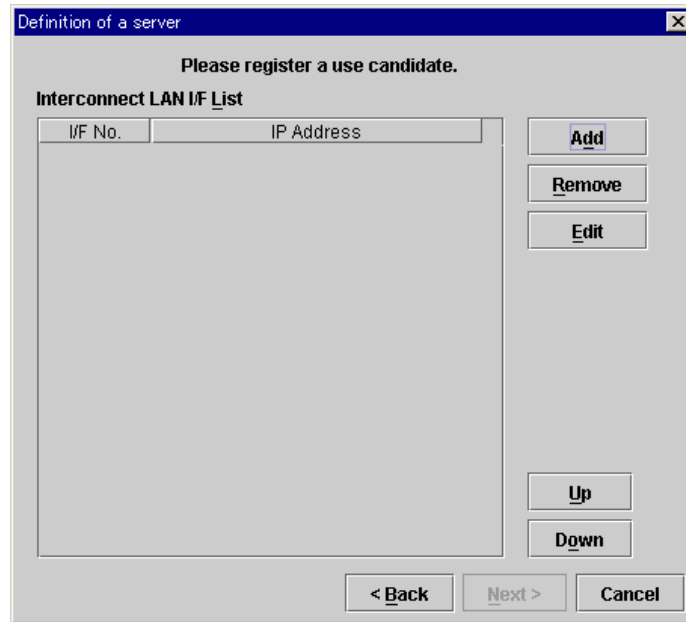
**Name**

**Comment**

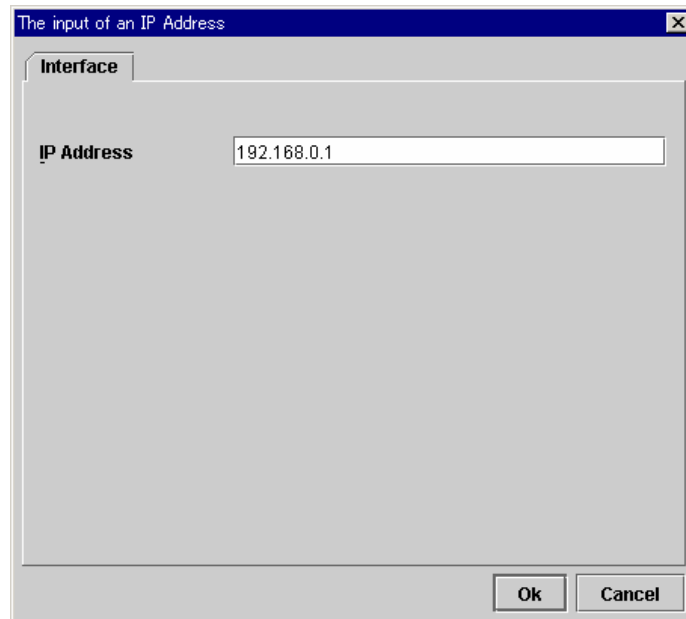
Please click the [Next] to continue.

< Back    Next >    Cancel

- B. Click [Add] in the following dialog box to set the LAN heartbeat IP address.



Enter the LAN heartbeat IP address (Dedicated) in the following dialog box and click [Ok]. Then, it will be added in "Interconnect LAN I/F List".



Likewise, enter the LAN heartbeat IP address (Backup). When you have set both LAN heartbeat IP addresses, click [Next].

Definition of a server

Please register a use candidate.

**Interconnect LAN IF List**

IF No.	IP Address
1	192.168.0.1
2	10.0.0.1

Buttons: Add, Remove, Edit, Up, Down, < Back, Next >, Cancel

- C. Click [Add] in the following dialog box to set the public IP address.

Definition of a server

Please register a use candidate.

**Public LAN IF List**

IF No.	IP Address
--------	------------

Add  
Remove  
Edit  
Up  
Down

< Back   Next >   Cancel

Enter the public IP address in the following dialog box. Click [Ok].

The input of an IP Address

Interface

IP Address   10.0.0.1

Ok   Cancel

Confirm the address is in "Public LAN I/F List". Click [Next].

Definition of a server

Please register a use candidate.

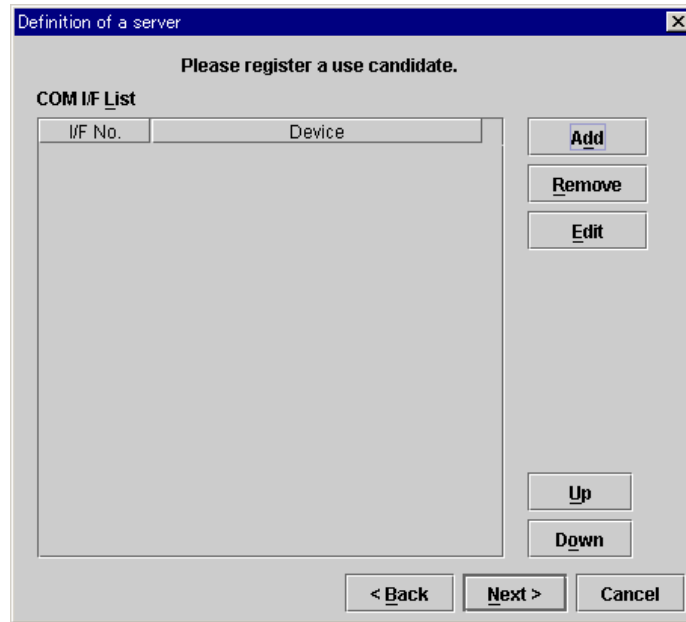
**Public LAN I/F List**

I/F No.	IP Address
1	10.0.0.1

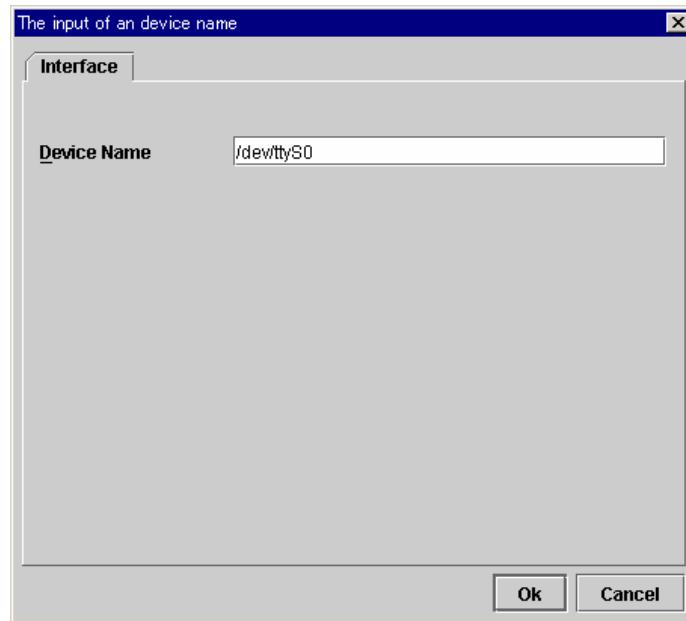
Add  
Remove  
Edit  
Up  
Down

< Back   Next >   Cancel

- D. Click [Add] in the following dialog box to set the COM heartbeat device.



The default COM heartbeat device name is set in the following dialog box. In this sample, you can keep the default value. Click [Ok].



Confirm the device is in "COM I/F List". Click [Next].

Definition of a server

Please register a use candidate.

**COM I/F List**

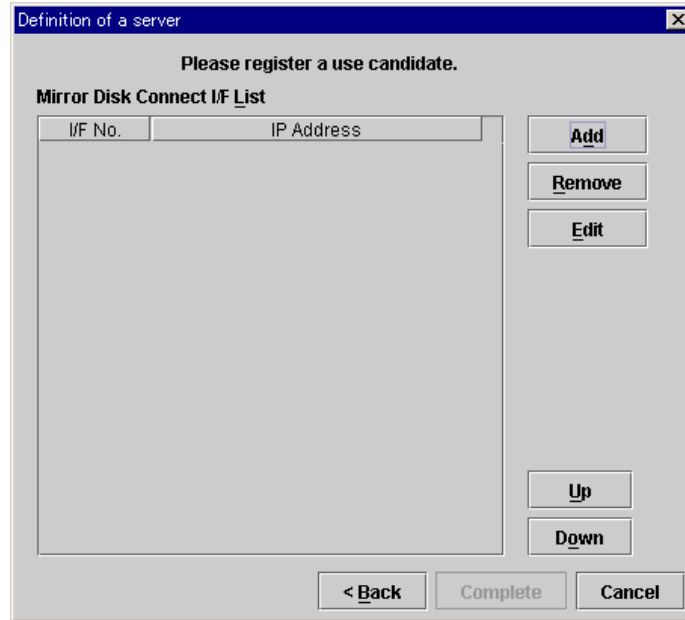
I/F No.	Device
1	/dev/ttyS0

Add  
Remove  
Edit  
Up  
Down

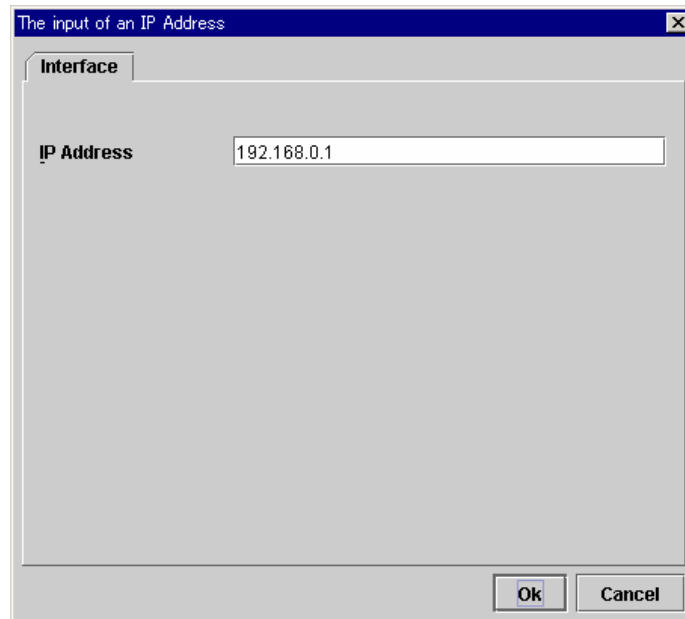
< Back   Next >   Cancel



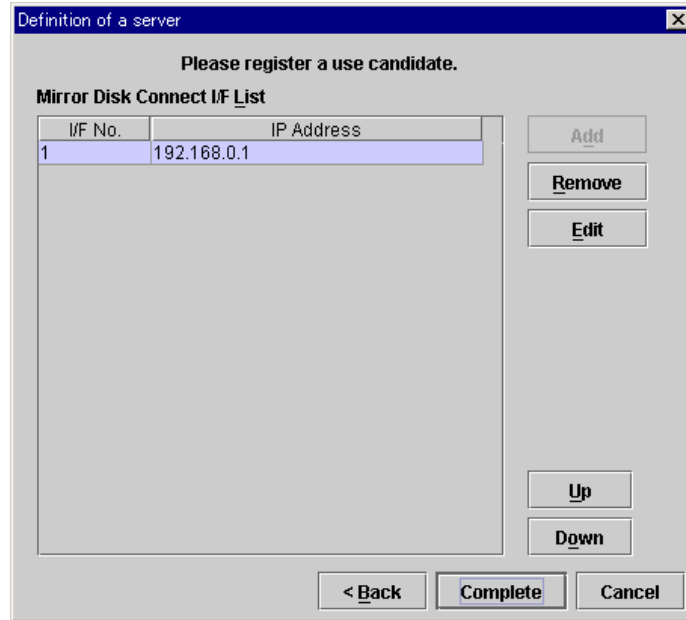
- E. Click [Add] in the following dialog box to configure a mirror disk connect I/F.



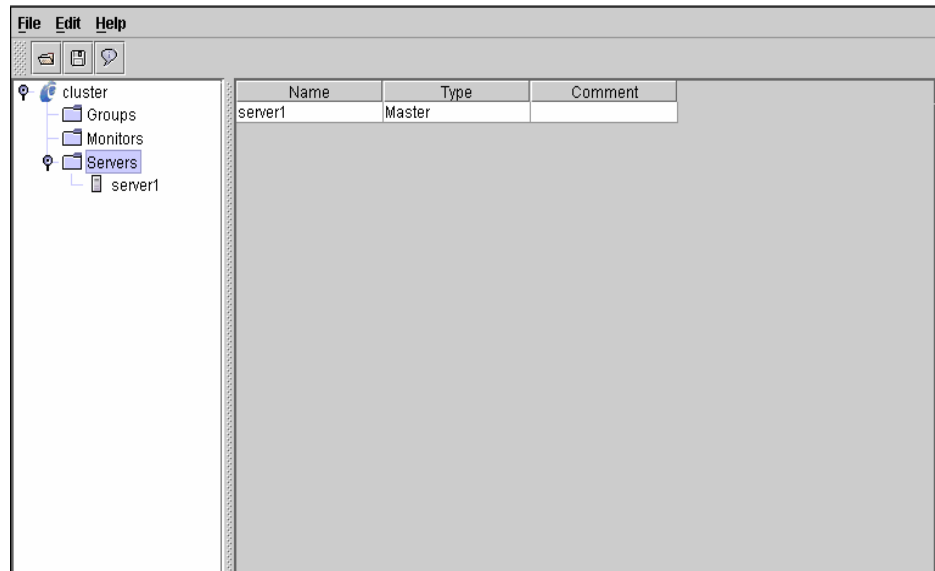
Enter the IP address used for the mirror disk connect in the following dialog box. Click [Ok].



Confirm the address is in "Mirror Disk Connect I/F List". Click [Complete].



The tree view looks like as follows. The first defined server becomes the master server by default.



- (4) Select "Servers" on the tree view. Select [Edit | Add] from the menu bar. Enter data for the second server.

Server name	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/ttyS0
Mirror disk connect	192.168.0.2

- A. Enter the server name in the following dialog box. Click [Next].

Definition of a server

**Name**

**Comment**

Please click the [Next] to continue.

< Back    Next >    Cancel

- B. Click [Edit] in the following dialog box to set the LAN heartbeat IP address. For the second and further server definitions, as many interfaces as the master server has are provided. The initial values are blank for IP address. Enter corresponding IP addresses to the interface numbers registered on other servers.

I/F No.	IP Address
1	
2	

Enter the LAN heartbeat IP address (Dedicated) in the following dialog box. Click [Ok]. Then, it will be added in "Interconnect LAN I/F List".

Interface

IP Address 192.168.0.2

Select "2" in I/F No. As you did in the previous step, enter the LAN heartbeat IP address (Backup), too. When you have entered two LAN heartbeat IP addresses, click [Next].

Definition of a server

Please register a use candidate.

**Interconnect LAN I/F List**

I/F No.	IP Address
1	192.168.0.2
2	10.0.0.2

Buttons: Add, Remove, Edit, Up, Down

Navigation: < Back, Next >, Cancel

- C. Click [Edit] in the following dialog box to set the Public IP address.

I/F No.	IP Address
1	

Enter the public IP address in the following dialog box. Click [OK].

Interface

IP Address: 10.0.0.2

Confirm that the IP address was added to “Public LAN I/F List”. Click [Next].

Definition of a server

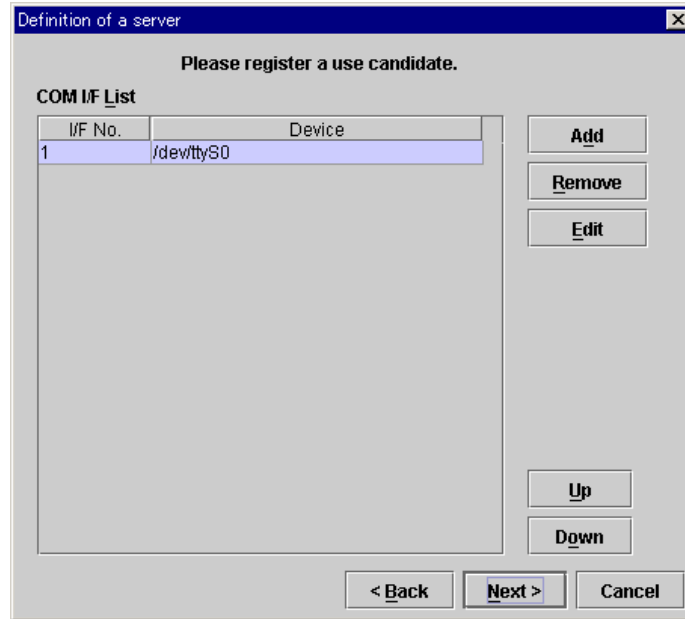
Please register a use candidate.

**Public LAN I/F List**

IF No.	IP Address
1	10.0.0.2

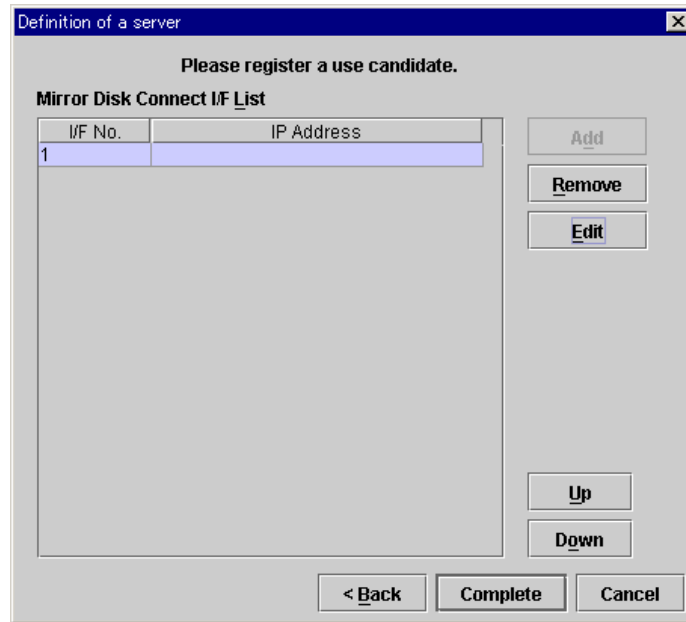
Buttons: Add, Remove, Edit, Up, Down, < Back, Next >, Cancel

- D. The following screen appears. Just, click [Next]. Like you saw in the previous step, as many interfaces as the master server has are provided. The COM heartbeat device name of the master server is set by default.

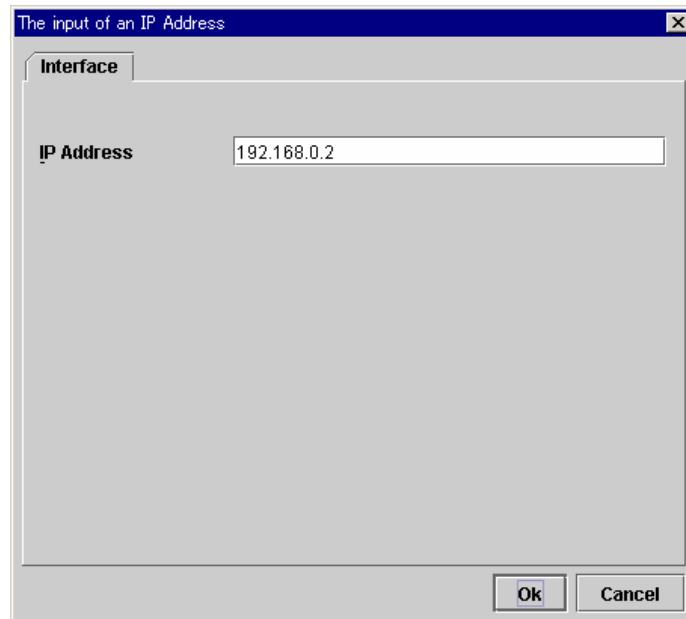




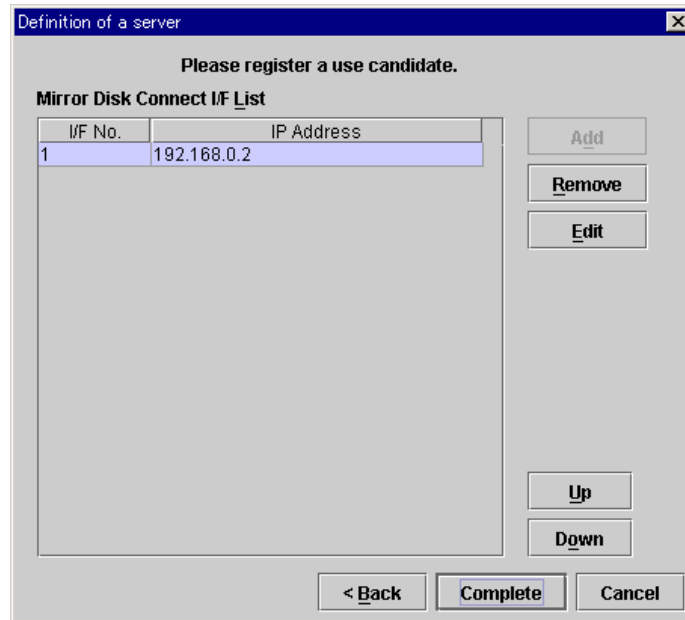
- E. Click [Edit] in the following dialog box to configure a mirror disk connect.



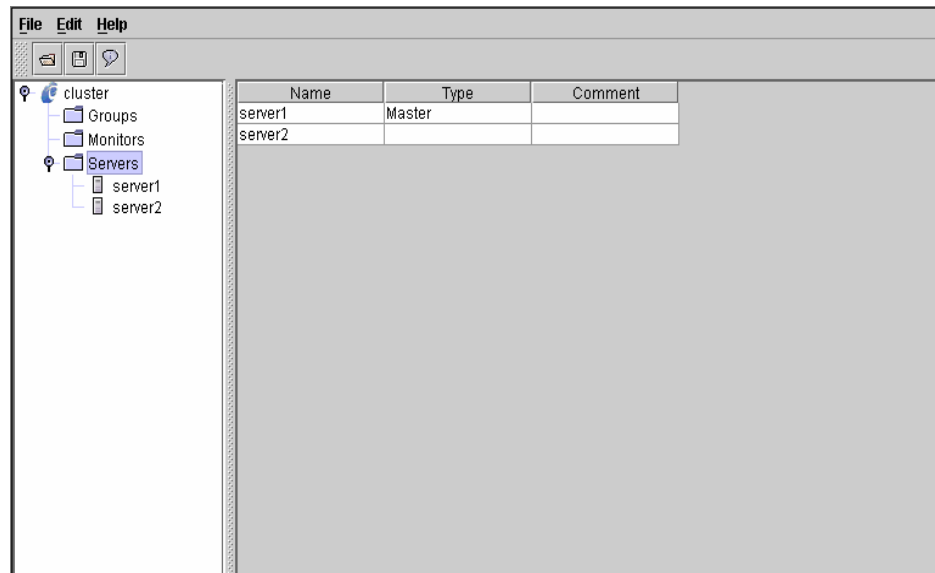
Enter the IP address you are going to use for the mirror disk connect in the following dialog box. Click [Ok].



Confirm the address was added to "Mirror Disk Connect I/F List". Click [Complete].



The tree view looks like as follows;



- (5) Select “Cluster name” in the tree view. Select [Edit | Property] from the menu bar.  
Select [Master Server] tab on the following dialog box.

The screenshot shows a dialog box titled "[ cluster ] Cluster Property". It has several tabs: Monitor, Mail Report, WebManager, Alert Log, Mirror, Information, Heartbeat I/F, Master Server (selected), Timeout, and Port No. The "Name" field contains the text "cluster". The "Comment" field is empty. At the bottom, there are buttons for "Ok", "Cancel", and "Apply".

- (6) Confirm you see the followings in the [Master Server] tab.  
If the master server setting is correct, select [Heartbeat I/F] tab.  
If not, click [Up] or [Down] button to set the master server to “server1”.

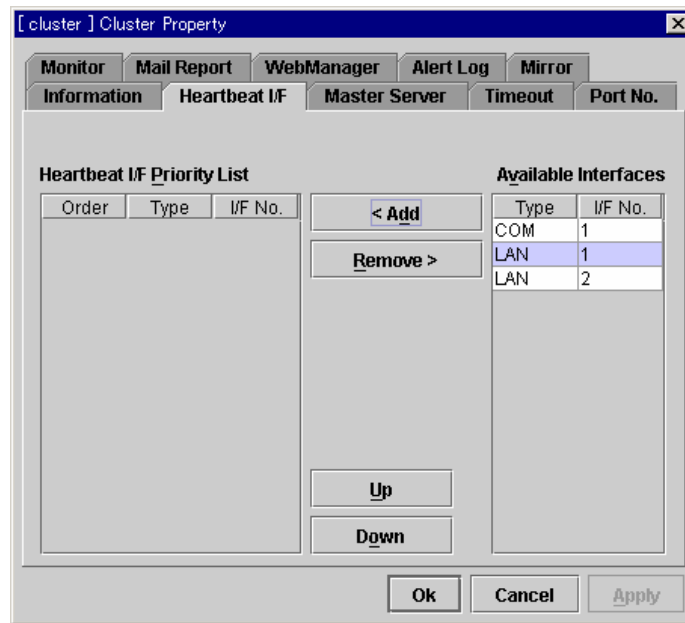
The screenshot shows the same dialog box, but the "Master Server" tab is active. It displays a "Server Priority List" table with two rows. The first row is highlighted and labeled "Master Server" in the "Order" column, with "server1" in the "Name" column. The second row has "1" in the "Order" column and "server2" in the "Name" column. To the right of the table are "Up" and "Down" buttons. At the bottom, there are buttons for "Ok", "Cancel", and "Apply".

Order	Name
Master Server	server1
1	server2

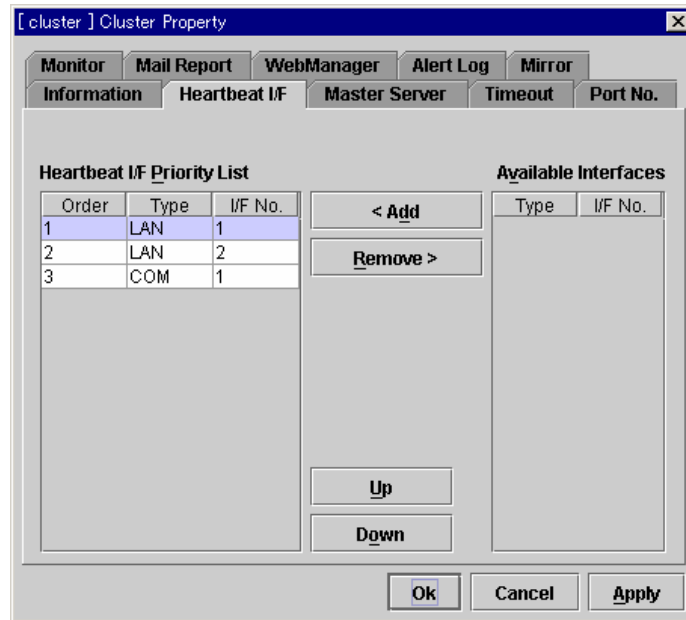
- (7) Make settings in [Heartbeat I/F] tab for interfaces which servers in the cluster use for heartbeat.

# of LAN heartbeats	2
# of COM heartbeats	1

- A. Select "LAN 1" in "Available Interfaces". Then click [Add].



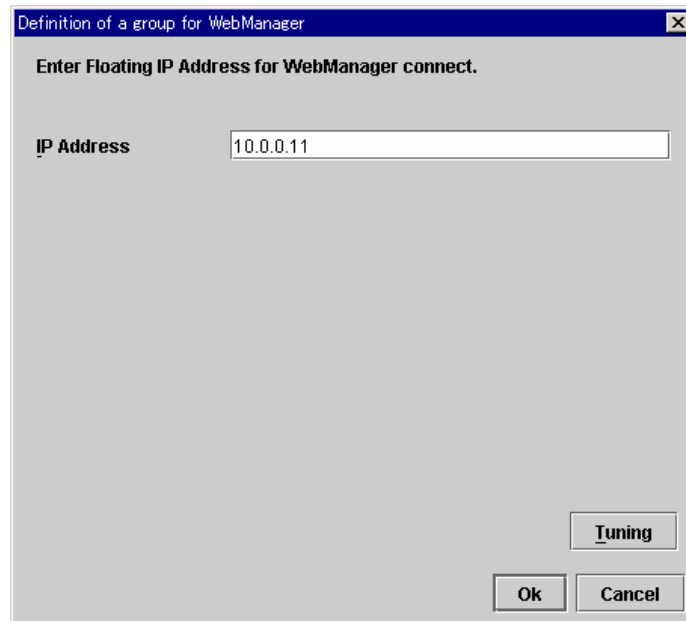
Likewise, add "LAN 2" and "COM 1" in this order.  
Confirm the heartbeat interface priorities are set as follows. Click [Ok].



- (8) Select "Groups" in the tree view. Select [Edit | Add group for WebManager] from the menu bar.  
Enter data for Web Manager group.

Floating IP address	10.0.0.11
---------------------	-----------

- A. Enter the IP address in the following dialog box. Click [OK].



Definition of a group for WebManager

Enter Floating IP Address for WebManager connect.

IP Address 10.0.0.11

Tuning

Ok Cancel

The tree view looks like as follows;

The screenshot shows a software interface with a menu bar (File, Edit, Help) and a toolbar. On the left is a tree view under the heading 'cluster'. The tree structure is as follows:

- cluster
  - Groups
    - WebManager
  - Monitors
  - Servers
    - server1
    - server2

The 'WebManager' item is selected. On the right side of the interface, there are two tabs: 'Resource List' (active) and 'Whole Dependence'. Below the tabs is a table with the following data:

Name	Type	Resource Information	Comment
WebManagerFIP1	floating ip resource	10.0.0.11	floating ip resource

- (9) Select “Groups” in the tree view. Select [Edit | Add] from the menu bar. Enter data for the second group.

Type	Failover
Group name	failover1
Startup server	server1→server2

- A. Enter the group name in the following dialog box. Click [Next].

Definition of a group

Type: failover

Name: failover1

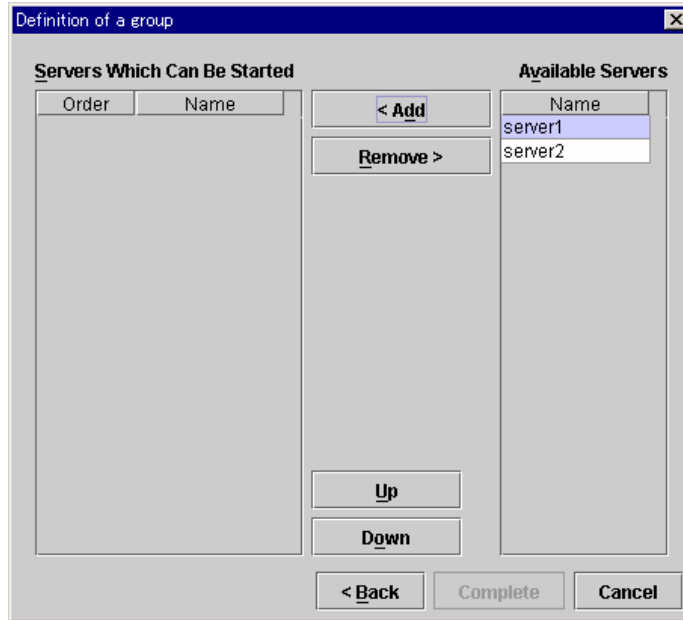
Comment:

Please click the [Next] to continue.

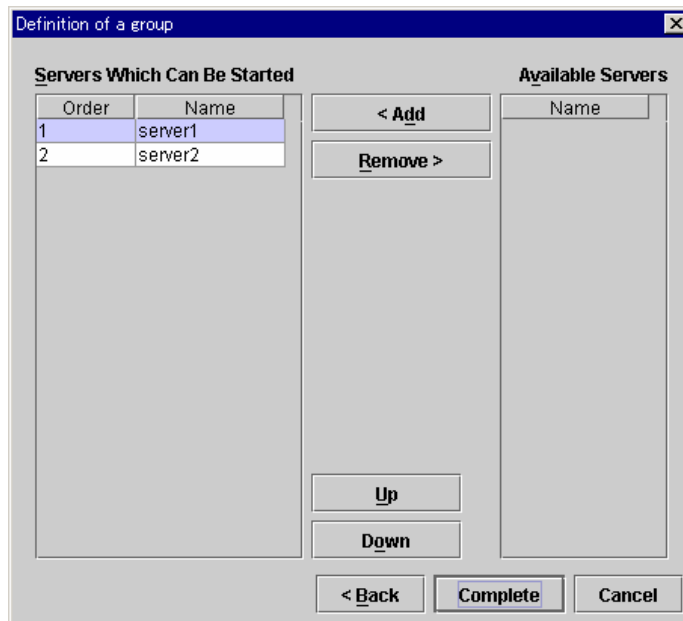
< Back   Next >   Cancel



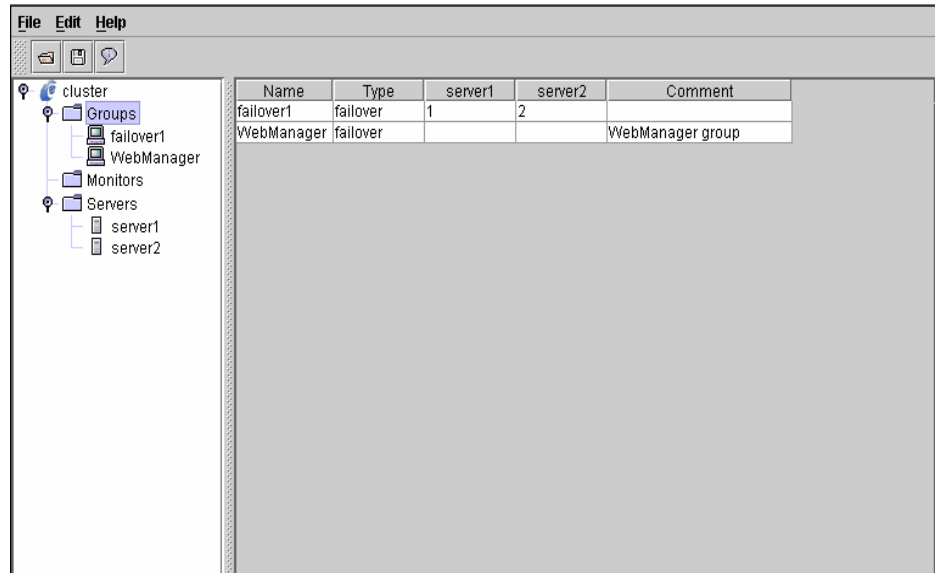
- B. Select "server1" from "Available Servers". Click [Add].



Likewise, add "server2".  
Confirm the priorities are set as follows. Click [Complete].



The tree view looks like as follows;



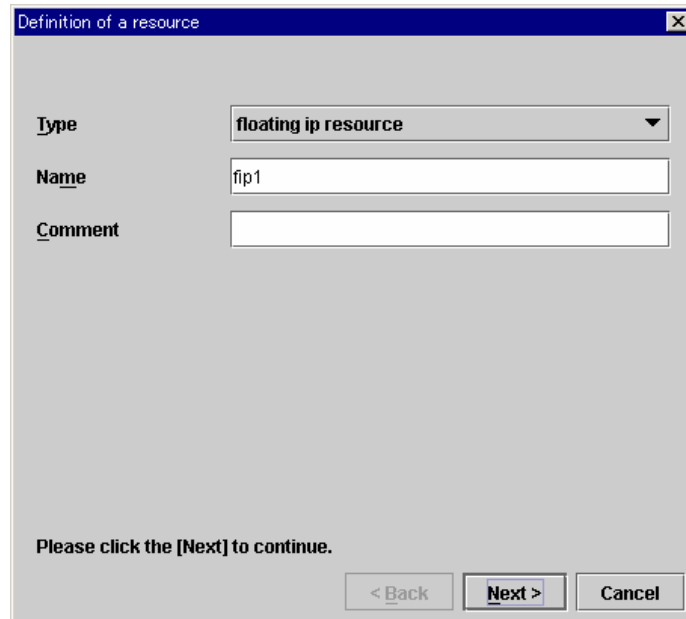
The screenshot displays a software interface with a menu bar (File, Edit, Help) and a toolbar. On the left is a tree view under a 'cluster' root, showing a 'Groups' folder containing 'failover1', 'WebManager', and 'Monitors', and a 'Servers' folder containing 'server1' and 'server2'. On the right is a table with the following data:

Name	Type	server1	server2	Comment
failover1	failover	1	2	
WebManager	failover			WebManager group

- (10) Select “failover1” in the tree view. Select [Edit | Add] from the menu bar. Enter data for the first group resource.

Type	floating ip resource
Group resource name	fip1
IP address	10.0.0.12

- A. Enter the type and group resource name in respective fields in the following dialog box. Click [Next].



Definition of a resource

Type: floating ip resource

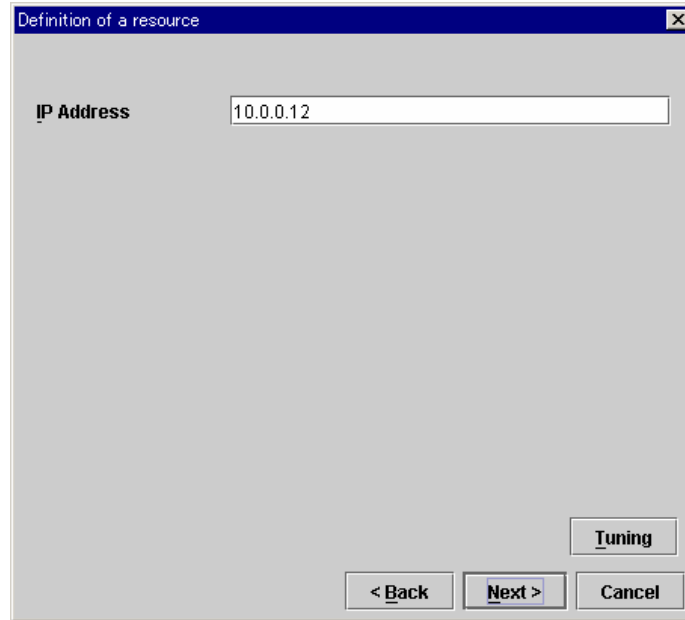
Name: fip1

Comment:

Please click the [Next] to continue.

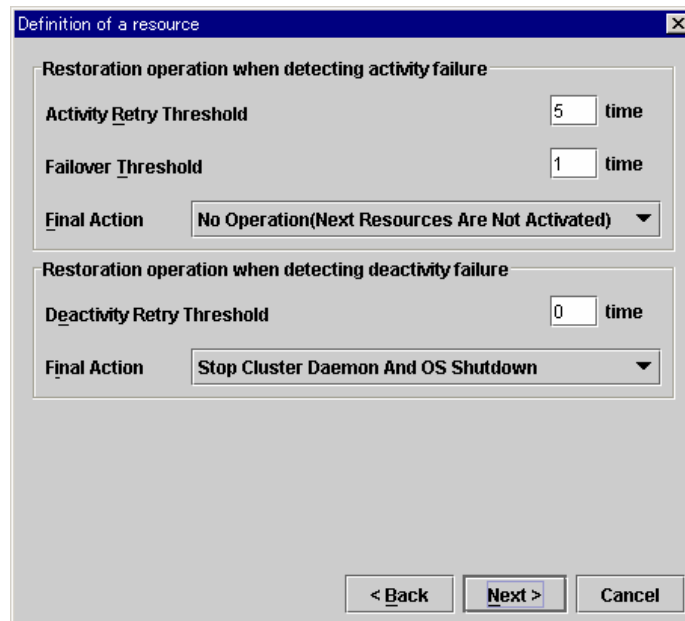
< Back   Next >   Cancel

- B. Enter "IP Address" in the following dialog box. Click [Next].



The screenshot shows a dialog box titled "Definition of a resource". It contains a text input field labeled "IP Address" with the value "10.0.0.12". At the bottom right, there are four buttons: "< Back", "Next >", "Cancel", and "Tuning".

- C. Click [Next] in the following dialog box.



The screenshot shows the same "Definition of a resource" dialog box, but with additional configuration options. It is divided into two sections:

- Restoration operation when detecting activity failure:**
  - Activity Retry Threshold: 5 time
  - Failover Threshold: 1 time
  - Final Action: No Operation(Next Resources Are Not Activated)
- Restoration operation when detecting deactivity failure:**
  - Deactivity Retry Threshold: 0 time
  - Final Action: Stop Cluster Daemon And OS Shutdown

At the bottom, there are three buttons: "< Back", "Next >", and "Cancel".

D. Click [Complete] in the following dialog box.

The dialog box is titled "Definition of a resource" and has a close button (X) in the top right corner. It contains the following elements:

- A checked checkbox labeled "Default dependence is followed".
- A section titled "Depended Resources" containing an empty table with two columns: "Name" and "Resource type".
- A section titled "Available Resources" containing an empty table with one column: "Name".
- Between the two tables are two buttons: "< Add" and "Remove >".
- At the bottom of the dialog are three buttons: "< Back", "Complete", and "Cancel".

- (11) Select “failover1” in the tree view. Select [Edit | Add] from the menu bar. Enter data for the second group resources.

Type	Mirror Disk Resource
Group resource name	md1
Mirror partition device name	/dev/NMP1
Mirror mount point	/mnt/sdb2
Data partition device name	/dev/sdb2
Cluster partition device name	/dev/sdb1
Disk device name	/dev/sdb
File system	ext3
Mirror data port number	29051

- A. Enter the type and group resource name in respective fields in the following dialog box. Click [Next].

Definition of a resource

Type: mirror disk resource

Name: md1

Comment:

Please click the [Next] to continue.

< Back   Next >   Cancel

- B. Enter “Mirror Partition Device Name”, “Mirror Mount Point”, “Data Partition Device Name”, “Cluster Partition Device Name”, “Disk Device Name”, “File System” and “Mirror Data Port Number” in the following dialog box. Click [Next].

Definition of a resource

Mirror Partition Device Name: /dev/NMP1

Mirror Mount Point: /mnt/sdb2

Data Partition Device Name: /dev/sdb2

Cluster Partition Device Name: /dev/sdb1

Disk Device Name: /dev/sdb

File System: ext3

Mirror Data Port Number: 29051

Tuning

< Back Next > Cancel

- C. Click [Next] in the following dialog box.

Definition of a resource

Restoration operation when detecting activity failure

Activity Retry Threshold: 0 time

Failover Threshold: 1 time

Final Action: No Operation(Next Resources Are Not Activated)

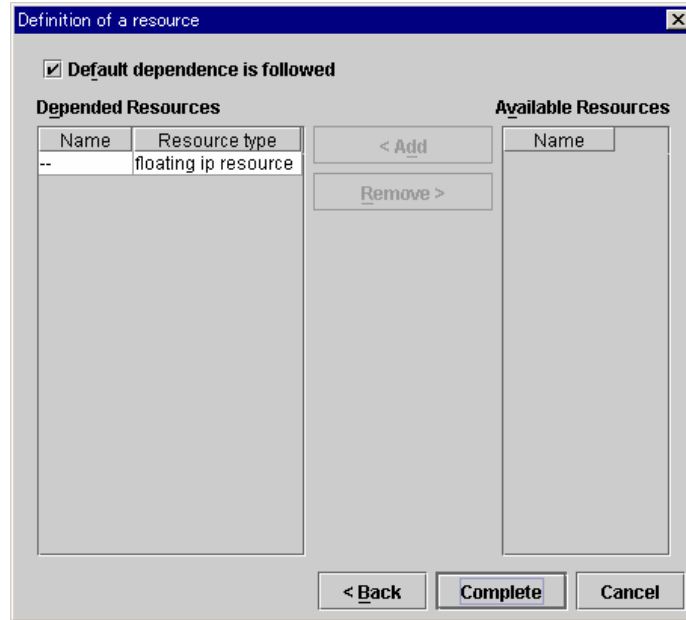
Restoration operation when detecting deactivity failure

Deactivity Retry Threshold: 0 time

Final Action: Stop Cluster Daemon And OS Shutdown

< Back Next > Cancel

D. Click [Complete] in the following dialog box.

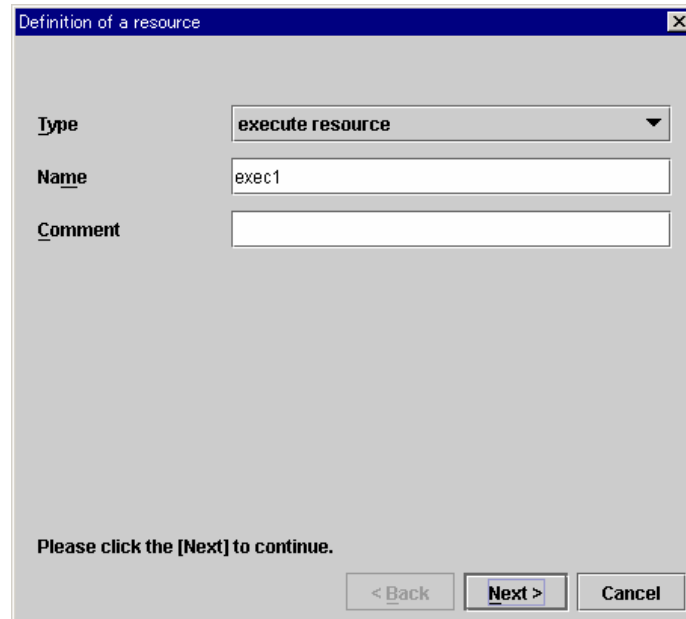




- (12) Select “failover1” in the tree view. Select [Edit | Add] from the menu bar. Enter data for the third group resources.

Type	execute resource
Group resource name	exec1
Script	Standard script

- A. Enter the type and group resource name in respective fields in the following dialog box. Click [Next].



Definition of a resource

Type: execute resource

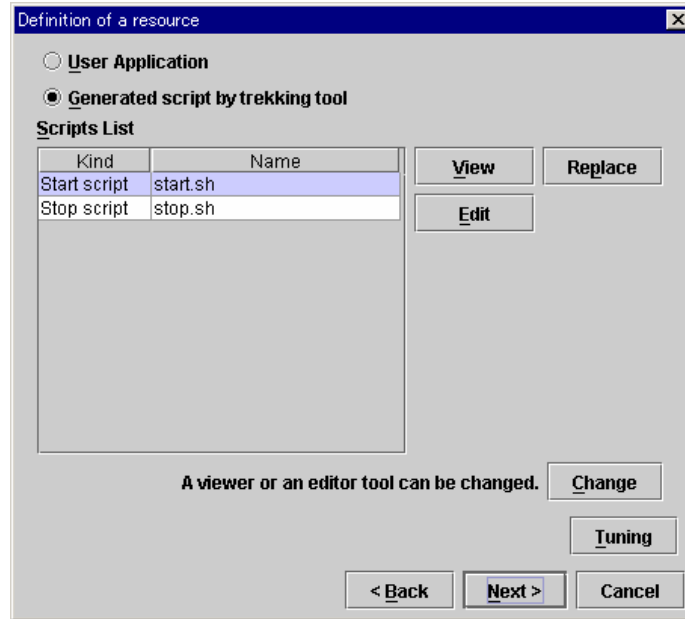
Name: exec1

Comment:

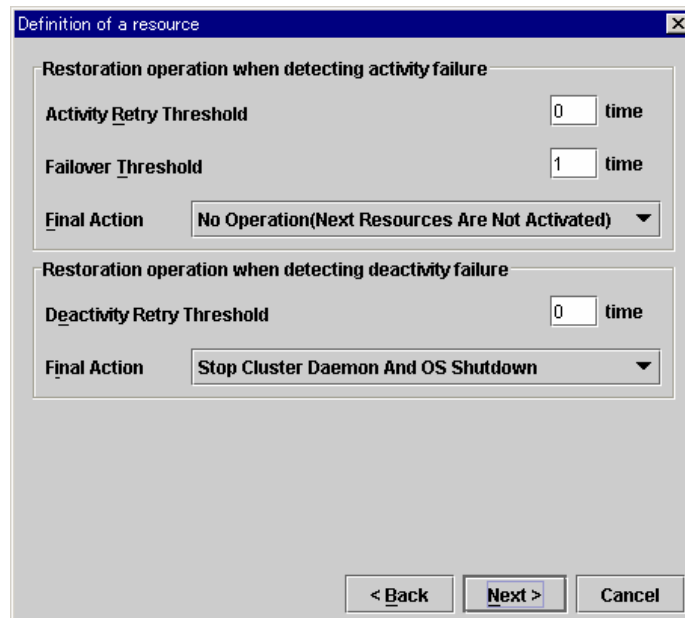
Please click the [Next] to continue.

< Back   Next >   Cancel

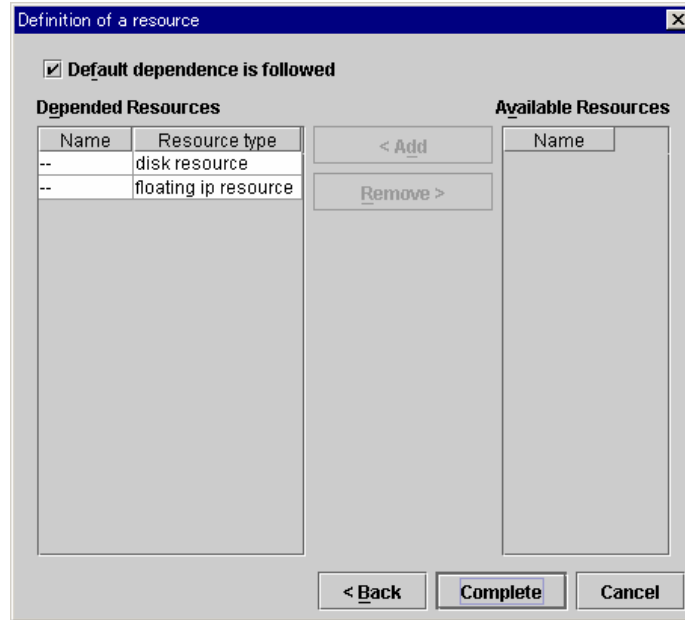
- B. Select [Generated script by configuration tool] in the following dialog box. Click [Next].  
 You can write codes to start or stop service applications by editing these scripts.



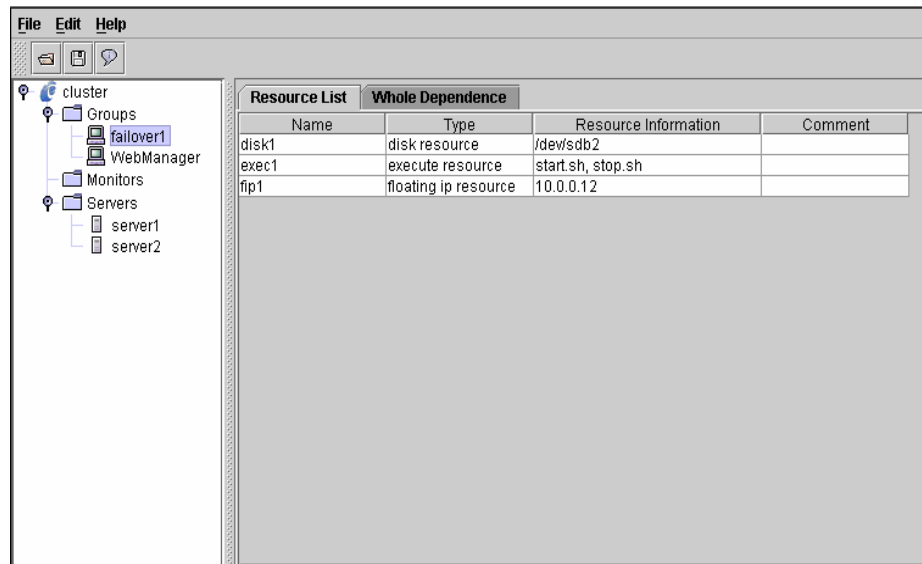
- C. Click [Next] in the following dialog box.



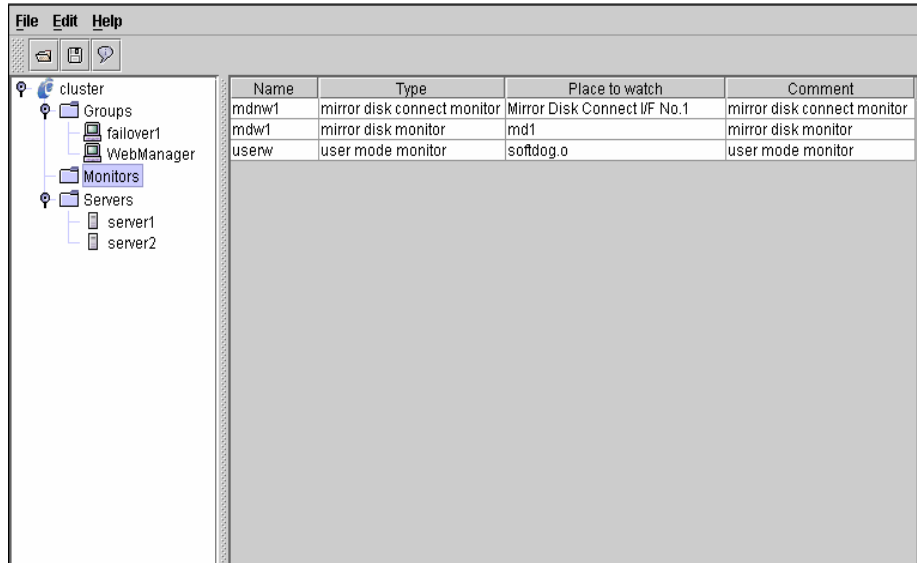
D. Click [Complete] in the following dialog box.



The table view of failover1 looks like:



When you have defined the mirror disk resource, “mirror disk connect monitor” and “mirror disk monitor” are defined.  
The table view of Monitors looks like:



The screenshot shows a software interface with a menu bar (File, Edit, Help) and a toolbar. On the left is a tree view showing a hierarchy: cluster > Groups > failover1 > WebManager > Monitors. Below this are Servers > server1 and server2. On the right is a table with the following data:

Name	Type	Place to watch	Comment
mdnw1	mirror disk connect monitor	Mirror Disk Connect I/F No.1	mirror disk connect monitor
mdw1	mirror disk monitor	md1	mirror disk monitor
userw	user mode monitor	softdog.o	user mode monitor

- (13) Select “Monitors” in the tree view. Select [Edit | Add] from the menu bar. Enter the data for the fourth monitor resource. The first monitor resource was created when the cluster name is defined. The second and third monitor resources were created when the mirror disk resource was defined.

Type	raw monitor
Monitor resource name	raww1
Monitored target raw device	/dev/raw/raw2
Device name	/dev/sdb
When abnormality detected	Stop Cluster Daemon And OS Shutdown

- A. Enter the type and monitor resource name in respective fields in the following dialog box. Click [Next].

Definition of a monitor resource

Type: raw monitor

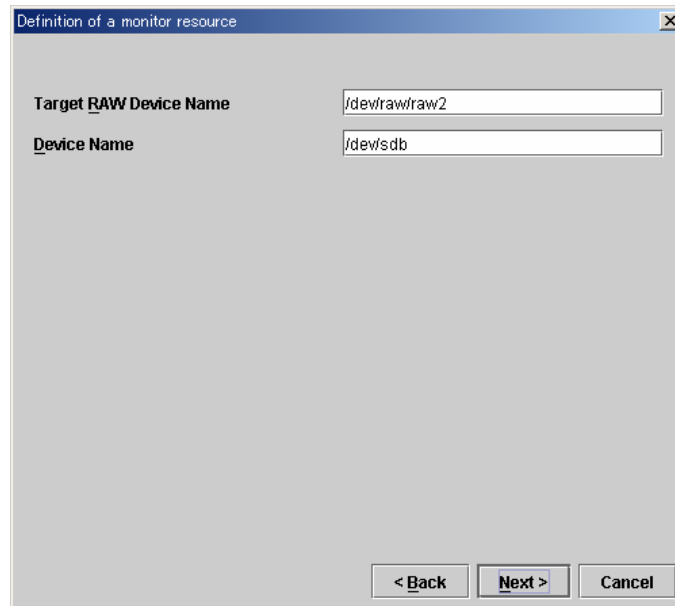
Name: raww1

Comment:

Please click the [Next] to continue.

< Back   Next >   Cancel

- B. Enter “Target Raw Device Name” and “Device Name” in the following dialog box. Click [Next].



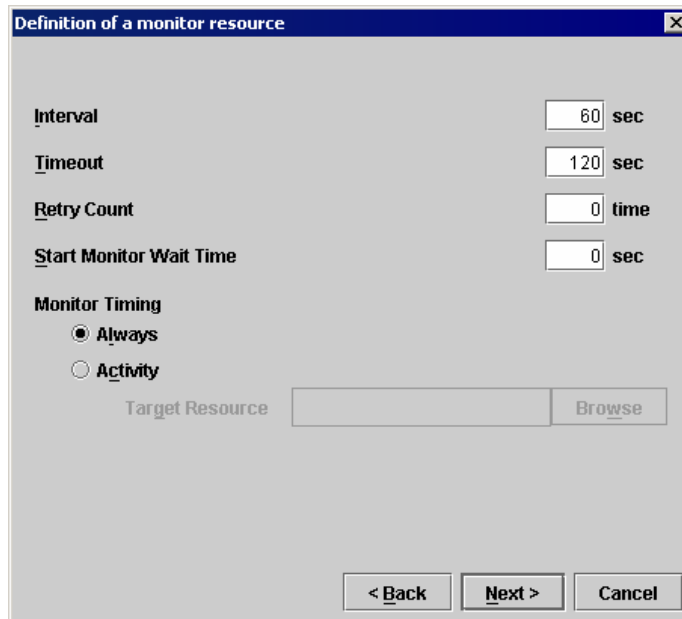
Definition of a monitor resource

Target RAW Device Name /dev/raw/raw2

Device Name /dev/sdb

< Back Next > Cancel

- C. Enter the values in the following dialog box. Click [Next].



Definition of a monitor resource

Interval 60 sec

Timeout 120 sec

Retry Count 0 time

Start Monitor Wait Time 0 sec

Monitor Timing

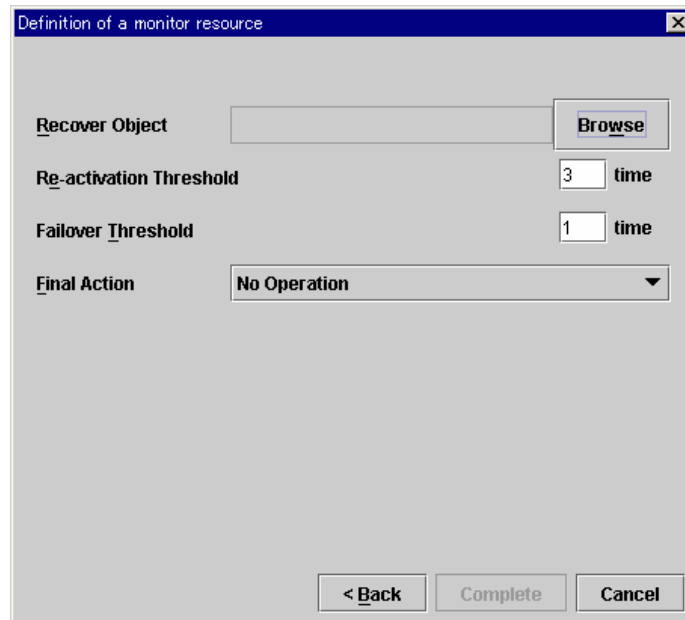
Always

Activity

Target Resource Browse

< Back Next > Cancel

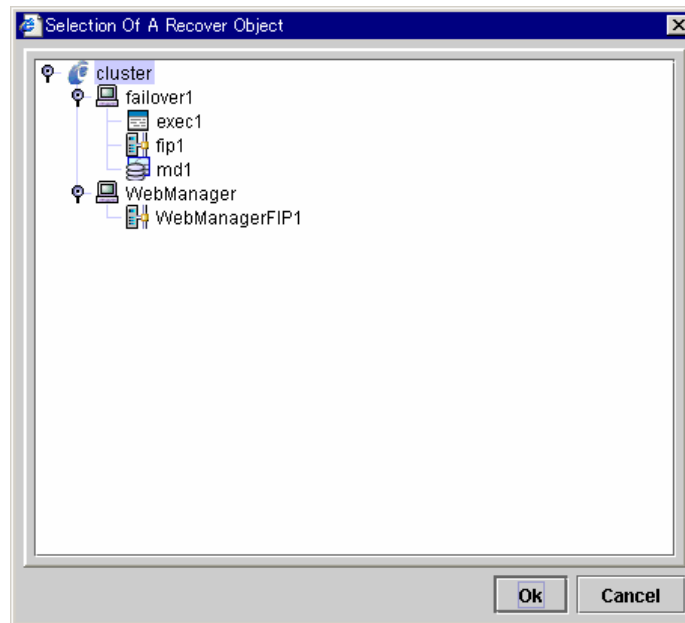
- D. Specify an action to be taken at abnormality detection in the following dialog box. Click [Browse].



The dialog box titled "Definition of a monitor resource" contains the following fields and controls:

- Recover Object:** An empty text box with a **Browse** button to its right.
- Re-activation Threshold:** A text box containing the number "3" followed by the label "time".
- Failover Threshold:** A text box containing the number "1" followed by the label "time".
- Final Action:** A dropdown menu currently displaying "No Operation".
- Buttons:** "< Back", "Complete", and "Cancel" buttons are located at the bottom of the dialog.

Select "cluster" in the following dialog box. Click [OK].



The dialog box titled "Selection Of A Recover Object" displays a tree view of resources:

- cluster
  - failover1
    - exec1
    - fp1
    - md1
  - WebManager
    - WebManagerFIP1

At the bottom of the dialog are **OK** and **Cancel** buttons.

- E. Confirm that “cluster” is selected in “Recover Object”. Select “Stop Cluster Daemon And OS Shutdown” in “Final Action”. Click [Complete].

Definition of a monitor resource

**R**ecover **O**bject cluster **B**rowse

**R**e-**a**ctivation **T**hreshold 0 time

**F**ailover **T**hreshold 0 time

**F**inal **A**ction Stop Cluster Daemon And OS Shutdown ▼

< Back Complete Cancel



- (14) Select “Monitors” in the tree view. Select [Edit | Add] from the menu bar. Enter data for the fifth monitor resource.

Type	ip monitor
Monitor resource name	ipw1
Monitored IP address	10.0.0.254 (Gateway)
When abnormality detected	“WebManager” group failover

- A. Enter the type and monitor resource name in respective fields in the following dialog box. Click [Next].

Definition of a monitor resource

Type: ip monitor

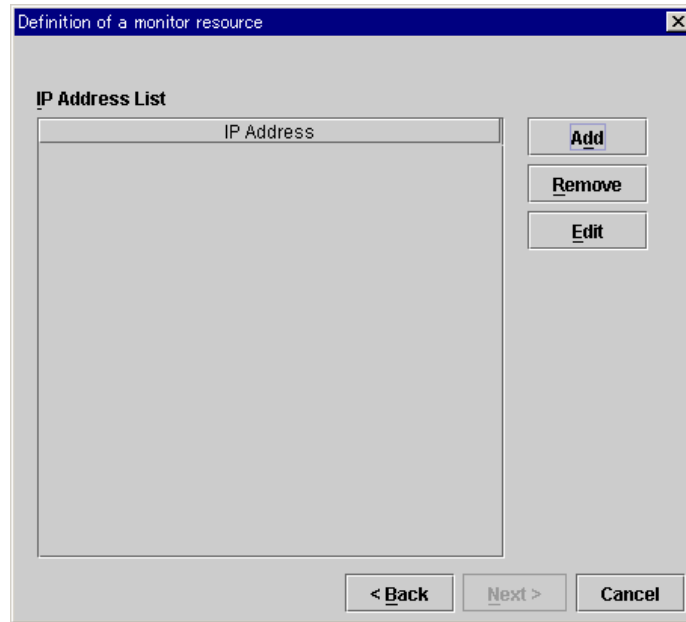
Name: ipw1

Comment:

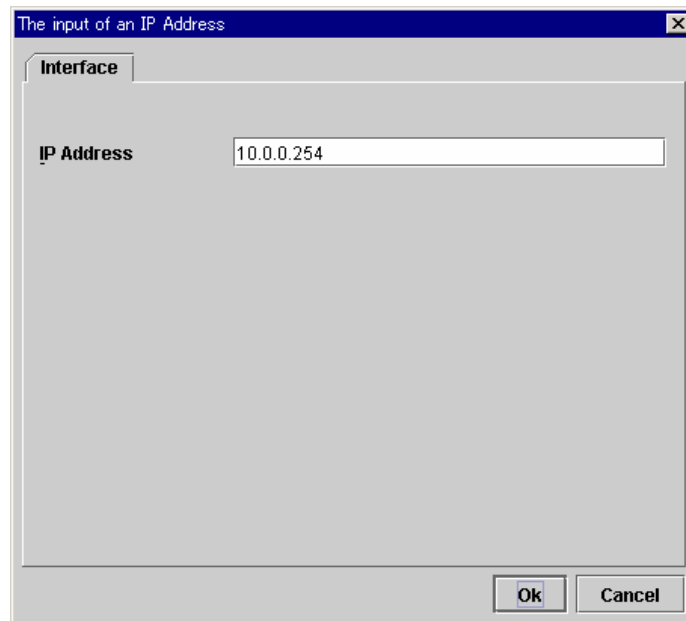
Please click the [Next] to continue.

< Back   Next >   Cancel

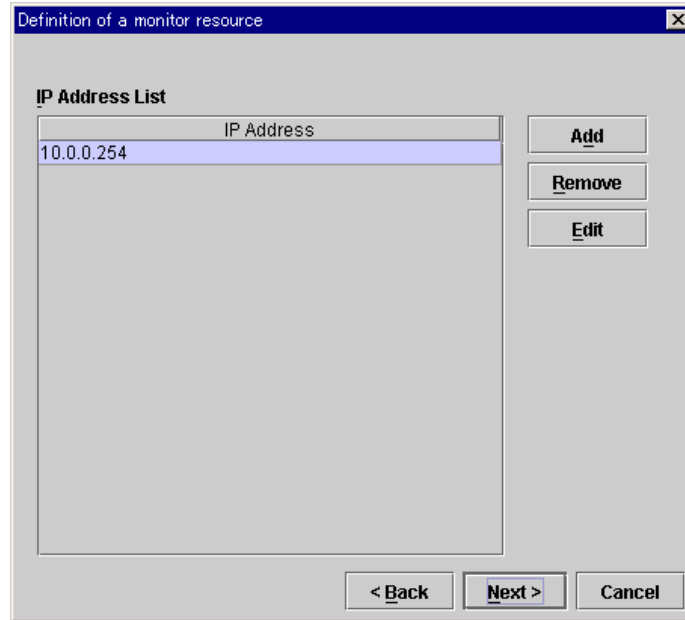
- B. Click [Add] in the following dialog box to add an IP address to be monitored.



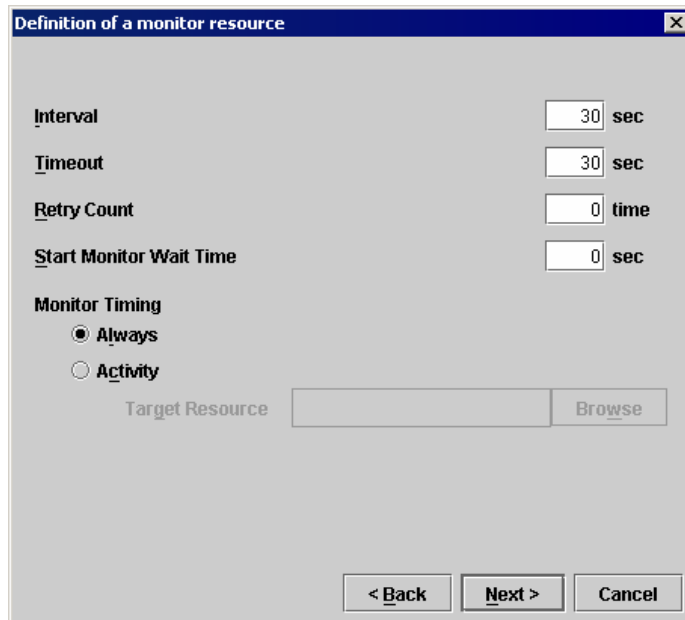
Enter the IP address to be monitored in the following dialog box. Click [Ok].



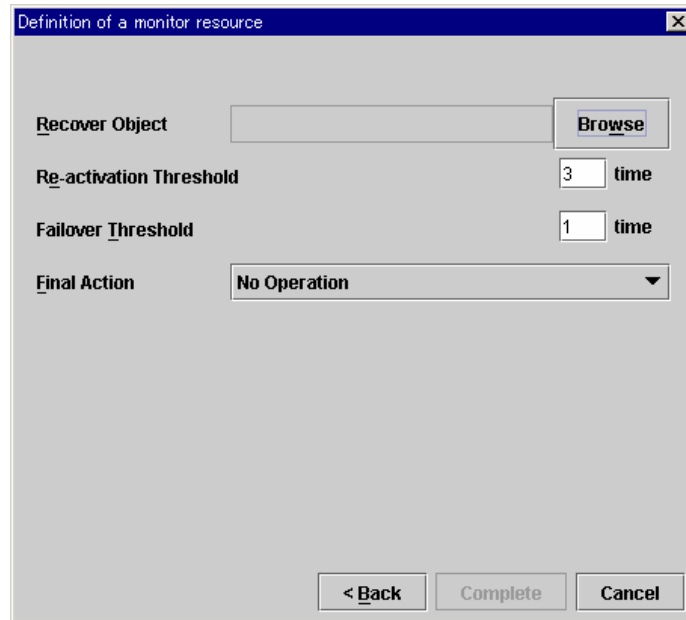
Confirm the address is added in "IP Address List". Click [Next].



C. Enter the values in the following dialog box. Click [Next].



- D. Enter an action to be taken at abnormality detection in the following dialog box. Select [Browse].

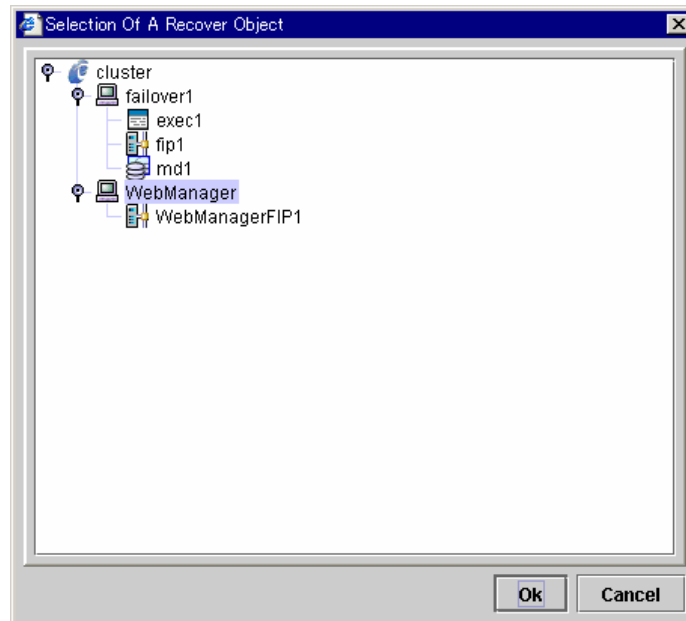


The dialog box titled "Definition of a monitor resource" contains the following fields and controls:

- Recover Object:** An empty text input field with a **Browse** button to its right.
- Re-activation Threshold:** A text input field containing the number "3" followed by the text "time".
- Failover Threshold:** A text input field containing the number "1" followed by the text "time".
- Final Action:** A dropdown menu currently displaying "No Operation".

At the bottom of the dialog box, there are three buttons: **< Back**, **Complete**, and **Cancel**.

Select "WebManager" in the following dialog box. Click [Ok].



The dialog box titled "Selection Of A Recover Object" displays a tree view of resources:

- cluster
  - failover1
    - exec1
    - fip1
    - md1
  - WebManager
    - WebManagerFIP1

The "WebManager" node is selected and highlighted. At the bottom of the dialog box, there are two buttons: **Ok** and **Cancel**.

- E. Confirm that "WebManager" is selected in "Recover Object". Set "Re-activation Threshold" to 0. Click [Complete].

Definition of a monitor resource

**Recover Object** WebManager **Browse**

**Re-activation Threshold** 0 time

**Failover Threshold** 1 time

**Final Action** No Operation

< Back Complete Cancel

- (15) Select “Monitors” in the tree view. Select [Edit | Add] from the menu bar. Enter data for the sixth monitor resource.

Type	ip monitor
Monitor resource name	ipw2
Monitored IP address	10.0.0.254 (Gateway)
When abnormality detected	“failover1” group failover

- A. Enter the type and monitor resource name in respective fields in the following dialog box. Click [Next].

Definition of a monitor resource

Type: ip monitor

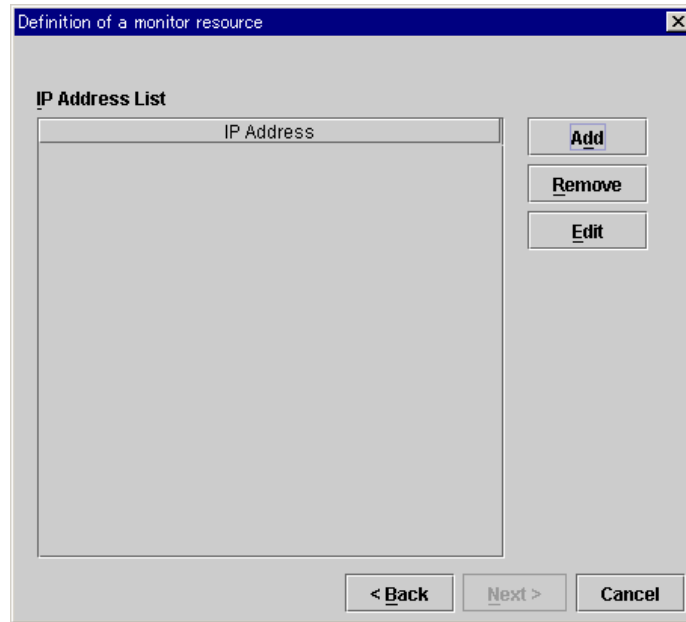
Name: ipw2

Comment:

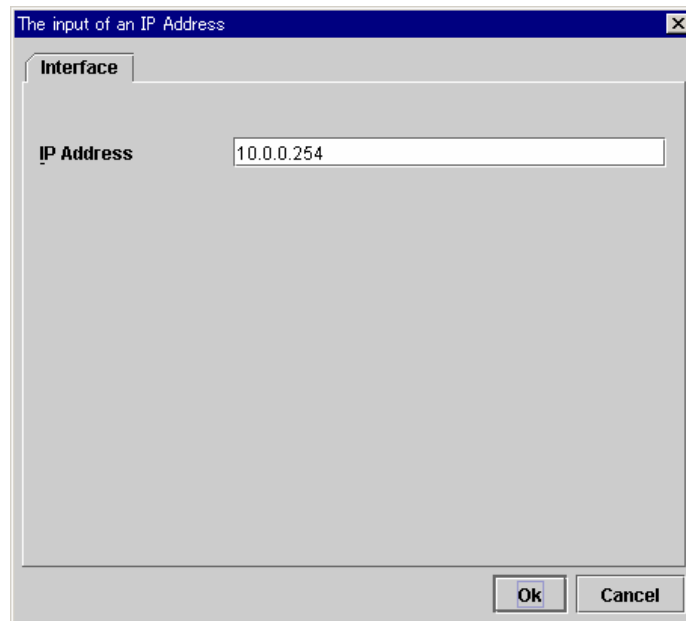
Please click the [Next] to continue.

< Back   Next >   Cancel

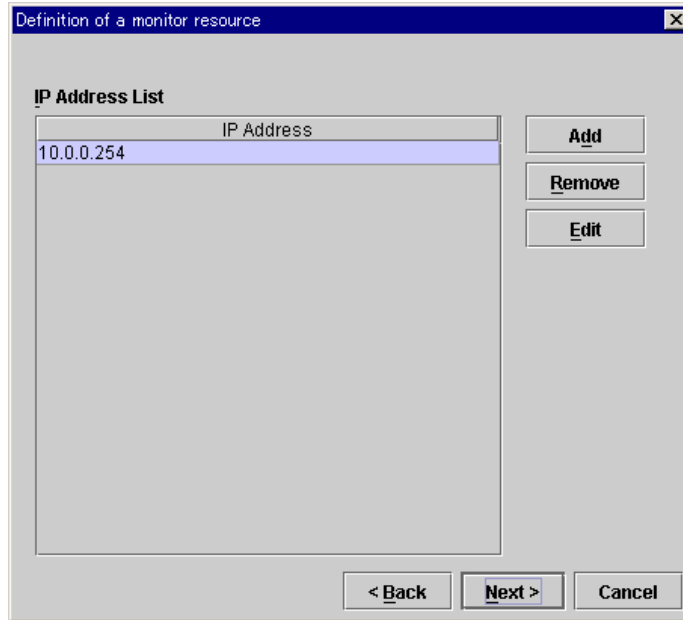
- B. Click [Add] in the following dialog box to add an IP address to be monitored.



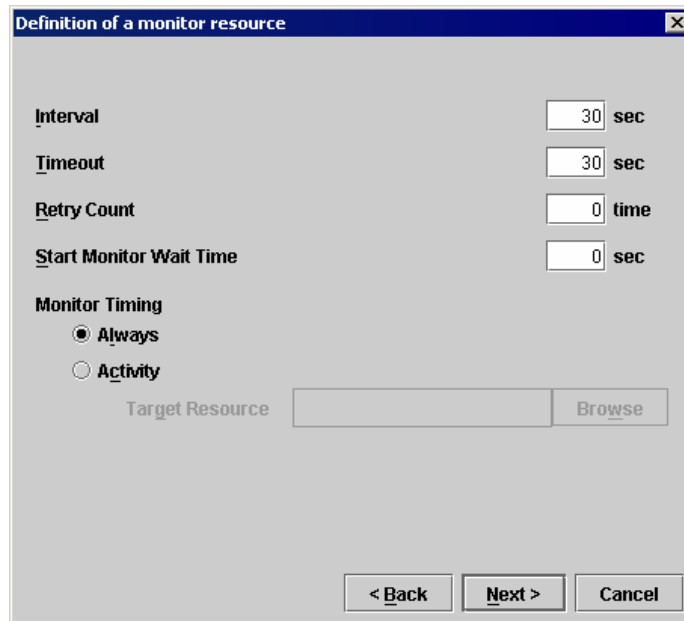
Enter the IP address to be monitored in the following dialog box. Click [Ok].



Confirm the address is added in "IP address List". Click [Next].

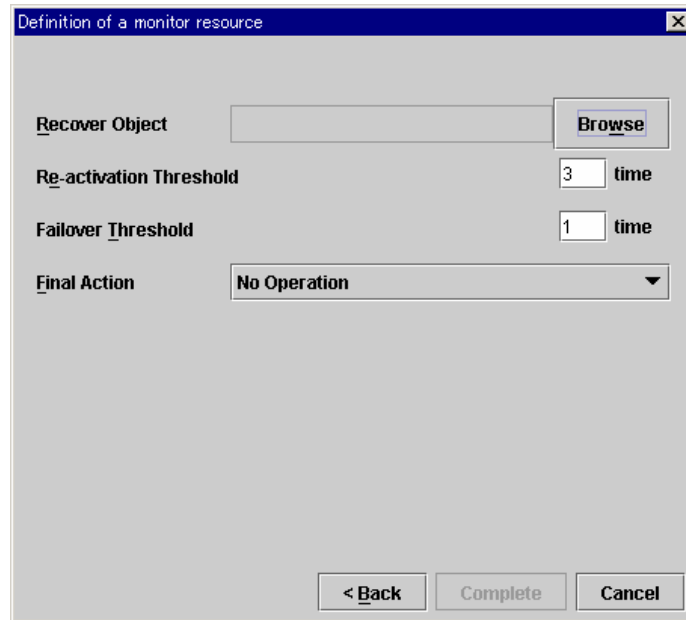


C. Enter the values in the following dialog box. Click [Next].





- D. Specify an action to be taken at abnormality detection in the following dialog box. Select [Browse].

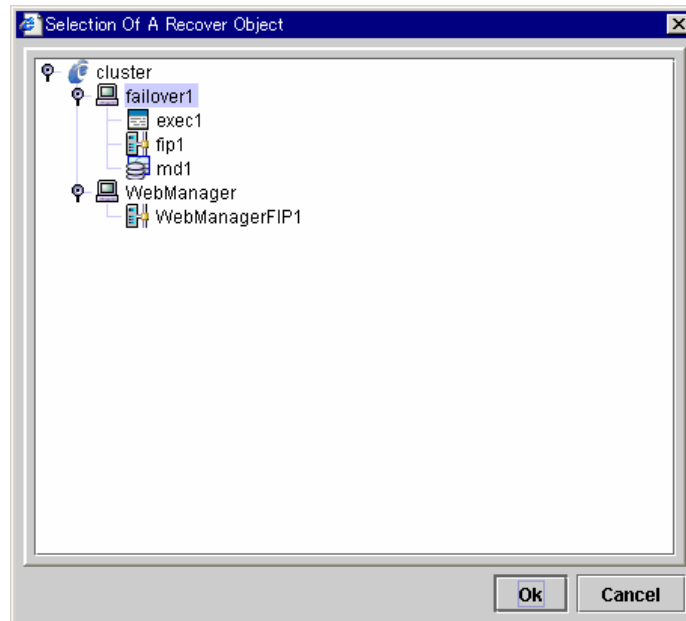


The dialog box is titled "Definition of a monitor resource". It contains the following fields and controls:

- Recover Object:** An empty text box with a "Browse" button to its right.
- Re-activation Threshold:** A text box containing the number "3" followed by the text "time".
- Failover Threshold:** A text box containing the number "1" followed by the text "time".
- Final Action:** A dropdown menu currently showing "No Operation".

At the bottom of the dialog box, there are three buttons: "< Back", "Complete", and "Cancel".

Select "failover1" in the following dialog box. Click [Ok].

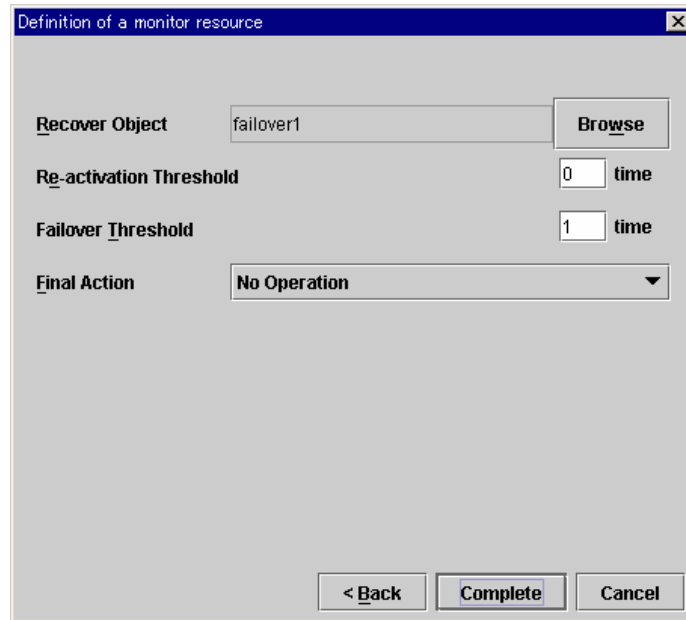


The dialog box is titled "Selection Of A Recover Object". It displays a tree view of resources:

- cluster
  - failover1 (selected)
  - exec1
  - fip1
  - md1
- WebManager
  - WebManagerFIP1

At the bottom of the dialog box, there are two buttons: "Ok" and "Cancel".

- E. Confirm that “failover1” is selected in “Recover Object”. Set “Re-activation Threshold” to 0. Click [Complete].

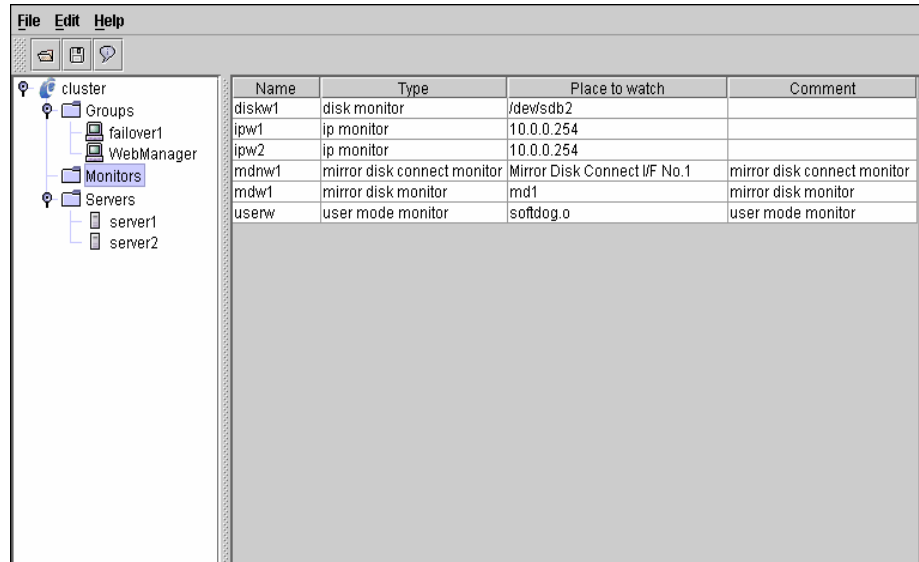


The screenshot shows a dialog box titled "Definition of a monitor resource" with a close button (X) in the top right corner. The dialog contains the following fields and controls:

- Recover Object:** A text input field containing "failover1" and a "Browse" button to its right.
- Re-activation Threshold:** A numeric input field containing "0" followed by the text "time".
- Failover Threshold:** A numeric input field containing "1" followed by the text "time".
- Final Action:** A dropdown menu currently displaying "No Operation".

At the bottom of the dialog, there are three buttons: "< Back", "Complete", and "Cancel".

The table view of Monitors looks like:



Name	Type	Place to watch	Comment
diskw1	disk monitor	/dev/sdb2	
ipw1	ip monitor	10.0.0.254	
ipw2	ip monitor	10.0.0.254	
mdnw1	mirror disk connect monitor	Mirror Disk Connect I/F No.1	mirror disk connect monitor
mdw1	mirror disk monitor	md1	mirror disk monitor
userw	user mode monitor	softdog.o	user mode monitor

You have made the cluster configuration data now. In environments where you can use floppy disks, go to Section 4.3 “How to Save Cluster Configuration Data in FD”. In environments where you cannot use floppy disks, go to Section 4.4 “How to Save Cluster Configuration Data in File System”.

## 4.3 How to Save Cluster Configuration Data in FD

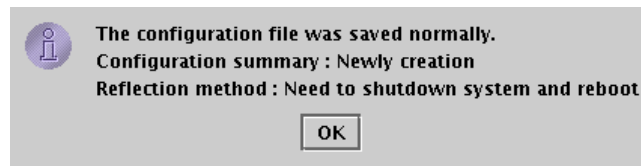
### 4.3.1 Linux

- (1) Insert a floppy disk into the floppy disk device. Select [File | Save the configuration file] from the menu bar.
- (2) Select the floppy disk device name in the following dialog box. Click [Ok].



When you select “For Windows”, prepare a Windows FAT (VFAT) formatted 1.44-MB floppy disk.  
For other additional functions, see a separate guide, “Configuration Tool”.

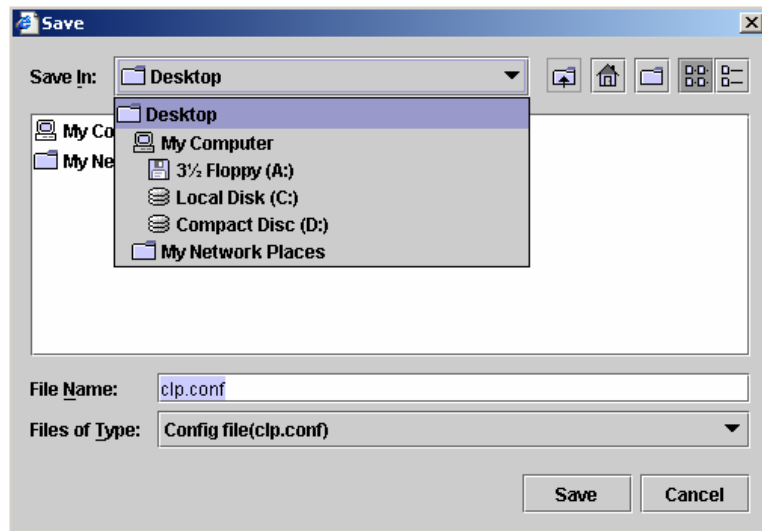
- (3) When the cluster configuration data is saved, you see the following message box.



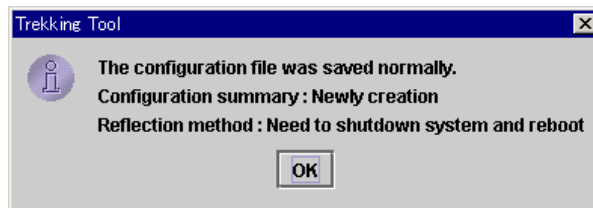
- (4) Use this floppy disk for clustering.

### 4.3.2 Windows

- (1) Prepare a formatted 1.44-MB floppy disk.
- (2) Insert the floppy disk into the floppy disk device. Select [File | Save the configuration file] from the menu bar.
- (3) Select the floppy disk drive in the following dialog box. Click [Save].



- (4) When the cluster configuration data is saved, you see the following message box.



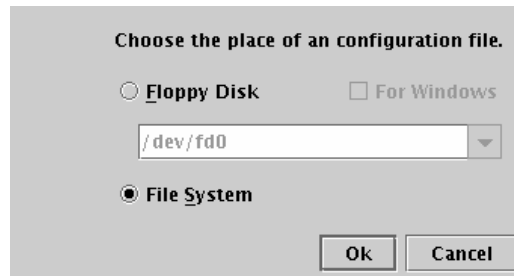
- (5) Use this floppy disk for clustering servers.

## 4.4 How to Save Cluster Configuration Data in File System

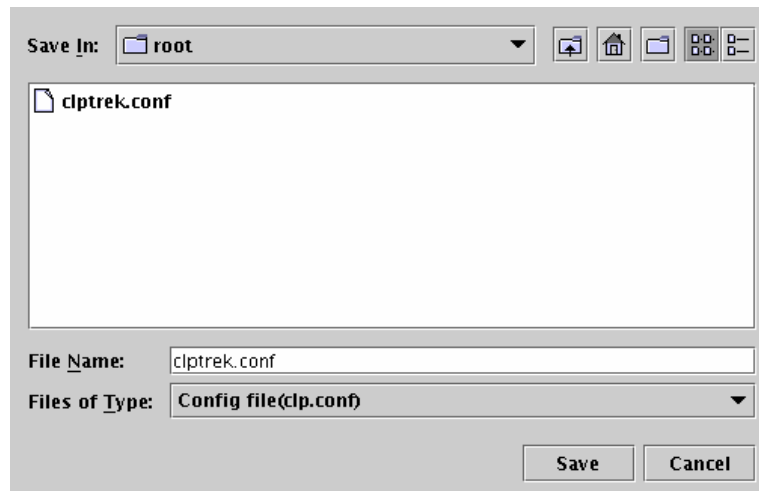
In environments where you cannot use floppy disks, save cluster configuration data in file system.

### 4.4.1 Linux

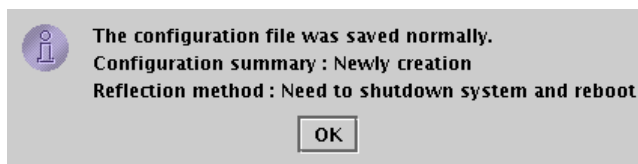
- (1) Select [File | Save the configuration file] from the menu bar.
- (2) Select “File System” in the following dialog box. Click [OK].



- (3) Select a place to save the data in the following dialog box. Click [Save].



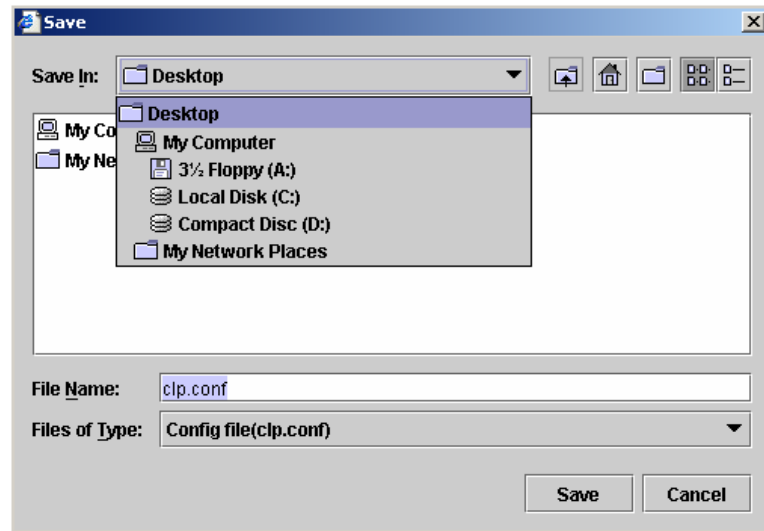
- (4) When the cluster configuration data is saved, you see the following message box.



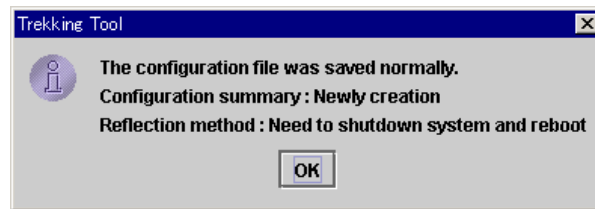
- (5) Use the saved cluster configuration data fro clustering.

## 4.4.2 Windows

- (1) Select [File | Save the configuration file] from the menu bar.
- (2) Select a place to save data in the following dialog box. Click [Save].



- (3) When the cluster configuration data is saved, you see the following message box.



- (4) Use the saved cluster configuration data for clustering servers.

## 5 HOW TO CREATE CLUSTER

### 5.1 In Environment Where You Can Use Floppy Disks

To cluster servers with the floppy disk created by Configuration Tool:

- (1) Hand-carrying the floppy disk  
Insert the floppy disk in the server which was specified as the master server by Configuration Tool.  
You have to restart all servers after installing the Server RPM.
- (2) Clustering  
Distribute the configuration data in the floppy disk to servers. Do either A or B depending on the type of floppy disk used to save data by Configuration Tool.

**A.** If you use the floppy disk whose data was saved by Configuration Tool on Linux, run the following command.

```
clpcfctrl --push -l
```

**B.** If you use the floppy disk (1.44-MB formatted) whose data was saved by Configuration Tool on Windows, or the floppy disk whose data was saved by Configuration Tool on Linux but Windows-formatted, run the following command.

```
clpcfctrl --push -w
```

After running the command, you see the following message. Press the return key.

```
Need to shutdown system and reboot  
please shutdown system after push. (hit return) :
```

After pressing the return key, if you see the following message, servers are successfully clustered.

```
success.(code:0)
```

clpcfctrl command uses by default /dev/fd0 as the floppy disk device, and /mnt/floppy as the mount point. If your environment is different from these default values, specify them in options. For details of options, see a separate guide, "Command".

For troubleshooting of clpcfctrl, see a separate guide, "Command".

- (3) Registering license  
According to Chapter 6 "LICENSE REGISTRATION", register the license.
- (4) Restarting servers  
Remove the floppy disk. Restart all servers.



## 5.2 In Environment Where You Can Not Use Floppy Disks

To cluster servers with the floppy disk created by Configuration Tool or data saved in the file system:

- (1) Viewing cluster configuration data  
By using FTP or other means, view the cluster configuration data saved in the file system or floppy disk from the server which was specified as the master server by Configuration Tool.  
You have to restart all servers after installing the server RPM.

- (2) Clustering  
Distribute the cluster configuration data in the file system to servers. Do either A or B depending on the type of cluster configuration data saved by Configuration Tool.  
Specify the full path to the cluster configuration data for the directory path.

**A.** If you use the cluster configuration data saved by Configuration Tool on Linux, run the following command.

```
clpcfctrl --push -l -x <Directory path>
```

**B.** If you use the cluster configuration data saved by Configuration Tool on Windows, or the cluster configuration data saved by Configuration Tool on Linux but Windows-formatted, run the following command.

```
clpcfctrl --push -w -x < Directory path >
```

After running the command, you see the following message. Press the return key.

```
Need to shutdown system and reboot  
please shutdown system after push. (hit return) :
```

After pressing the return key, if you see the following message, servers are successfully clustered.

```
success.(code:0)
```

For troubleshooting of clpcfctrl, see a separate guide, "Command".
--

- (3) Registering license  
According to Chapter 6 "LICENSE REGISTRATION", register the license.
- (4) Restarting servers  
Restart all servers.

## 6 LICENSE REGISTRATION

### 6.1 CPU License Registration

To run this product as a cluster system, you have to first register the CPU license. Register the CPU license on the master server where you intend to cluster servers. There are two types of license registration as follows;

- A. Product version
  - Run the license management command. Enter the license information attached to your licensed product interactively for license registration (see Section 6.2).
  - Specify a license file as the parameter of license management command for license registration (see Section 6.4).
  
- B. Trial version
  - Run the license management command. Enter the license information attached to your licensed product interactively for license registration (see Section 6.3).
  - Specify a license file as the parameter of license management command for license registration (see Section 6.4).

Before you start registering the license, confirm again that Chapter 5 “HOW TO CREATE CLUSTER” is performed on all servers that form a cluster.

To use FastSync Option, register the node license of FastSync Option after registering the CPU license. See “13.5 Registering the Node License” to register the node license.

## 6.2 Interactive License Registration (Product Version)

See the license sheet attached to your licensed product for values to be entered in each field as license information.

If your license sheet is as follows;

Product name:	<b>EXPRESSCLUSTER LE for Linux Ver 3.x</b>
License information:	
Type	Product Version
License Key	A1234567- B1234567- C1234567- D1234567
Serial Number	AA000000
Number Of Licensed CPUs	2

- (1) Run the following command on the master server where you intend to cluster servers.

```
# clplcncs -i -p PRODUCT-ID
```

- + To run the command, you should be a root user.
- + Use the product ID for **PRODUCT-ID** to be specified in the -p option. See Command for more information on product IDs.

- (2) Enter the product division.

```
Selection of product division  
1. Product  
2. Trial  
Select product division [ 1 or 2 ] ... 1
```

- + Enter "1" for the product version.

- (3) Enter the number of licenses.

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

- + If you press Enter key without entering a number, the default value "2" will be set. If the number of your licenses is other than "2", enter the number you see on your license sheet.

- (4) Enter the serial number.

```
Enter serial number [ Ex. XX000000 ] ... AA000000
```

- + Enter the number you see on your license sheet correctly. This is case-sensitive.

(5) Enter the license key.

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

- + Enter the key you see on your license sheet correctly.  
This is case-sensitive.
- + Confirm if the command is successfully completed. If you see a message, "command was success..", when the command is completed, it is successful. See a separate guide, "Command" for other completion messages.  
You can confirm the registered license with the command below.

```
# clplcncsc -l -p PRODUCT-ID
```

- + The **PRODUCT-ID** which you specify with -p option varies depending on the product version and edition. For details, see a separate guide, "Command".

## 6.3 Interactive License Registration (Trial Version)

See the license sheet you received for values to be entered in each field as license information.

If your license sheet is as follows;

Product name:	<b>EXPRESSCLUSTER LE for Linux Ver 3.x</b>
License information:	
Type	Trial Version
License Key	A1234567- B1234567- C1234567- D1234567
User Name	NEC
Trial Start Date	2003/01/01
Trial End Date	2003/12/31

- (1) Run the following command on the master server where you intend to cluster servers.

```
# clplcncsc -i -p PRODUCT-ID
```

- + To run the command, you should be a root user.
- + Use the product ID for **PRODUCT-ID** to be specified in the -p option. See Command for more information on product IDs.

- (2) Enter the product division.

```
Selection of product division  
1. Product  
2. Trial  
Select product division [ 1 or 2 ] ... 2
```

- + Enter "2" for the trial version.

- (3) Enter the user name.

```
Enter user name [ 1 to 64 byte ] ... NEC
```

- + Enter the user name you see on your license sheet correctly.

- (4) Enter the trial start date.

```
Enter trial start date [ Ex. yyyy/mm/dd ] ... 2003/01/01
```

- + Enter the trial start date you see on your license sheet correctly.

- (5) Enter the trial end date.

```
Enter trial end date [ Ex. yyyy/mm/dd ] ... 2003/12/31
```

- + Enter the trial end date you see on your license sheet correctly.

(6) Enter the license key.

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

- + Enter the key you see on your license sheet correctly.  
This is case-sensitive.
- + Confirm if the command is successfully completed. If you see a message, "command was success..", when the command is completed, it is successful. See a separate guide, "Command" for other completion messages.  
You can confirm the registered license with the command below.

```
# clplcncs -l -p PRODUCT-ID
```

- + The **PRODUCT-ID** which you specify with -p option varies depending on the product version and edition. For details, see a separate guide, "Command".

## 6.4 License Registration by File

Run the following command on the master server where you intend to cluster servers.

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

- + For *filepath* you specify with -i option, specify the file path to the distributed license file.
- + The *PRODUCT-ID* which you specify with -p option varies depending on the product version and edition. For details, see a separate guide, "Command".
- + To run the command, you should be a root user.
- + Confirm if the command is successfully completed. If you see a message, "command was success..", when the command is completed, it is successful. See a separate guide, "Command" for other completion messages. You can confirm the registered license with the command below.

```
# clplcncsc -l -p PRODUCT-ID
```

- + The *PRODUCT-ID* which you specify with -p option varies depending on the product version and edition. For details, see a separate guide, "Command".

## 6.5 License-related Troubleshooting

#	Behaviors and Message	Cause	Possible countermeasures
1	After the command was run, you saw the message below on the console. "permission denied."	You tried to run the command as a general user.	Log in as a root user. Or change to a root user with su -. Then, try again.
2	After the license registration command was run, you saw the message below on the console. "command success, but not sync license in cluster."	The transaction server may not be active yet, or the cluster configuration data may not be distributed yet.	Confirm again on all servers that the transaction server is active and cluster configuration data is distributed. If either of them is not yet done on any server, do it and register the license again.
3	When you have distributed the cluster configuration data created by Configuration Tool to all servers, and then tried shutting down and rebooting the cluster, you saw the message below on Web Manager's alert, and the cluster stopped. "The license is not registered. (%1)" %1: Product ID	This is because you have shut down and rebooted the cluster without registering its license.	Register the license on a server in the cluster.
4	When you have distributed the cluster configuration data created by Configuration Tool to all servers, and then tried shutting down and rebooting the cluster, you saw the message below on Web Manager's alert, but the cluster is working properly. "The license is insufficient. The number of insufficient is %1. (%2)" %1: The number of lacking licenses %2: Product ID	The number of licenses is insufficient.	Obtain a due license from your sales agent and register it.
5	You saw the message below while the cluster was working on the trial license, and the cluster stopped. "The license of trial expired by %1. (%2)" %1: Trial end date %2: Product ID	The license expired.	Ask your sales agent for extension of the trial version license, or obtain and register the product version license.



For details of command completion messages, see a separate guide, “Command”.

## 7 ACCESSING WEB MANAGER

Access the Web Manager in an environment where Java Runtime is installed as follows;

See a separate guide, "Web Manager" for details.

- (1) Start up your browser.
- (2) Enter the IP address and port number of the server in the URL of the browser.

- \* Make sure to enter the same port number as Web Manager HTTP port number of Configuration Tool.

If not all the icons are green after connecting to Web Manager, see a separate guide, "Maintenance" for information on what you should do.

## 8 VERIFYING ESTABLISHMENT OF INITIAL MIRRORING IS COMPLETED

When you restart the servers after registering the license, initial mirroring will be established. Depending on the size of the data partitions, it may take time to establish initial mirroring.

Check that establishment of initial mirroring has been completed after restarting the servers by using Web Manager or command.

### 8.1 Using Web Manager to Verify Establishment of Initial Mirroring is Completed

After Web Manager is connected, use Mirror Disk Helper to verify establishment of initial mirroring has been completed.

- (1) Start up Mirror Disk Helper.  
For information on Mirror Disk Helper, see “Web Manager.”
- (2) Check establishment of initial mirroring has been completed  
For information on how to verify establishment of initial mirroring is completed, see a separate guide, “Web Manager.”

### 8.2 Using a Command to Verify Establishment of Initial Mirroring is Completed

Use the `clpmdstat` command to verify establishment of initial mirroring has been completed. Run the following command to verify.

```
clpmdstat --mirror <mirror disk resource name (example: md1)
```

For more information on commands, see a separate guide, “Command”.

## 9 BEHAVIORS CHECK BY WEB MANAGER

After forming a cluster and accessing Web Manager, you do the followings step by step to confirm if your cluster works well. For details on how to use Web Manager, see a separate guide, "Web Manager".

If you find an error at behaviors check, see a separate guide, "Maintenance" to remove it.

- (1) Heartbeat resources  
Confirm the status of each server is ONLINE on Web Manager.  
Confirm the heartbeat resources status of each server is NORMAL.
- (2) Monitor resources  
Confirm the status of each monitor resources is NORMAL on Web Manager.
- (3) Group startup  
Start the group.  
Confirm the group status is ONLINE on Web Manager.
- (4) Group stoppage  
Stop the group.  
Confirm the group status is OFFLINE on Web Manager.
- (5) Mirror disk resources  
In a server where a group with mirror disk resources is activated, check that you can make access to a mirror disk mount point.  
Write data on the mount point.
- (6) FIP resources  
Confirm that while the group having FIP resources is active, you can ping the FIP address.
- (7) EXEC resources  
Confirm that applications are working on the server where the group having EXEC resources is active.
- (8) Group migration  
Move the group to another server.  
Confirm the group status is ONLINE on Web Manager.  
Move the group to all servers in the failover policy one after another, and confirm the status changes to ONLINE on each server.
- (9) Verify mirroring  
Check the data you wrote on the mirror disk resource mount point in Step (5) exists.

(10) Failover

Shut down the server where the group is active.

After the heartbeat timeout, confirm the group is failover. Also, confirm by Web Manager that the group status becomes ONLINE on the failover destination server. However, mirror disk resources change to the mirror break status.



If FastSync Option is not used, the recovery from mirror breaks means a full copy. When you check the behaviors, remember that the mirror recovery takes time depending on the size of mirror disks.

(11) Failback

If you made settings for the automatic failback, start the server which you have shut down in the previous step, “(10) Failover”. Confirm that the group fails back to the original server after it is started. Also, confirm by Web Manager that the group status becomes ONLINE on the failback destination server.

Note that you cannot make auto failback settings for a group with a mirror disk resource.

(12) Auto-mirror recovery

Start the server which was shut down in the above “(10) Failover”. If the auto-mirror recovery is enabled, check that the auto-mirror recovery is performed when the server has started up.



If FastSync Option is not used, the recovery from mirror breaks means a full copy. When you check the behaviors, remember that the mirror recovery takes time depending on the size of mirror disks.

(13) Mail report

If you made settings for Mail report, confirm that you receive the report mail at failover.

(14) Cluster shutdown

Shut down the cluster. Check that all servers in the cluster are successfully shut down.

## 10 BEHAVIORS CHECK WITH COMMANDS

After forming a cluster, you do the followings step by step to confirm if your cluster works well. For details on how to use commands, see a separate guide, "Command".

If you find an error at behaviors check, see a separate guide, "Maintenance" to remove it.

- (1) Heartbeat resources  
Confirm the status of each server is ONLINE with the clpstat command.  
Confirm the heartbeat resources status of each server is NORMAL.
- (2) Monitor resources  
Confirm the status of each monitor resources is NORMAL with the clpstat command.
- (3) Group startup  
Start the group with the clpgrp command.  
Confirm the group status is ONLINE with the clpstat command.
- (4) Group stoppage  
Stop the group with the clpgrp command.  
Confirm the group status is OFFLINE with the clpstat command.
- (5) Mirror disk resources  
In a server where a group with a mirror disk resources is activated, check that you can make access to a mirror disk mount point.  
Write data on the mount point.
- (6) FIP resources  
Confirm that while the group having FIP resources is active, you can ping the FIP address.
- (7) EXEC resources  
Confirm that applications are working on the server where the group having EXEC resources is active.
- (8) Group migration  
Move the group to another server with the clpgrp command.  
Confirm the group status is ONLINE with the clpstat command.  
Move the group to all servers in the failover policy one after another, and confirm the status changes to ONLINE on each server.

- (9) **Verify mirroring**  
Check the data you wrote on the mirror disk resource mount point in Step (5) exists.

- (10) **Failover**  
Shut down the server where the group is active.  
After the heartbeat timeout, confirm the group is failover with the `clpstat` command. Also, confirm with the `clpstat` command that the group status becomes **ONLINE** on the failover destination server. However, mirror disk resources change to the mirror break status.



If FastSync Option is not used, the recovery from mirror breaks means a full copy. When you check the behaviors, remember that the mirror recovery takes time depending on the size of mirror disks.

- (11) **Failback**  
If you made settings for the automatic failback, start the server which you have shut down in the previous step, “(10) Failover”. Confirm with the `clpstat` command that the group fails back to the original server after it is started. Also, confirm with the `clpstat` command that the group status becomes **ONLINE** on the failback destination server.

Note that you cannot make auto failback settings for a group with a mirror disk resource.

- (12) **Auto-mirror recovery**  
Start the server which was shut down in the above “(10) Failover”. If the auto-mirror recovery is enabled, check that the auto-mirror recovery is performed when the server has started up.



If FastSync Option is not used, the recovery from mirror breaks means a full copy. When you check the behaviors, remember that the mirror recovery takes time depending on the size of mirror disks.

- (13) **Mail report**  
If you made settings for Mail report, confirm that you receive the report mail at failover.

- (14) **Cluster shutdown**  
Shut down the cluster. Check that all servers in the cluster are successfully shut down.

## 11 OPERATION TEST

Check how the cluster behaves by performing dummy fault tests and/or backup/restoration for mirror disks. Check if an error is detected in monitor resources, or if any server goes down,

If any error is detected in monitor resources, or if any server goes down, you must tune the time-out or other values. See a separate guide, "Configuration Tool" for details about how to change parameter values.

- (1) Mirror disk error  
(If you can do dummy testing because mirror disks are RAID-configured.)

Tests must include disk errors in RAID, replacement and recovery of RAID.

- Make a dummy error occur in RAID.
- Recover RAID from the degenerated state to normal state.

For some RAID controllers, I/O may temporarily stop or become slower when RAID switches to the degenerated operation or when RAID is reconfigured.

If any time-out and/or delay occurs in disk monitors, RAW monitor or others, tune the time-out value of each monitor resource.

- (2) Backup/Restoration  
If regular backups are planned, try a backup actually.

Some backup software and archive commands give heavy loads on CPU and/or disk I/Os.

If any server goes down, heartbeat delays, and/or time-out/delay occurs in monitor resources, tune the heartbeat time-out value and/or time-out value of each monitor resource.



## 12 LOAD TEST

Some mirror disk parameters are configurable.

Perform a load test for mirror disks and configure the parameters. For information on configuring the parameters, see a separate guide, "Configuration Tool".

Load a server in which a mirror disk resource is activated by running applications that are actually used in business operation or test programs that are close to programs to be used in business operation. A mirror driver message appears in syslog if there is any parameter value that is not appropriately configured. See the section of syslog messages for mirror driver in a separate guide, "Maintenance" and configure parameters.

- (1) Maximum number of request queues  
Mirror driver makes I/O requests queue. This is the number of maximum queues used.  
When you create cluster configuration information by configuration tool, 2048 is set by default. When 2048 is set, a maximum of 16MB (2048\*4096\*2 bytes) is used for memory for request queue.

For example if the following message appears, the value set for maximum number of request queues is too large. Set a value smaller than the currently configured value.

**NMP%1 malloc buffer\_head failed. send ack1 with fail at once.**

- (2) Connection timeout  
Timeout for connection with a remote server  
When you create cluster configuration information by configuration tool, 10 seconds is set by default.

For example, if the following message appears, the value set for connection timeout is too small. Set a value greater than the currently configured value.

**NMP%1 connection failed(-110).**

- (3) Transmission timeout  
Timeout for sending data to a remote server  
When you create cluster configuration information by configuration tool, 30 seconds is set by default.

For example, if the following message appears, the value set for transmission timeout is too small. Set a value greater than the currently configured value.

**NMP%1 send data part failed(-110), start(%3) end(%4), try again.**

- (4) Receiving timeout  
Timeout for receiving data from a remote server  
When you create cluster configuration information by configuration tool, 100 seconds is set by default.

For example, if the following message appears, the value currently set for receiving timeout is too small. Set a value greater than the currently configured value.

**NMP%1 recv ack time out, try again, start(%2) end(%3).**

## 13 FASTSYNC OPTION

### 13.1 Features

FastSync Option is an option to shorten time for mirror recovery using differential data in a data mirroring system configured by ExpressCluster.

Typically, in ExpressCluster, data is inherited among servers by mirroring local disks on servers. If failover caused by server failure or otherwise occurs, data inconsistency (mirror break) is generated among mirrored disks, which then requires recovery by copy (mirror recovery).

FastSync Option records data update information during mirror break and copies only difference by using the data update information when recovering mirroring.

Because only the difference is copied, time needed to complete mirror recovery becomes shorter.

### 13.2 Performance

In ordinary operation, performance is no different from an environment where no FastSync Option is installed. Time actually needed for mirror recovery depends on the size of the data update information.

### 13.3 Important

In the following cases, differential copy will not be performed. Full copy (equivalent to mirror recovery in an environment where no FastSync Option is installed) will be performed.

- A. When establishing initial mirroring
- B. When recovering mirror forcefully

## 13.4 Registering FastSync Option

Follow the steps below to register FastSync Option.

- (1) Register the node license  
Register the node license of FastSync Option.  
See “13.5 Registering the Node License”, “13.6 Interactive License Registration (Product Version)”, “13.7 Interactive License Registration (Trial Version)”, and “13.8 License Registration by File” to register the license.

For information on troubleshooting related to the license, see “13.9 License-related Troubleshooting”.

- (2) Reboot servers  
Reboot the servers constituting the cluster.  
If the cluster is already operated, run the `clpstdn` command or Web Manager to shutdown the cluster, and then reboot all servers.
- (3) Check registration is completed  
Check that FastSync Option is successfully registered.  
See 13.10 Checking Registration of FastSync Option.”



After the license registration, a message that informs about the FastSync Option license will show on the system log and Web Manager.

Even when the license of the product ID "FSO31" is registered, the product ID number displayed in the message or system log and Alert View will say "FSO30".

See Command for more information on the product ID.

If you don't register your license yet, you see a message in the syslog and the alert view of Web Manager saying that FastSync Option license is not yet registered. This doesn't cause any problem if you don't use FastSync Option.

## 13.5 Registering the Node License

To use FastSync Option, you have to register the node license.  
Register the node license on the master server where you intend to cluster servers.  
There are two types of license registration as follows;

- A. Product version
  - Run the license management command. Enter the license information attached to your licensed product interactively for license registration (See 13.7).
  - Specify a license file as the parameter of license management command for license registration (See 13.8).
- B. Trial version
  - Run the license management command. Enter the license information attached to your licensed product interactively for license registration (See 13.7).
  - Specify a license file as the parameter of license management command for license registration (See 13.8).

Before you start registering the license, confirm again that Chapter 5 “HOW TO CREATE CLUSTER” is performed on all servers that form a cluster.

## 13.6 Interactive License Registration (Product Version)

See the license sheet attached to your licensed product for values to be entered in each field as license information.

If your license sheet is as follows;

Product name:	<b>EXPRESSCLUSTER FastSync Option for Linux Ver 3.x</b>		
License information:			
Type		Product Version	
License Key	A1234567- B1234567- C1234567- D1234567		
Serial Number	AA000000		
Number Of Licensed Nodes	2		

- (1) Run the following command on the master server where you intend to cluster servers.

```
# clplcncsc -i -p PRODUCT-ID
```

- + To run the command, you should be a root user.
- + Use the product ID for **PRODUCT-ID** to be specified in the -p option. See Command for more information on product IDs.

- (2) Enter the product division.

```
Selection of product division  
1. Product  
2. Trial  
Select product division [ 1 or 2 ] ... 1
```

- + Enter "1" for the product version.

- (3) Enter the number of licenses.

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

- + If you press Enter key without entering a number, the default value "2" will be set. If the number of your licenses is other than "2", enter the number you see on your license sheet.

- (4) Enter the serial number.

```
Enter serial number [ Ex. XX000000 ] ... AA000000
```

- + Enter the number you see on your license sheet correctly. This is case-sensitive.

(5) Enter the license key.

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

- + Enter the key you see on your license sheet correctly.  
This is case-sensitive.
- + Confirm if the command is successfully completed. If you see a message, "command was success..", when the command is completed, it is successful. See a separate guide, "Command" for other completion messages.  
You can confirm the registered license with the command below.

```
# clplcncsc -l -p PRODUCT-ID
```

- + The **PRODUCT-ID** which you specify with -p option varies depending on the product version and edition. For details, see a separate guide, "Command".

## 13.7 Interactive License Registration (Trial Version)

See the license sheet you received for values to be entered in each field as license information.

If your license sheet is as follows;

Product name:	<b>EXPRESSCLUSTER FastSync Option for Linux Ver 3.x</b>
License information:	
Type	Trial Version
License Key	A1234567- B1234567- C1234567- D1234567
User Name	NEC
Trial Start Date	2003/01/01
Trial End Date	2003/12/31

- (1) Run the following command on the master server where you intend to cluster servers.

```
# clplcncsc -i -p PRODUCT-ID
```

- + To run the command, you should be a root user.
- + Use the product ID for **PRODUCT-ID** to be specified in the -p option. See Command for more information on product IDs.

- (2) Enter the product division.

```
Selection of product division  
1. Product  
2. Trial  
Select product division [ 1 or 2 ] ... 2
```

- + Enter "2" for the trial version.

- (3) Enter the user name.

```
Enter user name [ 1 to 64 byte] ... NEC
```

- + Enter the user name you see on your license sheet correctly.

- (4) Enter the trial start date.

```
Enter trial start date [ Ex. yyyy/mm/dd ] ... 2003/01/01
```

- + Enter the trial start date you see on your license sheet correctly.

- (5) Enter the trial end date.

```
Enter trial end date [ Ex. yyyy/mm/dd ] ... 2003/12/31
```

- + Enter the trial end date you see on your license sheet correctly.

(6) Enter the license key.

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

- + Enter the key you see on your license sheet correctly.  
This is case-sensitive.
- + Confirm if the command is successfully completed. If you see a message, "command was success..", when the command is completed, it is successful. See a separate guide, "Command" for other completion messages.  
You can confirm the registered license with the command below.

```
# clplcncs -l -p PRODUCT-ID
```

- + The **PRODUCT-ID** which you specify with -p option varies depending on the product version and edition. For details, see a separate guide, "Command".



## 13.8 License Registration by File

Run the following command on the master server where you intend to cluster servers.

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

- + For *filepath* you specify with -i option, specify the file path to the distributed license file.
- + The *PRODUCT-ID* which you specify with -p option varies depending on the product version and edition. For details, see a separate guide, "Command".
- + To run the command, you should be a root user.
- + Confirm if the command is successfully completed. If you see a message, "command was success..", when the command is completed, it is successful. See a separate guide, "Command" for other completion messages. You can confirm the registered license with the command below.

```
# clplcncs -l -p PRODUCT-ID
```

- + The *PRODUCT-ID* which you specify with -p option varies depending on the product version and edition. For details, see a separate guide, "Command".

## 13.9 License-related Troubleshooting

#	Behaviors and Message	Cause	Possible countermeasures
1	After the command was run, you saw the message below on the console. "permission denied."	You tried to run the command as a general user.	Log in as a root user. Or change to a root user with su -. Then, try again.
2	After the license registration command was run, you saw the message below on the console. "command success, but not sync license in cluster."	The transaction server may not be active yet, or the cluster configuration data may not be distributed yet.	Confirm again on all servers that the transaction server is active and cluster configuration data is distributed. If either of them is not yet done on any server, do it and register the license again.
3	When you have distributed the cluster configuration data created by Configuration Tool to all servers, and then tried shutting down and rebooting the cluster, you saw the message below on Web Manager's alert, and the cluster stopped. "The license is not registered. (%1)" %1: Product ID	This is because you have shut down and rebooted the cluster without registering its license. If you do not use FastSync Option, there is no problem.	If you use FastSync Option, register the license on one of servers in the cluster.
4	When you have distributed the cluster configuration data created by Configuration Tool to all servers, and then tried shutting down and rebooting the cluster, you saw the message below on Web Manager's alert, but the cluster is working properly. "The license is insufficient. The number of insufficient is %1. (%2)" %1: The number of lacking licenses %2: Product ID	The number of licenses is insufficient.	Obtain a due license from your sales agent and register it.
5	You saw the message below while the cluster was working on the trial license, and the cluster stopped. "The license of trial expired by %1. (%2)" %1: Trial end date %2: Product ID	The license expired.	Ask your sales agent for extension of the trial version license, or obtain and register the product version license.

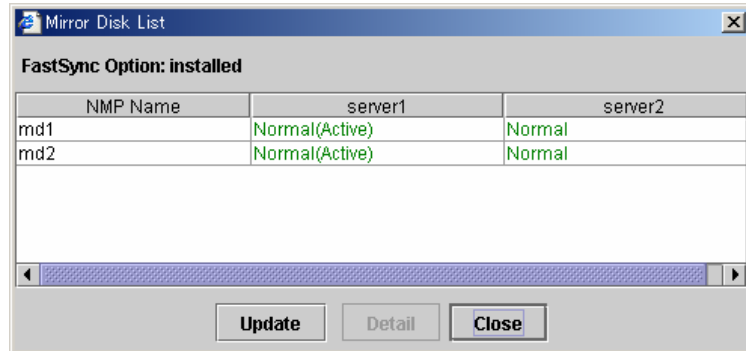
For details of command completion messages, see a separate guide, “Command”.

## 13.10 Checking Registration of FastSync Option

Check that FastSync Option has been registered by the following steps.

### 13.10.1 Web Manager

Use Web Manager to show the Mirror Disk List dialogue and check that, FastSync Option is enabled. If FastSync Option is enabled, "Installed" appears.



For more information on Web Manager and the Mirror Disk List dialogue, see a separate guide, "Web Manager".

### 13.10.2 Clpmdstat command

Run the clpmdstat command on a server in the cluster and check that FastSync Option is enabled.

#### **clpmdstat --list**

If FastSync Option is enabled, "Installed" appears.

FastSync Option : Installed

Mirror Name	Server Name	Mount Point
md1	server1	/mnt/md1
	server2	/mnt/md1

For more information on the clpmdstat command, see a separate guide, "Command".