

NEC EXPRESSCLUSTER

System Construction Guide

NEC EXPRESSCLUSTER for Windows Ver 7.0

NEC EXPRESSCLUSTER for Windows Ver7.0

Notes

Second Edition 05/26/2004

PREFACE

The "NEC EXPRESSCLUSTER/System Construction Guide" is intended for administrators who will construct cluster systems and for system engineers or maintenance personnel who will provide user support for these systems.

AUXILIARY INFORMATION

[Concerning the OS upgrade]

If an invalid procedure is used when upgrading the operating system of the cluster server, a failover may occur unexpectedly, or in the worst case, the system may be damaged.

This also holds for the application of service packs.

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NEC EXPRESSCLUSTER/System Construction Guide

Categories

The NEC EXPRESSCLUSTER/System Construction Guides are divided into separate volumes as follows according to the situations in which they are to be used and according to readers. If you are to construct a cluster system for the first time, please read “Introduction” first.

[Setup Card]

This is a reference card attached to the product, which describes the product configuration, operating environment, and so on.

[Introduction]

This is an introduction for someone who is to design and construct a cluster system for the first time.

[System Design (BASIC/Shared Disk, BASIC/Mirror Disk)]

This manual describes information necessary to install NEC EXPRESSCLUSTER and construct a system.

It explains necessary information and precautions concerning system construction.

There are two volumes, one for Shared Disk type and the other for Mirror Disk type.

[System Design (Application)]

This manual is a collection of knowhows for using advanced functions of NEC EXPRESSCLUSTER that are not described in System Design (BASIC).

[Cluster Installation and Configuration Guide (Shared Disk, Mirror Disk)]

This manual clearly explains environment settings to be made after installing NEC EXPRESSCLUSTER in the order that you will follow to build a cluster system.

There are two volumes, one for Shared Disk type and the other for Mirror Disk type.

[Operation/Maintenance]

This is a document that describes information required for operating a cluster system, how to deal with system failure, and lists of errors.

[GUI Reference]

This manual explains required concepts concerning NEC EXPRESSCLUSTER operation and describes how to operate NEC EXPRESSCLUSTER by using a graphical user interface (GUI) from a management client or a server.

[Command Reference]

This is a reference of commands that can be put in NEC EXPRESSCLUSTER scripts and maintenance commands that can be executed from the server’s command prompt.

[For PP]

Every PP mentioned in this document can be executed in cooperation with NEC EXPRESSCLUSTER.

It explains settings, script writings, and some notes that are necessary to operate the PPs and NEC EXPRESSCLUSTER together.

Read carefully the respective PP edition for the PP you would like to use.

[Notes]

This reference describes items to be remembered in constructing, operating, and trouble shooting a cluster system. Read when necessary.

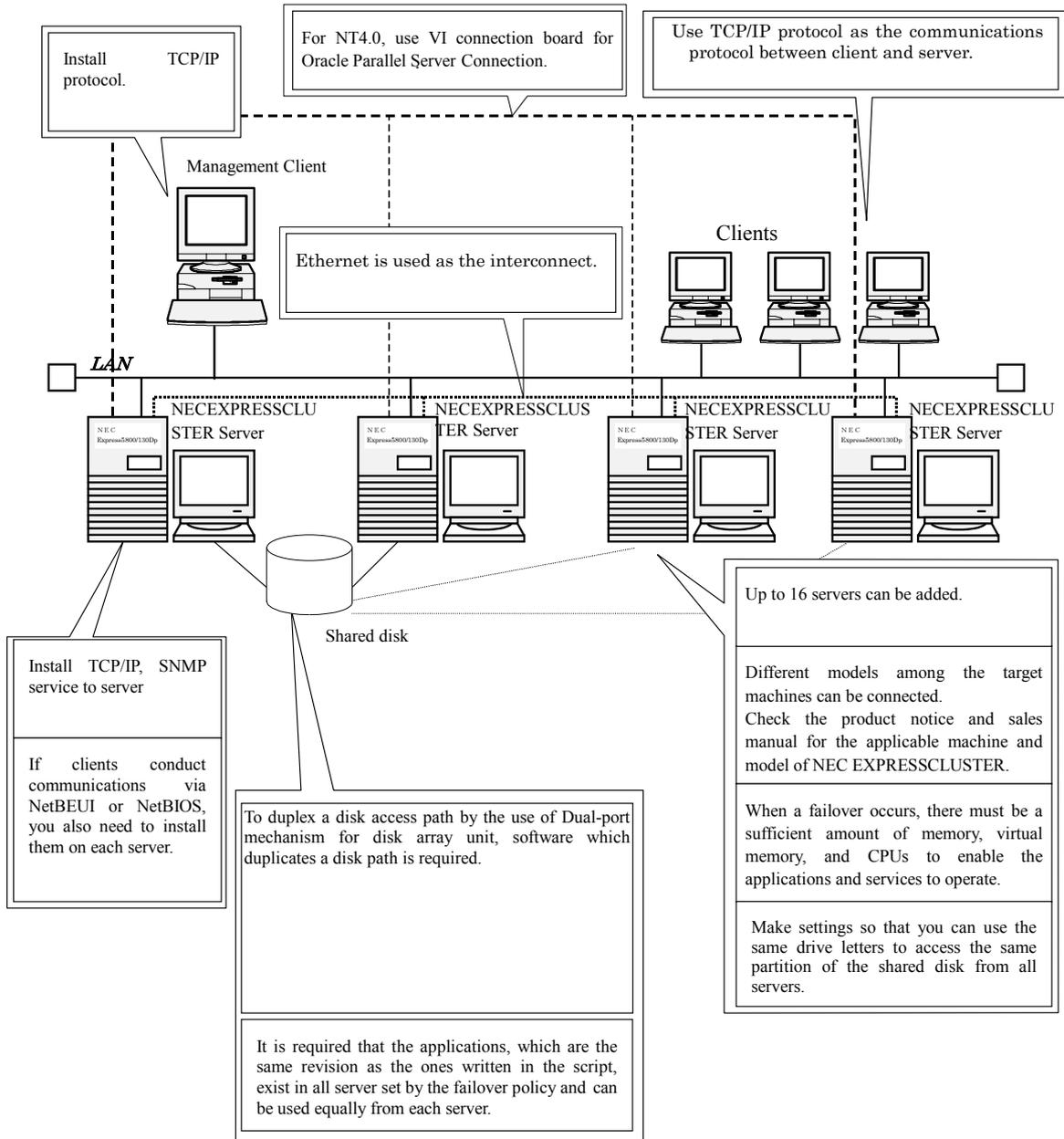
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1. NEC EXPRESSCLUSTER SYSTEM CONFIGURATION

This chapter describes the precautions and restrictions about configuration and construction of cluster system. Refer to this chapter when cluster system is constructed. For details, see “*NEC EXPRESSCLUSTER System Construction Guide / System Design*”.



1.1. NEC EXPRESSCLUSTER Server

1.1.1. Before installing

<Note> See “*NEC EXPRESSCLUSTER System Construction Guide/ Cluster Installation and Configuration Guide (Shared Disk)*” for details of installation.

Before constructing the cluster system, check if the following conditions are satisfied.

1. After installing an NEC EXPRESSCLUSTER Server, you cannot change its computer name. Be sure to decide on the computer name before installing an NEC EXPRESSCLUSTER Server.
2. When a failover occurs, there must be a sufficient amount of memory, virtual memory, and CPUs to enable the applications and services to operate.
3. There must be at least 2 interconnects for a single cluster system. The maximum number of interconnects that can be set is 16.
4. The primary interconnect cannot be used in common with a public LAN.
5. You need to install TCP/IP and SNMP service.
6. If a client uses NetBEUI or NetBIOS to communicate with the server, NetBEUI or NetBIOS must also be installed at the client.

1.1.2. NEC EXPRESSCLUSTER Configuration

<Note> See “*NEC EXPRESSCLUSTER System Construction Guide / System Design*” for the details of NEC EXPRESSCLUSTER configuration.

To configure the cluster system, follow the next precautions.

1. If you use NEC EXPRESSCLUSTER EE/SX, a cluster system can have up to 16 servers.
2. If you use NEC EXPRESSCLUSTER SE, the cluster system must consist of 2 servers.
3. To construct a load-distributed cluster system using Oracle Parallel Server, NEC EXPRESSCLUSTER/for Oracle Parallel Server option is required.
4. The maximum number of cluster systems that can be managed by a single NEC EXPRESSCLUSTER Manager is 128.
5. Up to 32 NEC EXPRESSCLUSTER Managers can access a server within a cluster system.
6. If you install a line switching unit for a load-distributed cluster system using Oracle Parallel Server, connect each server with the same RS232C port.
7. You cannot use a dynamic disk of Windows 2000 and Windows Server 2003 as a shared disk or data mirroring disks on NEC EXPRESSCLUSTER. Don't upgrade a basic disk to a dynamic disk. In addition, GPT type disk is not available.
8. Different models among the target machines can be connected. For information about NEC EXPRESSCLUSTER target machines and models, check the product notices and sales materials.

1.1.3. NEC EXPRESSCLUSTER Version compatibility

<Note> See “*NEC EXPRESSCLUSTER System Construction Guide / System Design*” for the details of NEC EXPRESSCLUSTER configuration.

There are the following precautions about the compatibility between NEC EXPRESSCLUSTER versions. Check if the following conditions are satisfied

NEC EXPRESSCLUSTER Manager of Ver 6.0 can manage the cluster system configured with NEC EXPRESSCLUSTER Ver 5.0 or later. It cannot manage the cluster system which contains Ver 4.2 or earlier.

And NEC EXPRESSCLUSTER Manager earlier than Ver 4.2 cannot manage the cluster system which contains NEC EXPRESSCLUSTER Ver 5.0 or later.

The functions of NEC EXPRESSCLUSTER are not supported on Windows 2000 terminal service.

If NEC EXPRESSCLUSTER server is installed in Windows 2000, media sense function's linkage with EtherNet becomes invalid. Media sense function is a function to detect an occurrence of a network disconnection. When this occurs, TCP/IP receives a notice from media sense function and makes IP address allotted to a disconnected network card not available during a disconnection.

When NEC EXPRESSCLUSTER is installed in Windows 2000, NEC EXPRESSCLUSTER sets a TCP/IP disconnection detection registry as a registry that a disappearance of IP address does not occur at a disconnection. And NEC EXPRESSCLUSTER displays a dialogue that asks to restore the registry to default value.

1.1.4. Precautions of settings

<Note> See “*NEC EXPRESSCLUSTER System Construction Guide / System Design/Cluster Installation and Configuration Guide*” for the details of the precautions of settings.

Precautions of setting

(1) Cluster name

- Only alphanumeric characters (upper and lowercases), hyphen (-) and underbar (_) are valid for cluster name.
- Case-insensitive.
- Up to 15 characters (15 bytes).
- The name must be a unique name for each cluster system.

(2) Server name

- The same rules that apply to computer names that can be set in Windows NT also apply to server names.
- Case-insensitive.
- Up to 15 characters (15 bytes).

(3) Cluster passwords

- The maximum password size is 15 bytes.

(4) User accounts

- A cluster system can have up to 16 user accounts.
- Only user names and passwords that were set by the user manager can be used.
- The maximum size of a user name is 31 bytes.
- The maximum size of a password is 31 bytes.

(5) Failover group

- A cluster system can have up to 64 failover groups.

(6) Failover group name

- Only alphanumeric characters (upper and lowercases), hyphen (-) and under bar (_) are valid for cluster name.
- Case-insensitive.
- Up to 15 characters (15 bytes).
- The name must be a unique name within the cluster system.
- A DOS input/output device name such as PRN cannot be used. (It can be set as the failover group name, but processing for starting the group will fail.

(7) Script

- If you start an application that needs a graphical user interface (GUI) from the script, select “Allow service to interact with desktop” of ActiveRecoveryManager services on the service setting window. Refer to (10) for the details of configuration.
- It is required that the applications, which are the same revision as the ones written in the script, exist in all server specified by the failover policy and are installed and specified to work equally for each server. See “*NEC EXPRESSCLUSTER System Construction Guide / System Design (Application)*” for details of Scripts, and “*System Design (Basic/Shared Disk)*” for Failover policy.

(8) Interconnects

- A cluster system can have at least 2, up to 16 interconnects.
- The primary interconnect cannot be used in common with a public LAN.

(9) DHCP Server

- To run NEC EXPRESSCLUSTER and the DHCP server on the same server when a virtual IP address is used, virtual IP address needs to be set statically.

(10) NEC EXPRESSCLUSTER related services

Setting [Permit dialogue with desktop as a service] of NEC EXPRESSCLUSTER related service must be as the following table.

- In Windows 2000, [Program]-[Administrative Tools]-[Services]-[Properties] of the selected service- [Log On] tab.
- In Windows Server 2003, [Administrative Tools]-[Services]-[Properties] of the selected service- [Logon] tab.

Service name	Allow service to interact with desktop
NEC EXPRESSCLUSTER Server	Either of Permit or Not permit is OK (*)
NEC EXPRESSCLUSTER Client	Permitted must be set
NEC EXPRESSCLUSTER Mirror Disk Agent	Permitted must not be set
NEC EXPRESSCLUSTER Log Collector	
NEC EXPRESSCLUSTER Manager	
NEC EXPRESSCLUSTER Web Manager	

(*)In case of confirming an operation of a printer or operating AP that needs GUI from a script, permit as necessary. Default value is not permitted.

(11) Power saving function

In NEC EXPRESSCLUSTER environment, power saving that uses OnNow, ACPI and APM function (Standby and hibernation) is not supported. Therefore, please put this function off following the next procedure.

1. On the [Control Panel], open [Power Option].
2. Select [Power Setting] tab to make the following settings:
Set "Always on for [Power Setting]
Set "None" for monitor power and hard disk power in [Always on for power setting].
Set "None" for [System standby].
3. Select the [Suspend State] tab to make the following settings:
Remove a check on [Support dormant status] in setting [Dormant status].
In this status, make sure not to become a status such as "OnNow".

(12) NEC EXPRESSCLUSTER Ver 3.0 Compatible operation

- Give the same name for failover group name as the primary server name.
- Failover groups whose primary server is each server are required. Even for uni-directional standby, an empty failover group whose primary server is the standby server is required.

1.2. Management Client

<Note> The machine to be installed NEC EXPRESSCLUSTER is called Manager Client

[Requirements]

Conditions for constructing Management Client

Any one of Windows 98, Windows Me, Windows NT 4.0, Windows 2000, Windows XP or Windows Server 2003 must be operational.

TCP/IP must be installed.

NEC EXPRESSCLUSTER Manager must be installed.

It need not belong to the same domain nor exist on the same LAN as the cluster servers.

<Note> **To create the cluster in NEC EXPRESSCLUSTER LE, management client needs to exist on the same LAN(same network address) as the cluster servers.**

[Precautions]

An NEC EXPRESSCLUSTER Manager can manage up to 128 cluster systems.

Up to 32 NEC EXPRESSCLUSTER Manager can be connected per one cluster server.

1.3. NEC EXPRESSCLUSTER Client

<Note> See “ADVANCED SYSTEM DESIGN” of “NEC EXPRESSCLUSTER System Construction Guide / System Design (Application)” for the details of NEC EXPRESSCLUSTER Client.

[Requirements]

Typically, you don't need to install an NEC EXPRESSCLUSTER Client on client machines. If you use functions listed below, however, you need to install it.

	Functions to use on client machines			
	Floating IP addresses	Virtual IP addresses	Pop-up messages	NEC EXPRESSCLUSTER Client API
Same LAN	-	O	O	O
Remote LAN	-	-	O	O

O: Functions that require installation of a NEC EXPRESSCLUSTER Client.

<Note>Regardless of the LAN configuration, NEC EXPRESSCLUSTER Client must be installed on a Windows 98, Windows Me, Windows NT4.0, Windows 2000, Windows XP or Windows Server 2003 client to use an NEC EXPRESSCLUSTER Client function (such as popup message output or application execution using the API).

<Note>You need to install an NEC EXPRESSCLUSTER Client to use a virtual computer name on Windows XP, Windows 2000 and Windows Me. Also, to use a virtual computer name on a Windows 98 client, you may need to install an NEC EXPRESSCLUSTER Client.

However, if a virtual computer name is associated with an FIP address, Windows 2000, Windows XP, Windows 98, Windows Me clients can use virtual computer names without installing NEC EXPRESSCLUSTER Client.

[Precautions for the configuration]

- (1) All Windows clients on the same LAN as the server or on a remote LAN can access to the server according to an FIP address. Also, even a client using a non-Windows operating system can access to the server according to an FIP address as long as ARP is supported. Though it does not guarantee the normal operation on all non-Windows hosts. Enough evaluation is required before the operation.
- (2) The cluster servers and clients need not belong to the same domain. However, a client that uses security functions provided by OS may need to belong to the same domain as the servers.

2. Disk

2.1. Shared Disk

* For details of shared disk, see “CLUSTER SYSTEM CONSTRUCTION” in “*NEC EXPRESSCLUSTER System Construction Guide System Design (BASIC/Shared Disk)*”.

[Requirement]

1. Make sure the file system of the switched partition is NTFS.
2. A shared partition must be a RAW partition. Do not format it. Also, assign cluster characters to a shared partition from the *NEC EXPRESSCLUSTER disk administrator*. Do not assign a drive letter to it.
3. Assign the same cluster character string to the same area at all servers.
4. Assign the same drive letter to the same area at servers that have failover policy.
5. It is not allowed on Windows 2000 or Windows Server 2003 to use a dynamic disk as shared disk. Don't upgrade a basic disk to a dynamic disk. GPT-type disks are not available, either.

[Precautions]

1. As necessary, You must install the management tool for array disk used in the cluster system. Confirm this by setup card etc.

[Precautions on construction]

1. You can create up to 32 partitions per disk.
2. On a shared disk, FT disk's functions such as stripe set, volume set, mirroring, and parity-protected stripe set aren't supported.
3. Restrictions of shared disk are as follows;
 - Up to 16 cluster partitions are allowed per cluster system.
 - Up to 26 switched disk partitions (including system disks) are allowed per cluster system.
 - The cluster/shared partitions are not displayed in the server's resource tree. If connection to a cluster or shared partition fails, that server will turn to yellow and a server status “Having some resources that connection is failed” will appear.

[Precautions on setting]

1. Up to 13 characters are allowed for cluster character strings.

3. NETWORK

3.1. Network Configuration

<Note> See “*Network Design*” of “*NEC EXPRESSCLUSTER System Construction Guide / System Design*” for the details of Network configuration.

3.1.1. Investigating network configuration

[Requirement]

The interconnect uses 100BASE-TX or higher.

All servers that form the cluster must exist in the same LAN and must constitute the same domain.

[Precautions on construction (Windows 2000)]

(1) Since a network system may burden the domain controller because of its characteristics, it is recommended not to use NEC EXPRESSCLUSTER Server as the domain controller when constructing the network.

(2) The network address of interconnect LAN must be different from the public LAN's network address.

The IP addresses of the interconnect LAN can be private IP addresses.

3.1.2. Router

No special setting is required for Floating IP addresses (FIP).

3.1.3. Duplication of LAN connection

<Note> See Section “*Duplication of LAN connection*” of “*NEC EXPRESSCLUSTER System Construction Guide / System Design (Application)*” for the details of duplication of LAN connection.

Floating IP addresses does not perform dynamic routing unlike virtual IP addresses in the duplicate LAN connection configuration. To use dynamic routing, use virtual IP addresses which have been supported.

3.2. IP Address

3.2.1. IP address general precautions

<Note> See “Network Design” of “NEC EXPRESSCLUSTER System Construction Guide / System Design (BASIC/Shared Disk)” for the details of IP address setting.

- 1 IP address regulations
 - A server can have up to 16 IP addresses. (Except floating IP address and virtual IP address)
 - A server cannot have multiple IP addresses belonging to the same network address.
 - Each IP address cannot be inclusive relation as following example.
 IP address: 10.1.1.10, Subnet mask: 255.255.0.0
 IP address: 10.1.2.10, Subnet mask: 255.255.255.0
- 2 Precautions on setting IP address
 - It is recommended to use floating IP addresses. (Virtual IP addresses also can be used)
- 3 Up to 64 addresses are allowed per cluster system as floating IP address and virtual IP address respectively.
- 4 Floating IP addresses and virtual IP addresses comparison

	Floating IP Addresses	Virtual IP Addresses
Available IP addresses	Same network address as the public LAN	Different network address than the public LAN or interconnect
Switching method	The MAC address in the ARP table is switched according to an ARP broadcast from the server	Gateway addresses on the routing table are switched by RIP broadcast from the servers and NEC EXPRESSCLUSTER Client.
Client operating system	Not selected	Clients on the same LAN should be Windows NT, Windows 2000, Windows Server 2003, Windows 98, Windows Me, and UNIX. The client operating system is not selected at a remote LAN.
Router setting	Not required	RIP must be interpreted.
NEC EXPRESSCLUSTER Client	Not required	Required at a client on the same LAN.
LAN multiplexing	Not allowed	Allowed
Potential resources	List of IP addresses that were set by using floating IP settings	-
Use between servers	Allowed (however, only for the public LAN)	Allowed (supports route switching according to disconnection)
Use in Oracle Parallel Server	Not allowed	Allowed

3.2.2. Floating IP address

<Note> See “*Floating IP address*” of “*NEC EXPRESSCLUSTER System Construction Guide / System Design (BASIC/Shared Disk)*” for the details of Floating IP address.

3.2.2.1. Floating IP address regulations

A cluster system can have up to 64 floating IP addresses.

A host address that is not being used within the same network address as the server’s Public-LAN must be assigned.

3.2.2.2. Path Control of Floating IP Addresses

Path control is not required.

Path control of switched disk partition is made by the network IP address used by the server.

3.2.2.3. Floating IP Addresses requirement for use

1. Floating IP addresses can be accessed from the machines listed below.
 - Cluster server
 - The other servers in the same cluster, the servers in the other cluster.
 - Clients belonging to same/remote LAN as the cluster servers.

2. If the following conditions are satisfied, non-Windows machines can use floating IP addresses. However, it is not guaranteed that all machines and architectures work normally. Enough evaluation is required about non-Windows OS before the operation.
 - TCP/IP is used as the communication protocol.
 - ARP protocol is supported.

3. The floating IP address mechanism will operate without problem even with a LAN in which a switching HUB is used.

4. When a server fails, a connected TCP/IP connection is disconnected.

5. Floating IP addresses can even be accessed from a machine on a remote LAN.

3.2.3. Virtual IP address

<Note> See “Virtual IP address” and “Duplication of LAN connection” of “NEC EXPRESSCLUSTER System Construction Guide / System Design (Application)” for the details of Virtual IP address.

3.2.3.1. Investigating virtual IP addresses

An IP address assigned for a virtual IP address must satisfy the following conditions.

- It is outside of the range of network addresses of the LAN to which the cluster servers belong.
- It does not conflict with an existing network address.

To satisfy these two conditions, select either of the following two assignment methods.

1. Obtain new legitimate network addresses to be used for virtual IP addresses and assign the virtual IP addresses from among them.
2. Determine suitable network addresses from the private IP address space and assign the virtual IP addresses from among them. The specific procedure is described below.

Select one network address from the network addresses 192.168.0 to 192.168.255 to be used for virtual IP addresses.

Assign at most 64 host IP addresses to be used for virtual IP addresses among the ones corresponding to the network address selected above. (For example, if you selected network address 192.168.10, assign two IP address 192.168.10.1 and 192.168.10.254 as the host IP address.)

Specify the net mask of the virtual IP address as 255.255.255.0.

- In addition, note the following points.

- Since private IP addresses are for closed networks within an organization, they cannot be accessed by using virtual IP addresses from outside of an organization that is shielded from Internet Service Providers.
- Path information related to private IP addresses cannot be transported outside of the organization.
- Regulation is required within the organization to prevent private IP addresses conflicts.

<Note> See RFC1597 for the detail of private IP address.

3.2.3.2. Path control

To access a virtual IP address from a remote LAN, virtual IP address path information must be enabled at all routers on the path from the remote LAN to the cluster servers' LAN.

Specifically, the following settings are required.

- The router belonging to the same LAN as cluster server can analyze host-RIP.
- Either all routers on the path from the cluster servers to the remote server must be set up for dynamic path control or information related to the virtual IP address path must be set as static path information.

3.2.3.3. Virtual IP address usage conditions

3.2.3.3.1. Conditions when virtual IP address can be used

Virtual IP addresses can be accessed correctly from the machines listed below. The virtual IP address mechanism will operate without problem even with a LAN in which a switching HUB is used. However, when a server fails, a connected TCP/IP connection is disconnected.

A prerequisite condition for connecting to a virtual IP address from a machine on a remote LAN is that the “path control” described in the previous section is performed correctly.

- (1) Cluster servers
- (2) Clients that belong to the same LAN as the cluster server

If the following three conditions are satisfied, a virtual IP address can be used.

- Windows 98, Windows Me, Windows NT 4.0, Windows 2000, Windows XP or Windows Server 2003 OS is running
- TCP/IP is used as the communication protocol between servers and clients.
- NEC EXPRESSCLUSTER Client is installed.

- (3) Clients on a remote LAN

Even if the client is a non-Windows host on which NEC EXPRESSCLUSTER Client is not operating. The cluster server can be accessed by using a virtual IP address.

Follow the next precautions.

1. NetBEUI and NBT are used for the communication between servers and clients.
A virtual IP address cannot be accessed. Either use the client API or switch the address according to the procedure described in the pop-up message.
2. Non-NEC EXPRESSCLUSTER Client belonging to the same LAN as Cluster Server.
Virtual IP address cannot be used by non-NEC EXPRESSCLUSTER Client belonging to the same LAN.

3.2.3.3.2. Environments in which virtual IP addresses cannot be used.

The NetBIOS protocol is not supported by virtual IP addresses.

Even if a virtual IP address is mapped to an appropriate host name such as LMHOSTS, it cannot be used for Windows browsing, access to network or printer resources, or user authentication.

Use virtual computer name to switch the direction of connection automatically via NetBIOS protocol.

A cluster system can have up to 64 Virtual IP address.

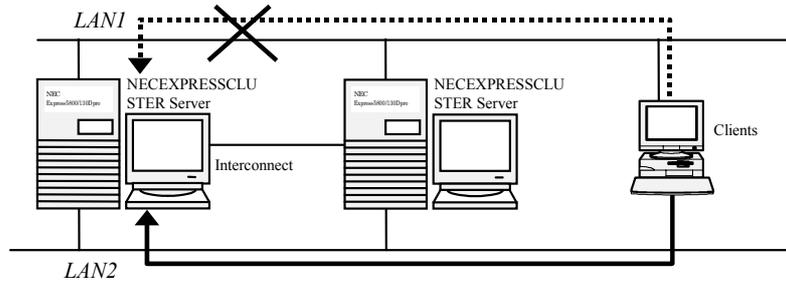
3.2.3.4. Precautions for duplication of LAN connection

If multiple LANs other than the interconnect-dedicated LAN are connected to the servers, the duplication of LAN connection is supported for virtual IP addresses and physical addresses acquired by using the client API.

Duplication of LAN connection is available in the following three configurations.

[Configuration 1]

When the client and server exist in the same network segment in the duplicate LAN connection



[Configuration 2]

When the routers exist between the client and server in both of the duplicate LAN connections

Figure 1

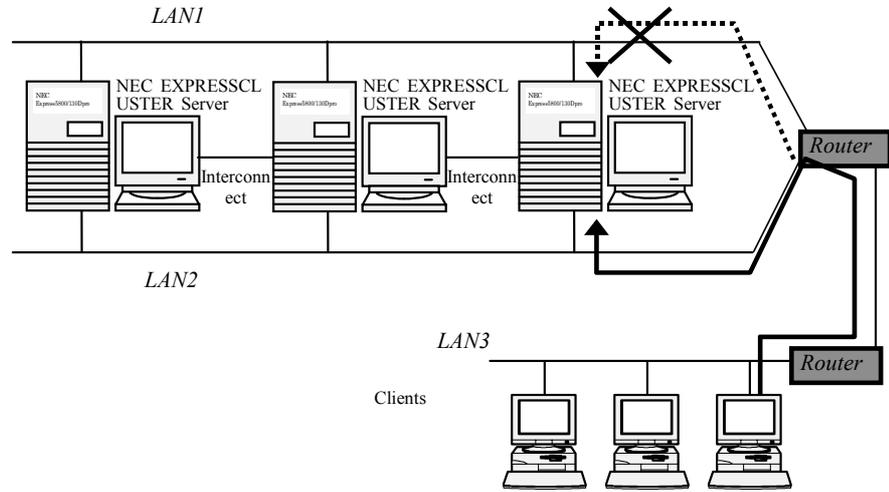
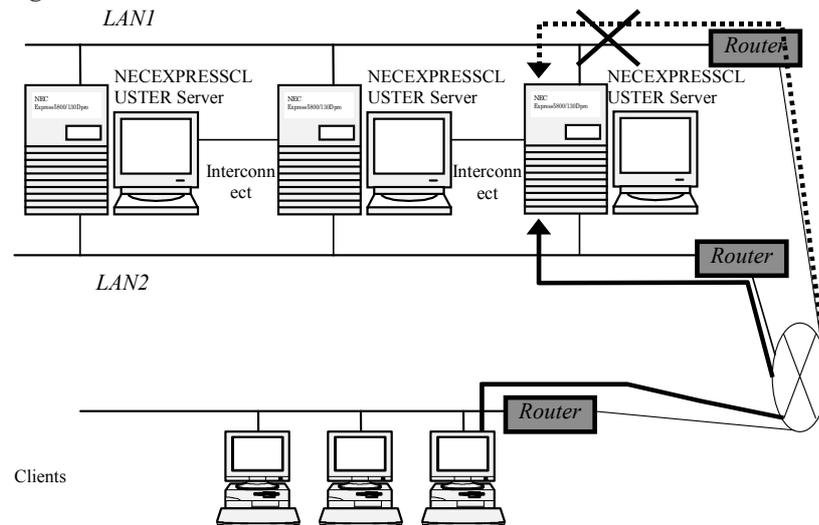


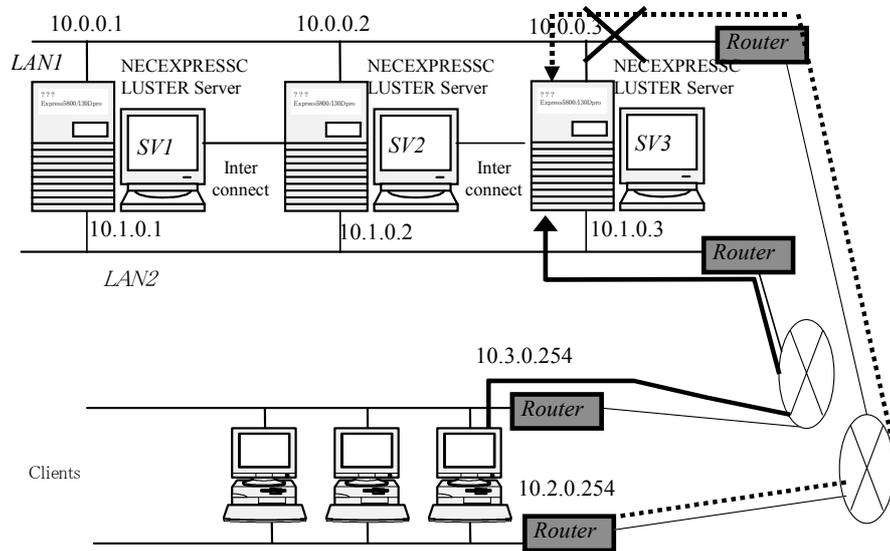
Figure 2



For Figure 2, dynamic path control must be performed by the entire network.

[Configuration 3]

When the routers exist between the clients and servers in both of the redundant public LANs and client machine divides the path.



Dynamic path control must be performed by the entire network.

1. For configuration3, if NEC EXPRESSCLUSTER Ver4.0 or NEC EXPRESSCLUSTER Ver5.0/5.1 are installed, RUR/update later than ESS RL1999/12 are required. If NEC EXPRESSCLUSTER Ver6.0 is used, you do not have to update it using RUR/update.
2. For configuration1 and configuration3, client machines need to be installed NEC EXPRESSCLUSTER Client. In configuration2, NEC EXPRESSCLUSTER Client is not required.
3. To configure configuration3, specify the client's gateway address to the client setup file. For example, in the above figure, client setup file is specified as follows.

```
@CLUSTER
%SV1:10.0.0.1/10.2.0.254,10.1.0.1/10.3.0.254:20006
%SV2:10.0.0.2/10.2.0.254,10.1.0.2/10.3.0.254:20006
%SV3:10.0.0.3/10.2.0.254,10.1.0.3/10.3.0.254:20006
```

If virtual IP address is used for client-server connection, the network path of virtual IP address is switched to use the normally working public LAN.

In configuration 1 and 3, NEC EXPRESSCLUSTER Client switches the network path.

In configuration 2, network path is switched by the dynamic path control function of the routers.

4. For every configuration, the IP address of the normally working public LAN is returned for the client API which acquires the physical IP address. To use client API, regardless of the configurations, the installation and settings of NEC EXPRESSCLUSTER Client are required.

5. For every configuration, to detect the network path failure and switch the path, an event notifying the start of failover is reported to the application which publicizing the monitoring API. After that, completion of failover event is reported.
Also, on the client screen, pop-up message reporting the network path failure/switch is displayed.
To use client API and pop-up messages, regardless of the configurations, the installation and settings of NEC EXPRESSCLUSTER Client are required.
6. For every configuration, if all the LANs do not respond and failover is not reported from the servers, the stop event of failover group is reported to the application publicizing the monitoring API.
Also, on the client screen, pop-up message reporting the network path failure/switch is displayed. And if it recovers to normal operation, the start event of failover group is reported to the application publicizing the monitoring API. And, on the client screen, pop-up message reporting that the responses from server are recovered is displayed.
To use client API and pop-up messages, regardless of the configurations, the installation and settings of NEC EXPRESSCLUSTER Client are required.
7. If the network path is switched since the failure occurred on the high-priority network path and the failed network path is recovered after that, client API, pop-up messages, and the network path of the virtual paths in configuration 1 and 3 are not switched back to the high-priority network path automatically.
To switch the path to the high-priority one, restart the client or execute the r-option of the armcpl command. The network path of virtual IP address in configuration 2 is determined with the algorithm used for configuring the network and the dynamic path control.

3.3. Virtual Computer Name

<Note> See “*Virtual Computer Name*” of “*NEC EXPRESSCLUSTER System Construction Guide / System Design (BASIC/Shared Disk)*” for the details of Virtual Computer Name.

3.3.1. Precautions for virtual computer name

A name assigned for a virtual computer name must satisfy the following conditions.

- It is a name that differs from the server name.
- It is a name that differs from the computer name of a machine connected to the same network segment.
- It contains at most 15 characters (not including NULL).
- It consists only of alphanumeric characters and hyphens (-).
- Case insensitive. (However, uppercase and lowercase used during entry are maintained directly)
- A cluster system can have up to 64 virtual computer names.

3.3.2. Clients which can use virtual computer name

If the following conditions are satisfied, a virtual computer name can be used.

- Windows NT 4.0, Windows 2000, Windows XP, Window Server 2003, Windows 98 or Windows Me OS is running.
- The communication protocol used between the server and client is TCP/IP or NETBEUL.

3.3.3. Precautions concerning the use of virtual computer names

You cannot make a network printer connection from [Control Panel].

net use command:

Connects the computer to shared resources, disconnects the computer from shared resources, or displays information related to computer connections. This command controls to reconnect to network in the next log on.
See the help of OS for the details of this command.

If a virtual computer name is associated with an FIP address, the following restrictions are avoided.

- * After a failover occurs due to a server failure, several minutes may be required until a reconnection can be made. This situation can be rectified by installing NEC EXPRESSCLUSTER Client.
- * After the cluster is started up, several minutes may be required until the virtual computer name is displayed by the network computer.
- * You cannot specify a virtual computer name for LMHOSTS.

3.3.4. To use virtual computer names on Windows 2000 and Windows XP

To use virtual computer names on Windows 2000 and Windows XP, you need to make the following settings.

[Requirement]

1. Install the NEC EXPRESSCLUSTER Client and setup the client. However, if a virtual computer name is associated with an FIP address, this step may not be required.

[Precautions]

1. If you made settings to use a DNS server and the DNS server is linked with a WINS server, failover switching will be disabled while cache information on virtual computer names remains on the DNS server. Shorten a cache retention period for WINS records to about one second. If a virtual computer name is associated with an FIP address, above restriction will be avoided.
2. On Windows 2000, you cannot use virtual computer names that meet the following conditions on a cluster server:
 - Virtual computer name is registered in a cluster that includes the own server, and is active on another server.

If a virtual computer name is associated with an FIP address, above restriction will be avoided.

3.3.5. To use virtual computer names on Windows 98

If a virtual computer name is associated with an FIP address, above restriction will be avoided.

To use virtual computer names on a Windows 98 client, you may need to install a NEC EXPRESSCLUSTER client.

If its version number shown in [System] on the [Control Panel] is

"Windows 98 Second Edition 4.10.2222 A", NEC EXPRESSCLUSTER installation will be required.

3.3.6. To use virtual computer names on Windows Me

If a virtual computer name is associated with an FIP address, above restriction will be avoided.

To use virtual computer names on Windows Me, you need to install a NEC EXPRESSCLUSTER Client.

4. OTHER PERIPHERAL DEVICES

4.1. UPS

4.1.1. Precautions concerning the setting of UPS

To use UPS, keep in mind the following.

[Requirements]

1. If multifunctional UPS is used as UPS, keep in mind the followings.⁴

- (1) Check the setting of DIP switch placed in the rear of UPS. (See manuals of multifunctional UPS for details.)

Before changing the setting of DIP switch, **be sure to turn off the enable switch of UPS and eject the power cable.** (The change of switch setting is not recognized if the power cable is connected.)

[Shared disk]

- Specify the UPS connected to server as [Master].
- Specify the UPS connected to shared disk as [Slave].

[Data Mirroring Disks configuration]

- Specify the UPS as [Master]

- (2) Confirm that [AUTO/LOCAL switch] placed in the rear of multifunctional UPS connected to the server and shared disk is specified as [AUTO].

4.1.2. Precautions concerning the UPS connection

Make sure that the power supply of network HUB, which connects between the servers, is provided from the UPS. (If the shared disk is included to the system, the UPS to which the shared disk is connected)

If the power supply of the HUB is directly connected to the commercial power, when the power supply is cut off, the communication between NEC EXPRESSCLUSTER servers is interrupted and shutdown may be failed.

⁴ See the manual attached to the Smart-UPS if Smart-UPS is used to the cluster configuration.

4.2. Server Management Board

<Note> See “Forced Stop of the Other Server (Server Management Board)” of “*NEC EXPRESSCLUSTER System Construction Guide / System Design (Application)*” for the details of Server Management Board.

If you connect NEC EXPRESSCLUSTER with NEC server management boards, (N8503-33 Server Management board) or the equivalent one, it will turn off the power when the heartbeat discontinues, regardless of the server conditions.

Bear in mind the following:

[Precautions]

1. If both LANs that are set as the Interconnect are disconnected, since the power is turned off even if the server is active, the data of applications or services that are being executed may not be saved.
2. If a sever failure occurred due to a panic, since the power is turned off even if a memory dump is being saved, the cause of the panic condition may not be able to be analyzed.
3. If OS shutdown is performed from the [Start menu], since the power is turned off even if the shutdown processing is in progress, the data of applications or services that are being executed may not be saved. To avoid this problem, set a longer interval for the heartbeat detection timeout interval than the time required for OS shutdown.

5. RESOURCES

5.1. Synchronization Target Registry Key

<Note> See “Failover group” of “*NEC EXPRESSCLUSTER System Construction Guide / System Design (BASIC/Shared Disk)*” for the details of synchronization target registry key.

5.1.1. Precautions when synchronizing the registry

- 1 Registry synchronization may fail in the following situation.
Failover occurred when the synchronization target registry key is opened at the failover destination server (since hive file expansion failed)
- 2 Set only the minimum required registry keys for synchronization target registry keys.
- 3 Registry keys to be synchronized.

Only arbitrary keys subordinate to the following two registry keys can be set.

Therefore, ~~the entire registry cannot be synchronized.~~

- Arbitrary keys subordinate to the HKEY_USERS directory.
- Arbitrary keys subordinate to the HKEY_LOCAL_MACHINE directory

Except the followings;

HKEY_LOCAL_MACHINE\SOFTWARE\NEC\ESMARM subordinates.

HKEY_LOCAL_MACHINE\SOFTWARE\NEC

HKEY_LOCAL_MACHINE\SOFTWARE

HKEY_LOCAL_MACHINE

5.1.2. Regulations of synchronizing the registry

- 1 The maximum number of synchronization target registry keys for a single failover group is 16.
- 2 The characters that can be used are determined according to the OS registry key specifications.
- 3 Up to 259 bytes.

5.2. Printer Resource

<Note> See “Resource” of “*NEC EXPRESSCLUSTER System Construction Guide / System Design (Application)*” for the details of Printer resource.

[Precautions]

The following rules are applied for the spool.

- 1 A cluster system can have up to 128 spools.
- 2 The maximum size of a printer name is 31 bytes.
- 3 The maximum size of a printer port name is 67 bytes.
- 4 The maximum size of a shared name is 31 bytes.
- 5 Spool directory path names can be up to 259 bytes including the drive letter.
- 6 Above names are all case-insensitive.

5.3. Line Switching Unit

<Note> See “Resource” of “*NEC EXPRESSCLUSTER System Construction Guide / System Design (Application)*” for the details of line switching unit.

To use the line resource function, NEC line switching unit (such as N8591-01/02 V.24/X.21 line switching unit, N8545-01/03 V.24/X.21 line switching unit, N8545-02/04 V.24/X.21 line switching expanded unit) or equivalent one is required. And NEC high-speed multi-lined board (N8104-102 high-speed multi-lined board) or the equivalent one is also required.

[Requirement]

Line resource is connected to the line switching unit, and available only in Ver3.0-compatible operations.

[Precautions]

A cluster system can have up to 16 line switching units.

5.4. Logical Service Name

<Note> See “Failover Attribute” of “*NEC EXPRESSCLUSTER System Construction Guide / System Design (Application)*” for the details of logical service name.

[Precautions]

The maximum number of logical service names for a single failover group is 48.

Allowed logical service name are;

- Single-byte alphanumeric characters (upper or lower case), hyphens (-), and underbars (_).
- The name is case-insensitive (uppercase and lowercase letters are not distinguished).
- Up to 31 characters (31 bytes).

5.5. Failover Group Name

<Note> See “Failover group” of “*NEC EXPRESSCLUSTER System Construction Guide / System Design (BASIC/Shared Disk)*” for the details of failover group name.

This is the name of a failover group.

Since the NEC EXPRESSCLUSTER Client API performs monitoring or obtains the status in terms of individual failover groups, the cluster name and failover group names are used as keys.

[Precautions]

- 1 Single-byte alphanumeric characters (upper or lower case), hyphens (-), and underbars (_).
- 2 Case-insensitive.
- 3 Up to 15 characters (15 bytes).
- 4 Unique name within the cluster system.
- 5 A DOS input/output device name such as PRN cannot be used.
(It can be set as the failover group name, but processing for starting the group will fail.)

5.6. ARMRSP Command

<Note> See “ADVANCED SYSTEM DESIGN” of “*NEC EXPRESSCLUSTER System Construction Guide / System Design*” for the details of Cluster Resources Monitor.

[Precautions]

1. To monitor the shared partition under Oracle Parallel Server (OPS) environment, specify to monitor CLUSTER Partition.
2. The server having the highest failover policy is determined as the failover destination server.
3. If there is no normally running server without the failed server, failover does not occur.
4. To avoid the repeat of failover caused by the failure of the resources shared by users, the failover stops after the failover is repeated specified times (default is 8). This counter is reset in the following cases.
 - Start up of server
 - Reboot of a server
 - Start up of the failover group which starts up the ARMRSP command.
 - Resources to be monitored keep running normally over 1 hour.
5. To monitor the public LAN, the ping is passed toward the specified IP addresses. Therefore, if ping cannot be passed, the server is determined as failed and failover occurs even the LAN itself is working.
6. If Resource Monitoring function of the failover group is used, the resource monitoring using ARMRSP, NEC EXPRESSCLUSTER command, becomes invalid.

6. PRECAUTIONS FOR THE USE OF APPLICATIONS

<Note> Refer to “Applications and Services in an NEC EXPRESSCLUSTER Environment” of “*NEC EXPRESSCLUSTER System Construction Guide / System Design (BASIC/Shared Disk)*” for the precautions concerning the use of applications also.

Cluster system may not work depending on the combinations of OS, NEC EXPRESSCLUSTER, and applications. The followings are the examples and explanations. Pay close attention to the following combinations when you construct the cluster system.

6.1. SQL Server

[Operation mode] Multi-directional standby

[Phenomenon]

NEC EXPRESSCLUSTER Manager cannot stop connecting to a shared disk even SQL server's service is stopped.

[Problem]

While SQL server's service is not stopped after the script stopped and SQL server's service is accessing to a shared disk, NEC EXPRESSCLUSTER fails to disconnect the shared disk. Then the active server fails and failover occurs.

[Measures]

Specify to wait 30 seconds with the ARMSLEEP command written in the stop script. (This sleep time should be sufficiently examined and specified to the enough value for stopping the script.)

6.2. IIS

[Operation mode] Multi-directional standby

[Phenomenon]

Even NEC EXPRESSCLUSTER moves the contents to the standby server when failover occurs, IIS does not recognize the moved contents. Therefore, the standby server cannot use the contents moved from the active server by failover.

[Problem]

Multiple IIS service cannot start up on one server. And IIS cannot recognize the contents failed over from the active server in real-time.

[Measures]

When multi-directional standby is operational, restart of IIS is required to fail over the contents when failover occurred.

6.3. Norton AntiVirus 4.0

NEC EXPRESSCLUSTER does not support this PP. Do not use this PP in NEC EXPRESSCLUSTER environment since the following problems will occur if this is used.

[Operation mode] coexistent operation

[Phenomenon]

The access to the active switched disk partition is failed since Norton AntiVirus 4.0 intercepts entire I/O for the disk when Norton AntiVirus 4.0 receives “Not Ready” for the I/O request to some partitions. (The other versions are not evaluated)

[Problem]

The above phenomenon occurs.

[Measures]

No measure for this problem. Please use the other virus checker software.

See “*NEC EXPRESSCLUSTER System Construction Guide/ [For PP]*” for details of construction

information about InocuLAN and ServerProtect of NEC EXPRESSCLUSTER.

7. PRECAUTIONS DURING THE OPERATIONS

<Note> Refer to “*NEC EXPRESSCLUSTER System Construction Guide /Operation/Maintenance*” also for the precautions during the operations.

7.1. Precautions Concerning the Maintenance During Normal Operations

7.1.1. Precautions concerning the adjustment of the clocks

To adjust change the time of the cluster system, perform the following steps:

- (1) For the below service related to NEC EXPRESSCLUSTER Server, set the startup types as manual.

<ul style="list-style-type: none">- NEC EXPRESSCLUSTER Server service- NEC EXPRESSCLUSTER LogCollector service- NEC EXPRESSCLUSTER MD Agent service

- (2) Shut down and restart the cluster.
- (3) Adjust the clocks so that every server indicates the same time.
- (4) Put back NEC EXPRESSCLUSTER Server related service whose startup type has been change to manual in (1), to automatic.
- (5) From the [Start] menu, shut down and restart the system.

Note: When you adjust the clocks, make sure that applications and database systems are not affected.

7.1.2. Concerning the stop of NEC EXPRESSCLUSTER services

- (1) The disconnect of shared disk and switch-mirror disk may be failed if applications/services are using the shared disk and switch-mirror disk. Make sure to stop the applications/services using the shared disk/switch-mirror disk before stopping the NEC EXPRESSCLUSTER services.
- (2) The disconnect of shared disk and switch-mirror disk may be failed if shared disk and switch-mirror disk is shared on the network. Make sure to cancel the sharing setting of the shared directory of shared disk and switch-mirror disk before stopping the NEC EXPRESSCLUSTER services.

7.1.3. Procedures to stop service related to NEC EXPRESSCLUSTER server

To stop a service related to NEC EXPRESSCLUSTER server, follow the next procedures.

- (1) Start [Services].
 - + [Program] - [Management Tool] - [Services]
- (2) For the below service related to NEC EXPRESSCLUSTER Server, the startup types are set as hand-operated.
 - NEC EXPRESSCLUSTER Server service
 - NEC EXPRESSCLUSTER LogCollector Service
 - NEC EXPRESSCLUSTER r MD Agent Service
 - + open a property of the above service and select [General] tab.
- (3) (1) and (2) are performed for all servers.
- (4) Shut down and restart the cluster.

To re-start a stopped service related to NEC EXPRESSCLUSTER Server follow the next procedures.

- (1) Start [Services].
- (2) Put back NEC EXPRESSCLUSTER Server related service whose startup types has been change to manual, to automatic.
- (3) (1) and (2) are performed for all servers.
- (4) In all servers, restart from [Start] - [Shutdown].

7.1.4. Note on executing CHKDSK on a shared disk

It is impossible to execute chkdsk on a shared disk with the recovery mode (/f option) when it is running as resource or system is booting.

If you would like to execute with the recovery mode, follow the steps below.

1. Change the Startup type of “NEC EXPRESSCLUSTER Server” service to “Manual” on all servers, then perform cluster shutdown.
2. Connect the target partition manually with NEC EXPRESSCLUSTER disk administrator.
3. Execute chkdsk against the connected partition.

7.2. Precautions Concerning the Maintenance during Abnormal Operation

7.2.1. Notice when one side of server has abnormally high load

[Phenomenon]

When one side of a server is in a status of abnormally high load and heartbeat timeout is detected in the other side of the server, failover occurs.

When shutdown process takes long time, there is a possibility that a similar phenomenon might occur. In this case a system may be halted during a shutdown process. Even if this happens fail-over process to the other server is preformed properly.

[Failover effects]

When a server becomes abnormally high load status, NEC EXPRESSCLUSTER prevents data destruction by forbidding an access to a switched disk partition of the server and shutting down the server.

[Measures]

If one side of server is predicted to be in high load status, adjust time of heartbeat timeout.

Time of heartbeat timeout is adjusted at monitoring time tab in cluster property dialogue box of NEC EXPRESSCLUSTER Manager.

[Causes of high load]

For example, in the following case a server becomes high loaded.

- (1) Saving partition information by using a disk administrator which is an administrator tool of Windows NT.

From start menu, Program->Management tool(Shared)-> Disk administrator-> Partition-> Configuration information-> Save

- (2) Using compression tool
- (3) Copying a large volume file

In Windows OS, if sufficient memory is not available when a large volume file is copied, page fault occurs frequently.

And also in order to avoid an abnormally high load status, set [Maximize throughput of a network application]. It makes an abnormally high load status difficult to occur.

<Windows 2000>

From [Start] menu, [Set]->[Control Panel]->[Network and Dial-up Connections]->Open a property of local area connection for public LAN->Open a property of [File and Printer Sharing for Microsoft Networks]->Maximize data throughput of a network application.

<Windows Server 2003>

From [Start] menu, [Control Panel]->[Network Connections]->Open a property of local area connection for public LAN->Open a property of [File and Printer Sharing for Microsoft Networks]->Maximize data throughput of a network application.

7.2.2. Precautions for the maintenance of network adapter

When maintenances such as the change of settings of network adapters are performed, some tools stop the I/O to the network during the maintenance.

If this phenomenon occurs, server may shut down and failover may occur.

See “*NEC EXPRESSCLUSTER System Construction Guide / Operation/Maintenance*” for the details of the procedures to changing the network adapters.

7.2.3. Precautions for the isolation of the server from the cluster

If a server is isolated from the cluster, the isolated server becomes “isolated status.”

In this status, this server is still the object of monitoring by network partition. Therefore, if maintenances are required due to LAN board failure, for example, isolate the server from cluster and set the startup of the NEC EXPRESSCLUSTER -related services to [Manual], and restart the server. That is, to maintain the server, follow the next procedure.

(1)Maintenance of software

1. Isolate the server from cluster using NEC EXPRESSCLUSTER Manager

(2)Maintenance of hardware

1. Isolate the server from cluster using NEC EXPRESSCLUSTER Manager.
2. Set the startup of the NEC EXPRESSCLUSTER Server services of isolated server to [Manual], and restart the server.

7.2.4. Connection error to CLUSTER Partition/Shared partition

If CLUSTER disk partition or shared disk partition connection fails, the server is displayed in yellow, and "Connection failed for a resource" is displayed for the server status.

Refer to the server’s event log to remove the fault.

7.2.5. Precautions when moving a failover group

1. Precautions concerning the creation of the shutdown script

When a group is moved, the shutdown script is executed at the server from which the group was moved. Use the shutdown script to stop all applications or services that are using the shared disk. As error processing for stopping applications or services in case some application or service cannot be stopped. Use of the ARMDOWN command is recommended since issuing the ARMDOWN command shuts down the servers, it plays a role in protecting data.

2. Operation when disconnection of the shared disk fails

If an application is accessing a disk when the group is moved, the disconnection of the shared disk/switch-mirror disks will fail. To protect data in this case, NEC EXPRESSCLUSTER will perform either of the following actions.

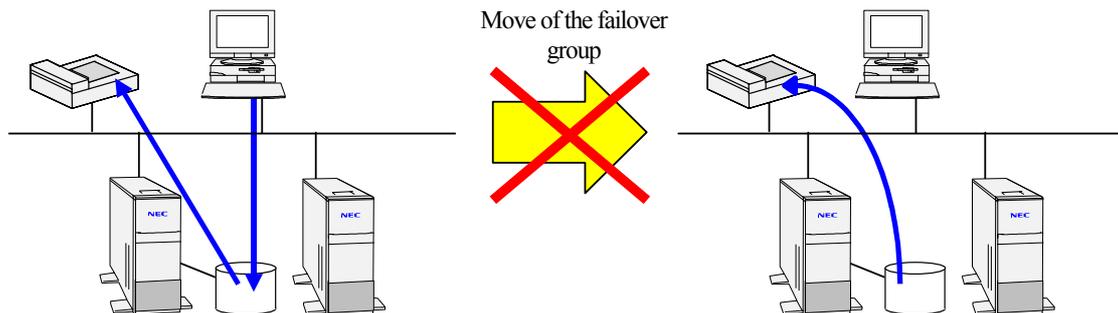
- * NEC EXPRESSCLUSTER forces to disconnect shared disk/data mirroring disks. In this case, the applications and services accessing to the shared disk/data mirroring disks may have application errors or terminated abnormally.
- * NEC EXPRESSCLUSTER shuts down the failed server, and moving of the group will be failed.

And failover destination server detects the down of failed server, and failover occurs.

3. The move of failover group during printing

Do not move the group while printing to a printer that is subject to print sharing.

Since a spool file has been set up on the shared disk, the disconnection of the shared disk may fail when moving the group.



4. Precautions for using NEC EXPRESSCLUSTER Client API

To acquire/monitor the status of the server using NEC EXPRESSCLUSTER Client API, the move of group is reported as a failover.

Therefore, the event notifying that failover occurs is reported when the move of group starts, and as the move of group is finished, the event notifying the completion of failover appears.

And during the group is moving, the status of the server is shown that failover is under processing.

See “*NEC EXPRESSCLUSTER System Construction Guide / API Reference*” for the details.

5. Precautions While Moving a Failover Group

To move or stop the failover group, or shut down the cluster, terminate all access to the shared disk to which the failover group belongs.

If there are accesses to the shared disk/data mirroring disks while moving/stopping the failover group, NEC EXPRESSCLUSTER perform the either of the following actions to disconnect the disks.

- * NEC EXPRESSCLUSTER forces to disconnect shared disk/data mirroring disks. In this case, the applications and services accessing to the shared disk/data mirroring disks may have application errors or terminated abnormally.

- * NEC EXPRESSCLUSTER shuts down the failed server, and moving of the group will be failed.

And failover-destination server detects the down of failed server, and failover occurs.

This function helps to avoid the destruction of the file system caused from the simultaneous access to the same disk from multiple servers.

The same phenomenon occurs when the servers constituting the cluster are monitored by using the performance monitor. To move the failover group, also terminate the Performance Monitor.

The same phenomenon occurs when data logging of the monitor service of resource kit is running. Terminate it before moving/stopping the failover group or shutting down the cluster.