ExpressCluster® X 3.1 *for Windows*

Getting Started Guide

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6th Edition

EXPRESSCLUSTER X

Revision History

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Preface

Who Should Use This Guide

The *ExpressCluster X Getting Started Guide* consists of two sections. Section I is intended for first-time users of the ExpressCluster. This section covers topics such as product overview of the ExpressCluster and its basic usage.
Section II is intended for users before installing ExpressCluster and those who update it after the installation. This section covers topics such as latest system requirements and restrictions are described.

How This Guide is Organized

ExpressCluster X Documentation Set

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

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

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

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

Integrated WebManager Administrator's Guide
This guide is intended for system administrators who manage cluster systems using ExpressCluster with Integrated WebManager, and also intended for system engineers who introduce Integrated WebManager. This guide describes detailed issues necessary for introducing Integrated WebManager in the actual procedures.

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

Conventions

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

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

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

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

The following conventions are used in this guide.

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

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Section I   Introducing ExpressCluster

This section helps you to understand the overview of ExpressCluster and its system requirements.
This section covers:

- Chapter 1   What is a cluster system?
- Chapter 2   Using ExpressCluster

Chapter 1   What is a cluster system?

This chapter describes overview of the cluster system.

This chapter covers:

Overview of the cluster system

A key to success in today's computerized world is to provide services without them stopping. A single machine down due to a failure or overload can stop entire services you provide with customers. This will not only result in enormous damage but also in loss of credibility you once had.

Introducing a cluster system allows you to minimize the period during which your system stops (down time) or to improve availability by load distribution.

As the word "cluster" represents, a system aiming to increase reliability and performance by clustering a group (or groups) of multiple computers. There are various types of cluster systems, which can be classified into following three listed below. ExpressCluster is categorized as a high availability cluster.

◆ **High Availability (HA) Cluster**

In this cluster configuration, one server operates as an active server. When the active server fails, a stand-by server takes over the operation. This cluster configuration aims for high-availability. The high availability cluster is available in the shared disk type and the mirror disk type.

◆ **Load Distribution Cluster**

This is a cluster configuration where requests from clients are allocated to each of the nodes according to appropriate load distribution rules. This cluster configuration aims for high scalability. Generally, data cannot be passed. The load distribution cluster is available in a load balance type or parallel database type.

◆ **High Performance Computing (HPC) Cluster**

This is a cluster configuration where the computation amount is huge and a single operation is performed with a super computer. CPUs of all nodes are used to perform a single operation.

High Availability (HA) cluster

To enhance the availability of a system, it is generally considered that having redundancy for components of the system and eliminating a single point of failure is important. "Single point of failure" is a weakness of having a single computer component (hardware component) in the system. If the component fails, it will cause interruption of services. The high availability (HA) cluster is a cluster system that minimizes the time during which the system is stopped and increases operational availability by establishing redundancy with multiple nodes.

The HA cluster is called for in mission-critical systems where downtime is fatal. The HA cluster can be divided into two types: shared disk type and mirror disk type. The explanation for each type is provided below.

Shared Disk Type	Mirror Disk Type

Mirroring

- Expensive since a shared disk is necessary.
- Ideal for the system that handles large data

- Cheap since a shared disk is unnecessary.
- Ideal for the system with less data volume because of mirroring.
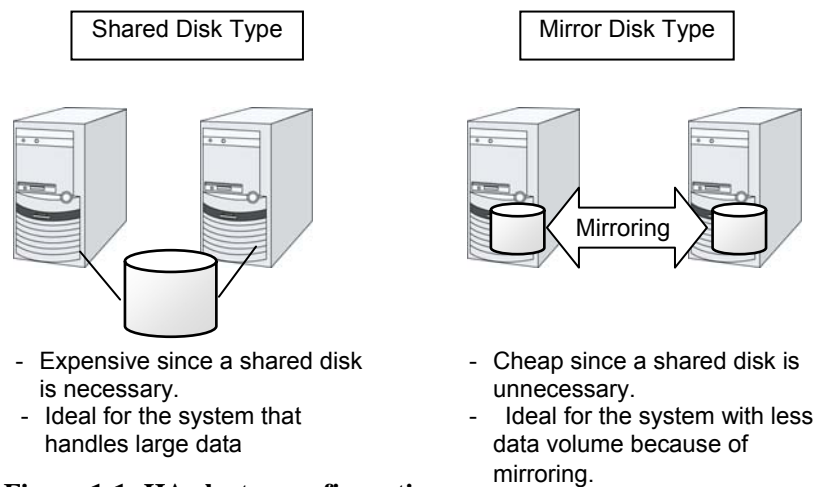
Figure 1-1: HA cluster configuration

Shared disk type

Data must be inherited from one server to another in cluster systems. A cluster typology where data is stored in an external disk (shared disk) accessible from two or more servers and inherited among them through the disk (for example, FibreChannel disk array device of SAN connection) is called shared disk type.

If a failure occurs on a server where applications are running (active server), the cluster system automatically detects the failure and starts applications in a stand-by server to take over operations. This mechanism is called failover. Operations to be inherited in the cluster system consist of resources including disk, IP address, and application.

In a non-clustered system, a client needs to access a different IP address if an application is restarted on a server other than the server where the application was originally running. In contrast, many cluster systems allocate a virtual IP address of another network but not of an IP address given to a server on an operational basis. A server where the operation is running, be it an active or a stand-by server, remains transparent to a client. The operation is continued as if it has been running on the same server.

If a failover occurs because an active server is down, data on the shared disk is inherited to a stand-by server without necessary application-ending processing being completed. For this reason, it is required to check logic of data on a stand-by server. Usually this processing is the same as the one performed when a non-clustered system is rebooted after its shutdown. For example, roll-back or roll-forward is necessary for databases. With these actions, a client can continue operation only by re-executing the SQL statement that has not been committed yet.

After a failure occurs, a server with the failure can return to the cluster system as a stand-by server if it is physically separated from the system, fixed, and then succeeds to connect the system. It is not necessary to failback a group to the original server when continuity of operations is important. If it is essentially required to perform the operations on the original server, move the group.

Normal Operation

Occurrence of Failure

Failover

Operation

Operation

Server Down

Recovery Completed

Recovering Server

Failback

Operation
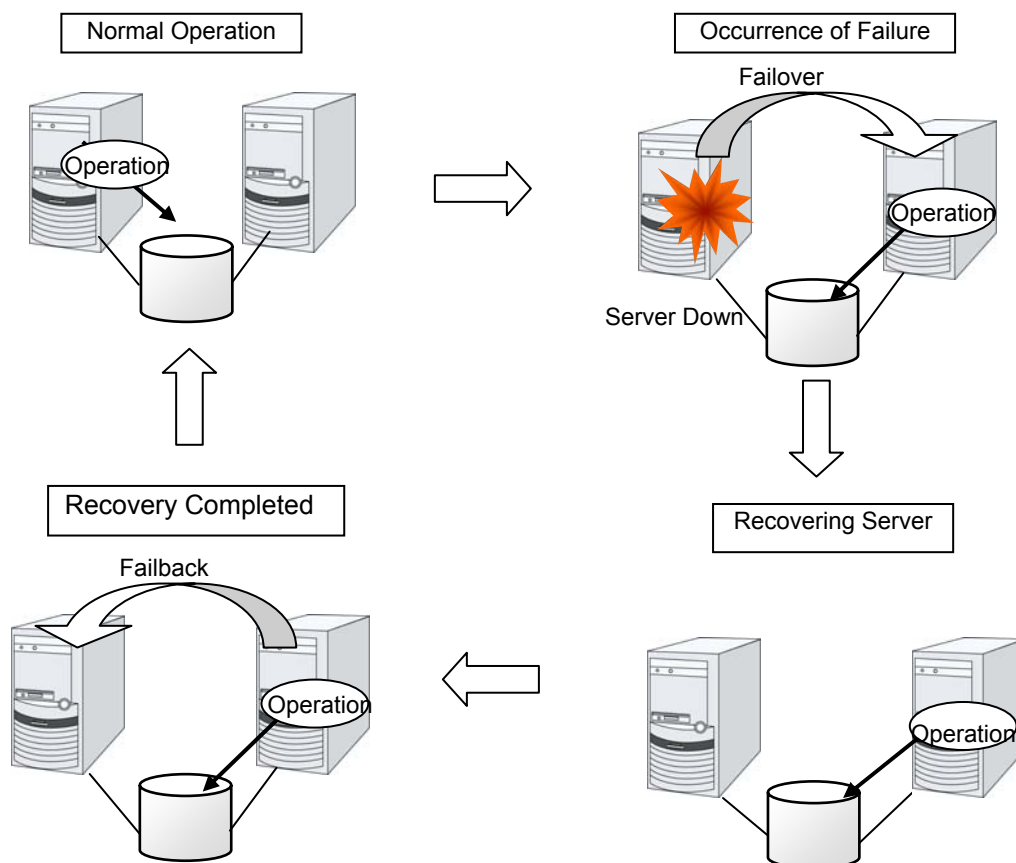
Operation

Figure 1-2: From occurrence of a failure to recovery

When the specification of the failover destination server does not meet the system requirements or overload occurs due to multi-directional stand-by, operations on the original server are preferred. In such a case, after finishing the recovery of the original node, stop the operations and start them again on the original node. Returning a failover group to the original server is called failback.

A stand-by mode where there is one operation and no operation is active on the stand-by server, as shown in Figure 1-3, is referred to as uni-directional stand-by. A stand-by mode where there are two or more operations with each node of the cluster serving as both active and stand-by servers is referred to as multi-directional stand-by.

Uni-directional stand-by

Multi-directional stand-by

Active
Server

Stand-by
Server

Active Server for
Operation A
Stand-by Server
for Operation B

Active Server for
Operation B
Stand-by Server
for Operation A

Operation

Operation

Operation
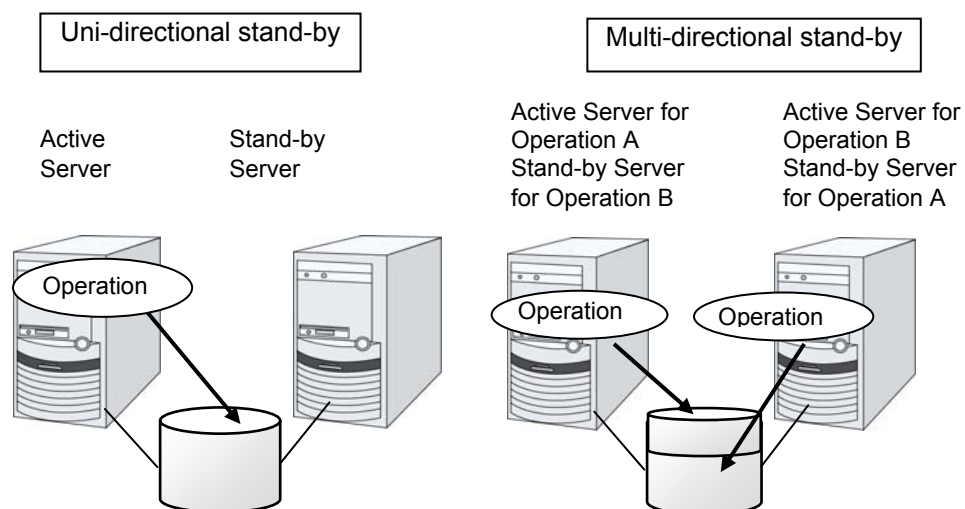
Figure 1-3: HA cluster topology

Mirror disk type

The shared disk type cluster system is good for large-scale systems. However, creating a system with this type can be costly because shared disks are generally expensive. The mirror disk type cluster system provides the same functions as the shared disk type with smaller cost through mirroring of server disks.

The mirror disk type is not recommended for large-scale systems that handle a large volume of data since data needs to be mirrored between servers.

When a write request is made by an application, the data mirror engine writes data in the local disk and sends the written data to the stand-by server via the interconnect. Interconnect is a cable connecting servers. It is used to monitor whether the server is activated or not in the cluster system. In addition to this purpose, interconnect is sometimes used to transfer data in the data mirror type cluster system. The data mirror engine on the stand-by server achieves data synchronization between stand-by and active servers by writing the data into the local disk of the stand-by server.

For read requests from an application, data is simply read from the disk on the active server.
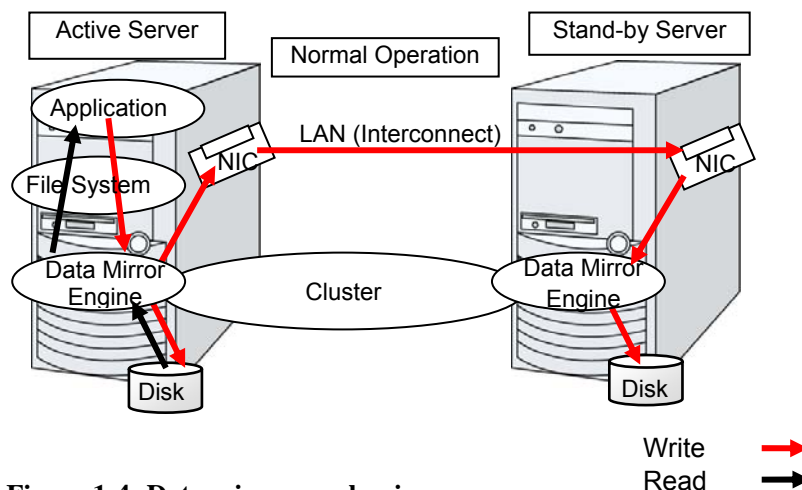
Figure 1-4: Data mirror mechanism

Snapshot backup is applied usage of data mirroring. Because the data mirror type cluster system has shared data in two locations, you can keep the data of the stand-by server as snapshot backup by simply separating the server from the cluster.

HA cluster mechanism and problems

The following sections describe cluster implementation and related problems.

System configuration

In a shared disk-type cluster, a disk array device is shared between the servers in a cluster. When an error occurs on a server, the standby server takes over the applications using the data on the shared disk.

In the mirror disk type cluster, a data disk on the cluster server is mirrored via the network. When an error occurs on a server, the applications are taken over using the mirror data on the stand-by server. Data is mirrored for every I/O. Therefore, the mirror disk type cluster appears the same as the shared disk viewing from a high level application.

The following the shared disk type cluster configuration.
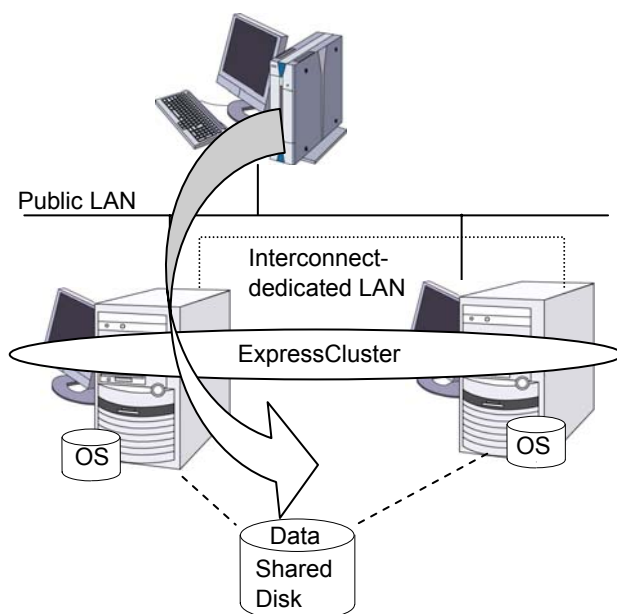
Figure 1-5: System configuration

A failover-type cluster can be divided into the following categories depending on the cluster topologies:

Uni-Directional Standby Cluster System

In the uni-directional standby cluster system, the active server runs applications while the other server, the standby server, does not. This is the simplest cluster topology and you can build a high-availability system without performance degradation after failing over.
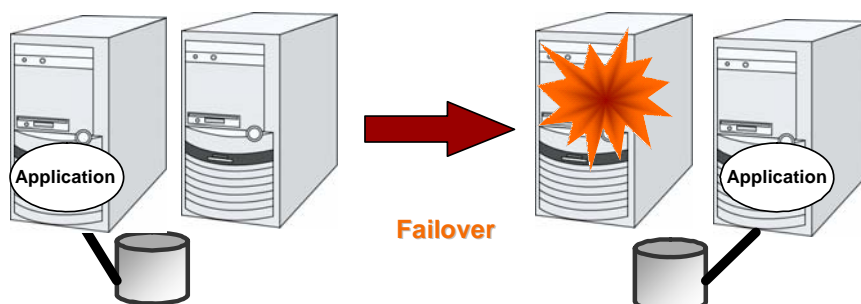
Figure 1-6: Uni-directional standby cluster system

Section I Introducing ExpressCluster

Same Application – Multi-Directional Standby Cluster System

In the same application multi-directional standby cluster system, the same applications are activated on multiple servers. These servers also operate as standby servers. These applications are operated on their own. When a failover occurs, the same applications are activated on one server. Therefore, the applications that can be activated by this operation need to be used. When the application data can be split into multiple data, depending on the data to be accessed, you can build a load distribution system per data partitioning basis by changing the client's connecting server.

* The applications in the diagram are the same applications.
* Multiple application instances are run on a single server after failover.
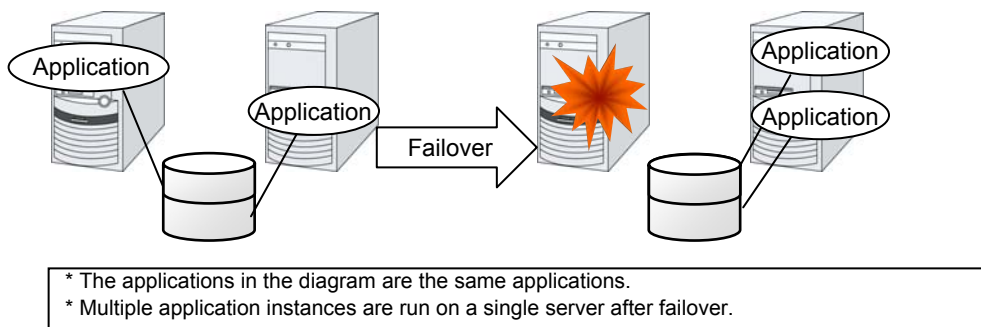
Figure 1-7: Same application – multi-directional standby cluster system

Different Application – Multi Directional Standby Cluster System

In the different application multi-directional standby cluster system, different applications are activated on multiple servers and these servers operate as standby servers. When a failover occurs, two or more applications are activated on one server. Therefore, these applications need to be able to coexist. You can build a load distribution system per application unit basis.

* Application 1 and application 2 are different applications.
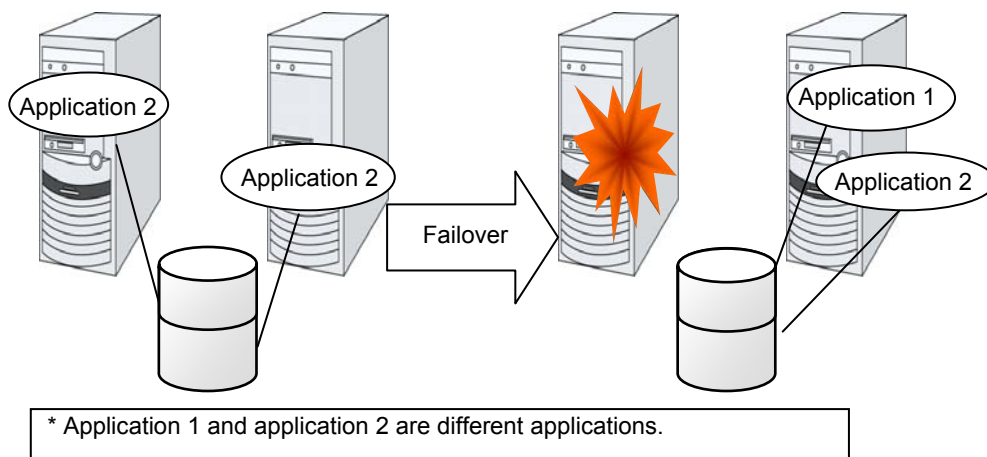
Figure 1-8: Different application – multi directional standby cluster system

N-to-N Configuration

The configuration can be expanded with more nodes by applying the configurations introduced thus far. In an N-to-N configuration described below, three different applications are run on three servers and one standby server takes over the application if any problem occurs. In a uni-directional standby cluster system, the stand-by server does not operate anything, so one of the two servers functions as a stand-by server. However, in an N-to N configuration, only one of the four servers functions as a stand-by server. Performance deterioration is not anticipated if an error occurs only on one server.
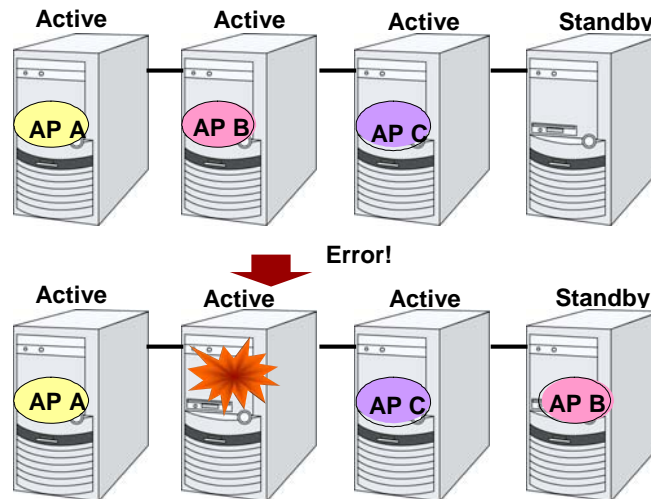
Figure 1-9: N-to-N configuration

Error detection mechanism

Cluster software executes failover (for example, passing operations) when a failure that can affect continued operation is detected. The following section gives you a quick view of how the cluster software detects a failure.

ExpressCluster regularly checks whether other servers are properly working in the cluster system. This function is called "heartbeat communication."

Heartbeat and detection of server failures

Failures that must be detected in a cluster system are failures that can cause all servers in the cluster to stop. Server failures include hardware failures such as power supply and memory failures, and OS panic. To detect such failures, the heartbeat is used to monitor whether the server is active or not.

Some cluster software programs use heartbeat not only for checking if the target is active through ping response, but for sending status information on the local server. Such cluster software programs begin failover if no heartbeat response is received in heartbeat transmission, determining no response as server failure. However, grace time should be given before determining failure, since a highly loaded server can cause delay of response. Allowing grace period results in a time lag between the moment when a failure occurred and the moment when the failure is detected by the cluster software.

Detection of resource failures

Factors causing stop of operations are not limited to stop of all servers in the cluster. Failure in disks used by applications, NIC failure, and failure in applications themselves are also factors that can cause the stop of operations. These resource failures need to be detected as well to execute failover for improved availability.

Accessing a target resource is used to detect resource failures if the target is a physical device. For monitoring applications, trying to service ports within the range not affecting operation is a way of detecting an error in addition to monitoring if application processes are activated.

Shared disk lock

In a failover cluster system of the shared disk type, multiple servers physically share the disk device. Typically, a file system enjoys I/O performance greater than the physical disk I/O performance by keeping data caches in a server.

What if a file system is accessed by multiple servers simultaneously?

Since a general file system assumes no server other than the local updates data on the disk, inconsistency between caches and the data on the disk arises. Ultimately the data will be destroyed. The failover cluster system locks the disk device to prevent multiple servers from mounting a file system, simultaneously caused by a network partition problem explained next.

Network partition (Split-Brain Syndrome)

When all interconnects between servers are disconnected, it is not possible to tell if a server is down, only by monitoring if it is activated by a heartbeat. In this status, if a failover is performed and multiple servers mount a file system simultaneously considering the server has been shut down, data on the shared disk may be corrupted.
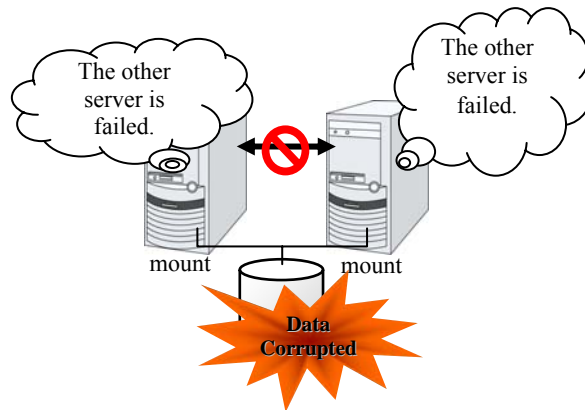
Figure 1-10: Network partition

The problem explained in the section above is referred to as "network partition" or "Split Brain Syndrome." To resolve this problem, the failover cluster system is equipped with various mechanisms to ensure shared disk lock at the time when all interconnects are disconnected.

Inheriting cluster resources

As mentioned earlier, resources to be managed by a cluster include disks, IP addresses, and applications. The functions used in the failover cluster system to inherit these resources are described below.

Inheriting data

In the shared disk type cluster, data to be passed from a server to another in a cluster system is stored in a partition in a shared disk. This means inheriting data is re-mounting the file system of files that the application uses from a healthy server. What the cluster software should do is simply mount the file system because the shared disk is physically connected to a server that inherits data.
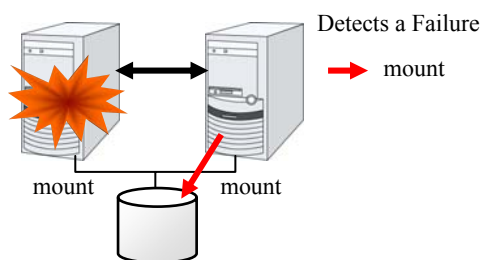
Figure 1-11: Inheriting data

The diagram above (Figure 1-11) may look simple. Consider the following issues in designing and creating a cluster system.

One issue to consider is recovery time for a file system or database. A file to be inherited may have been used by another server or to be updated just before the failure occurred. For this reason, a cluster system may need to do consistency checks to data it is moving on some file systems, as well as it may need to rollback data for some database systems. These checks are not cluster system-specific, but required in many recovery processes, including when you reboot a single server that has been shut down due to a power failure. If this recovery takes a long time, the time is wholly added to the time for failover (time to take over operation), and this will reduce system availability.

Another issue you should consider is writing assurance. When an application writes data into the shared disk, usually the data is written through a file system. However, even though the application has written data – but the file system only stores it on a disk cache and does not write into the shared disk – the data on the disk cache will not be inherited to a stand-by server when an active server shuts down. For this reason, it is required to write important data that needs to be inherited to a stand-by server into a disk, by using a function such as synchronous writing. This is same as preventing the data becoming volatile when a single server shuts down. Namely, only the data registered in the shared disk is inherited to a stand-by server, and data on a memory disk such as a disk cache is not inherited. The cluster system needs to be configured considering these issues.

Inheriting IP addresses

When a failover occurs, it does not have to be concerned which server is running operations by inheriting IP addresses. The cluster software inherits the IP addresses for this purpose.

Inheriting applications

The last to come in inheritance of operation by cluster software is inheritance of applications. Unlike fault tolerant computers (FTC), no process status such as contents of memory is inherited in typical failover cluster systems. The applications running on a failed server are inherited by rerunning them on a healthy server.

For example, when the database instance is failed over, the database that is started in the stand-by server can not continue the exact processes and transactions that have been running in the failed server, and roll-back of transaction is performed in the same as restarting the database after it was down. It is required to connect to the database again from the client. The time needed for this database recovery is typically a few minutes though it can be controlled by configuring the interval of DBMS checkpoint to a certain extent.

Many applications can restart operations by re-execution. Some applications, however, require going through procedures for recovery if a failure occurs. For these applications, cluster software allows to start up scripts instead of applications so that recovery process can be written. In a script, the recovery process, including cleanup of files half updated, is written as necessary according to factors for executing the script and information on the execution server.

Summary of failover

To summarize the behavior of cluster software:

◆ Detects a failure (heartbeat/resource monitoring)

◆ Resolves a network partition (NP resolution)

◆ Switches cluster resources

• Pass data

• Pass IP address

• Pass applications
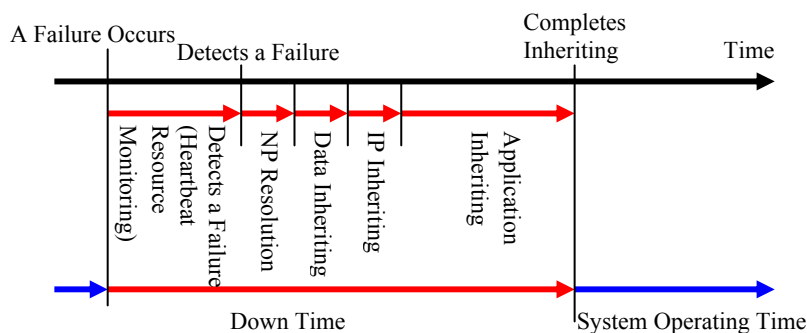
Figure 1-12: Failover time chart

Cluster software is required to complete each task quickly and reliably (see Figure 1-12.) Cluster software achieves high availability with due consideration on what has been described so far.

Eliminating single point of failure

Having a clear picture of the availability level required or aimed is important in building a high availability system. This means when you design a system, you need to study cost effectiveness of countermeasures, such as establishing a redundant configuration to continue operations and recovering operations within a short period, against various failures that can disturb system operations.

Single point of failure (SPOF), as described previously, is a component where failure can lead to stop of the system. In a cluster system, you can eliminate the system's SPOF by establishing server redundancy. However, components shared among servers, such as shared disk may become a SPOF. The key in designing a high availability system is to duplicate or eliminate this shared component.

A cluster system can improve availability but failover will take a few minutes for switching systems. That means time for failover is a factor that reduces availability. Solutions for the following three, which are likely to become SPOF, will be discussed hereafter although technical issues that improve availability of a single server such as ECC memory and redundant power supply are important.

◆ Shared disk

◆ Access path to the shared disk

◆ LAN

Shared disk

Typically a shared disk uses a disk array for RAID. Because of this, the bare drive of the disk does not become SPOF. The problem is the RAID controller is incorporated. Shared disks commonly used in many cluster systems allow controller redundancy.

In general, access paths to the shared disk must be duplicated to benefit from redundant RAID controller. There are still things to be done to use redundant access paths in Linux (described later in this chapter). If the shared disk has configuration to access the same logical disk unit (LUN) from duplicated multiple controllers simultaneously, and each controller is connected to one server, you can achieve high availability by failover between nodes when an error occurs in one of the controllers.
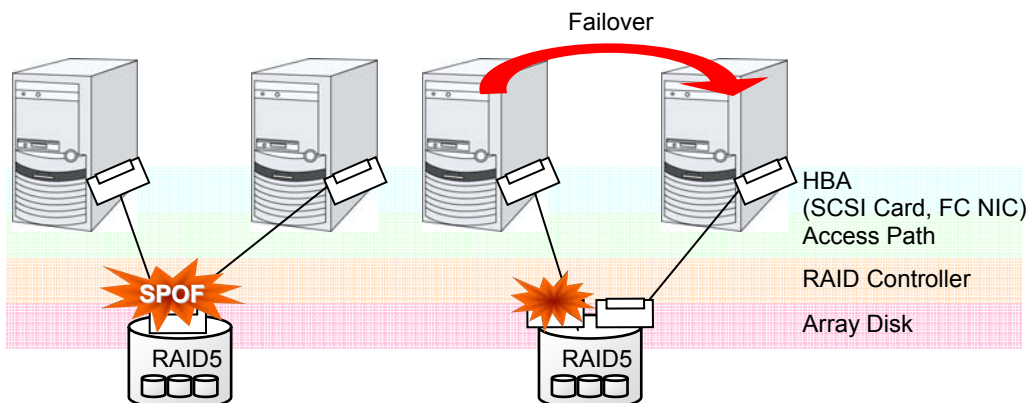
* HBA stands for Host Bus Adapter. This is an adapter of the server not of the shared disk.

Figure 1-13: Example of the shared disk RAID controller and access paths being SPOF (left) and an access path connected to a RAID controller

With a failover cluster system of data mirror type, where no shared disk is used, you can create an ideal system having no SPOF because all data is mirrored to the disk in the other server. However you should consider the following issues:

◆ Degradation of disk I/O performance in mirroring data over the network (especially writing performance)

◆ Degradation of system performance during mirror resynchronization in recovery from server failure (mirror copy is done in the background)

◆ Time for mirror resynchronization (failover cannot be done until mirror resynchronization is completed)

In a system with frequent data viewing and a relatively small volume of data, choosing the failover cluster of data mirror type is effective to increase availability.

Access path to the shared disk

In a typical configuration of the shared disk type cluster system, the access path to the shared disk is shared among servers in the cluster. To take SCSI as an example, two servers and a shared disk are connected to a single SCSI bus. A failure in the access path to the shared disk can stop the entire system.

What you can do for this is to have a redundant configuration by providing multiple access paths to the shared disk and make them look as one path for applications. The device driver allowing such is called a path failover driver.
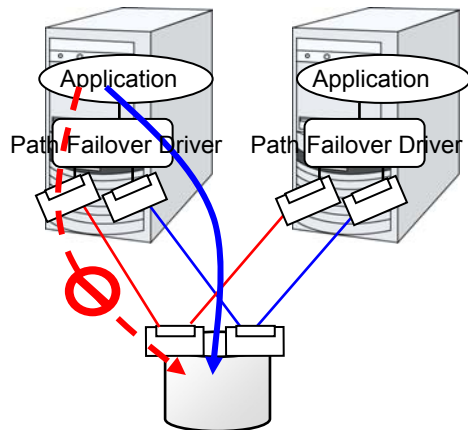
Figure 1-14: Path failover driver

LAN

In any systems that run services on a network, a LAN failure is a major factor that disturbs operations of the system. If appropriate settings are made, availability of cluster system can be increased through failover between nodes at NIC failures. However, a failure in a network device that resides outside the cluster system disturbs operation of the system.
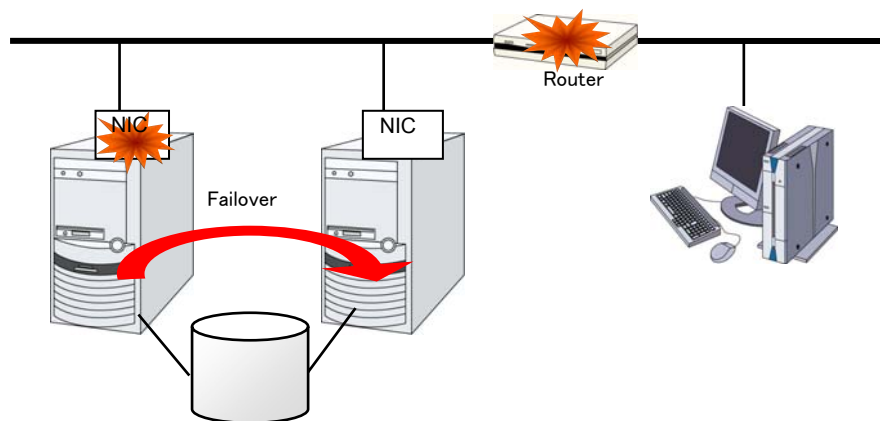
Figure 1-15: Example of router becoming SPOF

LAN redundancy is a solution to tackle device failure outside the cluster system and to improve availability. You can apply ways used for a single server to increase LAN availability. For example, choose a primitive way to have a spare network device with its power off, and manually replace a failed device with this spare device. Choose to have a multiplex network path through a redundant configuration of high-performance network devices, and switch paths automatically. Another option is to use a driver that supports NIC redundant configuration such as Intel's ANS driver.

Load balancing appliances and firewall appliances are also network devices that are likely to become SPOF. Typically, they allow failover configurations through standard or optional software. Having redundant configuration for these devices should be regarded as requisite since they play important roles in the entire system.

Operation for availability

Evaluation before starting operation

Given many of factors causing system troubles are said to be the product of incorrect settings or poor maintenance, evaluation before actual operation is important to realize a high availability system and its stabilized operation. Exercising the following for actual operation of the system is a key in improving availability:

◆ Clarify and list failures, study actions to be taken against them, and verify effectiveness of the actions by creating dummy failures.

◆ Conduct an evaluation according to the cluster life cycle and verify performance (such as at degenerated mode)

◆ Arrange a guide for system operation and troubleshooting based on the evaluation mentioned above.

Having a simple design for a cluster system contributes to simplifying verification and improvement of system availability.

Failure monitoring

Despite the above efforts, failures still occur. If you use the system for long time, you cannot escape from failures: hardware suffers from aging deterioration and software produces failures and errors through memory leaks or operation beyond the originally intended capacity. Improving availability of hardware and software is important yet monitoring for failure and troubleshooting problems is more important. For example, in a cluster system, you can continue running the system by spending a few minutes for switching even if a server fails. However, if you leave the failed server as it is, the system no longer has redundancy and the cluster system becomes meaningless should the next failure occur.

If a failure occurs, the system administrator must immediately take actions such as removing a newly emerged SPOF to prevent another failure. Functions for remote maintenance and reporting failures are very important in supporting services for system administration.

To achieve high availability with a cluster system, you should:

◆ Remove or have complete control on single point of failure.

◆ Have a simple design that has tolerance and resistance for failures, and be equipped with a guide for operation and troubleshooting.

◆ Detect a failure quickly and take appropriate action against it.

Chapter 2   Using ExpressCluster

This chapter explains the components of ExpressCluster, how to design a cluster system, and how to use ExpressCluster.

This chapter covers:

What is ExpressCluster?

ExpressCluster is software that enables the HA cluster system.

ExpressCluster modules

ExpressCluster consists of following three modules:

◆ ExpressCluster Server

A core component of ExpressCluster. Install this to the server machines that constitute the cluster system. The ExpressCluster Server includes all high availability functions of ExpressCluster. The server functions of the WebManager and Builder are included.

◆ ExpressCluster X WebManager (WebManager)

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

◆ ExpressCluster X Builder (Builder)

A tool for editing the cluster configuration data. The Builder also uses Web browsers as its user interface. There are offline and online versions. In the offline version, you can install and use the Builder on the machine where you use it, in addition to the ExpressCluster Server. In the online version, switch to the Builder by selecting the **Setting Mode** on the drop down menu on the left side in the WebManager window or by clicking **Setting Mode** on the **View** menu in the WebManager window. Usually, it is not required to install this. Install this separately only when this is used offline.

Software configuration of ExpressCluster

The software configuration of ExpressCluster should look similar to the figure below. Install the ExpressCluster Server (software) on a Linux server that constitutes a cluster. This function of the WebManager or Builder does not need to be installed separately, because it is included in the ExpressCluster Server. However, to use the Builder in the environment where you cannot access the ExpressCluster Server, it is required to install the offline version Builder on the management PC. The WebManager and the Builder can be used from the Web browser on the management PC, so they can be used from the Web browser on the servers that constitute a cluster.
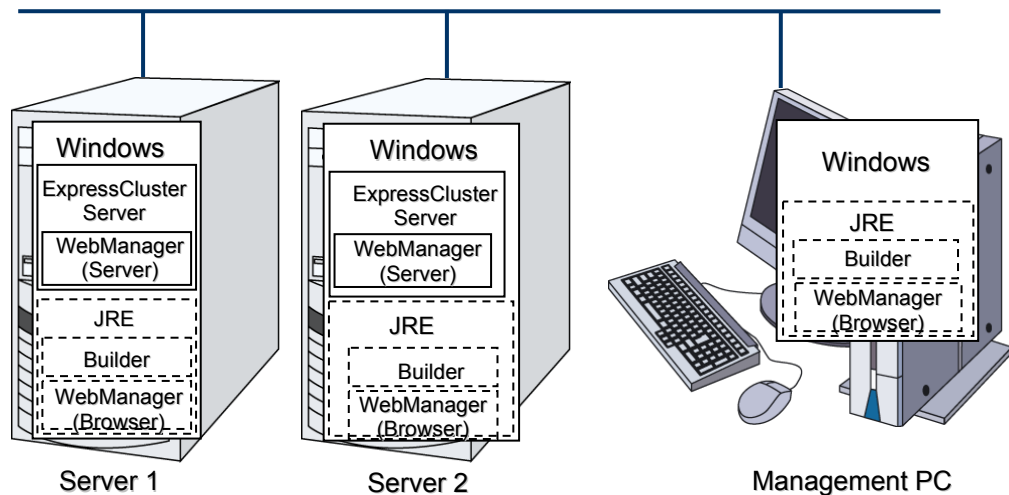
Figure 2-1: Software configuration of ExpressCluster

Note:
JRE stands for Java Runtime Environment.

How an error is detected in ExpressCluster

There are three kinds of monitoring in ExpressCluster: (1) server monitoring, (2) application monitoring, and (3) internal monitoring. These monitoring functions let you detect an error quickly and reliably. The details of the monitoring functions are described below.

What is server monitoring?

Server monitoring is the most basic function of the failover-type cluster system. It monitors if a server that constitutes a cluster is properly working.

Server Monitoring (heartbeat) uses the following communication paths:

◆ Primary Interconnect

LAN dedicated to communication between the cluster servers. This is used to exchange information between the servers as well as to perform heartbeat communication.

◆ Secondary Interconnect

This is used as a path to be used for the communicating with a client. This is used for exchanging data between the servers as well as for a backup interconnects.

◆ BMC

This is used to check that other server exists by performing a heartbeat communication via BMC between servers constructing a failover type cluster.

1.	Primary Interconnect
2	Secondary Interconnect
3	BMC
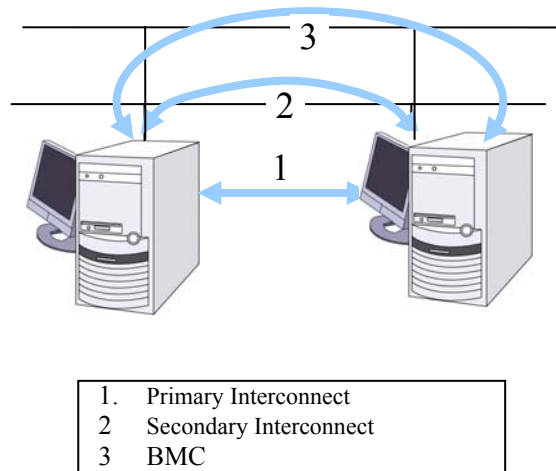
Figure 2-2: Server monitoring

What is application monitoring?

Application monitoring is a function that monitors applications and factors that cause a situation where an application cannot run.

◆ Monitoring applications and/or protocols to see if they are stalled or failed by using the monitoring option.

In addition to the basic monitoring of successful startup and existence of applications, you can even monitor stall and failure in applications including specific databases (such as Oracle, DB2), protocols (such as FTP, HTTP) and / or application servers (such as WebSphere, WebLogic) by introducing optional monitoring products of ExpressCluster. For the details, see Chapter 6, "Monitor resource details" in the *Reference Guide*.

◆ Monitoring activation status of applications

An error can be detected by starting up an application by using an application-starting resource (called application resource and service resource) of ExpressCluster and regularly checking whether the process is active or not by using application-monitoring resource (called application monitor resource and service monitor resource). It is effective when the factor for application to stop is due to error termination of an application.

Note 1:
· An error in resident process cannot be detected in an application started up by ExpressCluster.

Note 2:
· An internal application error (for example, application stalling and result error) cannot be detected.

◆ Resource monitoring

An error can be detected by monitoring the cluster resources (such as disk partition and IP address) and public LAN using the monitor resources of the ExpressCluster. It is effective when the factor for application to stop is due to an error of a resource that is necessary for an application to operate.

What is internal monitoring?

Internal monitoring refers to an inter-monitoring of modules within ExpressCluster. It monitors whether each monitoring function of ExpressCluster is properly working. Activation status of ExpressCluster process monitoring is performed within ExpressCluster.

◆ Monitoring activation status of an ExpressCluster process

Monitorable and non-monitorable errors

There are monitorable and non-monitorable errors in ExpressCluster. It is important to know what kind of errors can or cannot be monitored when building and operating a cluster system.

Detectable and non-detectable errors by server monitoring

Monitoring conditions: A heartbeat from a server with an error is stopped

◆ Example of errors that can be monitored:

- Hardware failure (of which OS cannot continue operating)

- Stop error

◆ Example of error that cannot be monitored:

- Partial failure on OS (for example, only a mouse or keyboard does not function)

Detectable and non-detectable errors by application monitoring

Monitoring conditions: Termination of application with errors, continuous resource errors, disconnection of a path to the network devices.

◆ Example of errors that can be monitored:

- Abnormal termination of an application

- Failure to access the shared disk (such as HBA failure)

- Public LAN NIC problem

◆ Example of errors that cannot be monitored:

- Application stalling and resulting in error.

  ExpressCluster cannot monitor application stalling and error results[1]. However, it is possible to perform failover by creating a program that monitors applications and terminates itself when an error is detected, starting the program using the application resource, and monitoring application using the application monitor resource.

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[1] Stalling and error results can be monitored for the database applications (such as Oracle, DB2), the protocols (such as FTP, HTTP) and application servers (such as WebSphere and WebLogic) that are handled by a monitoring option.

Network partition resolution

When the stop of a heartbeat is detected from a server, ExpressCluster determines whether it is an error in a server or a network partition. If it is judged as a server failure, failover (activate resources and start applications on a healthy server) is performed. If it is judged as network partition, protecting data is given priority over inheriting operations, so processing such as emergency shutdown is performed.
The following are the network partition resolution methods:

◆ COM method

◆ PING method

◆ Shared disk method

◆ COM + shared disk method

◆ PING + shared disk method

◆ Majority method

◆ Not solving the network partition

Related Information:

For the details on the network partition resolution method, see Chapter 8, "Details on network partition resolution resources" in the *Reference Guide*.

Failover mechanism

When the stop of heartbeat is detected from other servers, ExpressCluster determines whether it is an error in a server or a network partition before starting a failover. Then a failover is performed by activating various resources and starting up applications on a properly working server.

The group of resources which fail over at the same time is called a "failover group." From a user's point of view, a failover group appears as a virtual computer.

Note:

In a cluster system, a failover is performed by restarting the application from a properly working node. Therefore, what is saved in an application memory cannot be failed over.

From occurrence of error to completion of failover takes a few minutes. See the time-chart below:
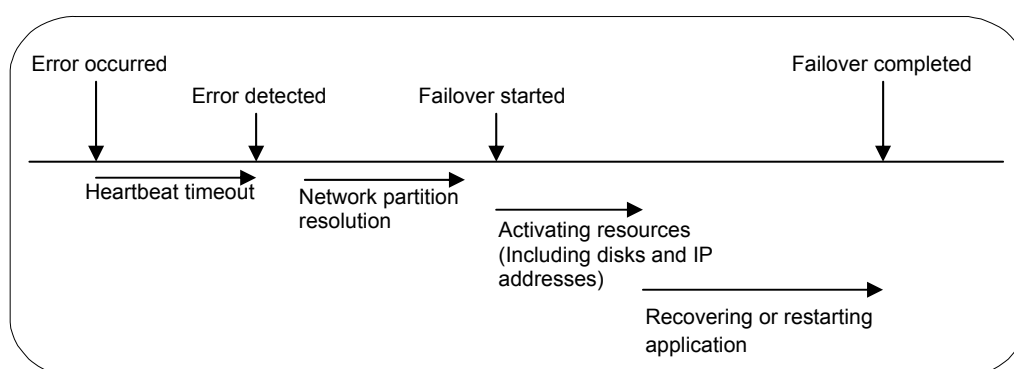
Figure 2-3: Failover time chart

◆ Heartbeat timeout

- The time for a standby server to detect an error after that error occurred on the active server.

- The setting values of the cluster properties should be adjusted depending on the delay caused by application load. (The default value is 30 seconds.)

◆ Network partition resolution

- This is the time to check whether stop of heartbeat (heartbeat timeout) detected from the other server is due to a network partition or an error in the other server.

- When the shared disk method is specified as the network partition method, 30 to 60 seconds of wait time is set by default because the time considering the disk I/O delay needs to be set. The required time changes in accordance with the time to access to a cluster partition and the heartbeat timeout value. When other method is specified, confirmation completes immediately.

◆ Activating resources

- The time to activate the resources necessary for operating an application.

- The resources can be activated in a few seconds in ordinary settings, but the required time changes depending on the type and the number of resources registered to the failover group. For more information, see the *Installation and Configuration Guide*.

◆ Recovering and restarting applications

- The startup time of the application to be used in operation. The data recovery time such as a roll-back or roll-forward of the database is included.

- The time for roll-back or roll-forward can be predicted by adjusting the check point interval. For more information, refer to the document that comes with each software product.

Hardware configuration of the shared disk type cluster configured by ExpressCluster

The hardware configuration of the shared disk type cluster in ExpressCluster is described below. In general, the following is used for communication between the servers in a cluster system:

◆ Two NIC cards (one for external communication, one for ExpressCluster)

◆ COM port connected by RS232C cross cable

◆ Specific space of a shared disk

SCSI or FibreChannel can be used for communication interface to a shared disk; however, recently FibreChannel is more commonly used.

Sample of cluster environment when a shared disk is used:
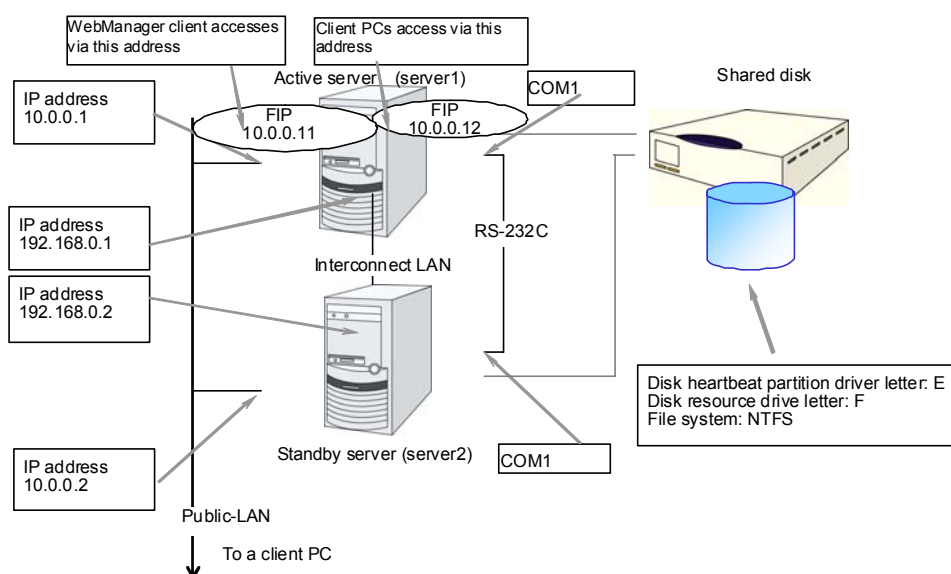
Figure 2-4: Sample of a cluster environment when a shared disk is used

Hardware configuration of the mirror disk type cluster configured by ExpressCluster

The mirror disk type cluster is an alternative to the shared disk device, by mirroring the partition on the server disks. This is good for the systems that are smaller-scale and lower-budget, compared to the shared disk type cluster.

Note:

To use a mirror disk, it is a requirement to purchase the Replicator option or the Replicator DR option.

A network for copying mirror disk data is required, but normally interconnect (NIC for ExpressCluster internal communication) is used for this purpose.

The hardware configuration of the data mirror type cluster configured by ExpressCluster is described below.
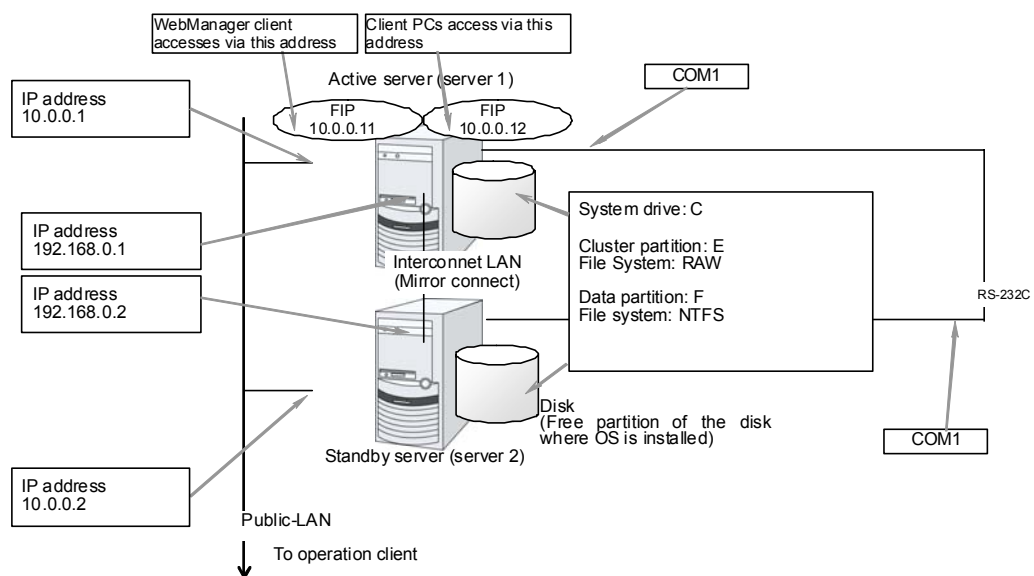
Figure 2-5: Sample of a cluster environment when mirror disks are used (when allocating cluster partition and data partition on the disk where OS is installed)

WebManager client accesses via this address

Client PCs access via this address

Mirror disk

Active server (server1)

IP address
10.0.0.1

FIP
10.0.0.11

FIP
10.0.0.12

IP address
192.168.0.1

Cluster partition: E
File System: RAW

Data partition: F
File System: NTFS

Interconnect LAN
（Mirror connect）

IP address
192.168.0.2

Standby server (server2)

Mirror disk

IP address
10.0.0.2

Public-LAN

To operation client

Figure 2-6: Sample of cluster environment when mirror disks are used (in case of preparing disks for cluster partition and data partition)

Hardware configuration of the hybrid disk type cluster configured by ExpressCluster

By combining the shared disk type and the mirror disk type and mirroring the partitions on the shared disk, this configuration allows the ongoing operation even if a failure occurs on the shared disk device. Mirroring between remote sites can also serve as a disaster countermeasure.

Note: To use the hybrid disk type configuration, it is a requirement to purchase the Replicator DR option.

As is the case with the mirror disk configuration, a network to copy the data is necessary. In general, NIC for internal communication in ExpressCluster is used to meet this purpose.

The hardware configuration of the hybrid disk type cluster configured by ExpressCluster is as follows:
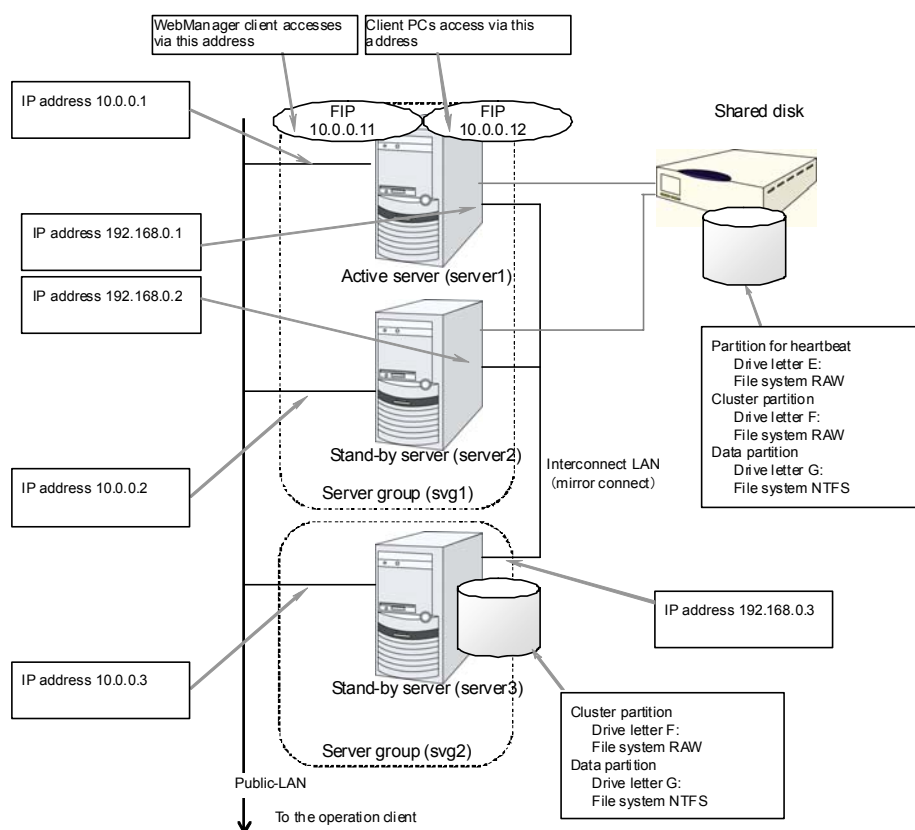
Figure 2-7: Sample of the hybrid disk type cluster environment when

The above figure shows a sample of the cluster environment where a shared disk is mirrored in the same network. While the hybrid disk type configuration mirrors between server groups that are connected to the same shared disk device, the sample above mirrors the shared disk to the local disk in server3. Because of this, the stand-by server group svg2 has only one member server, server3.
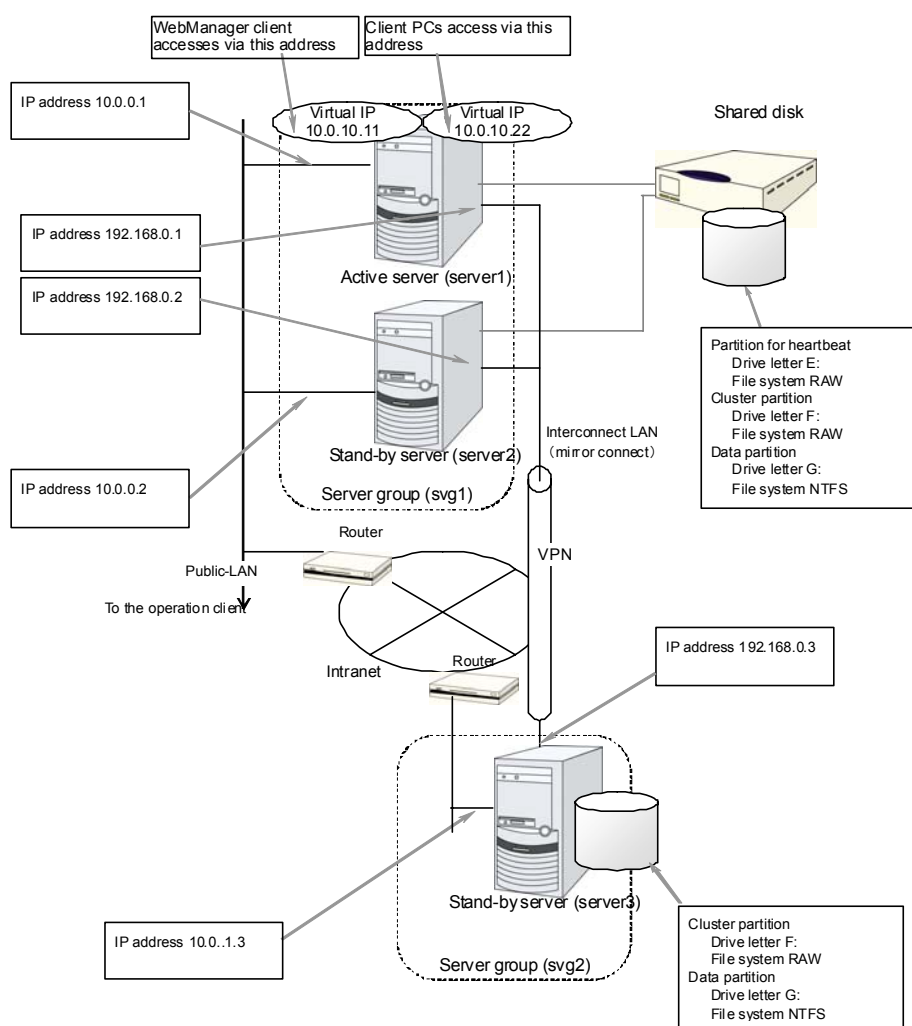
Figure 2-8: Sample of the remote cluster environment when the hybrid disk is used

The above sample shows a sample of the cluster environment where mirroring is performed between remote sites. This sample uses virtual IP addresses but not floating IP addresses because the server groups have different network segments of the Public-LAN. When a virtual IP address is used, all the routers located in between must be configured to pass on the host route. The mirror connect communication transfers the write data to the disk as it is. It is recommended to enable use a VPN with a dedicated line or the compression and encryption functions.

What is cluster object?

In ExpressCluster, the various resources are managed as the following groups:

◆ **Cluster object**
Configuration unit of a cluster.

◆ **Server object**
Indicates the physical server and belongs to the cluster object.

◆ **Server group object**
Indicates a group that bundles servers and belongs to the cluster object. This object is required when a hybrid disk resource is used.

◆ **Heartbeat resource object**
Indicates the network part of the physical server and belongs to the server object.

◆ **Network partition resolution resource object**
Indicates the network partition resolution mechanism and belongs to the server object.

◆ **Group object**
Indicates a virtual server and belongs to the cluster object.

◆ **Group resource object**
Indicates resources (network, disk) of the virtual server and belongs to the group object.

◆ **Monitor resource object**
Indicates monitoring mechanism and belongs to the cluster object.

What is a resource?

In ExpressCluster, a group used for monitoring the target is called "resources." The resources that perform monitoring and those to be monitored are classified into two groups and managed. There are four types of resources and are managed separately. Having resources allows distinguishing what is monitoring and what is being monitored more clearly. It also makes building a cluster and handling an error easy. The resources can be divided into heartbeat resources, network partition resolution resources, group resources, and monitor resources.

Related Information:
For the details of each resource, see Section II of the *Reference Guide*.

Heartbeat resources

Heartbeat resources are used for verifying whether the other server is working properly between servers. The following heartbeat resources are currently supported:

◆ **LAN heartbeat resource**
Uses Ethernet for communication.

◆ **BMC heartbeat resource**
Uses Ethernet for communication via BMC. This is available only when BMC hardware and firmware are supported.

Network partition resolution resources

Resources used for solving the network partition are shown below:

◆ **COM network partition resolution resource**
This is a network partition resolution resource by the COM method.

◆ **DISK network partition resolution resource**
This is a network partition resolution resource by the DISK method and can be used only for the shared disk configuration.

◆ **PING network partition resolution resource**
This is a network partition resolution resource by the PING method.

◆ **Majority network partition resolution resource**
This is a network partition resolution resource by the majority method.

Group resources

A group resource constitutes a unit when a failover occurs. The following group resources are currently supported:

◆ **Application resource (appli)**
Provides a mechanism for starting and stopping an application (including user creation application.)

◆ **Floating IP resource (fip)**
Provides a virtual IP address. A client can access a virtual IP address the same way as accessing a regular IP address.

◆ **Mirror disk resource (md)**
Provides a function to perform mirroring a specific partition on the local disk and control access to it. It can be used only on a mirror disk configuration.

◆ **Registry synchronization resource (regsync)**
Provides a mechanism to synchronize specific registries of more than two servers, to set the applications and services in the same way among the servers that constitute a cluster.

◆ **Script resource (script)**
Provides a mechanism for starting and stopping a script (BAT) such as a user creation script.

◆ **Disk resource (sd)**
Provides a function to control access to a specific partition on the shared disk. This can be used only when the shared disk device is connected.

◆ **Service resource (service)**
Provides a mechanism for starting and stopping a service such as database and Web.

◆ **Print spooler resource (spool)**
Provides a mechanism for failing over print spoolers.

◆ **Virtual computer name resource (vcom)**
Provides a virtual computer name. This can be accessed from a client in the same way as a general computer name.

◆ **Virtual IP resource (vip)**
Provides a virtual IP address. This can be accessed from a client in the same way as a general IP address. This can be used in the remote cluster configuration among different network addresses.

◆ **CIFS resource (cifs)**
Provides a function to disclose and share folders on the shared disk and mirror disks.

◆ **NAS resource (nas)**
Provides a function to mount the shared folders on the file servers as network drives.

◆ **Hybrid disk resource (hd)**
A resource in which the disk resource and the mirror disk resource are combined. Provides a function to perform mirroring on a certain partition on the shared disk or the local disk and to control access.

◆ **VM resource (vm)**
Starts, stops, or migrates the virtual machine.

Note:
To use a mirror disk resource, the ExpressCluster X Replicator license or the ExpressCluster X Replicator DR license is required.
To use a hybrid disk resource, the ExpressCluster X Replicator DR license is required.
Above resources are not listed on the resource list of the Builder (online version) if the licenses of those are not registered.

Monitor resources

A monitor resource monitors a cluster system. The following monitor resources are currently supported:

◆ **Application monitor resource (appliw)**
Provides a monitoring mechanism to check whether a process started by application resource is active or not.

◆ **Disk RW monitor resource (diskw)**
Provides a monitoring mechanism for the file system and function to perform a failover by resetting the hardware or an intentional stop error at the time of file system I/O stalling. This can be used for monitoring the file system of the shared disk.

◆ **Floating IP monitor resource (fipw)**
Provides a monitoring mechanism of the IP address started by floating IP resource.

◆ **IP monitor resource (ipw)**
Provides a mechanism for monitoring the network communication.

◆ **Mirror disk monitor resource (mdw)**
Provides a monitoring mechanism of the mirroring disks.

◆ **Mirror connect monitor resource (mdnw)**
Provides a monitoring mechanism of the mirror connect.

◆ **NIC Link Up/Down monitor resource (miiw)**
Provides a monitoring mechanism for link status of LAN cable.

◆ **Multi target monitor resource (mtw)**
Provides a status with multiple monitor resources.

◆ **Registry synchronization monitor resource (regsyncw)**
Provides a monitoring mechanism of the synchronization process by a registry synchronization resource.

◆ **Disk TUR monitor resource (sdw)**
Provides a mechanism to monitor the operation of access path to the shared disk by the TestUnitReady command of SCSI. This can be used for the shared disk of FibreChannel.

◆ **Service monitor resource (servicew)**
Provides a monitoring mechanism to check whether a process started by a service resource is active or not.

◆ **Print spooler monitor resource (spoolw)**
Provides a monitoring mechanism of the print spooler started by a print spooler resource.

◆ **Virtual computer name monitor resource (vcomw)**
Provides a monitoring mechanism of the virtual computer started by a virtual computer name resource.

◆ **Virtual IP monitor resource (vipw)**
Provides a monitoring mechanism of the IP address started by a virtual IP resource.

◆ **CIFS resource (cifsw)**
Provides a monitoring mechanism of the shared folder disclosed by a CIFS resource.

◆ **NAS resource (nasw)**
Provides a monitoring mechanism of the network drive mounted by a NAS resource.

◆ **Hybrid disk monitor resource (hdw)**
Provides a monitoring mechanism of the hybrid disk.

◆ **Hybrid disk TUR monitor resource (hdtw)**
Provides a monitoring mechanism for the behavior of the access path to the shared disk device used as a hybrid disk by the TestUnitReady command. It can be used for a shared disk using FibreChannel.

◆ **Custom monitor resource (genw)**
Provides a monitoring mechanism to monitor the system by the operation result of commands or scripts which perform monitoring, if any.

◆ **Process name monitor resource (psw)**
Provides a monitoring mechanism for checking whether a process specified by a process name is active.

◆ **DB2 monitor resource (db2w)**
Provides a monitoring mechanism for the IBM DB2 database.

◆ **ODBC monitor resource (odbcw)**
Provides a monitoring mechanism for the database that can be accessed by ODBC.

◆ **Oracle monitor resource (oraclew)**
Provides a monitoring mechanism for the Oracle database.

◆ **OracleAS monitor resource (oracleasw)**
Provides a monitoring mechanism for the Oracle application server.

◆ **OfficeScan CL monitor Resource (oscw)**
Provides a monitoring mechanism for OfficeScan client.

◆ **OfficeScan SV monitor Resource (ossw)**
Provides a monitoring mechanism for OfficeScan server.

◆ **PostgreSQL monitor resource (psqlw)**
Provides a monitoring mechanism for the PostgreSQL database.

◆ **SQL Server monitor resource (sqlserverw)**
Provides a monitoring mechanism for the SQL Server database.

◆ **FTP monitor resource (ftpw)**
Provides a monitoring mechanism for the FTP server.

◆ **HTTP monitor resource (httpw)**
Provides a monitoring mechanism for the HTTP server.

◆ **IMAP4 monitor resource (imap4w)**
Provides a monitoring mechanism for the IMAP server.

◆ **POP3 monitor resource (pop3w)**
Provides a monitoring mechanism for the POP server.

◆ **SMTP monitor resource (smtpw)**
Provides a monitoring mechanism for the SMTP server.

◆ **Tuxedo monitor resource (tuxw)**
Provides a monitoring mechanism for the Tuxedo application server.

◆ **Weblogic monitor resource (wlsw)**
Provides a monitoring mechanism for the WebLogic application server.

◆ **Websphere monitor resource (wasw)**
Provides a monitoring mechanism for the WebSphere application server.

◆ **WebOTX monitor resource (otxw)**
Provides a monitoring mechanism for the WebOTX application server.

◆ **VM monitor resource (vmw)**
Provides a monitoring mechanism for a virtual machine started by a VM resource

◆ **Message receive monitor resource (mrw)**
Specifies the action to take when an error message is received and how the message is displayed on the WebManager.

◆ **JVM monitor resource (jraw)**
Provides a monitoring mechanism for Java VM.

◆ **System monitor resource (sraw)**
Provides a monitoring mechanism for running processes on the server, system resources of OS and used space of disks.

Note:

To use the DB2 monitor resource, ODBC monitor resource, Oracle monitor resource, PostgreSQL monitor resource, and SQL Server monitor resource, the ExpressCluster X Database Agent license is required.

To use the FTP monitor resource, HTTP monitor resource, IMAP4 monitor resource, POP3 monitor resource and SMTP monitor resource, the ExpressCluster X Internet Server Agent license is required.

To use OracleAS monitor resource, Tuxedo monitor resource, Weblogic monitor resource, Websphere monitor resource and WebOTX monitor resource, the ExpressCluster X Application Server Agent license is required.

To use OfficeScan CL monitor resource and OfficeScan SV monitoring resource, the ExpressCluster X Anti-Virus Agent license is required.

To use the JVM monitor resources, the ExpressCluster X Java Resource Agent license is required.

To use the system monitor resources, the ExpressCluster X System Resource Agent license is required.

Above monitor resources are not listed on the monitor resource list of the Builder (online version) if the licenses of those are not registered.

Getting started with ExpressCluster

Refer to the following guides when building a cluster system with ExpressCluster:

Latest information

Refer to Section II, "Installing ExpressCluster" in this guide.

Designing a cluster system

Refer to Section I, "Designing a cluster system" in the *Installation and Configuration Guide* and Section II, "Resource details" in the *Reference Guide*.

Configuring a cluster system

Refer to the *Installation and Configuration Guide*

Troubleshooting the problem

Refer to Section III, "Maintenance information" in the *Reference Guide*.

Section II   Installing ExpressCluster

This section provides the latest information on the ExpressCluster. The latest information on the supported hardware and software is described in detail. Topics such as restrictions, known problems, and how to troubleshoot the problem are covered.

- Chapter 3   Installation requirements for ExpressCluster
- Chapter 4   Latest version information
- Chapter 5   Notes and Restrictions

Chapter 3 Installation requirements for ExpressCluster

This chapter provides information on system requirements for ExpressCluster.

This chapter covers:

System requirements for hardware

ExpressCluster operates on the following server architectures:

◆ IA32

◆ x86_64

General server requirements

Required specifications for the ExpressCluster Server are the following:

◆ RS-232C port   1 port (not necessary when configuring a cluster with 3 or more nodes)

◆ Ethernet port   2 or more ports

◆ Mirror disk or empty partition for mirror (required when the Replicator is used)

◆ CD-ROM drive

To use the Builder off-line, one of the following is required to send the cluster configuration data. (This is not required for using the Builder online.)

◆ Removable media (for example, floppy disk drive or USB memory)

◆ The method to share the file with the server machine on which the ExpressCluster Server has been installed.

Servers supporting Express5800/A1080a and Express5800/A1080aA1040a series linkage

The table below lists the supported servers that can use the Express5800/A1080a and Express5800/A1040a series linkage function of the BMC heartbeat resources and message receive monitor resources. This function cannot be used by servers other than the following.

Server	Remarks
Express5800/A1080a-E	Update to the latest firmware.
Express5800/A1080a-D	Update to the latest firmware.
Express5800/A1080a-S	Update to the latest firmware.
Express5800/A1040a	Update to the latest firmware.

System requirements for the ExpressCluster Server

Supported operating systems

ExpressCluster Server only runs on the operating systems listed below.

IA-32 version

OS	Remarks
Microsoft Windows Server 2003 Standard Edition Service Pack 2	
Microsoft Windows Server 2003 Enterprise Edition Service Pack 2	
Microsoft Windows Server 2003 Standard Edition R2 Service Pack 2	
Microsoft Windows Server 2003 Enterprise Edition R2 Service Pack 2	
Microsoft Windows Server 2008 Standard Service Pack 1	
Microsoft Windows Server 2008 Enterprise Service Pack 1	
Microsoft Windows Server 2008 Standard Service Pack 2	
Microsoft Windows Server 2008 Enterprise Service Pack 2	

x86_64 version

OS	Remarks
Microsoft Windows Server 2003 Standard x64 Edition Service Pack 2	
Microsoft Windows Server 2003 Enterprise x64 Edition Service Pack 2	
Microsoft Windows Server 2003 Standard x64 Edition R2 Service Pack 2	
Microsoft Windows Server 2003 Enterprise x64 Edition R2 Service Pack 2	
Microsoft Windows Server 2008 Standard Service Pack 1	
Microsoft Windows Server 2008 Enterprise Service Pack 1	
Microsoft Windows Server 2008 Standard Service Pack 2	
Microsoft Windows Server 2008 Enterprise Service Pack 2	
Microsoft Windows Server 2008 R2 Standard	
Microsoft Windows Server 2008 R2 Enterprise	
Microsoft Windows Server 2008 R2 Datacenter	
Microsoft Windows Server 2008 R2 Standard Service Pack 1	
Microsoft Windows Server 2008 R2 Enterprise Service Pack 1	
Microsoft Windows Server 2008 R2 Datacenter Service Pack 1	
Microsoft Windows Server 2012 Standard	
Microsoft Windows Server 2012 Datacenter	

Required memory and disk size

	Required memory size		Required disk size	
	User mode	**Kernel mode**	**Right after installation**	**Max. during operation**
IA-32	192 MB(*1)	32 MB + 4 MB (*2) x (number of mirror/hybrid resources)	34 MB	1290 MB
x86_64	256 MB(*1)	32 MB + 4 MB (*2) x (number of mirror/hybrid resources)	41 MB	1300 MB

(*1) excepting for optional products.

(*2) A single mirror/hybrid disk resource needs 4 MB RAM.

When changing to asynchronous method or changing the queue size, it is required to add more memory. Memory size increases as disk load increases because memory is used corresponding to mirror disk I/O.

Application supported by the monitoring options

The following applications are the target monitoring options that are supported.

IA32 version

Monitor resource	**Application to be monitored**	**ExpressCluster Version**
Oracle monitor	Oracle 10g Release 2 (10.2)	11.00 or later
	Oracle 11g Release 1 (11.1)	11.00 or later
	Oracle 11g Release 2 (11.2)	11.00 or later
DB2 monitor	DB2 V9.5	11.00 or later
	DB2 V9.7	11.00 or later
	DB2 V10.1	11.13 or later
PostgreSQL monitor	PostgreSQL 8.1	11.00 or later
	PostgreSQL 8.2	11.00 or later
	PostgreSQL 8.3	11.00 or later
	PostgreSQL 8.4	11.00 or later
	PostgreSQL 9.0	11.03 or later
	PostgreSQL 9.1	11.13 or later
	PostgreSQL 9.2	11.17 or later
	PowerGres on Windows V6.0	11.00 or later
	PowerGres on Windows V6.1	11.00 or later
	PowerGres on Windows V6.2	11.00 or later
	PowerGres on Windows V6.3	11.00 or later
	PowerGres on Windows V7.0	11.00 or later
	PowerGres on Windows V7.1	11.00 or later

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Monitor resource	Application to be monitored	ExpressCluster Version
	PowerGres on Windows V9.0	11.03 or later
SQL Server monitor	SQL Server 2005	11.00 or later
	SQL Server 2008	11.00 or later
	SQL Server 2008 R2	11.00 or later
	SQL Server 2012	11.13 or later
Tuxedo monitor	Tuxedo 10g R3	11.00 or later
	Tuxedo 11g R1	11.10 or later
OracleAS monitor	Oracle Application Server 10g Release 3 (10.1.3)	11.00 or later
	Oracle Application Server 10g Release 3 (10.1.4)	11.00 or later
Weblogic monitor	WebLogic Server 10g R3	11.00 or later
	WebLogic Server 11g R1	11.00 or later
	WebLogic Server 11g R2	11.00 or later
	WebLogic Server 12c	11.13 or later
Websphere monitor	WebSphere 6.1	11.00 or later
	WebSphere 7.0	11.00 or later
	WebSphere 8.0	11.15 or later
WebOTX monitor	WebOTX V8.0	11.00 or later
	WebOTX V8.1	11.00 or later
	WebOTX V8.2	11.00 or later
	WebOTX V8.3	11.03 or later
	WebOTX V8.4	11.10 or later
OfficeScan CL monitor	OfficeScan Corporate Edition 10.5	11.00 to 11.04
OfficeScan SV monitor		
JVM monitor	WebLogic Server 11g R1	11.10 or later
	WebLogic Server 12c	11.13 or later
	WebOTX V8.2	11.10 or later
	WebOTX V8.3	11.10 or later
	WebOTX V8.4	11.10 or later
	WebOTX Enterprise Service Bus V8.4	11.13 or later
	WebOTX Enterprise Service Bus V8.5	11.15 or later
	Apache Tomcat 6.0	11.13 or later
	Apache Tomcat 7.0	11.13 or later
	WebSAM SVF for PDF 9.0	11.13 or later

Section II Installing ExpressCluster

Monitor resource	Application to be monitored	ExpressCluster Version
	WebSAM SVF for PDF 9.1	11.14 or later
	WebSAM Report Director Enterprise 9.0	11.13 or later
	WebSAM Report Director Enterprise 9.1	11.15 or later
	WebSAM Universal Connect/X 9.0	11.13 or later
	WebSAM Universal Connect/X 9.1	11.15 or later
System monitor	N/A	11.10 or later

x86_64 version

Monitor resource	Application to be monitored	ExpressCluster Version
Oracle monitor	Oracle 10g Release 2 (10.2)	11.00 or later
	Oracle 11g Release 1 (11.1)	11.00 or later
	Oracle 11g Release 2 (11.2)	11.00 or later
DB2 monitor	DB2 V9.5	11.00 or later
	DB2 V9.7	11.00 or later
	DB2 V10.1	11.13 or later
PostgreSQL monitor	PostgreSQL 9.0	11.03 or later
	PostgreSQL 9.1	11.13 or later
	PostgreSQL 9.2	11.17 or later
	PowerGres on Windows V9.0	11.03 or later
SQL Server monitor	SQL Server 2005	11.00 or later
	SQL Server 2008	11.00 or later
	SQL Server 2008 R2	11.00 or later
	SQL Server 2012	11.13 or later
Tuxedo monitor	Tuxedo 11g R1	11.10 or later
Weblogic monitor	WebLogic Server 10g R3	11.00 or later
	WebLogic Server 11g R1	11.00 or later
	WebLogic Server 11g R2	11.00 or later
	WebLogic Server 12c	11.13 or later
Websphere monitor	WebSphere 6.1	11.00 or later
	WebSphere 7.0	11.00 or later
	WebSphere 8.0	11.15 or later
WebOTX monitor	WebOTX V8.0	11.00 or later
	WebOTX V8.1	11.00 or later
	WebOTX V8.2	11.00 or later
	WebOTX V8.3	11.03 or later
	WebOTX V8.4	11.10 or later
OfficeScan CL monitor	OfficeScan Corporate Edition 10.5	11.00 or later11.04

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Monitor resource	Application to be monitored	ExpressCluster Version
OfficeScan SV monitor		

Monitor resource	Application to be monitored	ExpressCluster Version
JVM monitor	WebLogic Server 11g R1	11.10 or later
	WebLogic Server 12c	11.13 or later
	WebOTX V8.2	11.10 or later
	WebOTX V8.3	11.10 or later
	WebOTX V8.4	11.10 or later
	WebOTX Enterprise Service Bus V8.4	11.13 or later
	WebOTX Enterprise Service Bus V8.5	11.15 or later
	Apache Tomcat 6.0	11.13 or later
	Apache Tomcat 7.0	11.13 or later
	WebSAM SVF for PDF 9.0	11.13 or later
	WebSAM SVF for PDF 9.1	11.14 or later
	WebSAM Report Director Enterprise 9.0	11.13 or later
	WebSAM Report Director Enterprise 9.1	11.15 or later
	WebSAM Universal Connect/X 9.0	11.13 or later
	WebSAM Universal Connect/X 9.1	11.15 or later
System monitor	N/A	11.10 or later

Note:
Above monitor resources are executed as 64-bit application in x86_64 environment.
So that, the target applications must be 64-bit binaries.

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Operation environment of VM resources

The followings are the version information of the virtual machines on which VM resources operation are verified.

Virtual Machine	Version	Remark
Hyper-V	Hyper-V 1.0	
	Hyper-V 2.0	
	Windows Server 2012 Hyper-V	

Operation environment for SNMP linkage functions

ExpressCluster with SNMP Service of Windows is validated on following OS.

IA32 version

OS	ExpressCluster version	Remarks
Microsoft Windows Server 2003 Service Pack 2	11.10 or later	
Microsoft Windows Server 2003 R2 Service Pack 2	11.10 or later	
Microsoft Windows Server 2008 Service Pack 2	11.10 or later	

x86_64 version

OS	ExpressCluster version	Remarks
Microsoft Windows Server 2003 x64 Edition Service Pack 2	11.10 or later	
Microsoft Windows Server 2003 x64 Edition R2 Service Pack 2	11.10 or later	
Microsoft Windows Server 2008 Service Pack 2	11.10 or later	
Microsoft Windows Server 2008 R2 Service Pack 1	11.10 or later	
Microsoft Windows Server 2012	11.17 or later	

Note:
SNMP Service of Windows Server 2003 does not support IPv6.

Operation environment for JVM monitor

The use of the JVM monitor requires a Java runtime environment.

Java™ Runtime Environment
Version6.0 Update 21 (1.6.0_21) or later

Java™ Runtime Environment
Version7.0

The use of the JVM monitor load balancer linkage function (when using BIG-IP Local Traffic Manager) requires a Microsoft .NET Framework runtime environment.

Microsoft .NET Framework 3.5 Service Pack 1

The tables below list the load balancers that were verified for the linkage with the JVM monitor.

IA32 version

Load balancer	ExpressCluster version	Remarks
Express5800/LB400h	11.10 or later	
BIG-IP v11	11.13 or later	
MIRACLE LoadBalancer	11.13 or later	
CoyotePoint Equalizer	11.13 or later	

x86_64 version

Load balancer	ExpressCluster version	Remarks
Express5800/LB400h	11.10 or later	
BIG-IP v11	11.13 or later	
MIRACLE LoadBalancer	11.13 or later	
CoyotePoint Equalizer	11.13 or later	

Operation environment for functions of monitoring the system and collecting system resource information

The use of the System Resource Agent requires the Microsoft .NET Framework environment.

Microsoft .NET Framework 3.5 Service Pack 1

Note:
The version of Microsoft .NET Framework must be 3.5.

Installation procedure under Windows Server 2008 R2

From the **Start** menu, select **Administrative Tools** and then **Server Manager**.

The **Server Manager** window appears. From the **Operation (A)** menu, select **Add Features**.
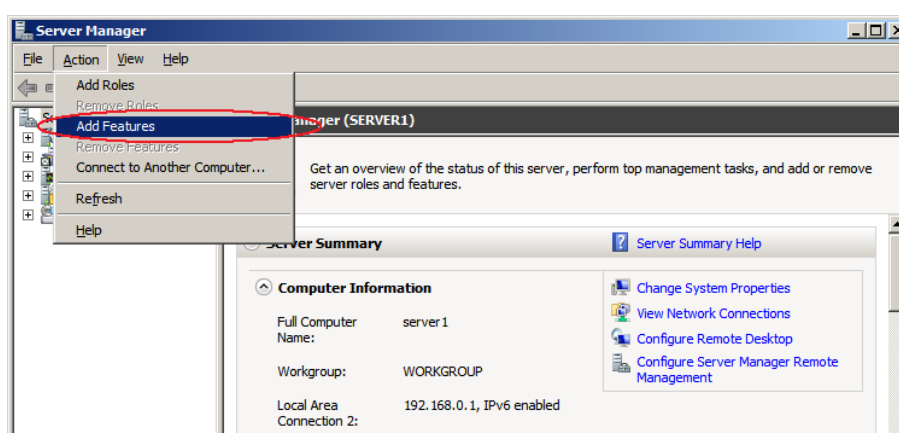
Figure 1: Server Manager window

The **Add Features Wizard** appears. Select the **.Net Framework 3.5.1 Features** checkbox, and then follow the instructions that appear in the window to perform installation.
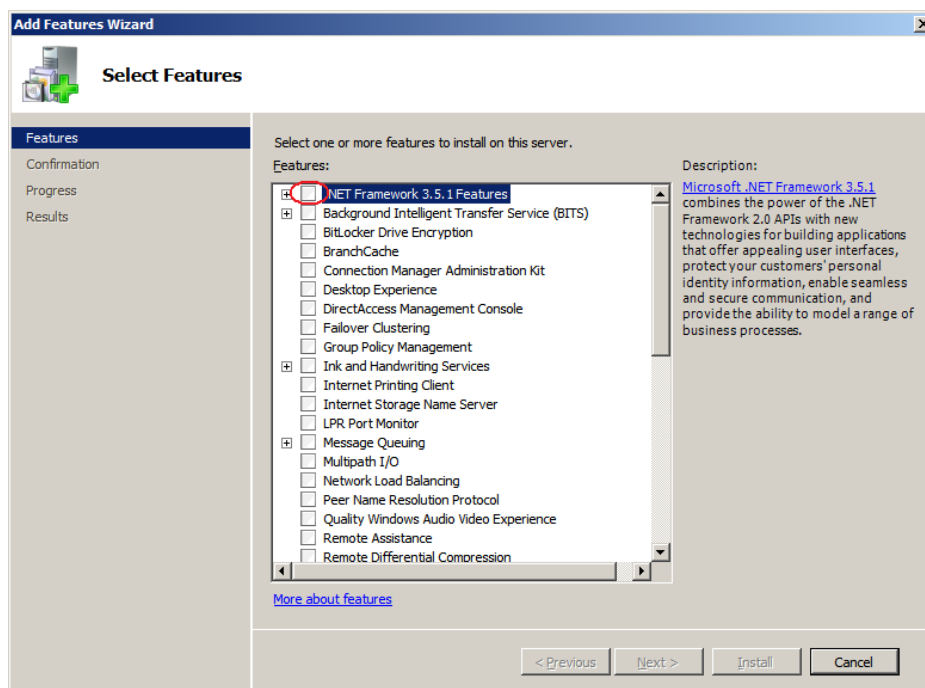
Figure 2: Add Features Wizard

You can check whether .Net Framework 3.5 has been installed by using the **Remove Features Wizard**.

In the **Server Manager** window, select **Remove Features** from the **Operation (A)** menu. The window shown below appears.

If you can select the **.Net Framework 3.5.1 Features** checkbox, .Net Framework 3.5 has been installed.
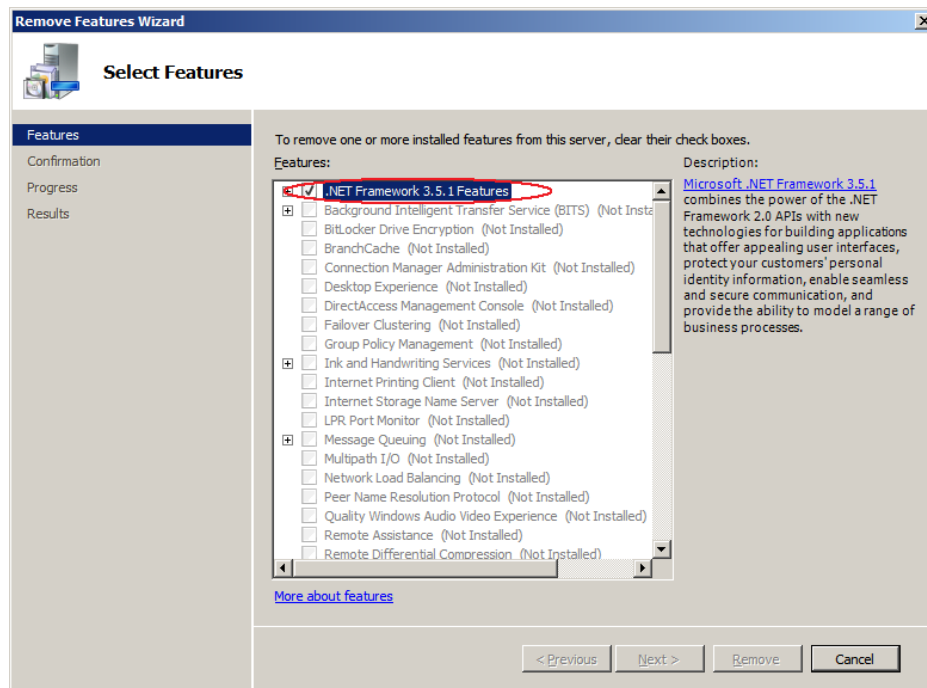
Figure 3: Remove Features Wizard

To install the System Resource Agent under Windows Server 2008 R2, you must first apply the following patch provided by Microsoft:

Patch number: KB981314

Download the patch from the following URL, and then apply it:

http://support.microsoft.com/kb/981314/

Installation procedure under Windows Server 2012

If the server is not connectable to the Internet, prepare the OS installation medium. If connectable, the installation medium is not required.

Start **Server Manager,** and select **QUICK START** in the **Dashboard** window.

Select **2 Add roles and features** from the displayed menu to open the **Add Roles and Features Wizard**.
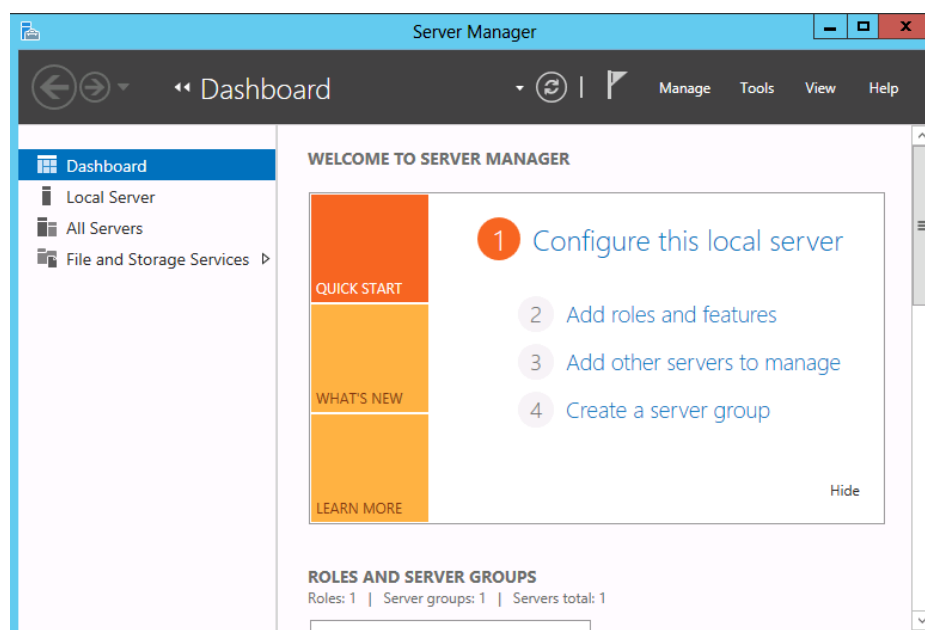
Figure 4: Server Manager

If the **Before You Begin** window appears, click **Next**.

In the **Installation Type** window, select **Role-based or feature-based installation** and click **Next**.

In the **Select Server** window, check **Select server from server pool**, select the target server from the list, and then click **Next**.
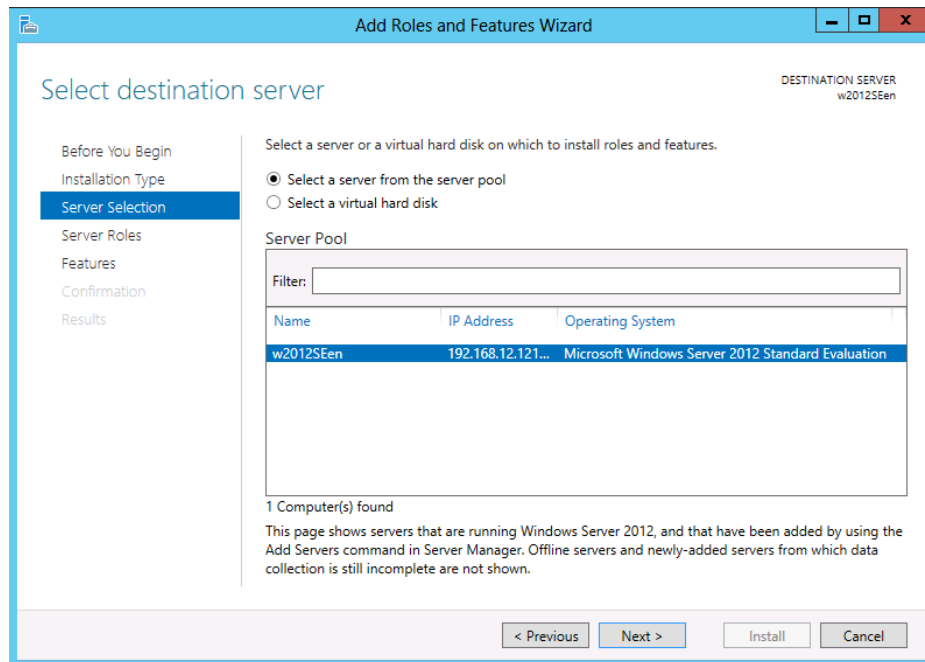
Figure 5: Select Server

Click **Next** in the **Server Roles** window.

In the **Features** window, select **.Net Framework 3.5 Features** and click **Next**.
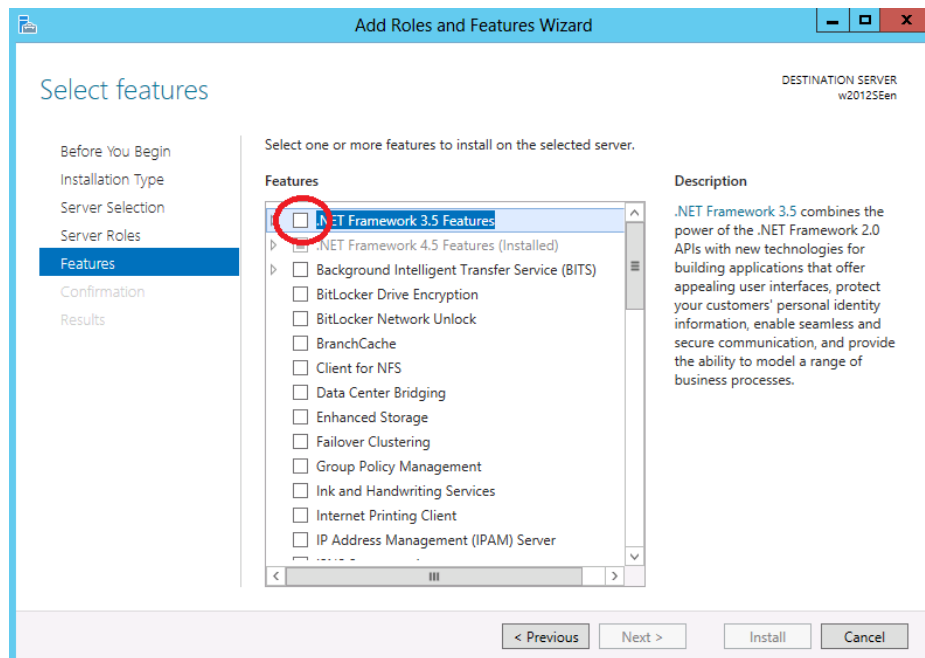
Figure 6: Select Features

If the server is connected to the Internet, click **Install** in the **Confirm installation selections** window to install .Net Framework 3.5.

If the server is not connectable to the Internet, select **Specify an alternative source path** in the **Confirm installation selections** window.
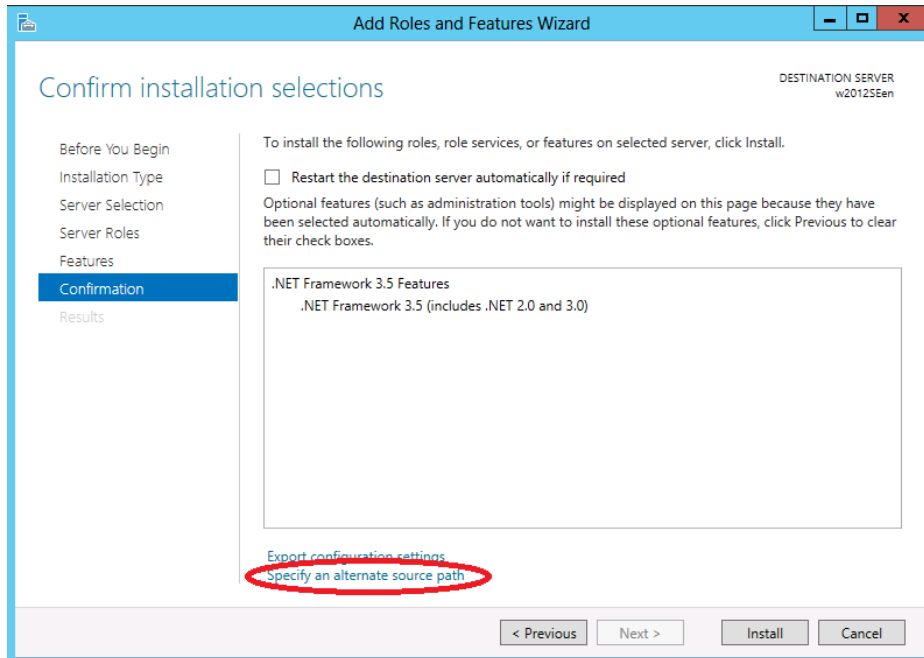
Figure 7: Confirm Installation Options

Specify the path to the OS installation medium in the **Path** field while referring to the explanation displayed in the window, and then click **OK**. After this, click **Install** to install .Net Framework 3.5.
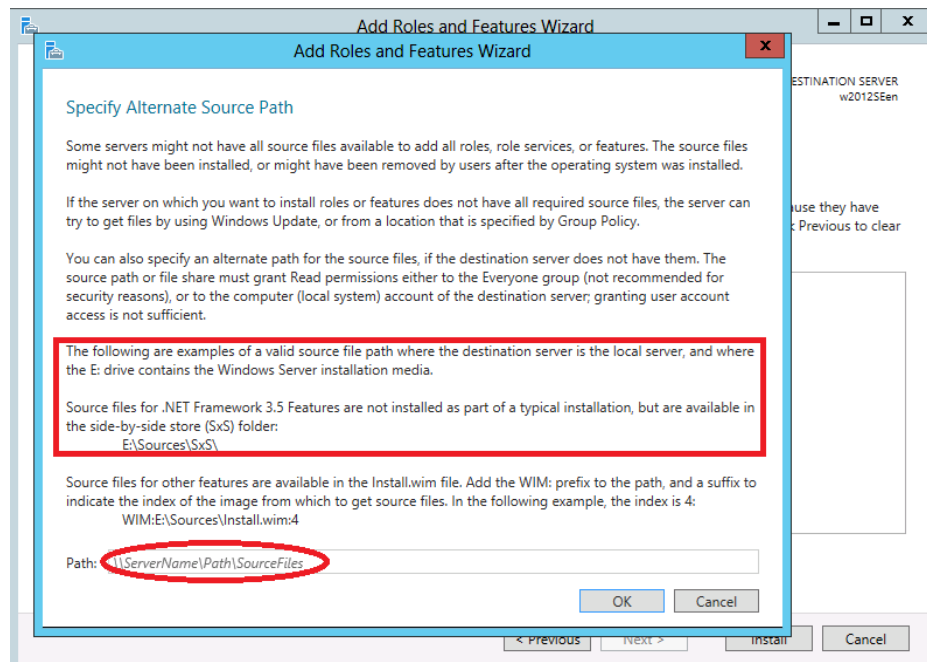
Figure 8: Specify Alternative Source Path

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System requirements for the Builder

Supported operating systems and browsers

For the latest information, please refer to the latest manual on ExpressCluster website. Currently supported operating systems and browsers are the following:

Operating system	Browser	Language
Microsoft Windows XP Service Pack 2	Internet Explorer 6 Service Pack 2	English/Japanese/Chinese
Microsoft Windows XP Service Pack 3	Internet Explorer 6 Service Pack 3	English/Japanese/Chinese
Microsoft Windows Vista Service Pack 1	Internet Explorer 7	English/Japanese/Chinese
Microsoft Windows Vista Service Pack 2	Internet Explorer 7	English/Japanese/Chinese
Microsoft Windows 7	Internet Explorer 8	English/Japanese/Chinese
Microsoft Windows 7 Service Pack 1	Internet Explorer 7	English/Japanese/Chinese
Microsoft Windows 7 Service Pack 1	Internet Explorer 8	English/Japanese/Chinese
Microsoft Windows 7 Service Pack 1	Internet Explorer 9	English/Japanese/Chinese
Microsoft Windows 8 (IA32, x86_64)	Internet Explorer 10	English/Japanese/Chinese
Microsoft Windows 8 (IA32, x86_64)	Firefox 15	English/Japanese/Chinese
Microsoft Windows Server 2003 Service Pack 1	Internet Explorer 6 Service Pack 1	English/Japanese/Chinese
Microsoft Windows Server 2003 Service Pack 2	Internet Explorer 6 Service Pack 1	English/Japanese/Chinese
Microsoft Windows Server 2003 R2	Internet Explorer 6 Service Pack 1	English/Japanese/Chinese
Microsoft Windows Server 2003 R2 Service Pack 2	Internet Explorer 6 Service Pack 2	English/Japanese/Chinese
Microsoft Windows Server 2008 Service Pack 1	Internet Explorer 7	English/Japanese/Chinese
Microsoft Windows Server 2008 Service Pack 2	Internet Explorer 7	English/Japanese/Chinese
Microsoft Windows Server 2008 R2	Internet Explorer 8	English/Japanese/Chinese
Microsoft Windows Server 2008 R2 Service Pack 1	Internet Explorer 8	English/Japanese/Chinese
Microsoft Windows Server 2008 R2	Internet Explorer 9	English/Japanese/Chinese
Microsoft Windows Server 2008 R2 Service Pack 1	Internet Explorer 9	English/Japanese/Chinese
Microsoft Windows Server 2012	Internet Explorer 10	English/Japanese/Chinese
Microsoft Windows Server 2012	Firefox 15	English/Japanese/Chinese

Note:
To use the Builder on x86_64 machines, it is necessary to use a 32-bit browser.

Note:

When you access to http://<IP_address>:29003 using Internet Explorer 9, you should add the IP address to Local intranet site.

Java runtime environment

Required:

Java™ Runtime Environment, Version 6 Update 21 (1.6.0_21) or later.

Java™ Runtime Environment, Version 7 Update 2 (1.7.0_2) or later.

Note:
To use the Builder on x86_64 machines, it is necessary to use the 32-bit Java Runtime.

Required memory size and disk size

Required memory size: 32 MB or more

Required disk size: 5 MB or more (excluding the size required for Java runtime environment)

Supported ExpressCluster versions

Builder version	ExpressCluster Server version
3.0.0-1	11.00
3.0.0-1	11.01
3.0.2-1	11.02
3.0.3-1	11.03
	11.04
3.1.0-1	11.10
3.1.1-1	11.11
3.1.3-1	11.13
3.1.4-1	11.14
3.1.5-1	11.15
	11.16
3.1.7-1	11.17

System requirements for the WebManager

Supported operating systems and browsers

For the latest information, please refer to the latest manual on ExpressCluster website. Currently the following operating systems and browsers are supported:

Operating system	Browser	Language
Microsoft Windows XP Service Pack 2	Internet Explorer 6 Service Pack 2	English/Japanese/Chinese
Microsoft Windows XP Service Pack 3	Internet Explorer 6 Service Pack 3	English/Japanese/Chinese
Microsoft Windows Vista Service Pack 1	Internet Explorer 7	English/Japanese/Chinese
Microsoft Windows Vista Service Pack 2	Internet Explorer 7	English/Japanese/Chinese
Microsoft Windows 7	Internet Explorer 8	English/Japanese/Chinese
Microsoft Windows 7 Service Pack 1	Internet Explorer 7	English/Japanese/Chinese
Microsoft Windows 7 Service Pack 1	Internet Explorer 8	English/Japanese/Chinese
Microsoft Windows 7 Service Pack 1	Internet Explorer 9	English/Japanese/Chinese
Microsoft Windows 8	Internet Explorer 10	English/Japanese/Chinese
Microsoft Windows 8	Firefox 15	English/Japanese/Chinese
Microsoft Windows Server 2003 Service Pack 1	Internet Explorer 6 Service Pack 1	English/Japanese/Chinese
Microsoft Windows Server 2003 Service Pack 2	Internet Explorer 6 Service Pack 1	English/Japanese/Chinese
Microsoft Windows Server 2003 R2	Internet Explorer 6 Service Pack 1	English/Japanese/Chinese
Microsoft Windows Server 2003 R2 Service Pack 2	Internet Explorer 6 Service Pack 2	English/Japanese/Chinese
Microsoft Windows Server 2008 Service Pack 1	Internet Explorer 7	English/Japanese/Chinese
Microsoft Windows Server 2008 Service Pack 2	Internet Explorer 7	English/Japanese/Chinese
Microsoft Windows Server 2008 R2	Internet Explorer 8	English/Japanese/Chinese
Microsoft Windows Server 2008 R2 Service Pack 1	Internet Explorer 8	English/Japanese/Chinese
Microsoft Windows Server 2008 R2	Internet Explorer 9	English/Japanese/Chinese
Microsoft Windows Server 2008 R2 Service Pack 1	Internet Explorer 9	English/Japanese/Chinese
Microsoft Windows Server 2012	Internet Explorer 10	English/Japanese/Chinese
Microsoft Windows Server 2012	Firefox 15	English/Japanese/Chinese

Note:
To use the Builder on x86_64 machines, it is necessary to use a 32-bit browser.

Note:

When you access to `http://<IP_address>:29003` using Internet Explorer 9, you should add the IP address to Local intranet site.

Java runtime environment

Required:

Java™ Runtime Environment, Version 6 Update 21 (1.6.0_21) or later.

Java™ Runtime Environment, Version 7 Update 2 (1.7.0_2) or later.

Note:
To use the Builder on x86_64 machines, it is necessary to use the 32-bit Java Runtime.

Required memory size and disk size

Required memory size: 40 MB or more

Required disk size: 300 KB or more (excluding the size required for Java runtime environment)

System requirements for the Integrated WebManager

This section explains system requirements to operate the Integrated WebManager. Refer to "Integrated WebManager Administrator's Guide" for the Java application version Integrated WebManager.

Supported operating systems and browsers

For the latest information, please refer to the latest manual on ExpressCluster website. Currently the following operating systems and browsers are supported:

Operating system	Browser	Language
Microsoft Windows XP Service Pack 2	Internet Explorer 6 Service Pack 2	English/Japanese/Chinese
Microsoft Windows XP Service Pack 3	Internet Explorer 6 Service Pack 3	English/Japanese/Chinese
Microsoft Windows Vista Service Pack 1	Internet Explorer 7	English/Japanese/Chinese
Microsoft Windows Vista Service Pack 2	Internet Explorer 7	English/Japanese/Chinese
Microsoft Windows 7	Internet Explorer 8	English/Japanese/Chinese
Microsoft Windows 7 Service Pack 1	Internet Explorer 7	English/Japanese/Chinese
Microsoft Windows 7 Service Pack 1	Internet Explorer 8	English/Japanese/Chinese
Microsoft Windows 7 Service Pack 1	Internet Explorer 9	English/Japanese/Chinese
Microsoft Windows 8	Internet Explorer 10	English/Japanese/Chinese
Microsoft Windows 8	Firefox 15	English/Japanese/Chinese
Microsoft Windows Server 2003 Service Pack 1	Internet Explorer 6 Service Pack 1	English/Japanese/Chinese
Microsoft Windows Server 2003 Service Pack 2	Internet Explorer 6 Service Pack 1	English/Japanese/Chinese
Microsoft Windows Server 2003 R2	Internet Explorer 6 Service Pack 1	English/Japanese/Chinese
Microsoft Windows Server 2003 R2 Service Pack 2	Internet Explorer 6 Service Pack 2	English/Japanese/Chinese
Microsoft Windows Server 2008 Service Pack 1	Internet Explorer 7	English/Japanese/Chinese
Microsoft Windows Server 2008 Service Pack 2	Internet Explorer 7	English/Japanese/Chinese
Microsoft Windows Server 2008 R2	Internet Explorer 8	English/Japanese/Chinese
Microsoft Windows Server 2008 R2 Service Pack 1	Internet Explorer 8	English/Japanese/Chinese
Microsoft Windows Server 2008 R2	Internet Explorer 9	English/Japanese/Chinese
Microsoft Windows Server 2008 R2 Service Pack 1	Internet Explorer 9	English/Japanese/Chinese
Microsoft Windows Server 2012	Internet Explorer 10	English/Japanese/Chinese
Microsoft Windows Server 2012	Firefox 15	English/Japanese/Chinese

Note:

To use the Builder on x86_64 machines, it is necessary to use a 32-bit browser.

Note:

When you access to `http://<IP_address>:29003` using Internet Explorer 9, you should add the IP address to Local intranet site.

Java runtime environment

Required:

Java™ Runtime Environment, Version 6 Update 21 (1.6.0_21) or later.

Java™ Runtime Environment, Version 7 Update 2 (1.7.0_2) or later.

Note:

To use the Builder on x86_64 machines, it is necessary to use the 32-bit Java Runtime.

Required memory size and disk size

Required memory size: 40 MB or more

Required disk size: 300 KB or more (excluding the size required for Java runtime environment)

System requirements for WebManager Mobile

This section explains the system requirements to run the WebManager Mobile.

Supported operating systems and browsers

Currently the following operating systems and browsers are supported:

Operating System	Browser	Language
Android 2.2	Standard browser	English/Japanese/Chinese
Android 2.3	Standard browser	English/Japanese/Chinese
Android 3.0	Standard browser	English/Japanese/Chinese
iOS 5	Safari (standard)	English/Japanese/Chinese

Chapter 4   Latest version information

This chapter provides the latest information on ExpressCluster. The latest information on the upgraded and improved functions is described in details.

This chapter covers:

Correspondence of ExpressCluster and manuals

Description in this manual assumes the following version of ExpressCluster. Make sure to note and check how ExpressCluster versions and the editions of the manuals are corresponding.

ExpressCluster version in detail	Manual	Edition
11.17	Installation and Configuration Guide	Sixth edition
	Getting Started Guide	Sixth edition
	Reference Guide	Sixth edition
	Integrated WebManager Administrator's Guide	Sixth edition
	WebManager Mobile Administrator's Guide	Second edition

The latest version

The latest internal version of ExpressCluster X 3.1, as of December 2012, is 11.17.

Check the version of ExpressCluster by using WebManager.

You can see the detailed version of a server by selecting the icon for the server on the tree view of the WebManager.

If the internal version is 11.16 or earlier, you can update it to 11.17 by applying the update CPRO-XW030-11. For the update application procedure and the failure information that is modified by the update, refer to the update procedure.

Function upgrade information

Upgrade has been performed on the following minor versions.

Number	Version (in detail)	Upgraded section
1	11.00	The WebManager and Builder can now be used from the same browser window.
2	11.00	The cluster configuration wizard has been upgraded.
3	11.00	Some settings can now be automatically acquired in the cluster configuration wizard.
4	11.00	A function has been implemented to check set IP address when uploading configuration data.
5	11.00	ExpressCluster can now automatically select the failover destination in accordance with the monitor resource status of each server or the group startup status when an error occurs.
6	11.00	A function has been implemented to control failovers across server groups.
7	11.00	**All Groups** can now be selected as the failover target when an error is detected.
8	11.00	The clpbwctrl command has been implemented which cancels the synchronization wait processing to wait startup of other servers when the cluster startup.
9	11.00	The clprexec command has been implemented which notifies failure from the external of the cluster or monitoring tools other than ExpressCluster to the cluster servers and message receive monitor resource has been implemented which runs recovery action to notified failure.
10	11.00	User mode process dump of Oracle monitor process can now be acquired when monitor process timed out.
11	11.00	Detailed information about an Oracle database can now be acquired when Oracle monitor resource detected any error.
12	11.00	Additional network warning lights are now supported.
13	11.00	Mirror data can now be compressed for transfer during asynchronous mirroring and mirror .
14	11.00	The full copy processing of mirror disk resource and hybrid disk resource has been accelerated.
15	11.00	When the host OS of Hyper-V is clustered, the guest OS can now be handled as a resource.
16	11.00	When the host OS of Hyper-V is clustered, quick migration can now be executed if an error is detected or an operation is performed.
17	11.00	A mirror connect can now be made redundant.

Section II Installing ExpressCluster

Number	Version (in detail)	Upgraded section
18	11.00	The termination code of an activated application executed by the application resource and a batch file executed by the script resource can now be identified by the existence of abnormity and then used to trigger for recovery operation.
19	11.00	The clpvolctrl command has been implemented which operates the access control to volumes on the shared disk not registered as a resource.
20	11.02	Different values can now be specified for **Normal Return Value** of the start and stop script of the script resources.
21	11.02	The options to display and reset the recovery operation count have been added to the clpmonctrl command.
22	11.02	When restoring the shared configuration at the CIFS resource activation, the CIFS resource can now be activated even if there is no user or collecting user information in a domain environment fails.
23	11.10	The number of group and resource has been doubled.
24	11.10	Options have been added for dynamic failover.
25	11.10	Waiting for startup or stopping a faiover group has been enabled.
26	11.10	Failover to a resource outside the server group has been added as a recovery action for an message receive monitor resource (mrw).
27	11.10	A function whereby the WebManager and the clpmonctrl command can be used to trigger a Dummy Failure for a monitor resource has been implemented.
28	11.10	WebManager that can be connected from an Android terminal has been implemented.
29	11.10	The MIB of ExpressCluster has been defined.
30	11.10	An SNMP trap transmission function has been added.
31	11.10	Information acquisition requests on SNMP are now supported.
32	11.10	A function has been implemented to execute a specified script to recover a monitor resource. In addition, script execution has been enabled prior to reactivation or failover.
33	11.10	A function has been implemented to disable recovery action caused by monitor resource error.
34	11.10	Parallel processing now occurs when all groups failover due to a monitoring error.
35	11.10	Database monitoring functions have been enhanced.
36	11.10	Some environment variables have been added for use in scripts.
37	11.10	Script setting has been simplified by the use of script templates.

Number	Version (in detail)	Upgraded section
38	11.10	The display of the configuration mode screen has been corrected for the 800*600 screen size.
39	11.10	Logs can be downloaded even if the browser is set to block popups.
40	11.10	Functions for which licenses have not been installed are no longer displayed during setup.
41	11.10	The number of monitor resources that are automatically registered has been increased.
42	11.10	The default command timeout value for the clprexec command has been changed from 30 seconds to 180 seconds.
43	11.10	Process name monitor resource (psw) has been added.
44	11.10	JVM monitor resource (jraw) has been added.
45	11.10	System monitor resource (sraw) has been added.
46	11.10	A function has been added to save the mirror disk performance data as a log.
47	11.10	Short options are available for mirror disk-related commands.
48	11.10	Configuration screen for mirror disk connect is now the same before and after running Cluster Generation Wizard.
49	11.10	A function has been added to acquire a list of the services, when configuring service resources, that are installed on the cluster server.
50	11.11	The conditions to wait for the group stop can now be specified. (Cluster stop, server stop)
51	11.11	The view of the recovery action control function popup window that is displayed at the end of the Cluster Generation Wizard is improved.
52	11.11	The number of disks of which size is to be monitored by System Resource Agent has been changed from 10 to 26.
53	11.11	In x64 environments, it is now possible to make the settings so that floating IP address resources and virtual computer name resources are not associated.
54	11.13	Heartbeat communication using a BMC inter-system network is now be possible (only for Express5800/A1040 and Express5800/A1080).
55	11.13	When a hardware error causing a machine reset occurs, a machine reset is now prevented until a failover is executed (only for Express5800/A1080).
56	11.13	A function for displaying time information has been added to WebManager.
57	11.13	A function for forcibly stopping a virtual machine has been added.
58	11.13	A function for automatically starting or resuming the cluster after reflecting the configuration data has been added.

Section II Installing ExpressCluster

Number	Version (in detail)	Upgraded section
59	11.13	A function has been added to prevent a Web browser from being terminated or reloaded when the configuration data is edited in WebManager **Config Mode**.
60	11.13	WebManager can now set and display physical machines and virtual machines separately.
61	11.13	The setting that assumes that a diskfull detection is not an error has been added to the disk RW monitor resource.
62	11.13	A function for monitoring the number of processes has been added to the process name monitor resource.
63	11.13	The Oracle monitor resource has been improved so that a specific error (ORA-1033) which occurs when Oracle is being started is regarded as the normal state.
64	11.13	The disk resource monitoring function of the system monitor resource can now monitor disks and mirror disks to which a drive letter was assigned after the system started.
65	11.13	A retry function has been added to the activity check of the disk resource, mirror disk resource, and hybrid disk resource.
66	11.13	An improvement has been made in the process to forcibly disconnect the disk resource, mirror disk resource, and hybrid disk resource.
67	11.13	Folders and files in a specific shared folder can now be specified as a target of **Access Check** of the CIFS monitor resource.
68	11.13	The floating IP monitor resource and message receive monitor resource can now be set to individual servers.
69	11.13	The `ipmiutil` command syntax now supports the physical machine forced stop function and chassis indentify linkage.
70	11.14	WebManager now supports Java SE Runtime Environment 7.
71	11.15	Windows Server 2012 is now supported.
72	11.15	The virtual machine resources now support Windows Server 2012 Hyper-V.
73	11.15	For Windows Server 2012 Hyper-V, live migration can now be performed for virtual machine resources.
74	11.15	The simplified version of the cluster configuration wizard, which facilitates configuration of a shared disk type cluster, is now supported.
75	11.15	You can now select the servers that continue to work even if it is detected that both systems are activated.
76	11.15	A warning message is now output if information becomes inconsistent between servers because both systems are activated or for some other reason.
77	11.15	The monitor resource exclusion list used for determining dynamic failover can now be edited.

Number	Version (in detail)	Upgraded section
78	11.15	Shutdown operations, including OS shutdown, can be now avoided if no other servers continue to work.
79	11.15	Script resources can now be registered in a virtual machine group.
80	11.15	The license information list can be now viewed from WebManager.
81	11.15	The shortcut icon for WebManager is now created on the desktop when ExpressCluster is installed.
82	11.15	The DN-1500GL series from ISA is now supported as the warning light for the ExpressCluster X Alert Service option.
83	11.15	When linked with DN-1500GL, the ExpressCluster X Alert Service option can link with the voice play function in DN-1500GL.
84	11.15	If an error occurs in a monitor resource registered in the exclusion list, that resource can be now restarted on the same server.
85	11.15	The Websphere monitor resource now supports WebSphere 8.0.
86	11.15	The load balancer link function for the JVM monitor resource now supports BIG-IP LTM.
87	11.15	The JVM monitor resource now supports WebOTX ESB 8.5, MasterScope/NEC Storage SVF for PDF 9.1, MasterScope/NEC Storage Report Director Enterprise 9.1, and MasterScope/NEC Storage Universal Connect/X 9.1.
88	11.15	A mode to monitor disk monitor resources by using write through has been added.
89	11.15	A command that can be used for capacity planning (clpprer) has been added. This command can estimate future values based on time-series data indicating system resource usage.
90	11.15	A function to collect system resource information that can be used to easily determine the cause of a failure resulting from a shortage of system resources has been added.
91	11.15	The restriction that the OS authentication setting could not be specified for Oracle monitor resources in the UAC environment of Windows Server 2008 or later has been lifted.
92	11.17	PostgreSQL monitor now supports PostgreSQL9.2.
93	11.17	It can now be judged as abnormal if an NIC Link down occurs at activation of floating IP resource.
94	11.17	It can now be judged as abnormal if an NIC Link down occurs at activation of virtual IP resource.
95	11.17	The NH-SPL from PATLITE is now supported as the warning light for the ExpressCluster X Alert Service option.
96	11.17	The DN-1300GL series from ISA is now supported as the warning light for the ExpressCluster X Alert Service option.

Section II Installing ExpressCluster

Number	Version (in detail)	Upgraded section
97	11.17	PRSH from PATLITE is now supported for the warning light control interface.
98	11.17	IRSH from ISA is now supported for the warning light control interface.
99	11.17	The SNMP linkage function now supports Windows Server 2012.
100	11.17	A specification change is made so that the "Forced Activation" function for floating IP resource/virtual IP resource cannot be configured.
101	11.17	Actions configurable for Action at NP Occurrence have been expanded.

Chapter 5   Notes and Restrictions

This chapter provides information on known problems and how to troubleshoot the problems.

This chapter covers:

Designing a system configuration

Hardware selection, system configuration, and shared disk configuration are introduced in this section.

Supported operating systems for the Builder and WebManager

◆ To operate the Builder and WebManager on a x86_64 machine, Java runtime for 32-bit is required.

Hardware requirements for mirror disk and hybrid disk

◆ Dynamic disks cannot be used. Use basic disks.

◆ To use a mirror disk resource or a hybrid disk resource, partitions for mirroring (i.e. data partition and cluster partition) are required.

◆ There are no specific limitations on locating partitions for mirroring, but the data partition sizes need to be perfectly matched with one another on a byte basis. A cluster partition also requires space of 17 MB or larger.

◆ When making data partitions as logical partitions on the extended partition, make sure to select the logical partition for both servers. Even when the same size is specified on both primary partition and logical partition, their actual sizes may different from each other.

◆ It is recommended to create a cluster partition and a data partition on different disks for the load distribution. (There are not any problems to create them on the same disk, but the writing performance will slightly decline, in case of asynchronous mirroring or in a state that mirroring is suspended.)

◆ Use the same type of disks for reserving data partitions that perform mirroring by mirror resources on both of the servers.

Example

Combination	server1	server2
OK	SCSI	SCSI
OK	IDE	IDE
NG	IDE	SCSI

◆ Partition size reserved by **Disk Management** is aligned by the number of blocks (units) per disk cylinder. For this reason, if disk geometries used as disks for mirroring differ between servers, the data partition sizes cannot be matched perfectly. To avoid this problem, it is recommended to use the same hardware configurations including RAID configurations for the disks that reserve data partitions on server1 and server2.

◆ When you cannot synchronize the disk type or geometry on the both servers, make sure to check the exact size of data partitions by using the `clpvolsz` command before configuring a mirror disk resource or a hybrid disk resource. If they do not match, make the larger partition small by using the `clpvolsz` command.

◆ When RAID-disk is mirrored, it is recommended to use writeback mode because writing performance decreases a lot when the disk array controller cache is set to write-thru mode. However, when writeback mode is used, it is necessary to use disk array controller with battery installed or use with UPS.

◆ A partition with the OS page file cannot be mirrored.

IPv6 environment

The following function cannot be used in an IPv6 environment:

◆ BMC heartbeat resource

The following functions cannot use link-local addresses:

◆ Kernel mode LAN heartbeat resource

◆ Mirror disk connect

◆ PING network partition resolution resource

◆ FIP resource

◆ VIP resource

Network configuration

The cluster configuration cannot be configured or operated in an environment, such as NAT, where an IP address of a local server is different from that of a remote server.

Example of network configuration
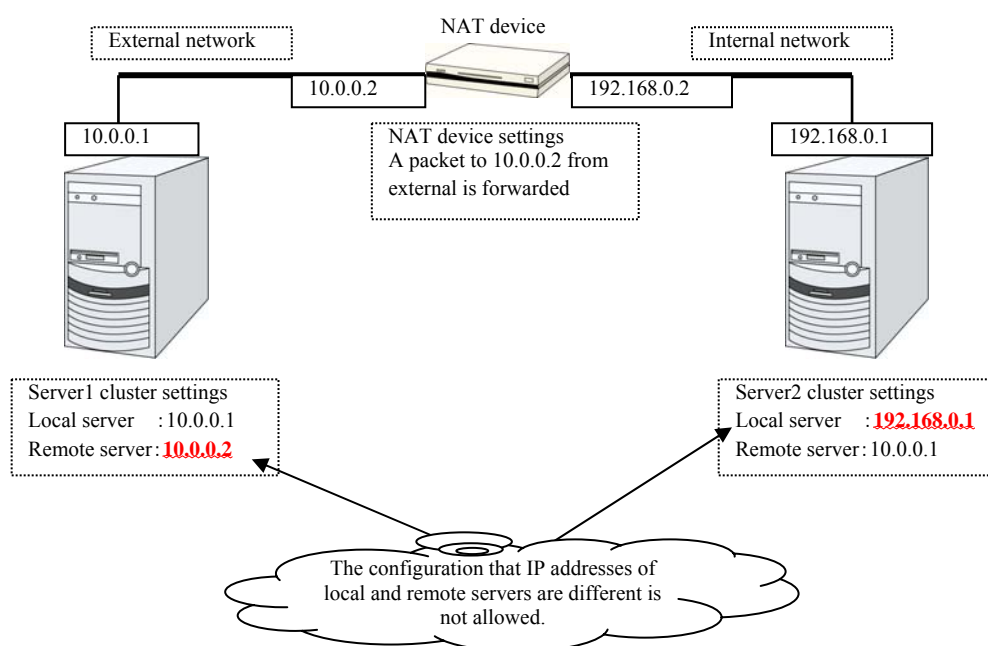
Hardware requirements for shared disks

◆ Dynamic disks cannot be used. Use basic disks.

◆ Software RAID (stripe set, mirror set, stripe set with parity) and volume set cannot be used.

NIC link up/down monitor resource

Some NIC boards and drivers do not support the required DeviceIoControl function. You cannot use this monitor resource in such a case. To use this monitor resource, use the trial license and check the operation in advance.

Write function of the mirror disk and hybrid disk

There are 2 types of disk mirroring of mirror disk resources and hybrid disk resources: synchronous mirroring and asynchronous mirroring.

In synchronous mirroring, data is written in the disks of both servers for every request to write data in the data partition to be mirrored and its completion is waited. Data is written in each of the servers along with this, but it is written in disks of other servers via network, so writing performance declines more significantly compared to a normal local disk that is not to be mirrored. In case of the remote cluster configuration, since the network communication speed is slow and delay is long, the writing performance declines drastically.

In asynchronous mirroring, data is written to the local server immediately. However, when writing data to other server, it is saved to the local queue first and then written in the background. Since the completion of writing data to other server is not waited for, even when the network performance is low, the writing performance will not decline significantly. However, in case of asynchronous mirror, the data to be updated is saved in the queue for every writing request as well, so the writing performance declines more significantly, compared to the normal local disk that is not to be mirrored and the shared disk. For this reason, it is recommended to use the shared disk for the system (such as the database system with lots of update systems) that is required high throughput for writing data in disks.

In case of asynchronous mirroring, the writing sequence will be guaranteed, but the data that has been updated to the latest may be lost, if an active server shuts down. For this reason, if it is required to inherit the data immediately before an error occurs for sure, use synchronous mirroring or the shared disk.

History file of asynchronous mirroring

In mirror disk or hybrid disk with asynchronous mode, data that cannot afford to be written in memory queue is recorded temporarily in a folder specified to save history files. When the limit of the file is not specified, history files are written in the specified folder without limitation. In this case, the line speed is too low, compared to the disk update amount of application, writing data to other server cannot catch up with updating the disk, and history files will overflow from the disk.

For this reason, it is required to reserve a communication line with enough speed in the remote cluster configuration as well, in accordance with the amount of disk application to be updated.

In case the folder with history files overflows from the disk because the communication band gets narrowed or the disk is updated continuously, it is required to reserve enough empty space in the drive and specify the limit of the history file size. This space will be specified as the destination to write history files, and to specify the drive different from the system drive as much as possible.

Data consistency among multiple asynchronous mirror disks

In mirror disk or hybrid disk with asynchronous mode, writing data to the data partition of the active server is performed in the same order as the data partition of the standby server.

This writing order is guaranteed except during the initial mirror disk configuration or recovery (copy) period after suspending mirroring the disks. The data consistency among the files on the standby data partition is guaranteed.

However, the writing order is not guaranteed among multiple mirror disk resources and hybrid disk resources. For example, if a file gets older than the other and files that cannot maintain the data consistency are distributed to multiple asynchronous mirror disks, an application may not run properly when it fails over due to server failure.

For this reason, be sure to place these files on the same asynchronous mirror disk or hybrid disk.

Multi boot

Avoid using multi boot if either of mirror disk or shared disk is used because if an operating system is started from another boot disk, access restrictions on mirroring and the shared disk become ineffective. The mirror disk consistency will not be guaranteed and data on the shared disk will not be protected.

JVM monitor resources

◆ Up to 25 Java VMs can be monitored concurrently. The Java VMs that can be monitored concurrently are those which are uniquely identified by the Builder (with **Identifier** in the **Monitor(special)** tab)

◆ Connections between Java VMs and Java Resource Agent do not support SSL.

◆ If, during the monitoring of Java VM, there is another process with the same name as the monitoring target, C heap monitoring may be performed for a different monitoring target.

◆ It may not be possible to detect thread deadlocks. This is a known problem in Java VM. For details, refer to "Bug ID: 6380127" in the Oracle Bug Database

◆ Monitoring of the WebOTX process group is disabled when the process multiplicity is two or more. WebOTX V8.4 and later can be monitored.

◆ The Java Resource Agent can monitor only the Java VMs on the server on which the JVM monitor resources are running.

◆ The Java installation path setting made by the Builder (with **Java Installation Path** in the **JVM monitor** tab in **Cluster Property**) is shared by the servers in the cluster. The version and update of Java VM used for JVM monitoring must be the same on every server in the cluster.

◆ The management port number setting made by the Builder (with **Management Port** in the **Connection Setting** dialog box opened from the J**VM monitor** tab in **Cluster Property**) is shared by all the servers in the cluster.

◆ Application monitoring is disabled when an application to be monitored on the IA32 version is running on an x86_64 version OS or when an application to be monitored on an x86_64 version is running on an IA32 version OS.

◆ If a large value such as 3,000 or more is specified as the maximum Java heap size by the Builder (by using Maximum Java Heap Size on the **JVM monitor** tab in **Cluster Property**), The Java Resource Agent will fail to start up. The maximum heap size differs depending on the environment, so be sure to specify a value based on the capacity of the mounted system memory.

◆ If you want to take advantage of the target Java VM load calculation function of coordination load balancer is recommended for use in SingleServerSafe.

Requirements for network warning light

◆ When using "DN-1000S" or "DN-1500GL," do not set your password for the warning light.

◆ To play an audio file as a warning, you must register the audio file for "DN-1500GL" beforehand. For details on how to register an audio file, see the "DN-1500GL" operation manual.

Before installing ExpressCluster

Consideration after installing an operating system, when configuring OS and disks are described in this section.

File system

Use NTFS for file systems of a partition to install OS, a partition to be used as a disk resource of the shared disk, and of a data partition of a mirror disk resource and a hybrid disk resource.

Communication port number

In ExpressCluster, the following port numbers are used by default. You can change the port number by using the Builder.

Make sure not to access the following port numbers from a program other than ExpressCluster.

Configure to be able to access the port number below when setting a firewall on a server:

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

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

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

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

Server that the browser is connected to the Integrated WebManager to Target server					
From			**To**		**Used for**
Server that the browser is connected to the Integrated WebManager	Automatic allocation	→	Server	29003/TCP	http communication
Server to be managed by the Integrated WebManager	29003	→	Client	29010/UDP	UDP communication

Others					
From			**To**		**Used for**
Server	Automatic allocation	→	Network warning light	See the manual for each product.	Network warning light control
Server	Automatic allocation	→	BMC Management LAN of the server	623/UDP	BMC control (Forced stop/chassis identify)
Management LAN of server BMC	Automatic allocation	→	Server	162/UDP	Monitoring target of the external linkage monitor configured for BMC linkage
Management LAN of server BMC	Automatic allocation	→	Management LAN of server BMC	5570/UDP	BMC HB communication
Server	Automatic allocation	→	Monitor target	icmp	IP monitor resource
Server	Automatic allocation	→	NFS server	icmp	Monitoring if NFS server of NAS resource is active
Server	Automatic allocation	→	Monitor target	icmp	Monitoring target of PING method of network partition resolution resource
Server	Automatic allocation	→	Server	Management port number set by the Builder	JVM monitor resource
Server	Automatic allocation	→	Monitoring target	Connection port number set by the Builder	JVM monitor resource
Server	Automatic allocation	→	Server	Management port number for Load Balancer Linkage set by the Builder	JVM monitor resource

Others					
From			**To**		**Used for**
Server	Automatic allocation	→	BIG-IP LTM	Communication port number set by the Builder	JVM monitor resource

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

JVM monitor uses the following four port numbers:

This management port number is the port number used to communicate with the Java VM on which the JVM monitor runs. To set the port number, open the **Cluster Properties** window of the Builder, select the **JVM monitor** tab, and then open the **Connection Setting** dialog box. For more information, refer to Chapter 2, "Functions of the Builder" in the *Reference Guide*.

This connection port number is the port number used to connect to the Java VM on the monitoring target (WebLogic Server or WebOTX). To set the port number, open the Properties window for the relevant JVM monitoring resource name, and then select the **Monitor(special)** tab. For more information, refer to Chapter 6, "Monitor resource details" in the *Reference Guide*.

This load balancer linkage port number is the port number used for load balancer linkage. When load balancer linkage is not used, the port number does not need to be set. To set the port number, open the **Cluster Properties** window of the Builder, select the **JVM monitor** tab, and then open the **Load Balancer Linkage Settings** dialog box. For more information, refer to Chapter 2, "Functions of the Builder" in the *Reference Guide*.

This communication port number is the port number used for load balancer linkage by BIG-IP LTM. When load balancer linkage is not used, the port number does not need to be set. To set the port number, open the **Cluster Properties** window of the Builder, select the **JVM monitor** tab, and then open the **Load Balancer Linkage Settings** dialog box. For more information, refer to Chapter 2, "Functions of the Builder" in the *Reference Guide*.

Clock synchronization

In a cluster system, it is recommended to synchronize multiple server clocks regularly. Synchronize server clocks by using the time server.

Partition for shared disk

◆ If multiple servers that are connected to the shared disk are started while access is not restricted by ExpressCluster, data on the shared disk may be corrupted. When the access is restricted, make sure to start only one of the servers.

◆ When a disk method is used to solve network partition, create a raw partition (disk heartbeat partition) with space larger than 17 MB that disk network partition resolution resources use on the shared disk.

◆ Format the partition (switchable partition) used to transfer data between servers as disk resources with NTFS.

◆ For each partition on the shared disk, assign the same drive letter on all servers.

◆ Partitions on the shared disk can be formatted and created from one of the servers. It is not necessary to recreate or reformat a partition on each server. However, the drive letter needs to be set in each server.

◆ When you continue using the data on the shared disk at times such as server reinstallation, do not create or format a partition. The data on the shared disk gets deleted if you allocate or format a partition.

Partition for mirror disk

◆ Create a raw partition with larger than 17 MB space on local disk of each server as a management partition for mirror disk resource (cluster partition.)

◆ Create a partition (data partition) for mirroring on local disk of each server and format it with NTFS. It is not necessary to recreate a partition when the existing partition is mirrored.

◆ Set the same data partition size to both servers. Use the `clpvolsz` command for checking and adjusting the partition size accurately.

◆ Set the same drive letter to both servers for a cluster partition and data partition.

Partition for hybrid disk

◆ As a partition for hybrid disk resource management (cluster partition), create a RAW partition of 17 MB or larger in the shared disk of each server group (or in the local disk if there is one member server in the server group).

◆ Create a partition to be mirrored (data partition) in the shared disk of each server group (or in the local disk if there is one member server in the server group) and format the partition with NTFS (it is not necessary to create a partition again when an existing partition is mirrored).

◆ Set the same data partition size to both server groups. Use the `clpvolsz` command for checking and adjusting the partition size accurately.

◆ Set the same drive letter to cluster partitions in all servers. Set the same drive letter to data partitions in all servers..

Access permissions of a folder or a file on the data partition

In the workgroup environment, you must set access permission of a folder or a file on the data partition for an user on each cluster server. For example, you must set access permission for "test" user of "server1" and "server2" which are cluster servers.

Adjusting OS startup time

It is necessary to configure the time from power-on of each node in the cluster to the server operating system startup to be longer than the following[3]:

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

◆ Heartbeat timeout time.

Verifying the network settings

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

◆ Check the network settings by using the `ipconfig` and `ping` commands.

　• Public LAN (used for communication with all the other machines)

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3 Please refer to Chapter 1, "Adjustment of the operating system startup time" of *Installation and Configuration Guide*.

- Interconnect-dedicated LAN (used for communication between servers in ExpressCluster)

- Mirror connect LAN (used with interconnect)

- Host name

◆ The IP address does not need to be set as floating IP resource in the operating system.

◆ When NIC is link down, IP address will be disabled in a server that only IPv6 is available. In that case, ExpressCluster may cause some problems. Please type following command to disable media sense function to avoid this problem.

```
netsh interface ipv6 set global dhcpmediasense=disabled
```

Coordination with ESMPRO/AutomaticRunningController

The following are the notes on ExpressCluster configuration when ExpressCluster works together with ESMPRO/AutomaticRunningController (hereafter ESMPRO/AC). If these notes are unmet, ExpressCluster may fail to work together with ESMPRO/AC.

The function to use ExpressCluster with ESMPRO/AC does not work on the OS of x64 Edition.

◆ You cannot specify only the DISK-method resource as a network partition resolution resource. When you specify the DISK method, do so while combining with other network partition resolution method such as PING method and COM method.

◆ When creating a disk TUR monitor resource, do not change the default value (No Operation) for the final action.

◆ When creating a disk RW monitor resource, if you specify a path on the shared disk for the value to be set for file name, do not change the default value (active) for the monitor timings.

◆ After recovery from power outage, the following alerts may appear on the ExpressCluster manager. This does not affect the actual operation due to the configuring the settings mentioned above.

➤ ID:18
Module name: nm
Message: `Failed to start the resource <resource name of DiskNP>. (server name:xx)`

➤ ID:1509
Module name: rm
Message: `Monitor <disk TUR monitor resource name> detected an error. (4 : device open failed. Check the disk status of the volume of monitoring target.)`

◆ For information on how to configure ESMPRO/AC and notes etc, see the chapter for ESMPRO/AC in the *EXPRESSCLUSTER X for Windows PP Guide*.

About `ipmiutil`

◆ The following functions use IPMI Management Utilities (`ipmiutil`), an open source of the BSD license, to control the BMC firmware servers. To use these functions, it is necessary to install `ipmiutil` in each server:

- Forcibly stopping a physical machine

- Chassis Identify

◆ When you use any of the above functions, configure Baseboard Management Controller (BMC) in each server so that the IP address of the management LAN port for the BMC can communicate with the IP address which the OS uses. These functions cannot be used on a

server where there is no BMC installed, or when the network for the BMC management is obstructed. For information on how to configure the settings for the BMC, see the manuals for servers.

◆ ExpressCluster does not come with `ipmiutil`. For information on how to acquire and install ipmiutil, see "Setup of BMC and `ipmiutil` (Required for the forced stop function and Chassis identify" in Chapter1, "Determining a system configuration" in the *Installation and Configuration Guide*.

◆ Users are responsible for making decisions and assuming responsibilities. NEC does not support or assume any responsibilities for:

- Inquires about `ipmiutil` itself

- Operations of `ipmiutil`

- Malfunction of `ipmiutil` or any error caused by such malfunction

- Inquiries about whether or not `ipmiutil` is supported by a given server

◆ Check if your server (hardware) supports `ipmiutil` in advance. Note that even if the machine complies with the IPMI standard as hardware, `ipmiutil` may not run when you actually try to run it.

Installation on Server Core

◆ When installing ExpressCluster on Server Core environment in Windows Server 2008, execute menu.exe just under the root of CD media at a command prompt. This displays the menu screen.
Although the procedures hereafter are the same as those in normal installation, you cannot select **Register with License File** in license registration. Make sure to select **Register with License Information**.

Mail reporting

The mail reporting function is not supported by STARTTLS and SSL.

Notes when creating the cluster configuration data

Notes when creating a cluster configuration data and before configuring a cluster system is described in this section.

Final action for group resource deactivation error

If select **No Operation** as the final action when a deactivation error is detected, the group does not stop but remains in the deactivation error status. Make sure not to set **No Operation** in the production environment.

Delay warning rate

If the delay warning rate is set to 0 or 100, the following can be achieved:

◆ When 0 is set to the delay monitoring rate

An alert for the delay warning is issued at every monitoring.
By using this feature, you can calculate the polling time for the monitor resource at the time the server is heavily loaded, which will allow you to determine the time for monitoring timeout of a monitor resource.

◆ When 100 is set to the delay monitoring rate
The delay warning will not be issued.

Be sure not to set a low value, such as 0%, except for a test operation.

Monitoring method TUR for disk monitor resource and hybrid disk TUR monitor resource

◆ You cannot use the TUR methods on a disk or disk interface (HBA) that does not support the Test Unit Ready (TUR) command of SCSI. Even if your hardware supports these commands, consult the driver specifications because the driver may not support them.

◆ TUR methods burdens OS and disk load less compared to Read methods.

◆ In some cases, TUR methods may not be able to detect errors in I/O to the actual media.

WebManager reload interval

◆ Do not set the **Reload Interval** on the **WebManager** tab or less than 30 seconds. If you set it for less than 30 seconds, it may affect the performance of ExpressCluster.

Heartbeat resource settings

◆ You need to set at least one kernel mode heartbeat resource.

◆ It is recommended to register an interconnect-dedicated LAN and a public LAN as kernel mode LAN heartbeat resources. (It is recommended to set more than two kernel mode LAN heartbeat resources.)

◆ The versions of the BMC hardware and firmware must be available for BMC heartbeat resources. For the available BMC versions, refer to "Servers supporting Express5800/A1080a or Express5800/A1040a series linkage" in Chapter 3, "Installation requirements for ExpressCluster" in the *Getting Started Guide*.

◆ Time for heartbeat timeout needs to be shorter than the time required for restarting the OS. If the heartbeat timeout is not configured in this way, an error may occur after reboot in some servers in the cluster because other servers cannot detect the reboot.

IP address of integrated WebManager (Public LAN IP address) settings

◆ The public LAN IP address setting of ExpressCluster X 2.1 or earlier is can be configured in **Connection IP address** of the **WebManager** tab in **Cluster Properties**.

Double-byte character set that can be used in script comments

◆ Scripts edited in Windows environment are dealt as Shift-JIS code, and scripts edited in Linux environment are dealt as EUC code. In case that other character codes are used, character corruption may occur depending on environment.

The number of server groups that can be set as servers to be started in a group

◆ The number of server groups that can be set as servers to be started in one group is 2. If three or more server groups are set, the ExpessCluster Disk Agent service (`clpdiskagent.exe`) may not operate properly.

JVM monitor resource settings

◆ When the monitoring target is WebLogic, the maximum values of the following JVM monitor resource settings may be limited due to the system environment (including the amount of installed memory):

- **The number** under **Monitor the requests in Work Manager**

- **Average** under **Monitor the requests in Work Manager**

- **The number** of **Waiting Requests** under **Monitor the requests in Thread Pool**

- **Average** of **Waiting Requests** under **Monitor the requests in Thread Pool**

- **The number** of **Executing Requests** under **Monitor the requests in Thread Pool**

- **Average** of **Executing Requests** under **Monitor the requests in Thread Poo**l

◆ To use the Java Resource Agent, install the Java runtime environment (JRE) described in "Operation environment for JVM monitor" in Chapter 3, "Installation requirements for ExpressCluster" or a Java development kit (JDK). You can use either the same JRE or JDK as that used by the monitoring target (WebLogic Server or WebOTX) or a different one. If both JRE and JDK are installed on a server, you can use either one.

◆ The monitor resource name must not include a blank.

System monitor resource settings

◆ Pattern of detection by resource monitoring

The System Resource Agent performs detection by using thresholds and monitoring duration time as parameters.

The System Resource Agent collects the data (used size of memory, CPU usage rate, and used size of virtual memory) on individual system resources continuously, and detects errors when data keeps exceeding a threshold for a certain time (specified as the duration time).

After start operating ExpressCluster

Notes on situations you may encounter after start operating ExpressCluster are described in this section.

Limitations during the recovery operation

Do not perform the following operations by the WebManager or from the command line while recovery processing is changing (reactivation → failover → last operation), if a group resource such as disk resource or application resource is specified as a recovery target and when a monitor resource detects an error.

◆ Stop and suspend of a cluster

◆ Start, stop, moving of a group

If these operations are controlled at the transition to recovering due to an error detected by a monitor resource, the other group resources in the group may not be stopped.

Even if a monitor resource detects an error, it is possible to control the operations above after the last operation is performed.

Executable format file and script file not described in the command reference

Executable format files and script files which are not described in Chapter 3, "ExpressCluster command reference" in the *Reference Guide* exist under the installation directory. Do not run these files on any system other than ExpressCluster. The consequences of running these files will not be supported.

Cluster shutdown and cluster shutdown reboot

When using a mirror disk, do not execute cluster shutdown or cluster shutdown reboot from the `clpstdn` command or the WebManager while a group is being activated. A group cannot be deactivated while being activated. OS may shut down while mirror disk resource is not properly deactivated and mirror break may occur.

Shutdown and reboot of individual server

When using a mirror disk, if you shut down the server or run the shutdown reboot command from the command or the WebManager, a mirror break occurs.

Recovery from network partition status

The servers that constitute a cluster cannot check the status of other servers if a network partition occurs. Therefore, if a group is operated (started/stopped/moved) or a server is restarted in this status, a recognition gap about the cluster status occurs among the servers. If a network is recovered in a state that servers with different recognitions about the cluster status are running like this, a group cannot be operated normally after that. For this reason, during the network partition status, shut down the server separated from the network (the one cannot communicate with the client) or stop the ExpressCluster Server service. Then, start the server again and return to the cluster after the network is recovered. In case that a network is recovered in a state that multiple servers have been started, it becomes possible to return to the normal status, by restarting the servers with different recognitions about the cluster status.

When a network partition resolution resource is used, even though a network partition occurs, emergent shut-down of a server (or all the servers) is performed. This prevents two or more servers that cannot communicate with one another from being started. When manually restarting the server that emergent shut down took place, or when setting the operations during the emergent shut down to restarting, the restarted server performs emergent shut down again. (In case of ping method or majority method, the ExpressCluster Server service will stop.) However, if two or more disk heartbeat partitions are used by the disk method, and if a network partition occurs in the state that communication through the disk cannot be performed due to a disk failure, both of the servers may continue their operations with being suspended.

Notes on the WebManager

◆ If the client data update method settings of the WebManager is set to **Polling**, the information displayed on the WebManager is regularly updated and the latest status is not immediately displayed even if the status has changed. If you want to get the latest information, click the **Reload** button.

◆ If the problems such as server shutdown occur while the WebManager is getting the information, acquiring information may fail and a part of object may not be displayed correctly. If the client data update method settings of the WebManager is set to **Polling**, wait for the next automatic update or click the **Reload** button to reacquire the latest information. If **Realtime** is set, the information is automatically updated to the latest status.

◆ Collecting logs of ExpressCluster cannot be executed from two or more WebManager simultaneously.

◆ If the WebManager is operated in the state that it cannot communicate with the connection destination, it may take a while until the control returns.

◆ If you move the cursor out of the browser in the state that the mouse pointer is displayed as a wristwatch or hourglass, the cursor may be back to an arrow.

◆ When going through the proxy server, configure the settings for the proxy server be able to relay the port number of the WebManager.

◆ When going through the reverse proxy server, the WebManager will not operate properly.

◆ When updating ExpressCluster, close all running browsers. Clear the Java cache (not browser cache) and open browsers.

◆ When updating Java, close all running browsers. Clear the Java cache (not browser cache) and open browsers

Notes on the Builder

◆ ExpressCluster does not have the compatibility of the cluster configuration data with the following products.

- The Builder of other than ExpressCluster X3.1 for Windows

- The Builder for ExpressCluster for Linux

- The Builder of ExpressCluster for Windows Value Edition

◆ Cluster configuration data created using a later version of this product cannot be used with this product.

◆ Cluster configuration data of ExpressCluster X1.0/2.0/2.1/3.0/3.1 for Windows can be used with this product.
You can use such data by clicking **Import** from the **File** menu in the Builder.

◆ Closing the Web browser (by clicking **Exit** from the menu), the dialog box to confirm to save is displayed.

> ⚠ Are you sure you want to navigate away from this page?
>
> The settings that have not been applied will be destroyed.
>
> Press OK to continue, or Cancel to stay on the current page.
>
> [OK]   [Cancel]

When you continue to edit, click the **Cancel** button.

Note:

This dialog box is not displayed if JavaScript is disabled.

◆ Reloading the Web browser (by selecting Refresh from the menu or tool bar) , the dialog box to confirm to save is displayed.

> ⚠ Are you sure you want to navigate away from this page?
>
> The settings that have not been applied will be destroyed.
>
> Press OK to continue, or Cancel to stay on the current page.
>
> [OK]   [Cancel]

When you continue to edit, click the **Cancel** button.

Note:

This dialog box is not displayed if JavaScript is disabled.

◆ When going through the reverse proxy server, the Builder will not operate properly.

ExpressCluster Disk Agent Service

Make sure not to stop the ExpressCluster Disk Agent Service. This cannot be manually started once you stop. Restart the OS, and then restart the ExpressCluster Disk Agent Service.

Changing the cluster configuration data during mirroring

Make sure not to change the cluster configuration data during the mirroring process including initial mirror configuration. The driver may malfunction if the cluster configuration is changed.

Returning the stand-by server to the cluster during mirror-disk activation

If the stand-by server is running while the cluster service (ExpressCluster server service) is stopped and the mirror disk is activated, restart the stand-by server before starting the service and returning the stand-by server to the cluster. If the stand-by server is returned without being restarted, the information about mirror differences will be invalid and a mirror disk inconsistency will occur.

Changing the configuration between the mirror disk and hybrid disk

To change the configuration so that the disk mirrored using a mirror disk resource will be mirrored using a hybrid disk resource, first delete the existing mirror disk resource from the configuration data, and then upload the data. Next, add a hybrid disk resource to the configuration data, and then upload it again. You can change a hybrid disk to a mirror disk in a similar way.

If you upload configuration data in which the existing resource has been replaced with a new one without deleting the existing resource as described above, the disk mirroring setting might not be changed properly, potentially resulting in a malfunction.

chkdsk command and defragmentation

The chkdsk command or defragmentation to be executed on a switchable partition controlled by a disk resource or a data partition mirrored by a mirror disk resource must be executed on the server where the resource has already been started. Otherwise, the command or defragmentation cannot be executed due to access restriction.

When the chkdsk command is run in the restoration mode (/f option), stop the failover group and execute it while only the target disk resource/mirror disk resource is running. If not, and files or folders in the target partition are open, running the command. When there is a disk RW monitor resource which monitors the target partition, it is necessary to suspend this monitor resource.

Index service

When you create a shared disk/mirror disk directory on the index service catalogue to make an index for the folders on the shared disk / mirror disk, it is necessary to configure the index service to be started manually and to be controlled from ExpressCluster so that the index service starts after the shared disk / mirror disk is activated. If the index service is configured to start automatically, the index service opens the target volume, which leads to failure in mounting upon the following activation, resulting in failure in disk access from an application or explorer with the message telling the parameter is wrong.

Issues with User Account Control (UAC) in Windows Server 2008 environment

In Windows Server 2008 or later environment, User Account Control (UAC) is enabled by default. When UAC is enabled, there are following issues.

Startup Program

If you log on a server with any account other than built-in Administrator account, following programs are not allowed to execute. Also, following window is displayed.
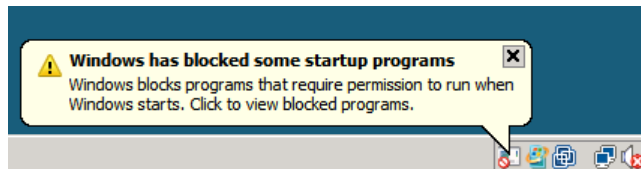
Even if following programs are not executed, there is no effect on clustering functions.

clpaltui.exe

This is an icon showed in the task bar that indicate of cluster status. It is one of functions of ExpressCluster Alert Service. For more detail, please refer to Chapter 9, "Alert Service" in the *Reference Guide*.

clphookstdn.exe

When you initiate shutdown from **Start** of the task bar, this program shows the display to notify you that you should shutdown the server with WebManager or ExpressCluster commands.

Even if you turn off UAC, above programs are not executed automatically when you log on.

Monitor Resource

Following resource has issues with UAC.

Oracle Monitor Resource

For the Oracle monitor resource, if you select **OS Authentication** for **Authentication Method** and then set any user other than those in the Administrators group as the monitor user, the Oracle monitoring processing will fail.

When you set **OS Authentication** in **Authentication Method**, the user to be set in **Monitor User** must belong to the Administrators group.

Compatible Command

Following command has issue with UAC.

armload.exe

If you use this command with /U option and any account other than built-in Administrator, the command will fail to execute the application or service that set as argument of it.

Screen display of application resource / script resource in the Windows Server 2008 environment

Since the processes started from the application resource or script resource of ExpressCluster are executed in session 0, when you start a process having GUI, the **Interactive services dialog detection** pop-up menu is displayed in Windows Server 2008. Unless you select **Show me the message**, GUI is not displayed.

Environment in which the network interface card (NIC) is duplicated

In an environment in which the NIC is duplicated, NIC initialization at OS startup may take some time. If the cluster starts before the NIC is initialized, the starting of the kernel mode LAN heartbeat resource (lankhb) may fail. In such cases, the kernel mode LAN heartbeat resource cannot be restored to its normal status even if NIC initialization is completed. To restore the kernel mode LAN heartbeat resource, you must first suspend the cluster and then resume it.

In that environment, we recommend to delay startup of the cluster by following setting or command.

◆ Network Initialization Complete Wait Time Setting
You can configure this setting in the **Timeout** tab of **Cluster Properties**. This setting will be enabled on all cluster servers. If NIC initialization is completed within timeout, the cluster service starts up.

◆ ARMDELAY command (armdelay.exe)
You must execute this command on each cluster server. The cluster service starts up after the time that you set with the command from OS startup.

For more details of above setting and command, please refer to the *Reference Guide*.

ExpressCluster service login account

The ExpressCluster service login account is set in **Local System Account**. If this account setting is changed, ExpressCluster might not properly operate as a cluster.

Monitoring the ExpressCluster resident process

The ExpressCluster resident process can be monitored by using software monitoring processes. However, recovery actions such as restarting a process when the process abnormally terminated must not be executed.

Message receive monitor resource settings

◆ Error notification to message receive monitor resources can be done in any of three ways: using the `clprexec` command, BMC linkage, or linkage with the server management infrastructure.

◆ To use the `clprexec` command, use the relevant file stored on the ExpressCluster CD. Use this method according to the OS and architecture of the notification-source server. The notification-source server must be able to communicate with the notification-destination server.

◆ To use BMC linkage, the BMC hardware and firmware must support the linkage function. For available BMCs, see "Servers supporting Express5800/A1080a and Express5800/A1080aA1040a series linkage" on page 56 in Chapter 3, "Installation requirements for ExpressCluster" in this guide. This method requires communication between the IP address for management of the BMC and the IP address of the OS.

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JVM monitor resources

◆ When restarting the monitoring-target Java VM, you must first suspend JVM monitor resources or stop the cluster.

◆ When changing the JVM monitor resource settings, you must suspend and resume the cluster.

◆ JVM monitor resources do not support a delay warning for monitor resources.

System monitor resources

◆ To change a setting, the cluster must be suspended.

◆ System monitor resources do not support a delay warning for monitor resources.

◆ If the date and time of the OS is changed during operation, the timing of analysis processing being performed at 10-minute intervals will change only once immediately after the date and time is changed. This will cause the following to occur; suspend and resume the cluster as necessary.

  • An error is not detected even when the time to be detected as abnormal elapses.

  • An error is detected before the time to be detected as abnormal elapses.

◆ Up to 26 disks that can be monitored by the disk resource monitor function at the same time.

Event log output relating to linkage between mirror statistical information collection function and OS standard function

If the linkage function for the mirror statistical information collection function and OS standard function is disabled, the following errors may be output in an application event log such as when performance monitor is being used:

◆ Event ID: 1008
Source: Perflib
Message: Open procedure for service "clpdiskperf" (DLL "<*ExpressCluster installation path*>\bin\clpdiskperf.dll") failed. Performance data of this service is not available. The error code is contained in the first four bytes (DWORD) of the data section.

◆ Event ID: 4806
Source: ExpressCluster X
Message: The number of processes of performance monitor is too large to collect mirror statistical information.

When the linkage function is not used, even if this message is out put, there is no problem in ExpressCluster and performance monitor operations. If this message is frequently output, execute the command below to enable the linkage function.

```
>lodctr.exe <ExpressCluster installation path>\perf\clpdiskperf.ini
```

Notes when changing the ExpressCluster configuration

The section describes what happens when the configuration is changed after starting to use ExpressCluster in the cluster configuration.

Failover exclusive attribute of group properties

When the failover exclusive attribute is changed, the change is reflected by suspending and resuming the cluster.

If the failover exclusive attribute is changed from **No exclusion** or **Normal** to **Absolute**, multiple groups of **Absolute** may be started on the same server depending on the group startup status before suspending the cluster.

Exclusive control will be performed at the next group startup.

Dependency between resource properties

When the dependency between resources has been changed, the change is applied by suspending and resuming the cluster.

If a change in the dependency between resources that requires the resources to be stopped during application is made, the startup status of the resources after the resume may not reflect the changed dependency.

Dependency control will be performed at the next group startup.

Compatibility with old versions

Compatibility with ExpressCluster X 1.0/2.0/2.1/3.0

The cluster configuration information created in Builder of X 1.0/2.0/2.1/3.0 can be used in X 3.1 or later. Since the type of failover destination server selection upon failure detection of group resource / monitor resource is the stable server which is the default, what is selected for failover destination in X 2.0 or later may differ from that of X 1.0 for the configuration of three nodes or more.

If the stable server is configured as failover destination and there are multiple failover destinations, a server with no error will be given a higher priority when a failover takes place. On the other hand, with X 1.0, since the server configured to have the highest priority among the movable servers is the failover destination, failback to the server where the error occurred in the first place takes place, which can result in failure to failing over to the third server.

For the reason described above, it is generally recommended to configure the stable server as failover destination . However if the same behavior as X 1.0 is required, change the failover destination select **Maximum Propriety Server** in the **Settings** tab of the properties in each resource.

Compatibility with EXPRESSCLUSTER Ver8.0 or earlier

To use the following functions, it is required to set the cluster name, the server name and the group name according to the naming conventions of the existing versions

◆ ExpressCluster client

◆ Function to work together with NEC ESMPRO/AC

◆ Function to work together with NEC ESMPRO/SM

◆ Virtual computer resource name

◆ Compatible API

◆ Compatible command

Naming conventions of the versions 8.or earlier are as follows:

◆ Cluster name
 - Up to 15 characters
 - Characters that can be used are alphanumeric characters, hyphens (-) and underscores (_).
 - Do not specify a DOS I/O device such as PRN.
 - Not case-sensitive

◆ Server name
 - Up to 15 characters
 - Characters that can be used are alphanumeric characters, hyphens (-) and underscores (_).
 - Not case-sensitive

◆ Group name
 - Up to 15 characters
 - Characters that can be used are alphanumeric characters, hyphens (-) and underscores (_).
 - Do not specify a DOS I/O device such as PRN.
 - Not case-sensitive

Compatible API

Compatible APIs indicates those that can be used with ExpressCluster Ver8.0 and earlier. They can be used with ExpressCluster X, but they have the following restrictions:

Only the resources below are supported. Even though other resources are set, they cannot be referred by using compatible APIs.

- Disk resource
- Mirror disk resource
- Virtual computer name resource
- Virtual IP resource
- Print spooler resource

It is required to set the cluster name, the server name and the group name by following the naming rules of the existing versions. If names that are not allowed by the rules are specified, they cannot be referred by using compatible APIs.

Compatible APIs cannot be used by using the resource name specified by the Builder.

Timings of cluster events occurrence is not completely compatible. The types of events are the same, but the number and order of events to be reported may be different from those of the existing versions.

If a compatible API is used with the resident process, when stopping the ExpressCluster Server service and rebooting it, it is required to run "ArmTerminateApi" and then "ArminitializeApi" and initialize the compatible API again. As a rule, set the processes to start or stop by using the start or stop scripts of the script resources.

Ver3.0 compatible I/F cannot be used.

Script files

When you port a script file used in ExpressCluster Ver8.0 or earlier, change the first "ARMS_" of the environment variable name to "CLP_".

Example) IF "*%ARMS_EVENT%*" == "START" GOTO NORMAL

↓

IF "*%CLP_EVENT%*" == "START" GOTO NORMAL

Appendix

This section covers:

- Appendix A   Glossary
- Appendix B   Index

Appendix A. Glossary

Active server

A server that is running for an application set.
(Related term: Standby server)

Cluster partition

A partition on a mirror disk. Used for managing mirror disks.
(Related term: Disk heartbeat partition)

Cluster shutdown

To shut down an entire cluster system (all servers that configure a cluster system).

Cluster system

Multiple computers are connected via a LAN (or other network) and behave as if it were a single system.

Data partition

A local disk that can be used as a shared disk for switchable partition. Data partition for mirror disks.
(Related term: Cluster partition)

Disk heartbeat partition

A partition used for heartbeat communication in a shared disk type cluster.

Failover

The process of a standby server taking over the group of resources that the active server previously was handling due to error detection.

Failback

A process of returning an application back to an active server after an application fails over to another server.

Failover group

A group of cluster resources and attributes required to execute an application.

Failover policy

A priority list of servers that a group can fail over to.

Floating IP address

Clients can transparently switch one server from another when a failover occurs.
Any unassigned IP address that has the same network address that a cluster server belongs to can be used as a floating address.

Heartbeat

Signals that servers in a cluster send to each other to detect a failure in a cluster.
(Related terms: Interconnect, Network partition)

Interconnect

A dedicated communication path for server-to-server communication in a cluster.
(Related terms: Private LAN, Public LAN)

Management client

Any machine that uses the WebManager to access and manage a cluster system.

Master server

The server displayed at the top of **Master Server** in **Server Common Properties** of the Builder

Mirror connect

LAN used for data mirroring in a data mirror type cluster. Mirror connect can be used with primary interconnect.

Mirror disk type cluster	A cluster system that does not use a shared disk. Local disks of the servers are mirrored.
Moving failover group	Moving an application from an active server to a standby server by a user.
Network partition	All heartbeat is lost and the network between servers is partitioned. (Related terms: Interconnect, Heartbeat)
Node	A server that is part of a cluster in a cluster system. In networking terminology, it refers to devices, including computers and routers, that can transmit, receive, or process signals.
Private LAN	LAN in which only servers configured in a clustered system are connected. (Related terms: Interconnect, Public LAN)
Primary (server)	A server that is the main server for a failover group. (Related term: Secondary server)
Public LAN	A communication channel between clients and servers. (Related terms: Interconnect, Private LAN)
Startup attribute	A failover group attribute that determines whether a failover group should be started up automatically or manually when a cluster is started.
Shared disk	A disk that multiple servers can access.
Shared disk type cluster	A cluster system that uses one or more shared disks.
Switchable partition	A disk partition connected to multiple computers and is switchable among computers. (Related terms: Disk heartbeat partition)
Secondary server	A destination server where a failover group fails over to during normal operations. (Related term: Primary server)
Server Group	A group of servers connected to the same network or the shared disk device
Standby server	A server that is not an active server. (Related term: Active server)
Virtual IP address	IP address used to configure a remote cluster.

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