ExpressCluster is widely used by customers all over the world

Case Studies

Dream Island Department Store Co., Ltd.
Retail, China

Dream Island Department Store Co., Ltd. is a leading large scale retail store in Nanning city in Guangxi Province in China. Through the deployment of ExpressCluster, they successfully achieved high availability of critical database systems, ensured the stability of their key application systems and reduced Total Cost of Ownership (TCO) at once.

Sumitomo Electric Semiconductor Materials, Inc.
Manufacturing, United States

Sumitomo Electric Semiconductor Materials, Inc. (SESMI) is a leading Gallium Arsenide (GaAs) semiconductor product manufacturer located in Oregon. Since deploying ExpressCluster, there have been no production process interruptions due to system failures.

Port of Yokohama
Government, Japan

Located on Tokyo's southwestern edge, the port has since played an important role in the modernization of Japan's international commerce. Since the implementation of Express5800/ft series of servers and ExpressCluster, the Port of Yokohama has not experienced a single interruption of service.

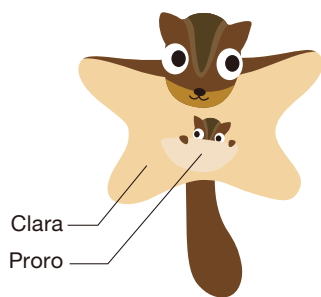**ROUX ET CIE**
Manufacturing, France

ROUX, specialized in the installation of electric, electronic and optical materials, has chosen ExpressCluster as the solution to protect and secure its SQL databases. This solution guarantees the performance of their production chain, allowing ROUX to offer an excellence in quality of service to its customers.

For more information, visit "http://www.nec.com/expresscluster"

High Availability Software

ExpressClusterX

Ensuring Mission-Critical System Continuity

The ExpressCluster mascots: Clara and Proro

|	
They keep important things in their pockets.	(= System protection)
They fly from tree to tree.	(= Failovers)
Their large eyes don't miss even minor dangers.	(= Powerful monitoring)
They shriek when they sense anything unusual.	(= Alerts)
They are nocturnal, and are busy even while we sleep.	(= 24-hour monitoring)
They are popular everywhere they go.	(= Installation at many locations)

Clara
Proro

Cat.No. E99-09090013E

http://www.nec.com/expresscluster

High reliability and proven technology protects your mission critical system.

The ExpressCluster series offers powerful and accurate failure monitoring features, failover features for quickly inheriting jobs to a healthy server when a failure occurs, and operation management features for determining where failures occurred at a glance.
The ExpressCluster series of middleware, which was developed in Japan, has been deployed worldwide and is a global standard for supporting business continuity.

ExpressCluster X

ExpressCluster X HA Series
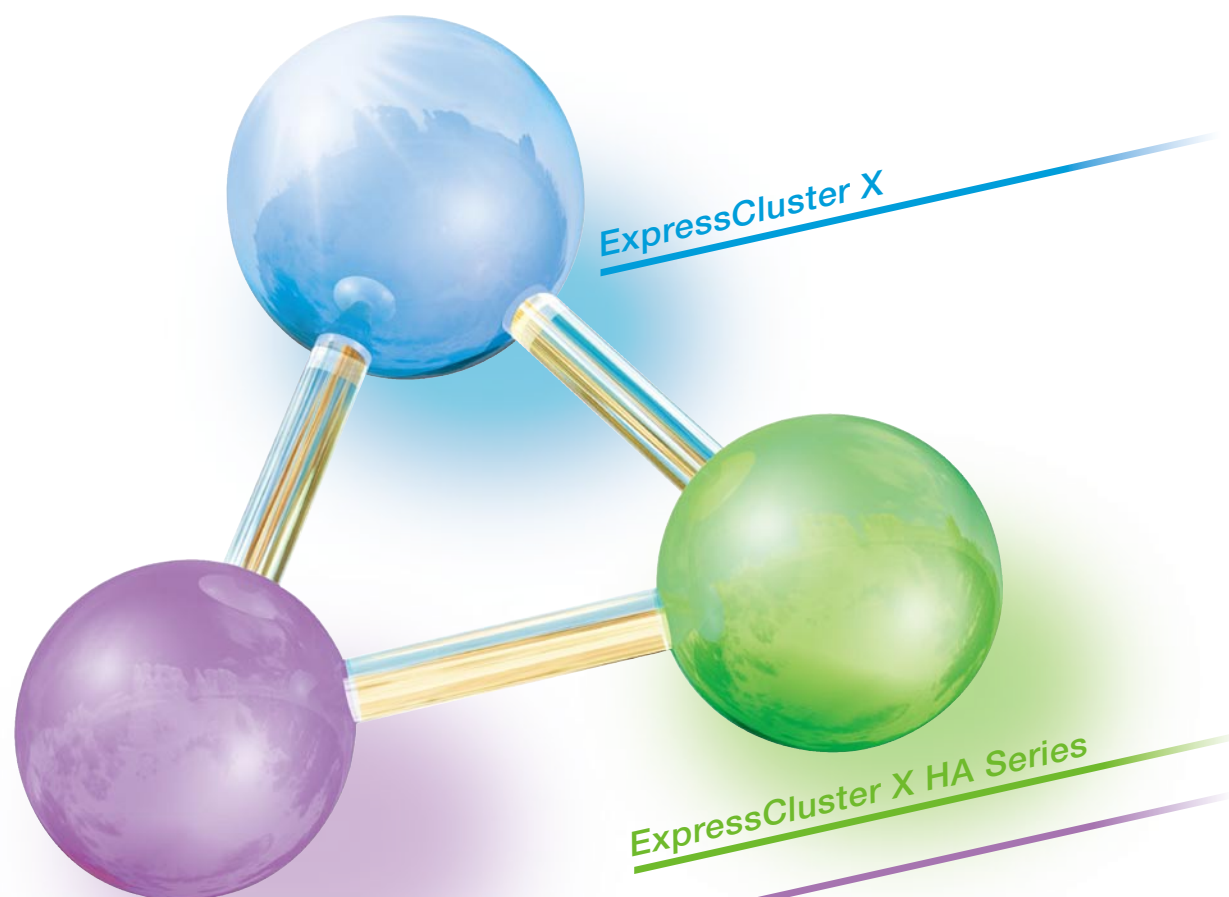
ExpressCluster X OperationHelper for Windows Server Failover Cluster

Concepts

ExpressCluster has been supporting mission-critical systems in Japan for over 10 years. We have used this wealth of experience to make ExpressCluster even more complete and to incorporate features for integrated management of different platforms and for recovering from disasters to enable business continuity. The result of these improvements is ExpressCluster X.

In addition, we have reorganized the HA series of products conventionally used to achieve high availability on UNIX platforms and Operation-Helper for WSFC (Windows Server Failover Cluster), which further increases the availability of WSFC, into ExpressCluster. ExpressCluster is the start of a new age of HA systems.

- Widely deployed across the world
- Designed for Small and Large System
- Powerful and Accurate Monitoring Features
- Extremely Easy to Use
- Trusted Brand Name
- Worldwide Adoption
- Thorough Japan Quality Assurance

Cross Platform

Standardization of building and operating clusters, as well as integrated management

Regardless of your operating system (Windows, Linux, or UNIX) or cluster configuration, you can collectively manage your entire system by using one management server, and all important features can be used similarly, which makes it easy to build and manage HA systems.

Flexible support for system consolidation and modification

Even migrating from a Windows system to a Linux system can be accomplished smoothly because the look and feel of ExpressCluster is the same for both. In addition, because a significantly wider variety of system configurations are now supported, the system changes involved when, for example, companies merge or cooperate can be handled flexibly to preserve the availability of the system.

ExpressCluster

Windows		OperationHelper
Linux	ExpressCluster X	
UNIX		HA Series
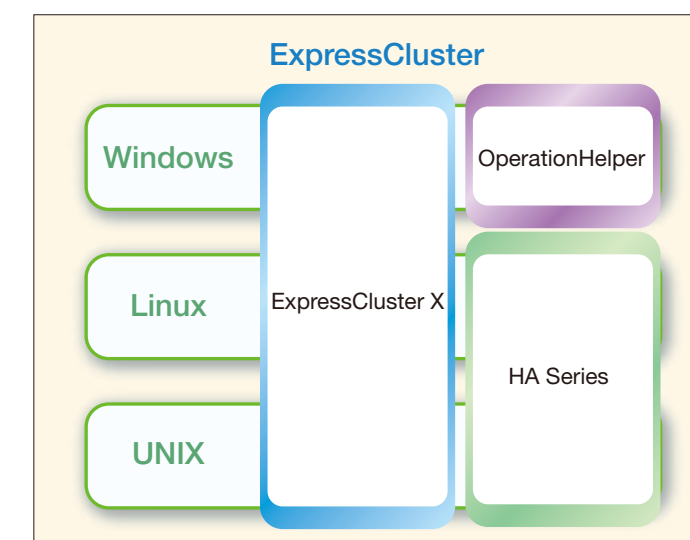
ExpressCluster X

ExpressCluster X realizes high availability by monitoring for system failures and inheriting jobs to a healthy server when a failure occurs.

ExpressCluster X product map

Upgrade licenses	SingleServerSafe Upgrade license*	Replicator DR Upgrade license*
	* Used to upgrade to a cluster configuration	* Used to upgrade Replicator to Replicator DR

Reporting — Alert Service

Failure monitoring

Monitored applications

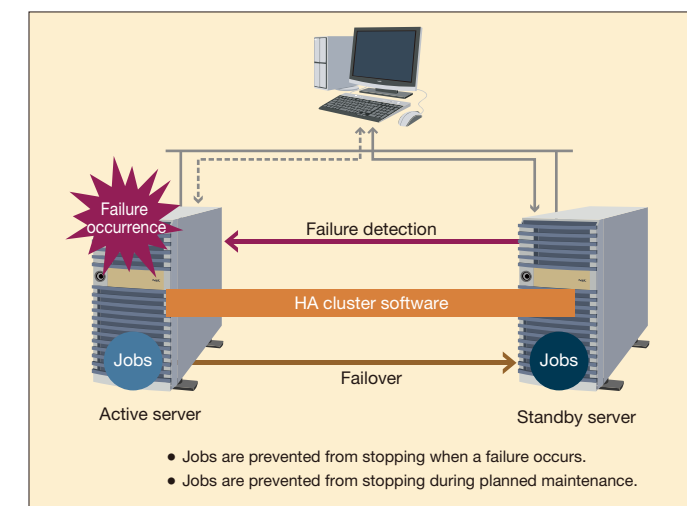| Database Agent	Oracle, DB2, PostgreSQL, SQL Server (Windows), MySQL (Linux), etc.
Internet Server Agent	http, ftp, smtp, pop3, imap4, etc.
Application Server Agent	Tuxedo, WebLogic, WebSphere, WebOTX, OracleAS, etc.
File Server Agent * Only for the Linux version	Samba, NFS
Anti-Virus Agent * Only for the Windows version	VirusBuster Corporate Edition

Data mirroring — Replicator | Replicator DR

Optional products

This product

ExpressCluster X SingleServerSafe

ExpressCluster X

ExpressCluster X CD

Windows, Linux, Solaris x86*

Single

Cluster

* For Solaris x86, ExpressCluster X SingleServerSafe and certain optional products are not supported. Also note that the Solaris x86 product CD differs from that used for Windows and Linux.
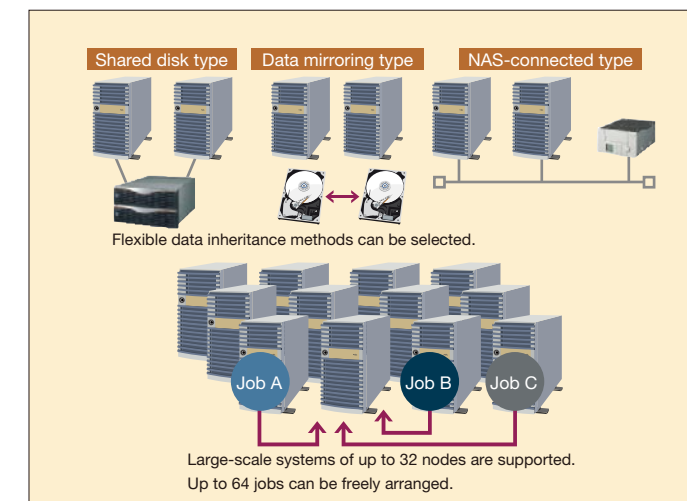* The license differs for some regions.

Minimizing downtime by building a high availability (HA) cluster system

If one server in a cluster stops due to a failure or for some other reason, the applications and services running on that server are automatically inherited to a different server to minimize downtime.

Failure occurrence — Failure detection

HA cluster software

Jobs — Failover — Jobs

Active server — Standby server

● Jobs are prevented from stopping when a failure occurs.
● Jobs are prevented from stopping during planned maintenance.

Flexible system configuration and high scalability

A significantly wider variety of system configurations are now supported such as mixed configuration of shared disk and data mirroring type.
Duplication of data mirroirng configuration is also available for further avaialbility.

Shared disk type | Data mirroring type | NAS-connected type

Flexible data inheritance methods can be selected.

Job A | Job B | Job C

Large-scale systems of up to 32 nodes are supported.
Up to 64 jobs can be freely arranged.

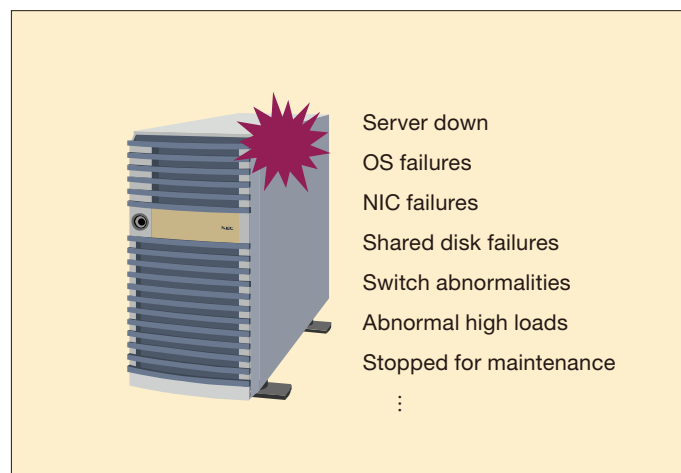## Integrated management of Windows and Linux by using single management console

Visual operations can be performed using the displayed tree views regardless of the system scale. In addition, because the views were developed based on Java, the same operations are possible regardless of the operating system.
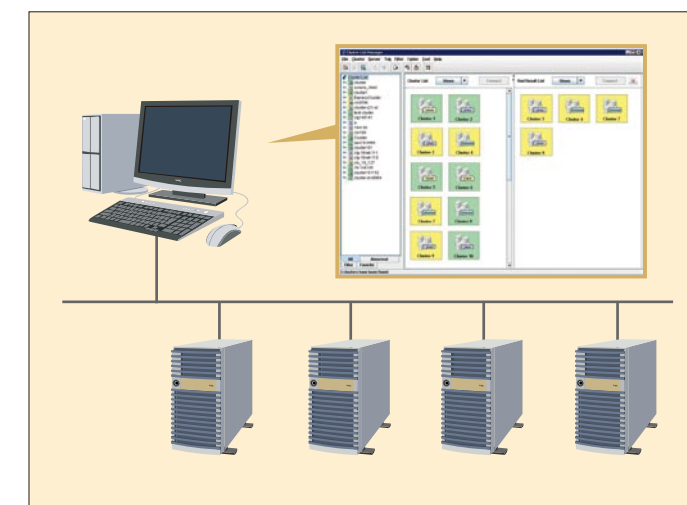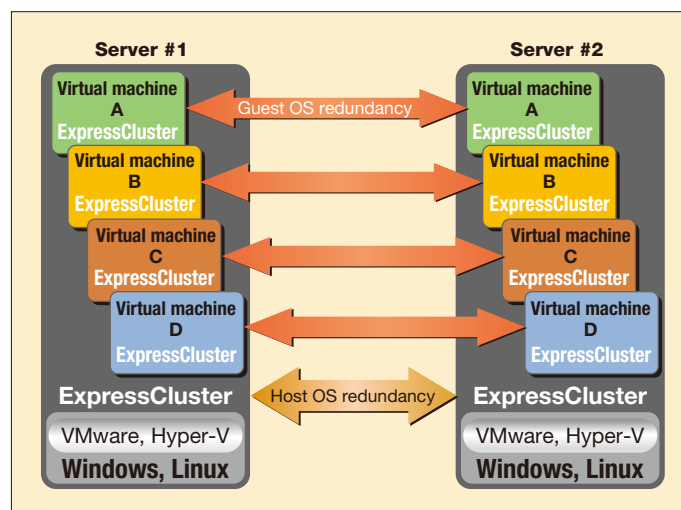
ExpressCluster X

Minimized downtime by using a variety of failure detection features

System disruption due to application bugs or human errors can be minimized by monitoring whether applications is dead or alive and by monitoring resources for failures.

Server down
OS failures
NIC failures
Shared disk failures
Switch abnormalities
Abnormal high loads
Stopped for maintenance
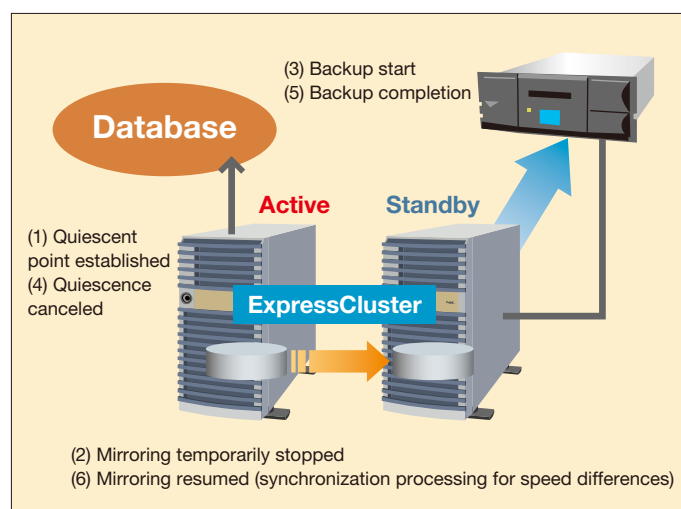
Virtual environment support

Virtualization technology is effective for server consolidation.
However, if a single server is used for consolidation, a problem such as a hardware failure might cause multiple guest operating systems to go down at the same time.
ExpressCluster makes it possible to cluster host operating systems and guest operating systems in virtual environments such as VMware and Hyper-V.
This makes it possible to achieve high availability even in virtual environments.

Server #1

Virtual machine A — ExpressCluster
Guest OS redundancy
Virtual machine B — ExpressCluster
Virtual machine C — ExpressCluster
Virtual machine D — ExpressCluster

ExpressCluster
VMware, Hyper-V
Windows, Linux

Host OS redundancy

Server #2

Virtual machine A — ExpressCluster
Virtual machine B — ExpressCluster
Virtual machine C — ExpressCluster
Virtual machine D — ExpressCluster

ExpressCluster
VMware, Hyper-V
Windows, Linux

Snapshot back up by establishing a quiescent point

It is possible to establish a quiescent point for an important database so that the database consistency is preserved when making a snapshot backup of the data.
This makes it possible to preserve consistency during backups while continuing jobs.

- Oracle 11g/10g (Windows/Linux)
- SQL Server 2008 (Windows)
- MySQL (Windows/Linux)
- PostgreSQL (Windows/Linux)

Database

(3) Backup start
(5) Backup completion

Active   **Standby**

(1) Quiescent point established
(4) Quiescence canceled

ExpressCluster

(2) Mirroring temporarily stopped
(6) Mirroring resumed (synchronization processing for speed differences)

Low-cost disaster recovery clusters

Asynchronous data mirroring makes it possible to build highly reliable and low-cost disaster recovery solution even for narrow-band network or far distance configurations.

Up until now, a complicated software configuration has been required for disaster recovery clusters, but such a cluster can now be built using only cluster software.
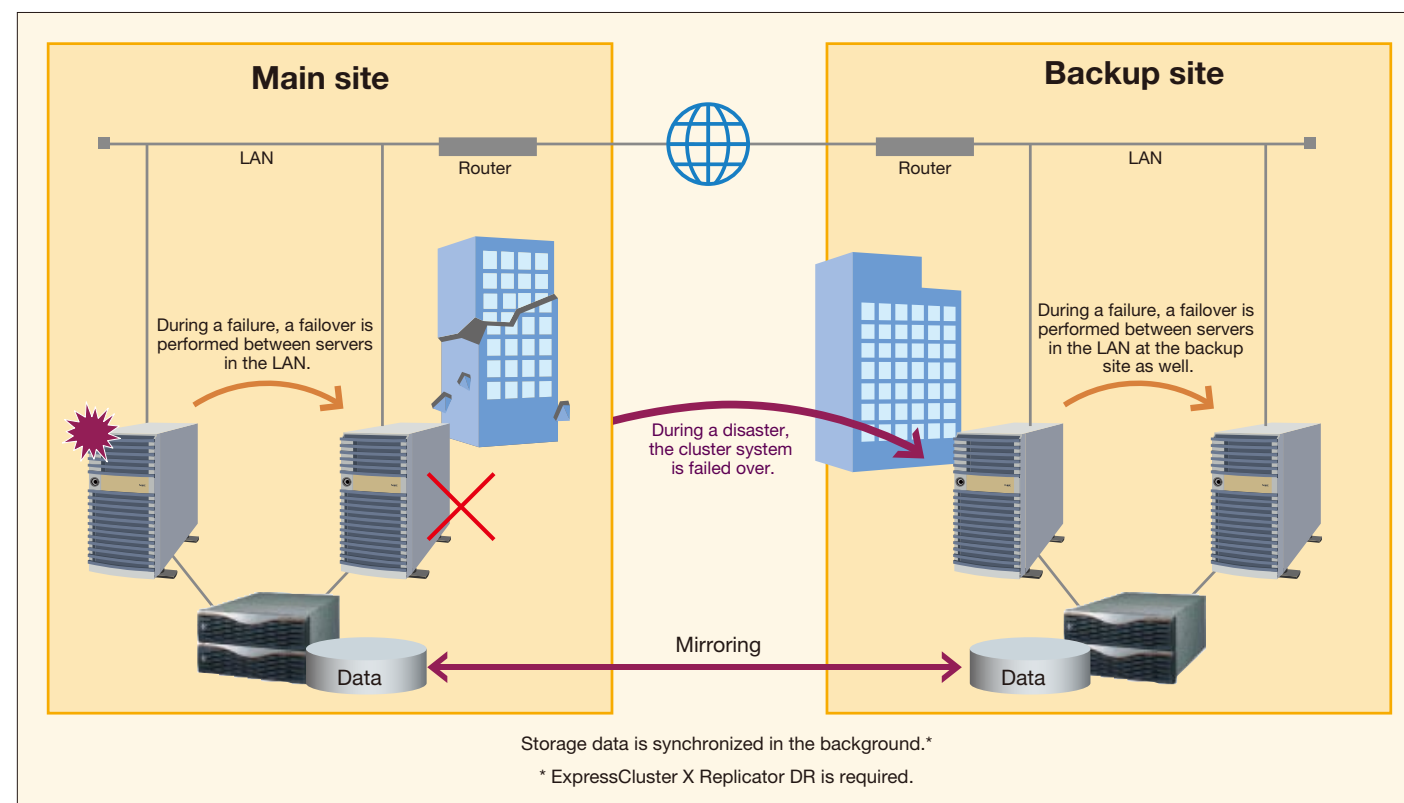
Business continuity
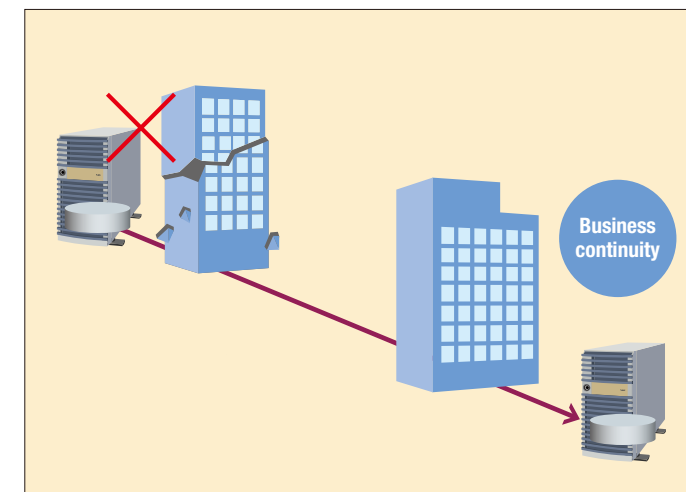
- Data mirroring features
- · Operation is possible even for narrow bandwidths.
- · Synchronous / Asynchronous data mirroring supported.
- · During data resynchronization, only data that differs is resynchronized.
- Features of clustering between different segments
- · Servers that straddle segments can be clustered.
- · Virtual IP addresses for use during routing are supported.

Shared storage mirroring

An advanced disaster recovery system can be built by combining normal cluster systems that use a shared disk at the main site and mirroring the data on the shared disk to the backup site.
When a small-scale failure occurs, a failover can be performed between clusters at the main site to continue jobs. In addition, if a large-scale failure occurs that affects the entire cluster system at the main site, the mirrored data can be used to fail over to the backup site and continue jobs.

Main site   **Backup site**

LAN   Router   Router   LAN

During a failure, a failover is performed between servers in the LAN.

During a failure, a failover is performed between servers in the LAN at the backup site as well.

During a disaster, the cluster system is failed over.

Data   Mirroring   Data

Storage data is synchronized in the background.*

* ExpressCluster X Replicator DR is required.

ExpressCluster X Add-On Options
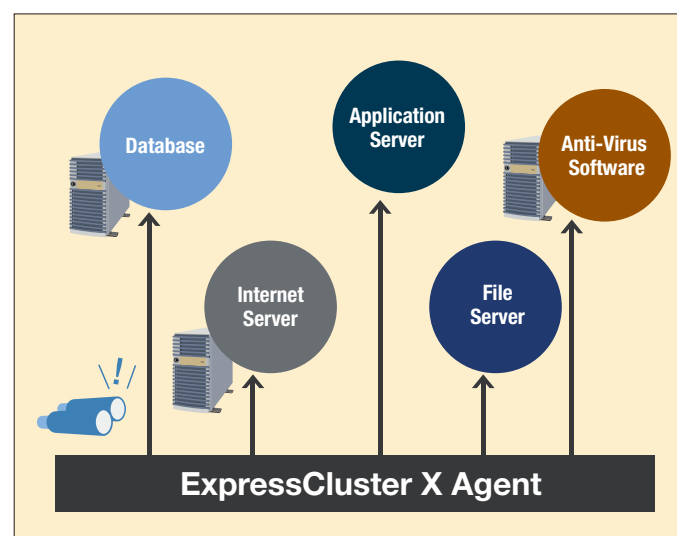
ExpressCluster X Replicator

This makes it possible to build a multi-node configuration that mirrors a specific disk area of multiple servers to build a cluster without a shared disk. A high-speed mirroring recovery feature enabled by differential resynchronization is also included.

Differential data is retained to greatly reduce how long it takes to resynchronize data.
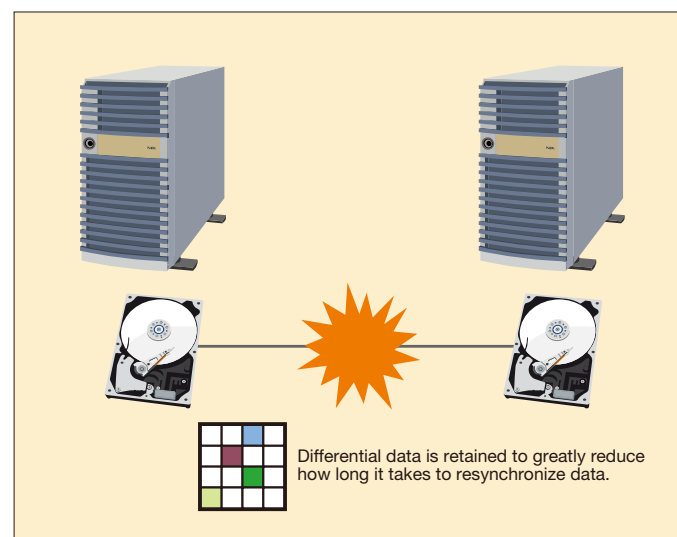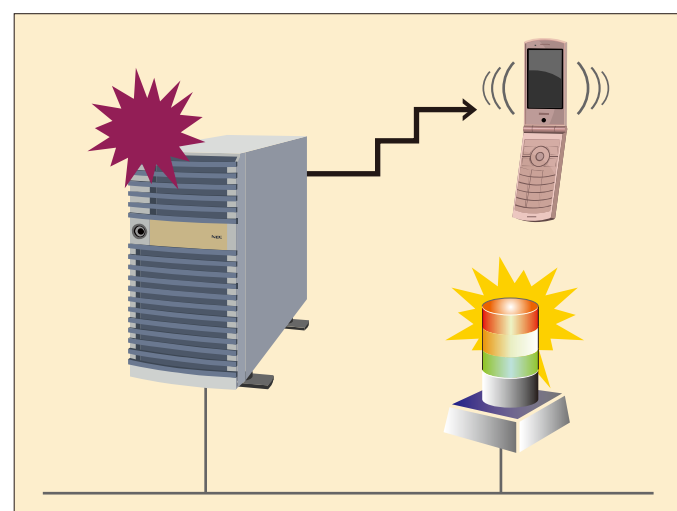
ExpressCluster X Agent

This monitors the status of various applications, including databases, HTTP, FTP, and Samba, and detects abnormalities such as hang-up and abnormal results.

* File Server Agent is only available for the Linux version, and Anti-Virus Agent is only available for the Windows version.

Database
Application Server
Anti-Virus Software
Internet Server
File Server
ExpressCluster X Agent

ExpressCluster X Alert Service

This makes it possible to send notification emails to the administrator when important events occur, such as server failures or failovers, just by specifying mail server information and the address to which to send the emails. Alerts are also issued through network warning lights.

ExpressCluster X SingleServerSafe

SingleServerSafe, which is based on skills and know-how gained through ExpressCluster development, monitors for and recovers from failures.

Product overview

ExpressCluster product technology can also be effectively used for a single-server configuration

● Stop
SingleServerSafe detects when applications or services stop abnormally. When an application is detected to unexpectedly stop, it is automatically restarted to perform recovery. Custom applications can also be monitored.
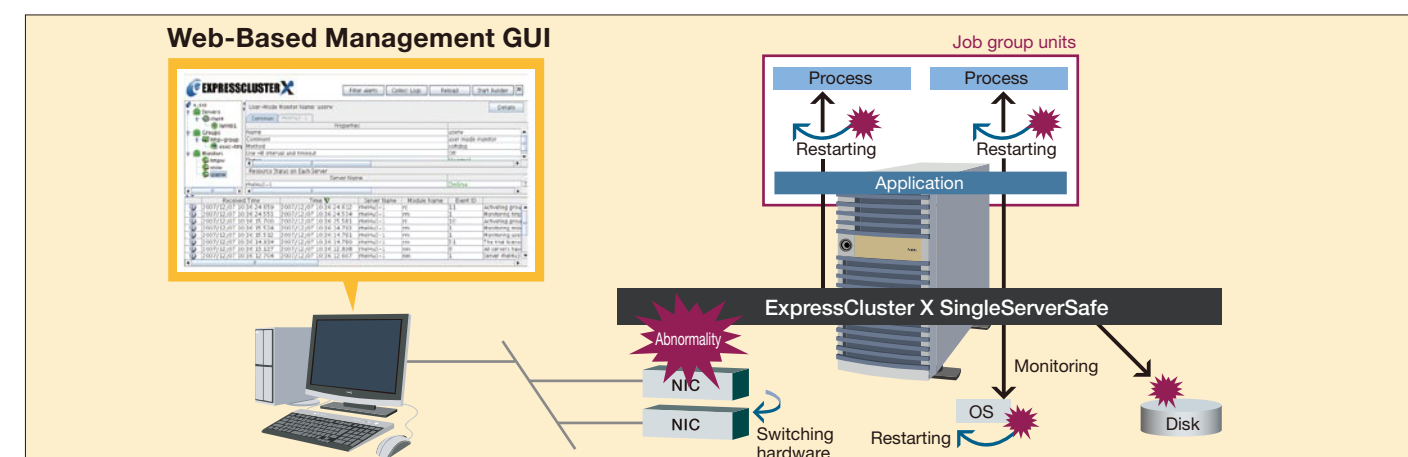
● Stall
SingleServerSafe detects when software, operating systems, or hardware access hang-up. In case of hang-up, which does not leave any evidence in the syslog or failure logs, is detected, restarting is automatically performed for recovery.

● Setup
Deployment is easy because setup information is saved in a file. Because settings are created offline, switching from test to production environment is easy, as is deploying a configuration you are already using for another system.
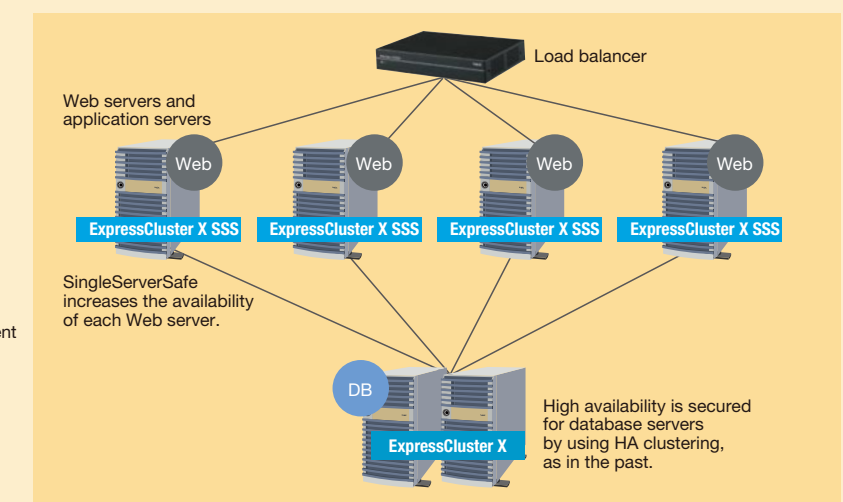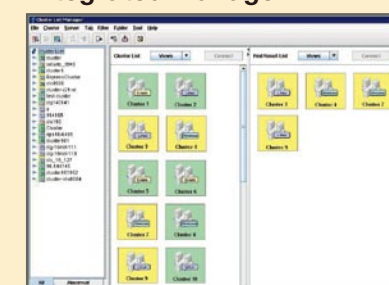
High reliability in single-server environments

Web-Based Management GUI

Job group units
Process   Process
Restarting   Restarting
Application

ExpressCluster X SingleServerSafe

Abnormality
NIC
NIC
Switching hardware
Monitoring
OS
Restarting
Disk

SingleServerSafe also enables integrated management of a system controlled by a load balancer possible.

If ExpressCluster X SingleServerSafe is installed on a single server or on a server controlled by a load balancer, integrated management and increased availability of the entire system from its front end to back end, can be achieved.

Integrated manager

Integrated management

Load balancer

Web servers and application servers

Web   Web   Web   Web
ExpressCluster X SSS   ExpressCluster X SSS   ExpressCluster X SSS   ExpressCluster X SSS

SingleServerSafe increases the availability of each Web server.

DB
ExpressCluster X

High availability is secured for database servers by using HA clustering, as in the past.

ExpressCluster X HA Series

ExpressCluster X HA Series provides high availability demanded by mission-critical systems.

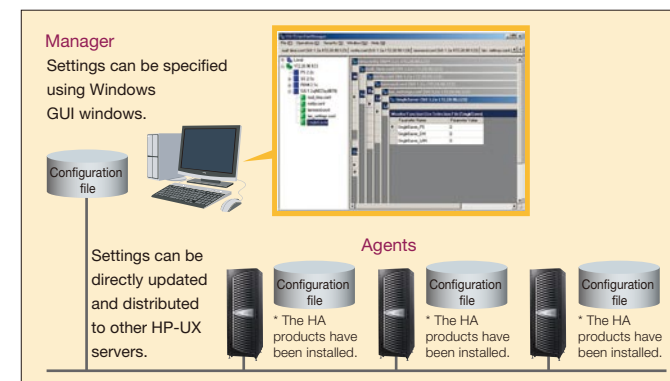## ExpressCluster HA Series product map

- **Operations**
  - HA/SimplifiedManager — HP-UX
  - HA/ClusterMaster — HP-UX

- **Failure monitoring**
  - **Oracle monitoring**
    - HA/ApplicationMonitor for Oracle SingleEdition — HP-UX
    - HA/ApplicationMonitor for Oracle for RAC — HP-UX / Linux
  - **Switch resource monitoring**
    - HA/SystemMonitor — HP-UX
    - HA/JVMSaver — HP-UX / Linux
  - **Process monitoring**
    - HA/ProcessSaver — HP-UX / Linux
    - HA/SingleSaver — HP-UX
  - **LAN monitoring**
    - HA/LANMonitor — HP-UX
  - **Disk monitoring**
    - HA/StorageSaver — HP-UX / Linux
    - HA/RootDiskMonitor — HP-UX / Linux

  - Serviceguard for ExpressCluster X
  - HP-UX, Linux

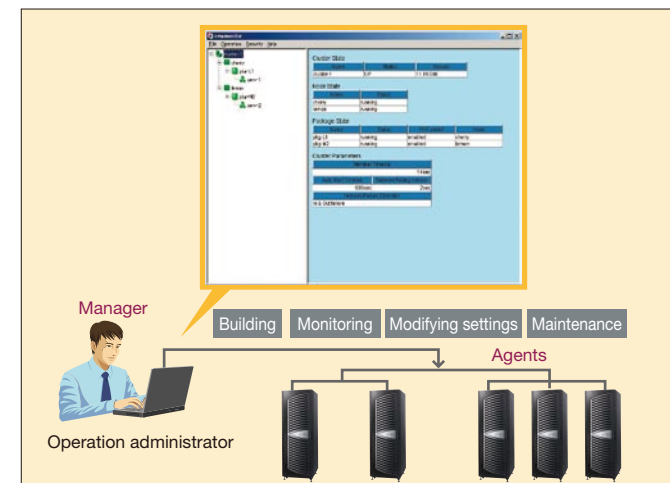 - **Single**
  - **Cluster**

Operations

ExpressCluster X HA/SimplifiedManager

This software is used to collectively set up ExpressCluster X HA Series products running on multiple HP-UX servers. Setup and management that once had to be performed for individual servers or features can now be easily performed using GUI, and cluster systems that consist of many HP-UX servers can be efficiently managed.

Manager
Settings can be specified using Windows GUI windows.

Configuration file

Settings can be directly updated and distributed to other HP-UX servers.

Agents

Configuration file
* The HA products have been installed.

Configuration file
* The HA products have been installed.

Configuration file
* The HA products have been installed.
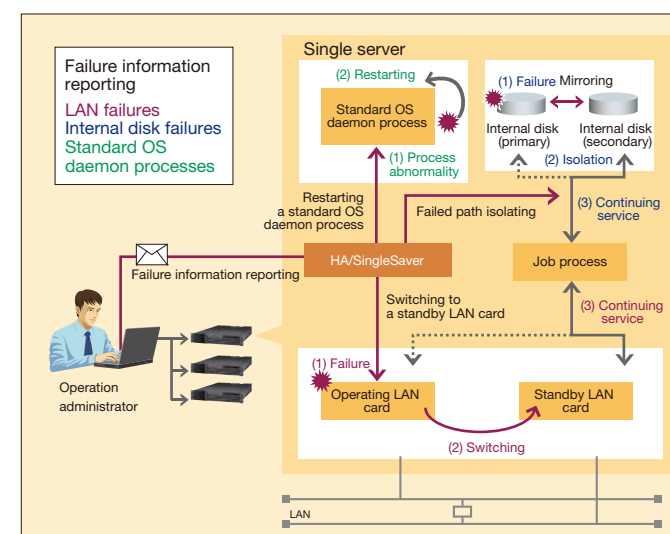
ExpressCluster X HA/ClusterMaster

This comprehensive operation software product is used to build, operate, monitor, and maintain HP-UX cluster systems by using GUI environment. The status of an HP-UX cluster can be displayed in the ExpressCluster X Integrated WebManager (GUI).

Manager

Building | Monitoring | Modifying settings | Maintenance

Agents

Operation administrator

Failure monitoring

ExpressCluster X HA/SingleSaver

This software increases availability when using a single server. The software is mostly based on high availability products for existing mission-critical systems that require cluster configurations, and it includes features that are considered necessary for single servers, such as failure monitoring. The software makes business continuity possible by detecting LAN, mirror disk, and system process (daemon) failures early and then isolating failure locations, switching to working components, or restarting processes.


Failure information reporting
LAN failures
Internal disk failures
Standard OS daemon processes

Single server

(2) Restarting
Standard OS daemon process

(1) Failure Mirroring
Internal disk (primary) — Internal disk (secondary)

(1) Process abnormality
(2) Isolation

Restarting a standard OS daemon process

Failed path isolating

(3) Continuing service

Failure information reporting

HA/SingleSaver

Job process

Switching to a standby LAN card

(3) Continuing service

Operation administrator

(1) Failure
Operating LAN card — Standby LAN card

(2) Switching

LAN

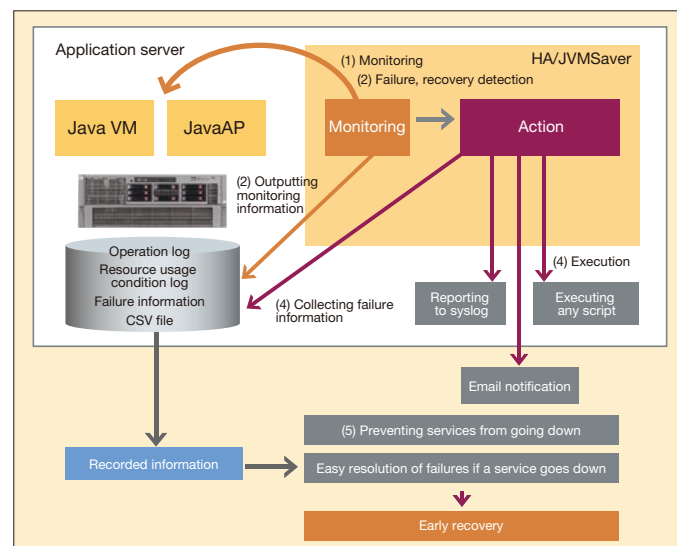# ExpressCluster X HA Series

Failure monitoring

ExpressCluster X HA/SystemMonitor

This provides features for continuously obtaining and analyzing statistics about resources used by processes to quickly detect various problems caused by processes resulting in resource depletion.
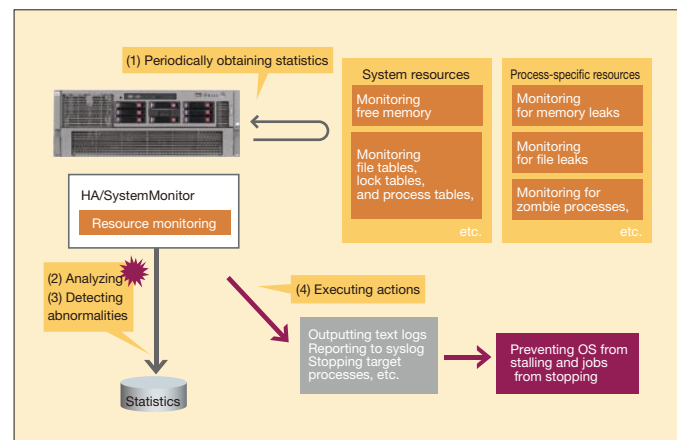
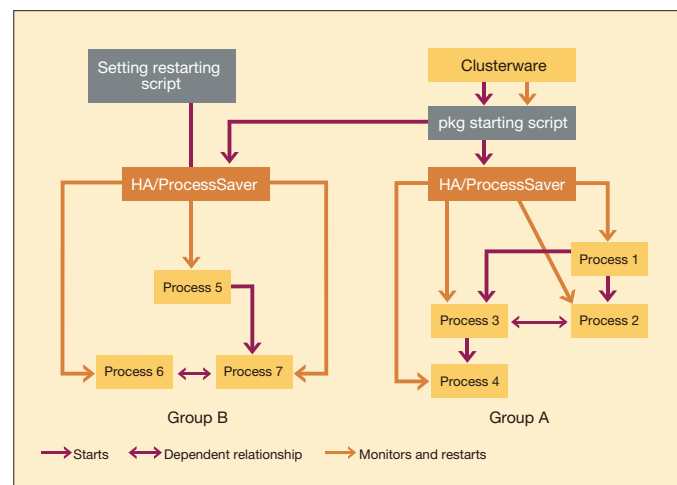

ExpressCluster X HA/JVMSaver

By monitoring operating conditions and the usage conditions of Java VM and JavaAP resources on application servers, it detects potential failures in advance and take action for them. This makes it possible to quickly resolve and recover from failures when a service goes down.

ExpressCluster X HA/ProcessSaver

This monitors the processes that make up business applications and middleware and automatically restarts terminated processes. In addition, if restarting a process fails, this software makes it possible to build a HA cluster system by, for example, linking with Clusterware to switch nodes and continue jobs.

The available optional plug-ins include HA/ProcessSaver WebEdition which provides a framework for monitoring Web server processes, HA/ProcessSaver ApsEdition which provides a framework for monitoring application servers, HA/ProcessSaver nfsEdition which provides a framework for monitoring NFS-related processes, and HA/ProcessSaver FailSafe Option which increases maintainability and availability.


Failure monitoring

ExpressCluster X HA/ApplicationMonitor

This software monitors for failures such as Oracle stopping or not responding.
By using products that support configurations ranging from single-instance configurations to RAC configurations, the availability demanded of database configurations can be achieved.

● **ExpressCluster X HA/ApplicationMonitor for Oracle**
This monitors an Oracle database system in an active-standby configuration. This makes it possible to link to Clusterware and fail over to a standby server to continue jobs when a failure occurs.
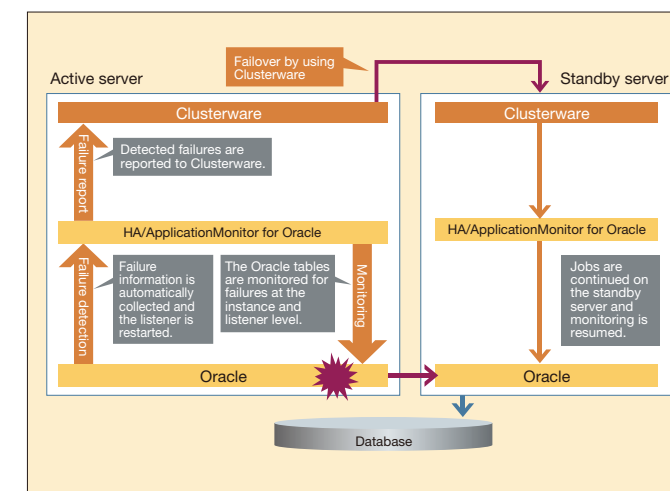
● **ExpressCluster X HA/ApplicationMonitor for Oracle SingleEdition**
This monitors an Oracle database system in a single-instance configuration. When a failure occurs, Oracle is automatically restarted, making it possible to continue jobs. This improves the availability of databases in a single-instance configuration, which do not have a substitute server.

● **ExpressCluster X HA/ApplicationMonitor ClientEdition**
This monitors Oracle databases on a database server from an application server to detect database access errors early. This makes it possible to quickly switch the connection destinations for business applications when such an error occurs.

● **ExpressCluster X HA/ApplicationMonitor for RAC**
This monitors an Oracle database system in an RAC configuration. When a failure occurs, Serviceguard is linked to and the server that failed is automatically restarted, making it possible to continue jobs and maintain availability.
This software supports features specific to RAC configurations, such as Oracle Clusterware monitoring.
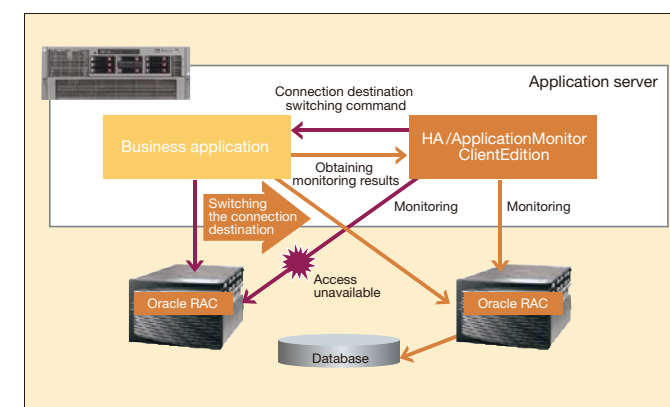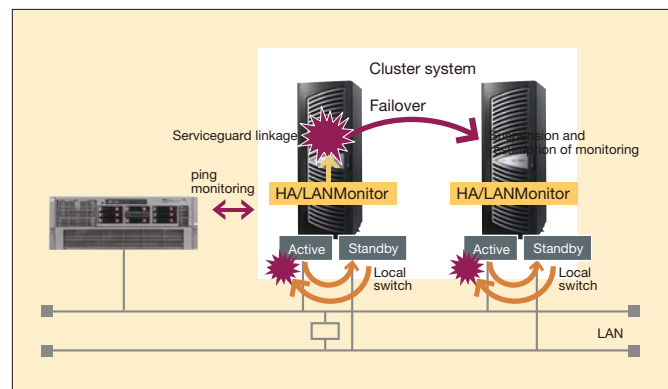
ExpressCluster X HA Series
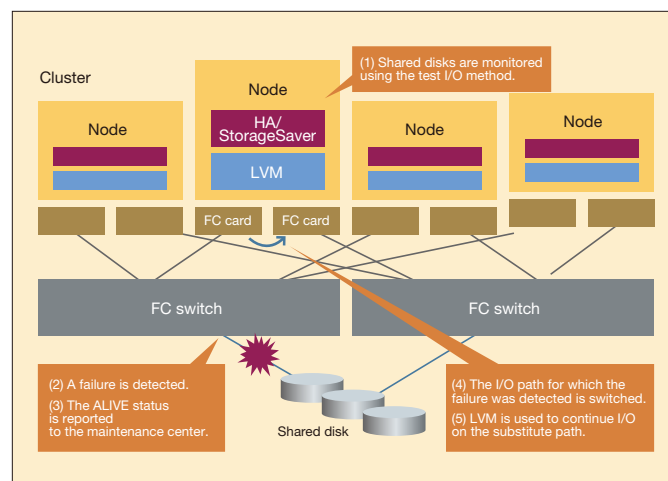
Failure monitoring

ExpressCluster X HA/LANMonitor

This software monitors for LAN failures on a cluster server. This makes it possible to detect when links go down, when packets arrive, and to perform online maintenance.

Cluster system
Failover
Serviceguard linkage
ping monitoring
HA/LANMonitor | HA/LANMonitor
Active | Standby | Active | Standby
Local switch | Local switch
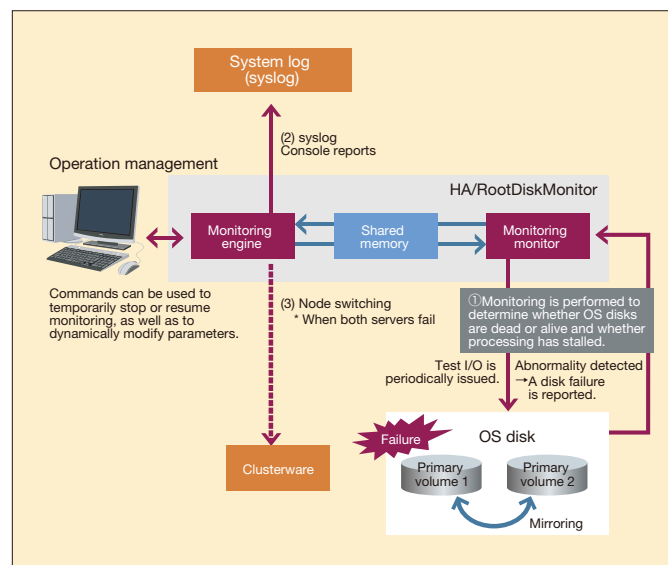LAN

ExpressCluster X HA/StorageSaver

This software, which is used to manage operations, monitors the FC connections used to build a cluster system and the shared disk devices connected using the SCSI interface.

Cluster
Node
(1) Shared disks are monitored using the test I/O method.
Node | HA/StorageSaver | Node | Node
LVM
FC card | FC card
FC switch | FC switch
(2) A failure is detected.
(3) The ALIVE status is reported to the maintenance center.
Shared disk
(4) The I/O path for which the failure was detected is switched.
(5) LVM is used to continue I/O on the substitute path.

FC: Fibre Channel

ExpressCluster X HA/RootDiskMonitor

RootDiskMonitor periodically monitors the operating status of the I/O paths that make up the root disk of a server. This software improves the availability of cluster systems by generating error reports when it detects I/O path abnormalities and by linking with Clusterware to switch nodes when the root disk becomes unusable.


System log (syslog)
(2) syslog Console reports
Operation management
HA/RootDiskMonitor
Monitoring engine | Shared memory | Monitoring monitor
Commands can be used to temporarily stop or resume monitoring, as well as to dynamically modify parameters.
(3) Node switching * When both servers fail
①Monitoring is performed to determine whether OS disks are dead or alive and whether processing has stalled.
Clusterware
Test I/O is periodically issued. | Abnormality detected →A disk failure is reported.
Failure | OS disk
Primary volume 1 | Primary volume 2
Mirroring

OperationHelper for Windows Server Failover Cluster

ExpressCluster improves WSFC by increasing its operational efficiency.

Increased operational efficiency

By automating the startup and shutdown of servers which must be performed manually in a standard WSFC environment, Operation-Helper helps prevent problems such as startup errors due to human mistakes, data corruption, and unnecessary failovers.

Stopped | Stopped
Automatic execution
Operating | Operating
Automatic execution
Stopped | Stopped
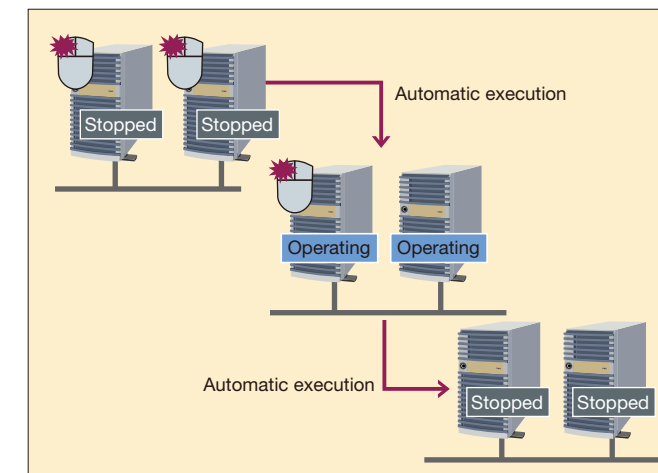
Improved availability

The group monitoring and local disk monitoring features of OperationHelper make it possible to monitor for failures of job tasks and disk resources, as well as for stalled disk I/O, and, when an abnormality is detected, failing over is automated.

Problem occurrence
Operating
Automatic execution
Operating
Failover
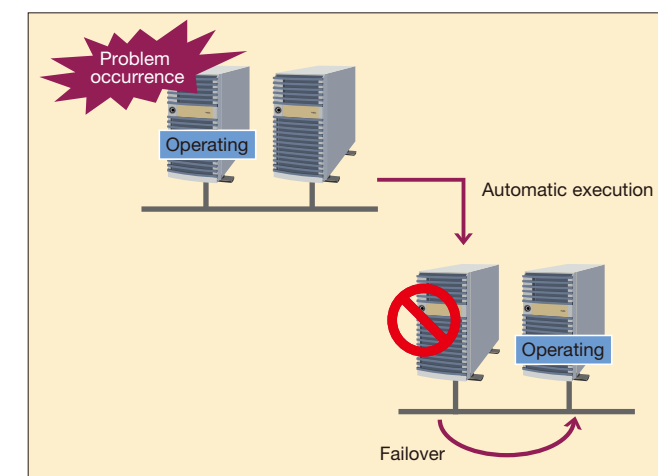
Enhanced monitoring features

Log data, such as data indicating when groups and resources are online or offline, has been added to the event log to make analysis easier. In addition, a notification email can be sent to the administrator when a failure occurs.

Problem occurrence
Operating
Detailed log
Operating
Email
Failover
Administrator