



Implementing Fault Resilient Protection for Microsoft Exchange Server with LifeKeeper[®]

Abstract

Messaging has become *the* critical business application. This white paper describes how to use LifeKeeper to provide high availability protection for Microsoft Exchange environments. All of the software mentioned in this white paper is available today from SteelEye Technology[®].

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Introduction

Businesses large and small are today leveraging the functionality of Microsoft Exchange to perform business critical as well as routine day-to-day tasks. As a result, it is mandatory that corporate messaging infrastructures be operational 24 hours a day, 7 days a week. The ability to have the messaging backbone available 7x24 year round has become a major “top of mind” issue for all CIOs and CEOs. Today, an hour of downtime in the messaging system can severely damage corporate functions. The constant availability of the messaging infrastructure is critical.

When downtime is associated with a dollar amount, an organization can quickly see why they need to ensure the availability of their messaging infrastructure. For example, on average, businesses with 10,000 users lose an estimated \$2.3M each year when their enterprise messaging system goes down (average of 3.5 hours of downtime per month) (Source: Network Computing, www.nwc.com/911/911f13.html). The result is a significant loss in productivity, lost revenue, increased response times to customers, increased operational costs, decreased customer satisfaction, and employee morale problems due to frustrations associated with a system failure. Corporations who care about customer and employee loyalty absolutely cannot afford these failures. The opportunity cost is too great. Businesses must protect their messaging assets from catastrophic failure since it has a direct impact on customer satisfaction, company revenues, and employee productivity.

With its singular focus on providing high availability solutions, SteelEye Technology® understands clients’ needs to minimize mission critical system down times. SteelEye’s flagship product, LifeKeeper®, has been delivering protection for mission critical applications since 1992.

What is High Availability?

High availability (HA) is generally defined by the amount of time systems are operational. Utility companies led the way in demanding more highly available systems and applications. Understandably, it was essential to the power and telecommunications industries to have systems that were available 24x7x365. The cost to achieve these levels of availability was high since initial solutions required specialized proprietary hardware. Over time, as more and more companies began to rely on their computing infrastructure to increase employee productivity, provide valuable information to management and better serve their customers, the demand for high availability solutions grew and the need to provide lower cost alternatives was born.

Two classes of high availability emerged: fault tolerance and fault resilience.

In fault tolerant systems, no failure of any kind can be tolerated. Annual outage time must be kept to hundredths of seconds, if that. In these environments, full redundancy of hardware must be planned, all software code paths must be tested to ensure no failures can be injected, and no single points of failure can exist in the environment. Some examples of industries where fault tolerant systems are used are flight control systems for space shuttle operations and passenger airlines, and utility companies. Fault tolerant systems are very expensive because of the way they are designed and the rigorous testing required prior to implementation.

Fault resilient systems, on the other hand, are designed such that should any component fail, another component can recognize that failure and then take over the operations of that failed component. This is called a failover. The time required to detect the failure and recover the operation on another system can range from seconds to minutes. Depending on the service being protected, the proper fault resilience scheme must be employed to ensure that failover

occurs within desired timeframes. Fault resilient systems are less costly than full fault tolerant systems due to their ability to be implemented using industry standard hardware components with the high availability protection being provided by software middleware.

The LifeKeeper® Microsoft Exchange Server Application Recovery Kit (ARK) for Windows NT® and Windows 2000® provides fault resilience for Exchange Server. The LifeKeeper for Exchange Server ARK furnishes a mechanism to easily tie the data integrity of Exchange Server to the increased availability provided by LifeKeeper.

The advantages of SteelEye's implementation of a high availability Exchange solution include:

- LifeKeeper works on all versions of Windows NT, Windows 2000 and Exchange servers, not just the higher-end (and more costly) versions.
- LifeKeeper supports clustering between 2 to 32 servers (nodes), thus providing greater flexibility in the configurations.
- Through support of cascading, multi-directional, and N+1 failover scenarios, LifeKeeper lets you have multiple active servers pointing to a single backup server, thereby reducing hardware requirements.
- LifeKeeper lets you run applications other than Exchange on the protected server and gives the ability to support any application running on that server. For a small business who cannot dedicate a server to Exchange, or for a business who wants to run "add-on" programs such as fax servers, on the Exchange server, this is a key differentiator.
- Through its web-enabled JAVA-based GUI, LifeKeeper is easier to install, configure, and administer than any competing clustering technology.

SteelEye's LifeKeeper is a fault-resilient product that exceeds most customer availability requirements. LifeKeeper provides an economical solution that protects a mission critical Exchange environment.

"These more scalable systems are being tapped for knowledge/document management tasks—and their very scalability often means more users eventually will rely on them for service," says editor Eric Arnum. "However, when you buy a system, you have to plan for that system to be 100 times bigger within two years. The user base will double, as will the number of messages per user, but the real crunch will come from multimedia attachments driving up the average message length." Network Computing Online, "Messaging Migration: It pays to do your Homework"

"Information Systems (IS) executives continually look for ways to ensure that their business critical applications stay up and running. LifeKeeper's high availability clustering software can help boost Intel server reliability for applications and can do so in both Sun Solaris and Windows NT environments." Aberdeen Group

Today, SteelEye delivers 99.99% high availability in an Exchange environment. LifeKeeper delivers the functionality and performance that your enterprise requires, and provides customers the highest application availability for the lowest cost. This solution is not vaporware—it is available today and is installed worldwide on a variety of heterogeneous platforms. SteelEye's LifeKeeper does not require proprietary hardware. And LifeKeeper has the broadest range of custom recovery kits to support high availability solutions.

Businesses must protect their messaging assets from catastrophic failure since the result is a significant loss in productivity, lost revenue, decreased customer satisfaction and increased operational costs. Corporations who care about customer and employee loyalty and retention

absolutely cannot afford these failures. The opportunity cost is too great. Can you afford not to protect your enterprise messaging system?

Protection for the Exchange Environment

SteelEye's high availability solution for Exchange has unique capabilities that meet the critical reliability needs of end-users, while allowing businesses to get more value for their HA investment.

Improve Availability

Not only does LifeKeeper perform a failover in case of a catastrophic hardware failure, but it also monitors Exchange server services. LifeKeeper increases the uptime of the Exchange Server by constantly monitoring key Exchange Server Components: Message Transfer Agent (MTA), System Attendant, Directory and Information Store (Exchange 5.5) and World Wide Web Publishing Service, SMTP, Information Store and Routing Engine (Exchange 2000). LifeKeeper can also monitor other Exchange services (configurable by the administrator). In the event that one or more of these services stops, LifeKeeper will initiate a restart of the failed service(s) locally on the active server. This application monitoring function of LifeKeeper is termed "Quick Check" and "Deep Check". Quick Check is a simple test to monitor the Exchange services to ensure that they are properly running. If the Exchange services fail to restart, then LifeKeeper will initiate a failover to the backup server. Deep Check performs a more rigorous test that validates the functionality of the services.

Reduce Total Cost of Ownership

Tally Systems Company, a message management company, estimates enterprises pay \$3,770 a year per user, and each user averages 20 messages a day. With 120 employees, Tally Systems estimates e-mail costs at approximately \$452,000 a year. Tally breaks down annual e-mail costs per user as follows: \$870 for hardware, software and connection costs; and \$2,900 in productivity time that employees spend on receiving and responding to messages¹. Obviously, this investment must be protected. The cost to provide that protection must be factored into the overall Total Cost of Ownership (TCO) messaging model.

The feature functionality of the Exchange Recovery Kit allows a company to reduce both their direct and indirect Exchange system costs due to reduced number of systems, administrators, and ongoing maintenance costs. By minimizing these costs, a company can redirect precious budget dollars and make investments in other value-add applications. With fewer systems to manage, the IT administrator can be performing other value-add activities. SteelEye is the only vendor in the Exchange arena that is able to provide the highest level of availability for the lowest cost solution. Users can dramatically decrease TCO by implementing the SteelEye's LifeKeeper for Exchange solution.

Overall maintenance costs for the LifeKeeper Exchange environment are reduced because fewer systems are implemented, and therefore have a positive impact on the bottom line. The functionality of the 'N+1' LifeKeeper for Exchange configuration reduces the TCO.

Greater Flexibility

LifeKeeper allows flexible configuration options that give it a competitive advantage over other Exchange offerings.

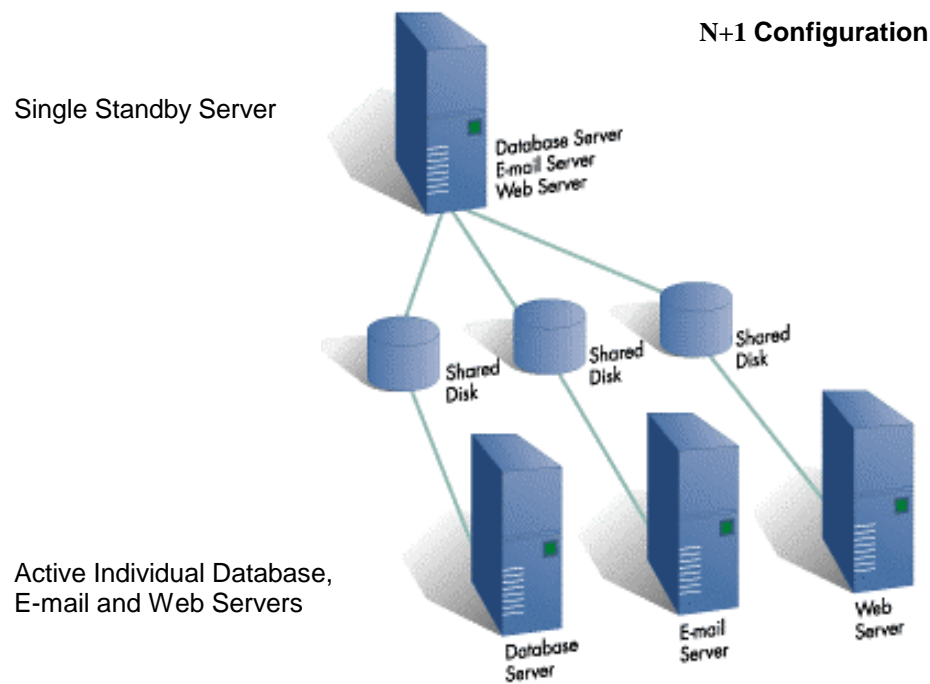
¹ "Vendors and Enterprises Tighten Systems to Curtail E-mail Costs", Electronic Commerce News, Tuesday, February 24, 1998

N+1 Configuration

The Exchange Recovery Kit allows the administrator to extend the number of nodes within a cluster and the number of clusters supported, which lowers the risk if one server fails and as a result improves the overall reliability of the company's Exchange system.

N+1 is an enhanced LifeKeeper feature that requires only one backup server for up to 16 active servers and the backup server can be actively running all applications except Exchange until needed. The N+1 (N=2-15) combination is an extension of the active/passive configuration, allowing multiple active servers to failover to one backup server. With LifeKeeper's N+1 capability, the administrator's nightmare of managing so many servers is finally overcome. N+1 eliminates unnecessary 'passive' servers that many competitive solutions require. Once again, this minimizes administrator's responsibility and increases overall administrative efficiency.

The illustration below shows a 3+1 configuration where a single hot stand-by server backs up three servers, each performing their own services. Although there are four-node cluster solutions available from other vendors, they still require a one-to-one ratio of active to backup servers to implement failover. With LifeKeeper, the user gets 15 servers to one, thus eliminating the need to purchase 14 additional servers.

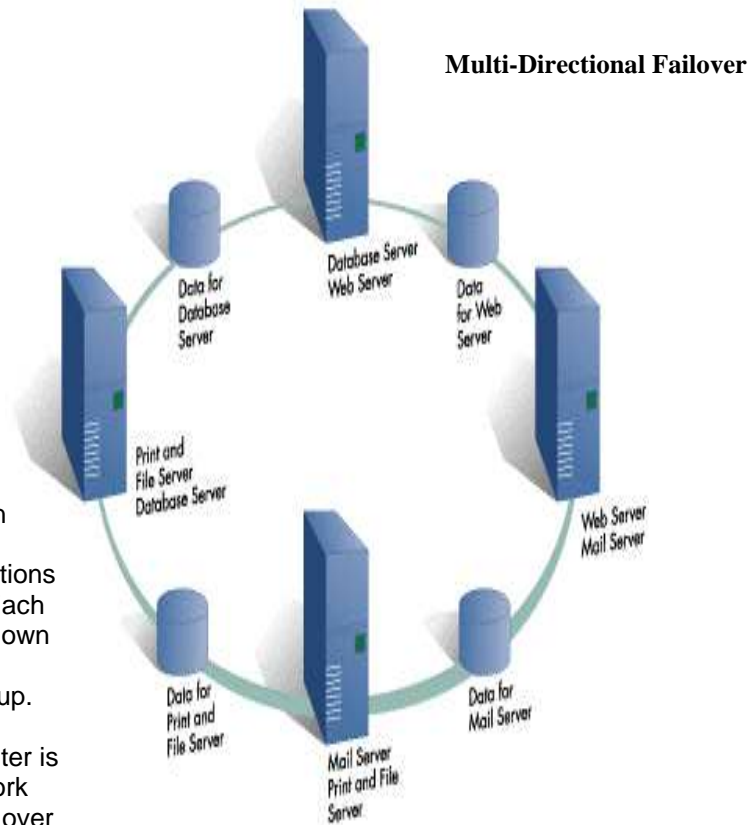


Multi-Directional Failover Configuration

In an exclusive high availability Exchange environment using LifeKeeper and the Exchange ARK, the backup systems in the cluster cannot be actively processing Exchange, but can be actively servicing other applications and clients. So when the one active system fails, the standby system will assume the load of the failed system. A benefit is the ability of LifeKeeper to negate any possible client aggravation during the switchover process. With the backup system assuming the load of the failed system, the 'new' operational system will continue to send and receive mail as well as the other Exchange services. The Exchange clients are not affected by the switchover, and users will not even notice that the other system failed.

The diagram below shows that customers can failover active Exchange servers to other active non-Exchange servers.

In this configuration, all systems are active doing their own work while simultaneously monitoring for failover of the other nodes in the cluster.



Each server runs its own application and acts as backup for other applications running in the cluster. Each server has access to its own data and to data for the application it is backing up.

Every system in the cluster is actively doing its own work while monitoring to take over for other systems if needed.

Maintenance

LifeKeeper is not only useful for preventing system disasters, but can also be used to facilitate system upgrades for installing new hardware components and/or upgrading new applications. The online maintenance capability of LifeKeeper for Exchange reduces or eliminates the need to schedule downtime for common maintenance tasks and upgrades. When there is a need to repair failed hardware or to add new hardware or software products, LifeKeeper allows for continuous e-mail availability for clients by allowing a manual switchover from the active Exchange server to the backup Exchange server.

Configuration Considerations

The Exchange Server ARK provides for the installation and operation of a Microsoft Exchange Server system in a shared environment using a computer alias name. This Exchange Server instance is active on only one computer at a given time. This instance may be transferred to another running computer by choice (for example, to do maintenance on the first computer), or the transfer may occur automatically as the result of a computer failure. This provides both maximum availability and fault resilience for the Exchange Server application. Some of the basic characteristics and current limitations for Exchange Server in a LifeKeeper environment are described below.

Active/Standby Configuration. Microsoft Exchange Server itself is designed so that a given computer can run only one instance, and the name of the Exchange Server is fixed and cannot be changed.

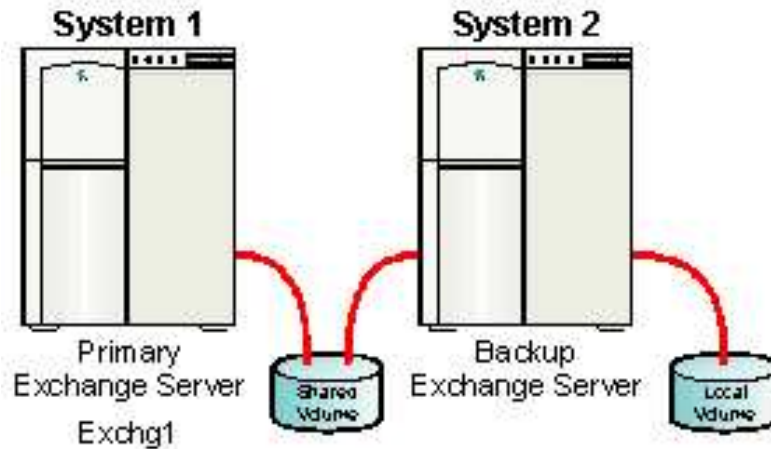
Client and Other Exchange Server Access. Clients access the Exchange Server system using the computer alias name as the *home server* for their mailbox. Since LifeKeeper supports only TCP/IP and NetBIOS protocols, at least one of these protocols must be installed and configured on the client and server systems. Otherwise, no special installation or configuration is required for Exchange clients. If the Exchange Server/LifeKeeper system is installed into a multi-Exchange-server site or is connected to other sites, it must be configured to use TCP/IP. The Exchange Server installation is administered as a typical installation using the Microsoft Exchange Administrator application and connecting to the computer alias name. This can be done from a remote server or on the LifeKeeper node where Exchange Server is active.

Log-Off/Log-On Not Required after Transfer of Service. During transfer of the Exchange Server instance from one computer to another, clients attempting to open a message or address book will get an error saying the server is not available. After Exchange Server has been restored on the other LifeKeeper system, clients attempting to open a message will get an error indicating the operation failed. The user may retry the operation or log off from Exchange and then login, to access messages (no reboot of the client is required).

Exchange Server Installation. Installation of Microsoft Exchange Server into a LifeKeeper environment requires installation onto both a “*primary*” server a “*backup*” server. Detailed installation instructions are provided in the *MS Exchange Server Recovery Kit Administration Guide* available on the LifeKeeper Documentation CD. After the Exchange Server software has been installed onto each system in the cluster, the MS Exchange hierarchy is created in LifeKeeper. The resulting MS Exchange hierarchy consists of an Exchange Server resource with LAN Manager, volume(s), and IP resources attached to it. The Exchange Server resource component is responsible for starting and stopping the Exchange Server services in the correct order. LifeKeeper brings the LAN Manager hierarchy with all the resources needed by Exchange Server into service prior to starting the Exchange Server services. These resources are taken out of service in the opposite order.

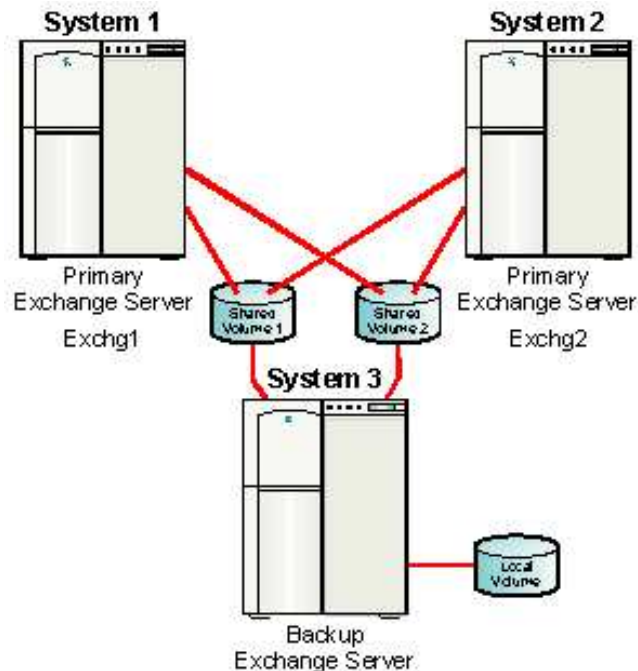
Configuration Examples

The following examples depict a couple of LifeKeeper/Exchange configurations. The first is a simple one-to-one two-node cluster showing a *primary* and a *backup* server. In this configuration, the Exchange application has been installed on both servers and the mail store and all data files are on the shared volume.



Two-Node Cluster

This example shows a three-node cluster with two active Exchange servers and a single system acting as a *backup* server. In this configuration, the Exchange application has been installed on all three servers and the mail store and all data files are on the shared volumes. Since we are not able to run more than one instance of Exchange on a server at a time, System 3 will be able to backup either of System 1 or System 2, but not both of them at the same time.



Three-Node Cluster

Conclusion

In summary, SteelEye understands the demands for high availability that are driven by today's compute-centric business operations. LifeKeeper has a heritage of addressing these concerns with regards to availability, costs, scalability and manageability for the Exchange Server environment. The combination of SteelEye's high availability expertise and LifeKeeper's ability to protect your corporate messaging infrastructure delivers an economical solution to the need for fault-resilient 24x7 availability.

APPENDIX - LifeKeeper Application Recovery Kit for Exchange Functionality Matrix

Functionality	Description
Maximum Nodes Supported	LifeKeeper for Exchange supports a cluster of up to 32 nodes.
Mixed Platforms	LifeKeeper does not require that each system in the cluster be identical. Systems must simply be: <ul style="list-style-type: none"> • An Intel-based platform • On the Microsoft Hardware Compatibility List for the respective Windows release • Configured appropriately to handle the workload, under which it may be placed
Exchange Administration	When an Exchange hierarchy is in-service, the Exchange server name, or computer LAN Manager alias name, is set in the Active Computer Name registry key. This allows easier online MS Exchange administration and configuration without requiring the use of any special LifeKeeper support utilities.
Exchange Configuration/ Environment Monitoring	The LifeKeeper Exchange Recovery Kit has the ability to continually monitor and save MS Exchange configurations or services that may be added. In the event of a hierarchy failover, these additional configurations or services will also be transferred over to the backup server.
Client Reconnect	In the event of a LifeKeeper MS Exchange failover, Exchange clients will not be required to exit their email. An error message may be displayed on the client machine indicating their inability to connect to the Exchange server. The client will only have to click OK to this message and resume without the need of logging back on.
N+1 Configuration	This allows multiple Exchange hierarchies to be created within a cluster of servers, with at least one server designated as the backup server. Each server is only allowed to have one Exchange hierarchy in service at a time. In other words, no server may have more than one Exchange hierarchy in service at the same time. Extending a hierarchy to other nodes in a cluster is part of the N+1 feature.
Manual and Automatic Switchover	With LifeKeeper, you can manually invoke a switchover of the Exchange server to a standby server while maintenance is being performed on the primary Exchange system. No more downtime due to system maintenance.
Resource Monitoring	Resources required for Exchange services can be monitored by LifeKeeper, as well as by Exchange itself. In the event one or more of these services dies, LifeKeeper will initiate a restart of the failed Exchange service(s) locally on the active server. In the event that the services fail to restart properly, LifeKeeper will initiate a failover of the Exchange hierarchy to the backup server.
Protected Services	LifeKeeper provides out-of-the-box protection for the following components: Message Transfer Agent (MTA), System Attendant, Directory and Information Store for Exchange 5.5. Additionally, out-of-box protection is provided for the World Wide Web Publishing Service, SMTP, Information Store and Routing Engine for Exchange 2000. Protection for other services can be added.
Connectors	The following connectors have been tested and certified with the Exchange Application Recovery Kit: Lotus Connector, X.400 connector, MS-Mail connector, cc:Mail.

Functionality	Description
Remote Administration of LifeKeeper	The administration for the LifeKeeper for Exchange Application Recovery Kit is accessible from either the system console or any JAVA-enabled web browser.
Automatic Switchback	<p>When the primary node for the resource fails or dies, and LifeKeeper switches the hierarchy resource to the backup server, if Automatic Switchback is enabled, once the primary nodes returns to service and the LifeKeeper communication path is reestablished, the hierarchy will automatically switch back to the primary node.</p> <p>If Automatic Switchback is not enabled then the hierarchy must be manually switched back to its primary server, commonly known as intelligent switchback. The default is Intelligent Switchback.</p>
Multiple Network Communication Paths	It is possible (and recommended) to configure multiple network (sockets) communication paths between a given pair of LifeKeeper systems. This enables customers to more cost effectively configure larger clusters. It also provides for more flexible detection mechanisms for configurations that may not have TTY ports available. Each path is also given a priority value, which LifeKeeper uses to determine the path to be used for normal inter-node communication.
Auto-Configure Network Communication Paths	To simplify the administration of configuring communication paths, LifeKeeper offers the ability to establish these communication paths bi-directionally. It is not necessary to separately create your communication path from the primary to the secondary server, then from the secondary to the primary server. Both directions of systems communication are created simultaneously.
In-the-Box IP Switchover (IP Local Recovery)	For servers that are configured with more than a single network interface card (NIC), LifeKeeper offers the ability to switchover LifeKeeper configured IP addresses from a failed NIC to a functioning one. This feature allows for near instantaneous recovery if the system fails due to a problem with the NIC thereby avoiding a system switchover.
External Interface Support	LifeKeeper provides a set of external interface mechanisms that allow it to report LifeKeeper events and status information to external system or network management facilities. This includes SNMP traps for critical cluster events.
Cascading Failover	<p>The ability to have resources failover in continuum is termed Cascading Failover.</p> <p><u>An example:</u> Each system in the cluster hierarchy is assigned a priority (i.e. primary server = priority 1, backup server = priority 2, and any additional server were the hierarchy is extended would have incremental priorities as 3,4....).</p> <p>When the resource on the primary server (priority-1) fails, the hierarchy is switched to the backup server (priority-2 node). If the backup node (priority-2) fails while the primary server (priority-1) is still down, then the hierarchy will failover to next highest priority (i.e. priority 3).</p>