



**LifeKeeper® for Linux v6 Update 4
Release Notes**

April 2009

***Read This Document Before Attempting
To Install Or Use This Product!***

**This document contains information about factors that must be
considered before, during, and after installation.**

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Introduction

This release notes document is written for the person who installs, configures, and/or administers the LifeKeeper for Linux product. The document contains important information not detailed in the formal LifeKeeper documentation set, such as package versions, last-minute changes to instructions and procedures, product restrictions, and troubleshooting hints and tips that were discovered through final product testing. It is important that you review this document before installing and configuring your LifeKeeper software.

LifeKeeper Product Description

The LifeKeeper product includes fault detection and recovery software that provides high availability for file systems, network addresses, applications, and processes running on Linux. LifeKeeper supports the configuration and switchover of a given application across multiple servers. The servers on which the application is configured are assigned priorities to determine the sequence in which the application will move from server to server in the event of multiple failures.

LifeKeeper for Linux provides switchover protection for a range of system resources. Automatic recovery is supported for the following resource types.

- Processes and Applications
- Shared Storage Devices
- Network Attached Storage Devices
- LVM volume groups and logical volumes
- File Systems (ext2, ext3, reiserfs, vxfs, xfs, and nfs)
- Communication Resources (TCP/IP)
- Database Applications (Oracle, Informix Dynamic Server, MySQL, DB2, SAP DB/MaxDB, PostgreSQL, EnterpriseDB Postgres Plus Advanced Server, Sybase)
- Web Server Resources (Apache, Apache SSL)
- Mail Server Resources (SAMS, SMMS, Postfix)
- Samba Resources (file)
- Data Replication (SDR, DRBD)
- SAP Application Environment Resources
- ClearCase Configuration Management Resources
- Software RAID (md) Resources
- WebSphere MQ Resources
- VMware ESX Server and VMware Server Virtual Machines

LifeKeeper for Linux provides Disaster Recovery protection for the following resource type:

- Citrix XenServer Express Edition, Standard Edition, Enterprise Edition, and Platinum Edition Storage Repository
- Linux Multi-Site Cluster configurations in which data from a shared storage cluster is replicated to a disaster recovery site

LifeKeeper Core

LifeKeeper for Linux is bundled and runs on 32-bit and 64-bit systems (x86, Opteron, and EM64T systems). The LifeKeeper Core Package Cluster includes the following installable packages:

Package	Package Name	Description
LifeKeeper	steeleye-lk-6.4.2-4.i386.rpm	The LifeKeeper package provides recovery software for failures associated with core system components such as memory, CPUs, the operating system, the SCSI disk subsystem, and file systems.
LifeKeeper GUI	steeleye-lkGUI-6.4.2-4.i386.rpm	The LifeKeeper GUI package provides a graphical user interface for LifeKeeper administration and status monitoring.
LifeKeeper IP Recovery Kit	steeleye-lkIP-6.4.2-4.noarch.rpm	The LifeKeeper IP Recovery Kit provides recovery software for automatic switchover of IP addresses.
LifeKeeper Raw I/O Recovery Kit	steeleye-lkRAW-6.4.2-4.noarch.rpm	Provides support for applications that use raw i/o to bypass kernel buffering.
LifeKeeper CCISS Recovery Kit	steeleye-lkCCISS-6.4.0-2.i386.rpm (on the LK Installation Support CD)	Provides support for HP devices using the CCISS block driver. This includes ProLiant servers that use the Smart Array 5i, 6i, 532, and 642 controllers.
LifeKeeper IPS/ServerRAID Recovery Kit	steeleye-lkIPS-6.4.0-2.noarch.rpm (on the LK Installation Support CD)	Provides support for the IBM ServerRAID controllers.
LifeKeeper Man Pages	steeleye-lkMAN-6.4.2-4.noarch.rpm	The LifeKeeper Man Page package provides reference manual pages for the LifeKeeper product.
LifeKeeper Online Product Manual	steeleye-lkHLP-6.4.2-4.noarch.rpm	The LifeKeeper Online Product Manual (help) package provides HTML-based product documentation. The manual includes product feature information and instructions for the LifeKeeper core administration tasks.

LifeKeeper Optional Recovery Software

The following optional software provides resource definition and recovery software for the application versions listed:

Package	Package Name	Protected Applications
LifeKeeper Apache Web Server Recovery Kit	steeleye-lkAPA-6.2.0-1.noarch.rpm	Apache Web Server 1.3 and 2.x
LifeKeeper SAP Recovery Kit	steeleye-lkSAP-6.2.0-5.noarch.rpm	SAP R/3 version 4.6C (Kernel 4.6D), SAP R/3 Enterprise 4.7 (Web AS 6.20) , SAP NetWeaver 04 (Web AS 6.40) and SAP NetWeaver 2004s (Web AS 7.00)
LifeKeeper SAP DB / MaxDB Recovery Kit	steeleye-lkSAPDB-5.0.4-1.noarch.rpm	SAP DB 7.3.0 Build 21 and higher (Requires Build 35 and higher for use with SAP) MaxDB v7.5.x and v7.6.x
LifeKeeper DB2 Recovery Kit	steeleye-lkDB2-5.2.1-1.noarch.rpm	IBM DB2 Universal Database v8.1, Enterprise Server Edition (ESE) and Workgroup Server Edition (WSE). IBM DB2 Express Edition v8.1 and Express Edition v9. IBM DB2 Universal Database v9, Enterprise Server Edition (ESE) and Workgroup Server Edition (WSE).
LifeKeeper Oracle Recovery Kit	steeleye-lkORA-6.3.2-1.noarch.rpm	Oracle 9i Standard Edition and Enterprise Edition, Oracle 10g Standard Edition, Standard Edition One and Enterprise Edition, Oracle 11g Standard Edition, Standard Edition One and Enterprise Edition
LifeKeeper Informix Recovery Kit	steeleye-lkINF-6.1.0-1.noarch.rpm	Informix Dynamic Server 9.2, 9.3, 9.4, and 10 products
LifeKeeper MySQL Recovery Kit	steeleye-lkSQL-6.1.1-2.noarch.rpm	MySQL 3.23.x, 4.x, 5.x and MySQL Enterprise
LifeKeeper PostgreSQL Recovery Kit	steeleye-lkPGSQL-6.4.0-2.noarch.rpm	PostgreSQL v7.x and v8.x EnterpriseDB Postgres Plus Advanced Server v8.3.x
LifeKeeper Sybase ASE Recovery Kit	steeleye-lkSYBASE-6.1.0-1.noarch.rpm	Sybase ASE 12.5.x and 15.x

Package	Package Name	Protected Applications
LifeKeeper SAMS Recovery Kit	steeleye-ikSAM-5.1.2-2.noarch.rpm	Sendmail Advanced Message Server (SAMS) 1.2, 2.1, 2.2 and Sendmail Switch 2.2, 3.1
LifeKeeper Postfix Recovery Kit	steeleye-ikPOSTFIX-6.2.0-2.noarch.rpm	Postfix provided with the supported Linux distributions
LifeKeeper Samba Recovery Kit	steeleye-ikSMB-5.1.1-1.noarch.rpm	Samba file shares
LifeKeeper NFS Server Recovery Kit	steeleye-ikNFS-5.1.2-1.noarch.rpm	NFS exported file systems on Linux distributions with a kernel version of 2.4.21 or later
LifeKeeper Network Attached Storage Recovery Kit	steeleye-ikNAS-5.0.0-1.noarch.rpm	Mounted NFS file systems from an NFS server or Network Attached Storage (NAS) device
LifeKeeper Logical Volume Manager (LVM) Recovery Kit	steeleye-ikLVM-6.4.0-2.noarch.rpm	LVM volume groups and logical volumes
LifeKeeper ClearCase Recovery Kit	steeleye-ikCLEARCASE-6.2.0-1.noarch.rpm	ClearCase VOB and View Storage locations, ClearCase Registry files, and the ClearCase Release Area
LifeKeeper DRBD Recovery Kit	steeleye-ikDRBD-6.2.0-1.noarch.rpm	DRBD (Distributed Remote Block Device) data replication software Alternative for data replication in a WAN environment where LifeKeeper Data Replication v5 is not suitable
LifeKeeper Software RAID (md) Recovery Kit	steeleye-ikMD-6.4.0-3.noarch.rpm	Software RAID devices based on md
LifeKeeper PowerPath Recovery Kit	steeleye-ikPPATH-6.4.0-2.noarch.rpm	EMC PowerPath multipath I/O devices
LifeKeeper IBM Subsystem Device Driver (SDD) Recovery Kit	steeleye-ikSDD-6.4.0-2.noarch.rpm	IBM SDD multipath I/O devices
LifeKeeper Device Mapper Multipath (DMMP) Recovery Kit	steeleye-ikDMMP-6.4.0-2.noarch.rpm	Linux dm-multipath I/O devices
Hitachi Dynamic Link Manager Software (HDLM) Recovery Kit	steeleye-ikHDLM-6.4.0-2.noarch.rpm	Hitachi Dynamic Link Manager Software devices

Package	Package Name	Protected Applications
LifeKeeper NEC iStorage StoragePathSavior (SPS) Recovery Kit	steeleye-lkSPS-6.4.1-1.noarch.rpm	NEC iStorage StoragePathSavior multipath I/O devices
LifeKeeper Data Replication (v4)	steeleye-lkDR-4.7.6-1.noarch.rpm	Network RAID devices (synchronous mirrors only)
SteelEye Data Replication (v6)	steeleye-lkDR-6.4.2-3.noarch.rpm	Network RAID devices (synchronous or asynchronous mirrors, with intent logging)
LifeKeeper VMware Virtual Machine Recovery Kit	steeleye-lkVMWARE-6.1.0-4.noarch.rpm	VMware ESX Server and VMware Server virtual machines
LifeKeeper WebSphere MQ Recovery Kit	steeleye-lkMQS-6.2.2-1.noarch.rpm	WebSphere MQ queue managers including the command server, the listener and the persistent queue manager data
LifeKeeper Extender	steeleye-lkEXTENDER-5.0.1-1.noarch.rpm	Provides sample code and a tool for creating a basic application Recovery Kit. Documentation includes an overview of the Recovery Kit architecture, and a detailed description of Recovery Kit components and APIs.

LifeKeeper Optional Support Software

The following software enables the SteelEye Protection Suite for Citrix XenServer:

Package	Package Name	Protected Applications
LifeKeeper XenServer Support Package	Steeleye-lkXEN-6.4.0-5	Citrix XenServer Express Edition, Standard Edition, Enterprise Edition, and Platinum Edition storage repositories

New Features Supported in LifeKeeper v6 Update 4

As a SteelEye customer with a valid Support contract you are entitled to access the new **SteelEye Support Self Service Portal**.

The **SteelEye Support Self Service Portal** offers you the following capabilities:

- Search our Solution Knowledge Base to find solutions to problems and answers to questions
- Always on 24/7 service with the SteelEye Support team to:
 - Log A Case to report new incidents
 - View Cases to see all of your open and closed incidents
 - Review Top Solutions which provides information on the most popular problem resolutions being viewed by our customers

Contact SteelEye Support at support@steeleye.com to set-up and activate your Self Service Portal account.

Product	Version	New Features
LifeKeeper Core and Installation Support	v6 U4	Support for Citrix XenServer Express Edition, Standard Edition, Enterprise Edition, and Platinum Edition providing the ability to replicate running virtual machines from a XenServer system or resource pool to a disaster recovery site. General maintenance
SteelEye Data Replication	v6 U4	Support for Citrix XenServer Express Edition, Standard Edition, Enterprise Edition, and Platinum Edition. Support for Linux Multi-Site Cluster configurations. Please refer to the "SteelEye Protection Suite for Linux Multi-Site Cluster" section of the SteelEye Data Replication Administration Guide for more information. General maintenance

Product	Version	New Features
Citrix XenServer Support Package	v6 U4	<p>Enables the SteelEye Protection Suite for Citrix XenServer XenServer Express Edition, Standard Edition, Enterprise Edition, and Platinum Edition are supported.</p> <p>XenServer 5.0 support:</p> <p>High Availability (HA) is supported. Note: The "heartbeat Storage Repository (SR)" cannot be a SteelEye Protection Suite for Citrix XenServer replicated SR. When importing the metadata for a Virtual Machine (VM) where HA is enabled, the administrator should verify that the HA settings are correct.</p> <p>Portable Storage Repository (SR) is supported. Note: Once a SteelEye Protection Suite for Citrix XenServer replicated SR is created, if there is space available on the SR, the replicated SR can be used as a Portable SR. It is recommended that if the Portable SR feature is used that all replicated SRs be setup as Portable SRs.</p> <p>Please refer to the SteelEye Protection Suite for Citrix XenServer Administration Guide for more information.</p>
Oracle Recovery Kit	v6 U3	General maintenance
NFS Recovery Kit	V5 U1	General maintenance
LVM Recovery Kit	v6 U4	General maintenance
MD Recovery Kit	v6 U4	General maintenance
PostgreSQL Recovery Kit	v6 U4	Added EnterpriseDB Postgres Plus Advanced Server v8.3.x support General Maintenance
DMMP Recovery Kit	v6 U4	General maintenance
SPS Recovery Kit	v6 U4	General maintenance
HDLM Recovery Kit	v6 U4	General maintenance
SDD Recovery Kit	v6 U4	General maintenance
PowerPath Recovery Kit	v6 U4	Supports the PowerPath v5.3 driver only Takes advantage of new features in the PowerPath 5.3 driver

LifeKeeper Product Requirements

LifeKeeper for Linux is currently targeted for any Linux platform that satisfies the minimum requirements included in the table below.

Note: LifeKeeper on a Linux server will not inter-operate with LifeKeeper for Windows NT/2000, Solaris, or NCR SVR4 MP-RAS.

Description	Requirement
Linux Operating System	Red Hat Enterprise Linux 3.0 (AS and ES) * Red Hat Enterprise Linux 4.0 (AS and ES) * Red Hat Enterprise Linux 5 and Red Hat Enterprise Linux 5 Advanced Platform * SUSE LINUX Enterprise Server (SLES) 9 and SLES 10 * Asianux 2.0 VMware ESX Server v3.0 Console OS Oracle Enterprise Linux 4 Update 5 Oracle Enterprise Linux 5 The Community ENTERprise Operating System (CentOS) 4 Update 5 The Community ENTERprise Operating System (CentOS) 5 Citrix XenServer Express Edition v5.0 Citrix XenServer Standard Edition v5.0 Citrix XenServer Enterprise Edition v5.0 Citrix XenServer Platinum Edition v5.0 Note: LifeKeeper does not support open source Xen.

Description	Requirement				
Virtual Environments	<p>LifeKeeper for Linux can be run in the virtual machines of the following virtualization technologies, as long as the guest operating system running in the virtual machine is one of the supported versions listed above.</p> <ul style="list-style-type: none"> • VMware ESX Server 2.5 • VMware ESX Server 3.0 • VMwareESX Server 3.5 • Microsoft Virtual Server 2005 R2 • VMWare Server 1.0 • Citrix XenServer Express Edition v5.0 • Citrix XenServer Standard Edition v5.0 • Citrix XenServer Enterprise Edition v5.0 • Citrix XenServer Platinum Edition v5.0 <p>Please refer to the documents "LifeKeeper for Linux in VMware ESX Server Virtual Machines, Configuration Guidelines" for more detailed configuration requirements and limitations.</p> <p>LifeKeeper for Linux running in a Microsoft Virtual Server 2005 R2 virtual machine is supported with the following cluster storage options: NAS, and SteelEye Data Replication. All of these storage options can be used in virtual-to-virtual, virtual-to-physical, and physical-to-virtual failover configurations. The configuration of NAS and data replication in a Microsoft Virtual Server 2005 R2 environment is exactly the same as in a physical machine environment.</p> <p>Fiber channel SAN and shared SCSI cluster configurations are not supported with LifeKeeper for Linux running in a Microsoft Virtual Server 2005 R2 virtual machine.</p> <p>LifeKeeper for Linux running in a Citrix XenServer virtual machine should function with no modifications. Currently, shared storage clusters are not supported. Clusters created with SteelEye Data Replication, DRBD, or network attached storage should operate correctly.</p>				
Korn Shell	pdksh-5.2.14 (or later)				
Memory	The minimum memory requirement for a system supporting LifeKeeper is 128 MB. Additional memory (beyond that required for LifeKeeper) is required to run user applications. Refer to Application Configuration in the Technical Notes section.				
Disk Space	<p>The LifeKeeper Core Package Cluster requires the following disk space:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; vertical-align: top;">/opt</td> <td style="vertical-align: top;">Approx. 17000 (1024-byte) disk blocks on 32-bit systems Approx. 60100 (1024-byte) disk blocks on 64-bit systems</td> </tr> <tr> <td style="vertical-align: top;">/</td> <td style="vertical-align: top;">Approximately 89100 (1024-byte) disk blocks</td> </tr> </table>	/opt	Approx. 17000 (1024-byte) disk blocks on 32-bit systems Approx. 60100 (1024-byte) disk blocks on 64-bit systems	/	Approximately 89100 (1024-byte) disk blocks
/opt	Approx. 17000 (1024-byte) disk blocks on 32-bit systems Approx. 60100 (1024-byte) disk blocks on 64-bit systems				
/	Approximately 89100 (1024-byte) disk blocks				

* Refer to "Kernel updates" under [Linux Configuration](#) in the Technical Notes section of this document.

LifeKeeper Optional Recovery Software

The following table shows the software and disk space requirements for the optional LifeKeeper recovery software.

See [Application Configuration](#) under the Technical Notes section of this document for additional requirements and/or restrictions that may apply to applications under LifeKeeper protection.

Product	Requirement(s)	Disk Space Required
Apache Web Server	Apache Web Server 1.3.14 and 2.x LifeKeeper v5.0.0 or later Core Package Cluster	Approximately 215 (1024-byte) disk blocks in <i>/opt</i>
SAP	SAP R/3 version 4.6C (Kernel 4.6D), SAP R/3 Enterprise 4.7 (Web AS 6.20), NetWeaver '04 (Web AS 6.40), or NetWeaver 2004s (Web AS 7.00) Refer to the "Supported SAP configurations" topic under Application Configuration for detailed distribution, kernel, and database requirements. LifeKeeper v5.1.3 or later Core Package Cluster LifeKeeper NFS Server Recovery Kit v5.1.0 or later LifeKeeper Network Attached Storage Recovery Kit v5.0.0 or later	Approximately 170 (1024-byte) disk blocks in <i>/opt</i>
ClearCase	ClearCase version 2003.06, version 7, or version 7.0.1.0 LifeKeeper v5.0.0 or later Core Package Cluster LifeKeeper NFS Server Recovery Kit v5.0.0 or later (required only if ClearCase storage does not reside exclusively on network-attached storage devices)	Approximately 150 (1024-byte) disk blocks in <i>/opt</i>
Oracle	Oracle 9i Standard or Enterprise Edition Oracle 10g Standard Edition, Standard Edition One, or Enterprise Edition Oracle 11g Standard Edition, Standard Edition One, or Enterprise Edition LifeKeeper v6.2.0-5 or later Core Package Cluster	Approximately 525 (1024-byte) disk blocks in <i>/opt</i>

Product	Requirement(s)	Disk Space Required
DB2	IBM DB2 Enterprise Server Edition (ESE) v8.1 or later and v9. IBM DB2 Workgroup Server Edition (WSE) v8.1 or later and v9. IBM DB2 Express v8.1. LifeKeeper v5.0.0 or later Core Package Cluster LifeKeeper NFS Server Recovery Kit v5.0.0 or later (for DB2 EEE and DB2 ESE with multiple partitions only)	Approximately 215 (1024-byte) disk blocks in <i>/opt</i>
Informix	Informix Dynamic Server 9.2 and Informix Dynamic Server 10 LifeKeeper v5.0.0 or later Core Package Cluster	Approximately 200 (1024-byte) disk blocks in <i>/opt</i>
MySQL	MySQL 3.23.x, 4.x, 5.x and MySQL Enterprise LifeKeeper v5.0.0 or later Core Package Cluster	Approximately 140 (1024-byte) disk blocks in <i>/opt</i>
PostgreSQL	PostgreSQL v7.x and v8.x EnterpriseDB Postgres Plus Advanced Server v8.3.x LifeKeeper v6.2.0 or later Core Package Cluster	Approximately 144 (1024-byte) disk blocks in <i>/opt</i>
SAP DB / MaxDB	SAP DB 7.3.0 Build 21 for standalone use SAP DB 7.3.0 Build 35 for use with SAP MaxDB 7.5.x or MaxDB 7.6.x LifeKeeper v5.0.0 or later Core Package Cluster	Approximately 205 (1024-byte) disk blocks in <i>/opt</i> .
Sybase ASE	Sybase ASE 12.5.x and 15.x LifeKeeper v5.0.0 or later Core Package Cluster	Approximately 200 (1024-byte) disk blocks in <i>/opt</i>
Sendmail Advanced Message Server	Sendmail Advanced Message Server (SAMS) 1.2, 2.1 and 2.2 Sendmail Switch 2.2 and 3.1 LifeKeeper v5.0.0 or later Core Package Cluster	Approximately 196 (1024-byte) disk blocks in <i>/opt</i>
Postfix	Postfix software provided with the supported Linux distributions installed and configured on each server. The same version of Postfix should be installed on each server. LifeKeeper v5.0.0 or later Core Package Cluster	Approximately 150 (1024-byte) disk blocks in <i>/opt</i>
Samba	Standard Samba file services provided with the supported Linux distributions. LifeKeeper v5.0.0 or later Core Package Cluster	Approximately 265 (1024-byte) disk blocks in <i>/opt</i>

Product	Requirement(s)	Disk Space Required
NFS Server	Linux kernel version 2.4.21 or later LifeKeeper v4.6.1 or later Core Package Cluster	Approximately 160 (1024-byte) disk blocks in <i>/opt</i>
Network Attached Storage	LifeKeeper v5.0.0 or later Core Package Cluster	Approximately 125 (1024-byte) disk blocks in <i>/opt</i>
Logical Volume Manager (LVM)	Linux Logical Volume Manager (LVM) version 1 or 2 LifeKeeper v5.0.0 or later Core Package Cluster	Approximately 130 (1024-byte) disk blocks in <i>/opt</i>
Software RAID (md)	LifeKeeper v5.0.0 or later Core Package Cluster	Approximately 204 (1024-byte) disk blocks in <i>/opt</i>
EMC PowerPath	A 2.6 based Linux kernel and distribution PowerPath Kit v6.4.0-2: PowerPath for Linux v5.3 or later Prior to the PowerPath Kit v6.4.0-2: PowerPath for Linux v4.4.x, 4.5.x,5.0.x, or 5.1.x The sg3_utils rpm is required on Red Hat and the scsi rpm is required on SLES LifeKeeper v6.0.0 or later Core Package Cluster	Approximately 168 (1024-byte) disk blocks in <i>/opt</i>
IBM Subsystem Device Driver (SDD)	A 2.6 based Linux kernel and distribution IBM SDD driver v1.6.0.1-8 or later The sg3_utils rpm is required on Red Hat and the scsi rpm is required on SLES LifeKeeper v6.0.0 or later Core Package Cluster	Approximately 164 (1024-byte) disk blocks in <i>/opt</i>
Device Mapper Multipath (DMMP)	A 2.6 based Linux kernel and distribution multipath tools 0.4.5 or later The sg3_utils rpm is required on Red Hat and the scsi rpm is required on SLES LifeKeeper v6.0.0 or later Core Package Cluster	Approximately 176 (1024-byte) disk blocks in <i>/opt</i>

Product	Requirement(s)	Disk Space Required
<p>Hitachi Dynamic Link Manager Software (HDLM)</p>	<p>RHEL 4 (AS/ES) (x86 or x86_64) Update 1, 2, 3, 4, Update 4 Security Fix (*1), Update 5, Update 5 Security Fix (*2), and Update 6.</p> <p>(*1) the following kernels are supported with RHEL4 Update 4 Security Fix x86 or X86_64: 2.6.9-42.0.3.EL, 2.6.9-42.0.3.ELsmp x86: 2.6.9-42.0.3.ELhugemem x86_64: 2.6.9-42.0.3.ELlargesmp</p> <p>(*2) the following kernels are supported with RHEL4 Update 5 Security Fix 86 or X86_64: 2.6.9-55.0.12.EL, 2.6.9-55.0.12.ELsmp, x86: 2.6.9-55.0.12.ELhuge x86_64: 2.6.9-55.0.12.ELlargesmp</p> <p>RHEL 5(x86/x86_64) and Update1, Update1 Security Fix(*3)</p> <p>(*3)the following kernels are supported with RHEL5 Update1 Security Fix x86: 2.6.18-53.1.13.el5 2.6.18-53.1.13.el5PAE x86_64: 2.6.18-53.1.13.el5</p> <p>Hitachi HDLM for Linux 05-80, 05-81, 05-90, 05-91, 05-92, 05-93, 05-94, and 6.0.0.</p> <p>NOTE: HDLM 05-93 is not supported on RHEL4 Update2</p> <p>LVM version and file system type that are supported by HDLM</p> <p>The sg3_utils rpm is required on Red Hat and the scsi rpm is required on SLES</p> <p>LifeKeeper v6.0.1-2, 6.1.0-5, 6.2.0-5 or later Core Package Cluster (Japanese and English versions)</p>	<p>Approximately 168 (1024-byte) disk blocks in <i>/opt</i></p>
<p>NEC iStorage Storage Path Savior (SPS)</p>	<p>iStorage StoragePathSavior for Linux Version 3.3 or later</p> <p>RHEL4 (AS/ES) Update4, RHEL4.5(AS/ES),RHEL4.6(AS/ES)</p> <p>NOTE: the following kernels are supported with RHEL4.5 errata: kernel-2.6.9-55.0.12.EL</p> <p>RHEL5</p> <p>SPS driver package (for RHEL4 or RHEL5)</p> <p>sps-L, sps-S or sps-E</p> <p>The sg3_utils rpm is required on Red Hat and the scsi rpm is required on SLES</p>	<p>Approximately 250 (1024-byte) disk blocks in <i>/opt</i></p>

Product	Requirement(s)	Disk Space Required
DRBD	DRBD version 0.7.5 or 0.8 LifeKeeper v5.0.0 or later Core Package Cluster	Approximately 70 (1024-byte) disk blocks in <i>/opt</i>
Data Replication (v4)	raidtools-0.90-6 or later LifeKeeper v4.6.0 or later Core Package Cluster Linux kernel version 2.4	Approximately 350 (1024-byte) disk blocks in <i>/opt</i>
Data Replication (v6)	LifeKeeper v6.2.0 or later Core Package Cluster Linux kernel version 2.6 (2.6.16 or later for intent logging and asynchronous write support)	Approximately 1800 (1024-byte) disk blocks in <i>/opt</i>
VMware Virtual Machines	VMware ESX Server version 3.0.x, or VMware Server version 1.0.x on a LifeKeeper-supported Linux Host OS LifeKeeper v6.1.2 or later Core Package Cluster Note: Support for LifeKeeper running in the VMware ESX Server v2.5 Console OS is provided by v5.2 of LifeKeeper and the VMware ESX Server Virtual Machine Recovery Kit.	Approximately 120 (1024-byte) disk blocks in <i>/opt</i>
WebSphere MQ	WebSphere MQ versions 5.3, 5.3 Express Edition, and 6.0 LifeKeeper v5.2.0 or later Core Package Cluster	Approximately 415 (1024-byte) disk blocks in <i>/opt</i>
LifeKeeper Extender	LifeKeeper v5.0.0 or later Core Package Cluster	Approximately 185 (1024-byte) disk blocks in <i>/opt</i>

LifeKeeper Optional Support Software

The following table shows the software and disk space requirements for the optional LifeKeeper Support Software:

Product	Requirement(s)	Disk Space Required
Citrix XenServer Virtual Machines	Citrix XenServer Express Edition, Standard Edition, Enterprise Edition, or Platinum Edition v5.0 LifeKeeper v6.4.0 or later Core Package Cluster LifeKeeper SDR v6.4.0 or later LifeKeeper Citrix XenServer Support Package v6.4.0 or later	Approximately 140 (1024-byte) disk blocks in <i>/opt</i>

Client Platforms and Browsers

The LifeKeeper web client can run on any platform that provides support for Java Runtime Environment J2RE 1.4 or later. The currently supported configurations are Firefox 1.5 or 2 and Internet Explorer 6 or 7 on Linux, Windows 2000, Windows Server 2003, Windows XP, or Windows Vista with J2RE 1.4, JRE 5, or JRE 6. Other recent platforms and browsers will likely work with the LifeKeeper web client (for example, Firefox 1.0 on Linux systems, or Firefox 2 on Macintosh), but they have not been tested by SteelEye Technology, Inc.

You should specify all the hostnames and addresses in your cluster in the client machine's local hosts file (usually */etc/hosts* or *C:\windows\system32\drivers\etc\hosts*). This minimizes the client connection time, and allows the client to connect even in the event of a Domain Name Server (DNS) failure.

Storage and Adapter Options

The following tables list the disk array storage models and adapters currently supported by LifeKeeper in shared storage configurations. For each storage or adapter model, the type of certification is indicated. If storage vendors support other adapter models related to those listed in [Supported Adapter Models](#), then LifeKeeper for Linux supports those adapter models too. Refer to [Storage and Adapter Configuration](#) under the Technical Notes section of this document for details about driver versions and other configuration requirements for these arrays and adapters.

Note that a supported disk array and adapter are not required in LifeKeeper configurations involving non-shared storage with IP failover only, or when using LifeKeeper Data Replication or Network Attached Storage.

Supported Storage Models

Vendor	Storage Model	Certification
ADTX	ArrayMasStor P ArrayMasStor L ArrayMasStor FC-II	Partner testing Partner testing Partner testing
Altix	TP9100	SteelEye Technology testing
Baydel Storage Arrays	DAR3/5SE68C DAR3/C/5SE68C	SteelEye Technology testing SteelEye Technology testing
Consan	CRD5440 CRD7220 (f/w 3.00)	SteelEye Technology testing SteelEye Technology testing
Datacore	SANsymphony	SteelEye Technology testing
Dell	650F (CLARiiON) Dell EMC CX3-10c/CX3-40c/CX3-20c, CX3-80/CX3-40(F)/CX3-20(F), Dell EMC CX300/CX600/CX400/CX700/CX500 PowerVault (w/ Dell PERC, LSI Logic MegaRAID) DELL MD3000 Dell EqualLogic PS5000	SteelEye Technology testing Partner Testing SteelEye Technology testing SteelEye Technology testing Partner Testing Partner Testing
EMC	Symmetrix 3000 Series Symmetrix 8000 Series Symmetrix DMX/DMX2 Symmetrix DMX3/DMX4 CLARiiON CX200, CX400, CX500, CX600, and CX700 CLARiiON CX300 CLARiX CX3-20 CLaRiiON CX3FC and combo 40290 CLaRiiON CX310c CLaRiiON AX45 CLaRiiON CX4-120, CX4-240, CX4-480, CX4-960	SteelEye Technology testing Vendor support statement Partner testing Partner testing SteelEye Technology testing Partner testing Partner testing Partner testing Partner testing Partner testing

Vendor	Storage Model	Certification
Fujitsu	ETERNUS3000 (w/ PG-FC105, PG-FC106, or PG-FC107), single path only ETERNUS6000 (w/ PG-FC106), single path only ETERNUS4000 Model 80 and Model 100 (w/ PG-FC106, PG-FC107, or PG-FC202), single path only FibreCAT S80 (See Note) ETERNUS SX300 (w/ PG-FC106 or PG-FC107), multipath only ETERNUS2000 Series: Model 50, Model 100, and Model 200 (with PG-FC202), single path and multipath configurations ETERNUS4000 Series: Model 300 and Model 500 (with PG-FC202), single path and multipath configurations	Partner testing Partner testing Partner testing Partner testing Partner testing Partner testing Partner testing
Hitachi Data Systems	HDS 7700 HDS 5800 HDS 9570V HDS 9970V HDS 9980V AMS 500 SANRISE USP/NSC (TagmaStore USP/NSC) BR1600 AMS2100 AMS 2300 AMS 2500	Vendor support statement Vendor support statement Partner testing Partner testing Partner testing SteelEye Technology testing Partner testing Partner testing Partner testing Partner testing Partner testing
HP/Compaq	RA 4100 MA/RA 8000 MSA1000 / MSA1500 (active/active and active/passive firmware configurations) HP MSA1000 Small Business SAN Kit EVA3000/5000 EVA4X00/6X00/8X00 (NOTE: EVA 4400/6400/8400 are not supported) MSA500 (formerly Smart Array Cluster Storage) MSA500 G2 MSA2000 Fiber Channel MSA2000 iSCSI MSA2000 SA MSA 2300 Fiber Channel	SteelEye Technology testing SteelEye Technology testing SteelEye Technology testing SteelEye Technology testing SteelEye Technology and Partner testing SteelEye Technology and Partner testing SteelEye Technology testing SteelEye Technology testing Partner Testing Partner Testing Partner Testing Partner Testing

Vendor	Storage Model	Certification
IBM	FASiT200 FASiT500 DS4100 * DS4200 DS4300 (FASiT600) * DS4400 (FASiT700) * DS4500 (FASiT900) * DS4700 DS4800 DS4300 (FASiT600) DS4400 (FASiT700) DS5000 EXP300 (w/ ServeRAID) EXP400 (w/ ServeRAID) ESS Model 800 * DS6800 * DS8100 * DS400 (single path only) DS3400 DS3200 DS3300 IBM eServer xSeries Storage Solution Server Type445-R for SANmelody IBM eServer xSeries Storage Solution Server Type445-FR for SANmelody IBM SAN Volume Controller * * IBM TotalStorage Proven	SteelEye Technology testing SteelEye Technology testing Partner testing Partner testing SteelEye Technology testing SteelEye Technology testing SteelEye Technology testing Partner testing Partner testing SteelEye Technology testing SteelEye Technology testing Partner Testing SteelEye Technology testing Partner testing SteelEye Technology testing SteelEye Technology testing SteelEye Technology testing SteelEye Technology testing SteelEye Technology testing SteelEye Technology testing Partner testing Partner testing SteelEye Technology testing
JetStor	JetStor II	SteelEye Technology testing
MicroNet	Genesis One	Vendor support statement
MTI	Gladiator 2550 Gladiator 3550 Gladiator 3600	Vendor support statement Vendor support statement Vendor support statement
NEC	NEC iStorage S500 / S1500 / S2500 (single path only) NEC iStorage S Series (Single path and multipath configuration using the SPS Recovery Kit) NEC iStorage D3-10 / D1-10 (Single path and multipath configuration using the SPS Recovery Kit)	SteelEye Technology testing Vendor support statement Partner testing

Vendor	Storage Model	Certification
Network Appliance (NetApp)	NAS FAS2xx Series FAS9xx Series FAS2xxx Series FAS3xxx Series FAS6xxx Series SAN FAS3xxx Series (w/ QLogic QLE246x and DMMP)	Vendor support statement Vendor support statement Vendor support statement Vendor support statement Vendor support statement Vendor support statement
Newtech	SweeperStor SATA SweeperStor SAS	Partner testing Partner testing
nStor	NexStor 4320F	Partner testing
ProCom	Reliant 1000	Vendor support statement
Radion Systems	Rack U2W Microdisk U2W	Vendor support statement Vendor support statement
SILVERstor	Giant GT-3000 series	Partner testing
Sun	StorEdge 3310 StorEdge 3510 FC (w/ Sun StorEdge 2Gb PCI Single FC Network Adapter) StorEdge 6130 FC (w/ Sun StorEdge 2Gb PCI Single FC Network Adapter) StorageTek 2540 (w/ Sun StorageTek 4Gb PCI-E Dual FC Host Bus Adapter or Sun StorageTek 4Gb PCI Dual FC Network Adapter)	Partner testing Partner testing Partner testing Partner testing
TID	MassCareRAID II	Partner testing
Winchester Systems	FlashDisk OpenRAID (SCSI) FlashDisk OpenRAID (FC)	SteelEye Technology testing SteelEye Technology testing
Xiotech	Magnitude 3D	SteelEye Technology testing

Supported Adapter Models

Adapter Type	Adapter Model	Certification
Differential SCSI Adapter	<p>Adaptec 2944 W, Adaptec 2944 UW, or Adaptec 2940 U2W</p> <p>Compaq 64bit PCI Dual Channel Wide Ultra2 SCSI Adapter</p> <p>Compaq SA 5i, 6i, 532, and 642 PCI Dual Channel Wide Ultra3 SCSI Adapters</p> <p>IBM ServeRAID-4Lx, ServeRAID-4Mx, ServeRAID-4H, and ServeRAID-6M SCSI Controllers</p> <p>Dell PERC 2/DC, PERC 4/DC</p> <p>LSI Logic MegaRAID Elite 1600 (Dell PERC 3/DC is the OEM version of this adapter)</p> <p>Adaptec 39160</p> <p>Adaptec ASR-2010S (Fujitsu PG-140C / CL) – see note</p> <p>Adaptec ASR-3200S (Fujitsu PG-142B /C /D) – see note</p> <p>LSI Logic MegaRAID SCSI 3200-2 (Fujitsu PC-142E) – see note</p> <p>Note: these adapters are Fujitsu tested in LifeKeeper configurations involving non-shared storage with IP failover only or when using LifeKeeper Data Replication.</p>	<p>SteelEye Technology testing</p> <p>SteelEye Technology testing</p> <p>SteelEye Technology testing</p> <p>SteelEye Technology testing</p> <p>SteelEye Technology testing</p> <p>SteelEye Technology testing</p> <p>Partner testing</p> <p>Vendor support statement</p> <p>Vendor support statement</p> <p>Vendor support statement</p>
Fibre Channel	<p>QLogic QLA 2100, QLogic QLA 2200, QLogic QLA 2340, QLogic QLA 200 (HP Q200)</p> <p>HP StorageWorks 2GB 64-bit/133MHz PCI-X to Fibre Channel Host Bus Adapter (FCA2214)</p> <p>Compaq 64 bit/66MHz Fibre Channel Host Bus Adapter 120186-B21</p> <p>Sun StorEdge 2Gb PCI Single FC Network Adapter (OEM'ed QLogic QLA 2310)</p> <p>Sun StorageTek 4Gb PCI-E Dual FC Host Bus Adapter</p> <p>Sun StorageTek 4Gb PCI Dual FC Network Adapter</p> <p>Emulex LP9002 (PG-FC105), Emulex LP1050, Emulex LP10000. (See Emulex Drivers for the required driver and version for these adapters.)</p> <p>HP QLogic QMH2462 4Gb FC HBA</p> <p>Qlogic QLE2460 (4Gb HBA), Qlogic QLE2462 (4Gb HBA)</p> <p>FC1142SR 4Gb single channel PCI-Express Fibre Channel adapter</p> <p>FC1242SR 4Gb dual channel PCI-Express Fibre Channel adapter</p>	<p>SteelEye Technology testing</p> <p>SteelEye Technology testing</p> <p>SteelEye Technology testing</p> <p>Partner testing</p> <p>Partner testing</p> <p>Partner testing</p> <p>SteelEye Technology testing</p> <p>Partner Testing</p> <p>Partner Testing</p> <p>Partner Testing</p> <p>Partner Testing</p>
Serial Attached SCSI (SAS)	DELL SAS 5/e adapters	Partner Testing

SteelEye Technology does not specifically certify fibre channel hubs and switches, because there are no known LifeKeeper-specific restrictions or requirements on these devices. Unless otherwise noted for a given array in the [Storage and Adapter Configuration](#) section, LifeKeeper recommends the hubs and switches that the disk array vendor supports.

Installation and Configuration

See the following documents for installation and configuration instructions:

- For detailed LifeKeeper configuration planning considerations and installation tasks, consult the *LifeKeeper Planning and Installation Guide*.
- The individual *Recovery Kit Administration Guides* provide configuration tips for their associated applications.

Upgrades

LifeKeeper can be upgraded while preserving existing resource hierarchies. See the *LifeKeeper Planning and Installation Guide* for instructions on upgrading from a previous LifeKeeper version, and also for information about upgrading your Linux operating system.

Note: Customers who have developed customized *remove* and *restore* scripts for your applications should contact your SteelEye Systems Engineer before upgrading LifeKeeper.

Before Starting Your Upgrade

If you are already running LifeKeeper v4.3.0 or later and are upgrading to a later version, use the **`/opt/LifeKeeper/bin/lkbackup`** command to create a backup copy of your LifeKeeper configuration files.

If you are currently running a version of LifeKeeper prior to v4.3.0, run the **`/opt/LifeKeeper/bin/lcdstatus`** command on the server to be upgraded, and save the output to a file or print it for later reference. You may also want to save copies of various LifeKeeper configuration files (for instance, */etc/default/LifeKeeper*) prior to the upgrade.

Upgrading to LifeKeeper v6

It is recommended that LifeKeeper customers follow the upgrade instructions included in the *LifeKeeper Planning and Installation Guide*. This includes switching all applications away from the server to be upgraded before running the setup script on the LifeKeeper Installation Support CD and/or updating your LifeKeeper packages.

LifeKeeper license keys for versions prior to 4.4.0 will not work with LifeKeeper v4.4.0 and later. Because a new key is required before the upgraded product can start, and because this version of LifeKeeper also requires license keys for any separately packaged recovery kits that are installed, you should install your new license keys on your system prior to performing the upgrade of the LifeKeeper core packages. This can be performed when prompted for license keys by the *setup* script on the LifeKeeper Installation Support CD. There is no need to remove the old license keys either before or after installing the new keys.

Versions of LifeKeeper prior to v4.3.0 included LUN numbers in the resource ID of the disk and device resources that represent some shared storage devices. LifeKeeper v4.3.0 and later has been modified to no longer include these LUN numbers. When upgrading from a version of LifeKeeper prior to v4.3.0 to LifeKeeper v4.3.0 or later, any existing resource IDs that include the LUN number will be converted to the new format. During this conversion process, which

occurs during the installation of the LifeKeeper Core package, you may encounter an error message regarding “duplicate ID’s found with new lk_cspect.” This error indicates either that your storage device is one that requires the use of the LUN number in the resource ID in order to make the IDs unique, or that you are attempting to use LifeKeeper in an unsupported multipath I/O configuration. The first of these cases can be resolved by adding the entry “ADD_LUN_TO_DEVICE_ID=TRUE” to the */etc/default/LifeKeeper* configuration file prior to restarting LifeKeeper. This entry instructs LifeKeeper to continue its previous mode of adding the LUN number to the resource ID.

With LifeKeeper GUI v5.2.0, the GUI server is not compatible with earlier versions of LifeKeeper GUI clients, because of security enhancements used to implement the roles. Earlier versions of the GUI client will be unable to connect to LifeKeeper GUI server version 5.2.0. Version 5.2.0 GUI clients are able to connect to earlier server versions, although these earlier servers will not be able to support non-administrative user roles until they are upgraded.

Keep this in mind during rolling upgrades, where resources are moved in and out of service from one server to the next in order to minimize application down time. During rolling upgrades all the versions of the LifeKeeper GUI in a cluster are not the same until the upgrade of the each server in the cluster is complete. If you are doing a rolling upgrade to LifeKeeper version 5.2.0, always run the GUI client from one of the servers that has already been upgraded.

With the *Generic Application Recovery Kit* in LifeKeeper v4.1.1 or later, the *Application with File System* and *Application with Disk Partition* Recovery Kits are deprecated. While these deprecated recovery kits are currently still implemented (extension and monitoring only) for migration purposes, they will be removed in future implementations, and we recommend using the *Generic Application Recovery Kit*. **Note:** Customers who may have developed a customized application recovery kit that uses the *Generic Application Recovery Kit* application/resource type name “gen/app” will need to contact your SteelEye Systems Engineer before upgrading LifeKeeper.

See the *LifeKeeper Planning and Installation Guide* for detailed instructions on upgrading from a previous version of LifeKeeper.

Upgrading to NFS Server Recovery Kit v5.0

The LifeKeeper NFS Server Recovery Kit v5.0 and later has been re-architected to take advantage of features now available in Linux kernels starting with 2.4.21. As such this package can only be installed on 2.4.21 or greater kernels. Servers running kernels older than 2.4.21 require the installation of the LifeKeeper NFS Server Recovery Kit v4.5.x.

The new recovery kit no longer requires the installation of a SteelEye HANFS package for the running kernel, but it does require the installation of a nfs-utils package with HA capabilities, which is available via LifeKeeper Installation Support setup.

Because of the many differences between the v4.x and v5.0 NFS recovery kit implementations, no migration path is available for installations currently running the 4.x version of the recovery kit. Therefore, prior to running Installation Support setup you must first:

1. Ensure the server is running at least a 2.4.21 kernel
2. Remove all hierarchies that contain an nfs resource
3. Remove all HANFS packages
4. Remove the steeleye-lkNFS package
5. Disconnect all clients from the server (umount the export on all client systems)

Once these steps are complete you can run the LifeKeeper Installation Support setup script and select to install the HA enabled nfs-utils package when prompted. Once Installation Support setup is complete:

1. Ensure that NFS is running on the server.
2. Install the steeleye-lkNFS v5.0.0 or greater package.
3. Recreate all the LifeKeeper hierarchies that were removed in preparation for the installation of the NFS Server Recovery Kit version 5.0.0 (the action taken in step 2 above). Do not restore from an lkbackup as resource information must be recreated to account for the changes in the new kit.
4. Reconnect all clients (remount on all client systems).

Because of a bug in early versions of the 2.6 kernel, installations on SLES 9 may require a patched nfsd module from SteelEye Technology, Inc. This module is only required if the underlying disk resource is skewed between the servers in the cluster (e.g. disk is /dev/sdb1 on Server A and /dev/sdc1 on Server B). This module must be installed and loaded before attempting to create any NFS resource hierarchies.

Technical Notes

We strongly recommend that you read the following technical notes concerning configuration and operational issues related to your LifeKeeper environment.

LifeKeeper Features

Item	Description
Licensing	LifeKeeper requires unique runtime license keys for each server. This applies to both physical and virtual servers. A license key is required for the LifeKeeper core software, as well as for each separately packaged LifeKeeper recovery kit. The installation support script installs a Licensing Utilities package that obtains and displays the host ID of your server. The host IDs and authorization code provided with your software are used to obtain permanent license keys from the SteelEye Technology Inc. website. You will also need to provide the host IDs of your servers to obtain 30-day evaluation licenses for demo or evaluation purposes.
Large Cluster Support	LifeKeeper supports large cluster configurations, up to 32 servers. There are many factors other than LifeKeeper, however, that can affect the number of servers supported in a cluster. This includes items such as the storage interconnect, and operating system or storage software limitations. Refer to the vendor-specific hardware and software configuration information to determine the maximum supported cluster size.
Internationalization and localization	LifeKeeper for Linux v5.2 and later does support wide/multi-byte characters in resource and tag names, but does not include native language message support. The LifeKeeper GUI can be localized by creating locale-specific versions of the Java property files, although currently only the English version is fully localized. However, many of the messages displayed by the LifeKeeper come from the LifeKeeper core, so localization of the GUI will provide only a partial solution for users until the core software is fully localized. See also Iklin00002100 under “Restrictions or Known Issues - LifeKeeper Core” for additional information.
LifeKeeper MIB File	LifeKeeper can be configured to issue SNMP traps describing the events that are occurring within the LifeKeeper cluster. See the <code>lk_configsnmp(8)</code> man page for more information about configuring this capability. The MIB file describing the LifeKeeper traps can be found at <code>/opt/LifeKeeper/include/LifeKeeper-MIB.txt</code> .

Tuning

Item	Description																		
IPC semaphores and IPC shared memory	<p>LifeKeeper requires Inter-Process Communication (IPC) semaphores and IPC shared memory. The default Red Hat values for the following Linux kernel options are located in <code>/usr/src/linux/include/linux/sem.h</code>, and should be sufficient to support most LifeKeeper configurations.</p> <table border="0"> <thead> <tr> <th style="text-align: left;">Option</th> <th style="text-align: left;">Required</th> <th style="text-align: left;">Default Red Hat 6.2</th> </tr> </thead> <tbody> <tr> <td>SEMOPM</td> <td>14</td> <td>32</td> </tr> <tr> <td>SEMUME</td> <td>20</td> <td>32</td> </tr> <tr> <td>SEMMNU</td> <td>60</td> <td>32000</td> </tr> <tr> <td>SEMMAP</td> <td>25</td> <td>32000</td> </tr> <tr> <td>SEMMNI</td> <td>25</td> <td>128</td> </tr> </tbody> </table>	Option	Required	Default Red Hat 6.2	SEMOPM	14	32	SEMUME	20	32	SEMMNU	60	32000	SEMMAP	25	32000	SEMMNI	25	128
Option	Required	Default Red Hat 6.2																	
SEMOPM	14	32																	
SEMUME	20	32																	
SEMMNU	60	32000																	
SEMMAP	25	32000																	
SEMMNI	25	128																	
System File Table	<p>LifeKeeper requires that system resources be available in order to failover successfully to a backup system. For example, if the system file table is full, LifeKeeper may be unable to start new processes and perform a recovery. In kernels with enterprise patches, including those supported by LifeKeeper, <code>file-max</code>, the maximum number of open files in the system, is configured by default to 1/10 of the system memory size, which should be sufficient to support most LifeKeeper configurations. Configuring the <code>file-max</code> value lower than the default could result in unexpected LifeKeeper failures.</p> <p>The value of <code>file-max</code> may be obtained using the following command:</p> <pre>cat /proc/sys/fs/file-nr</pre> <p>This will return three numbers. The first represents the high water mark of file table entries (i.e. the maximum the system has seen so far), the second represents the current number of file table entries, and the third is the <code>file-max</code> value.</p> <p>To adjust <code>file-max</code>, add (or alter) the "<code>fs,file-max</code>" value in <code>/etc/sysctl.conf</code> (see <code>sysctl.conf(5)</code> for the format) and then run</p> <pre>sysctl -p</pre> <p>to update the system. The value in <code>/etc/sysctl.conf</code> will persist across reboots.</p>																		

LifeKeeper Operations

Item	Description
Kernel Debugger (kdb) init s	<p>Before using the Kernel Debugger (kdb) or moving to init s on a LifeKeeper protected server, you should first either shutdown LifeKeeper on that server, or switch any LifeKeeper protected resources over to the backup server. Use of kdb with the LifeKeeper SCSI Reservation Daemons (lkcsid and lkccissd) enabled (they are enabled by default) can also lead to unexpected panics.</p>

Item	Description
System Panic on Locked Shared Devices	<p>LifeKeeper uses a lock to protect shared data from being accessed by other servers on a shared SCSI Bus. If LifeKeeper cannot access a device as a result of another server taking the lock on a device, then a critical error has occurred and quick action should be taken or data can be corrupted. When this condition is detected, LifeKeeper enables a feature that will cause the system to panic.</p> <p>If LifeKeeper is stopped by some means other than 'lkstop,' with shared devices still reserved (this could be caused by executing kdb or init s), then the LifeKeeper locking mechanism may trigger a kernel panic when the other server recovers the resource(s). All resources must be placed out-of-service before stopping LifeKeeper in this manner.</p>
Recovering out-of-service hierarchies	<p>As part of the recovery following the failure of a LifeKeeper server, resource hierarchies that were configured on the failed server, but which were not <i>in-service</i> anywhere at the time of the server failure, are recovered on the highest priority <i>alive</i> server at the time of the failure. This is the case no matter where the <i>out-of-service</i> hierarchy was last in service, including the failed server, the recovering server, or some other server in the cluster.</p>
Coexistence with Linux Firewalls	<p>LifeKeeper uses specific ports for communication paths, GUI, IP, and Data Replication. When using the linux firewall feature the specific ports that LifeKeeper is using need to be opened. Refer to the On-Line Product Manual (under Maintenance Tasks, Running LifeKeeper with a Firewall) on the SteelEye web site under Documentation for details.</p>

Server Configuration

Item	Description
BIOS updates	The latest available BIOS should always be installed on all LifeKeeper servers.

Confirm Failover and Block Resource Failover Settings

Make sure you review and understand the following descriptions, examples and considerations before setting the Confirm Failover or Block Resource Failover in your LifeKeeper environment. These settings are available from the command line or on the Properties panel in the LifeKeeper GUI.

Confirm Failover On:

Definition – Enables manual failover confirmation from system A to system B (where system A is the server whose properties are being displayed in the Properties Panel and system B is the system to the left of the checkbox). If this option is set on a system, it will require a manual confirmation by a system administrator before allowing LifeKeeper to perform a failover recovery of a system that it detects as failed.

Use the `lk_confirmso` command to confirm the failover. By default, the administrator has 10 minutes to run this command. This time can be changed by modifying the `CONFIRMSOTO` setting in `/etc/default/LifeKeeper`. If the administrator does not run the `lk_confirmso` command within the time allowed, the failover will either proceed or be blocked. By default, the failover

will proceed. This behavior can be changed by modifying the CONFIRMSODEF setting in /etc/default/LifeKeeper.

Example: If you wish to block automatic failovers completely then you should set the Confirm Failover On option in the Properties panel and also set CONFIRMSODEF to 1 (block failover) and CONFIRMSOTO to 0 (don't wait to decide on the failover action).

When to select this setting:

This setting is used in most Disaster Recovery, XenServer and other WAN configurations, where the configuration does not include redundant heartbeat communications paths.

In a regular site (non multi-site cluster and non XenServer), open the properties page from one server and then select the server that you want the Confirm Failover flag to be set on.

For a Multi-site **WAN** configuration: **Enable** manual failover confirmation

For a Multi-site **LAN** configuration: **Do not** enable manual failover confirmation

In a multi-site cluster environment – from the non-disaster system, select the DR system and check the set confirm failover flag. You will need to open the properties panel and select this setting for each non-disaster server in the cluster.

In a XenServer environment, all servers in the list (not just the DR site), need to be checked.

Set Block Resource Failover On:

Definition - By default, all resource failures will result in a recover event that will attempt to recover the failed resource on the local system. If local recovery fails or is not enabled, then LifeKeeper transfers the resource hierarchy to the next highest priority system for which the resource is defined. However, if this setting is selected on a designated system(s), all resource transfers due to a resource failure will be blocked from the given system.

When the setting is enabled, the following message is logged:

```
Local recovery failure, failover blocked, MANUAL INTERVENTION
REQUIRED
```

Conditions/Considerations:

In a Multi-site configuration, **do not select** Block Failover for any server in the configuration.

In a XenServer environment, **select** Block Failover for each system in the cluster.

Remember: This setting will **not** affect failover behavior if there is a complete system failure. It will only block failovers due to local resource failures.

Storage and Adapter Configuration

Item	Description
Multipath I/O and Redundant Controllers	<p>There are several multipath I/O solutions either already available or currently being developed for the Linux environment. SteelEye Technology, Inc. is actively working with a number of server vendors, storage vendors, adapter vendors, and driver maintainers to enable LifeKeeper to work with their multipath I/O solutions. LifeKeeper's use of SCSI reservations to protect data integrity presents some special requirements that frequently are not met by the initial implementation of these solutions.</p> <p>Refer to the technical notes below for supported disk arrays to determine if a given array is supported with multiple paths and with a particular multipath solution. Unless an array is specifically listed as being supported by LifeKeeper with multiple paths and with a particular multipath solution, it must be assumed that it is not.</p>

Item	Description
Heavy I/O in Multipath Configurations	<p>In multipath configurations, performing heavy I/O while paths are being manipulated can cause a system to temporarily appear to be unresponsive. When the multipath software moves the access of a LUN from one path to another, it must also move any outstanding I/O's to the new path. The rerouting of the I/O's can cause a delay in the response times for these I/O's. If additional I/O's continue to be issued during this time, they will be queued in the system and can cause a system to run out of memory available to any process. Under very heavy I/O loads, these delays and low memory conditions can cause the system to be unresponsive, such that LifeKeeper may detect a server as down and initiate a failover.</p> <p>There are many factors that will affect the frequency at which this issue may be seen.</p> <ul style="list-style-type: none"> • The speed of the processor will affect how fast I/O's can be queued. A faster processor may cause the failure to be seen more frequently. • The amount of system memory will affect how many I/O's can be queued before the system becomes unresponsive. A system with more memory may cause the failure to be seen less frequently. • The number of LUNs in use will affect the amount of I/O that can be queued. • Characteristics of the I/O activity will affect the volume of I/O queued. In test cases where the problem has been seen, the test was writing an unlimited amount of data to the disk. Most applications will both read and write data. As the reads are blocked waiting on the failover, writes will also be throttled, decreasing the I/O rate such that the failure may be seen less frequently. <p>For example, during testing of the IBM DS4000 multipath configuration with RDAC, when the I/O throughput to the DS4000 was greater than 190MB per second and path failures were simulated, LifeKeeper would (falsely) detect a failed server approximately 1 time out of 12. The servers used in this test were IBM x345 servers with dual Xeon 2.8GHz processors and 2GB of memory connected to a DS4400 with 8 volumes (LUNs) per server in use. To avoid the failovers, the LifeKeeper parameter LCMNUMHBEATS (in <i>/etc/default/LifeKeeper</i>) was increased to 16. The change to this parameter results in LifeKeeper waiting approximately 80 seconds before determining that an unresponsive system is dead, rather than the default wait time of approximately 15 seconds.</p>
Special Considerations for Switchovers with Large Storage Configurations	<p>With some large storage configurations (for example, multiple logical volume groups with 10 or more LUNs in each volume group) LifeKeeper may not be able to complete a sendevent within the default timeout of 300 seconds when a failure is detected. This results in the switchover to the backup system failing. All resources are not brought in-service and the following error message is logged in the LifeKeeper log:</p> <pre> ***ERROR*** recover[51,mes.C]:lcdsendremote: ::receive(300) did not receive message within 300 seconds on incoming_mailbox PM1798.21634 /opt/LifeKeeper/bin/recover: lcdsendremote transfer resource "<resource-name>" to "<resource- name>" on machine "system-name" failed (rt=-1) </pre> <p>The recommendation with large storage configurations is to change SCSIERROR from "event" to "halt" in the <i>/etc/default/LifeKeeper</i> file. This will cause LifeKeeper to perform a "halt" on a SCSI error. LifeKeeper will then perform a successful failover to the backup system.</p>
HP RA4100	<p>Certified by SteelEye Technology, Inc. with the Compaq FC HBA with the cpqfc driver, version 2.1.1 or later, on 2.4 kernels.</p>

Item	Description
HP MA8000	Certified by SteelEye Technology, Inc. with QLogic 2200 adapters. Use the qla2200 driver version 6.04.50 or later.
HP MSA1000 and MSA1500	Certified by SteelEye Technology with HP FCA2214 (QLA 2340) adapters in both single and multiple path configurations. Configuration requirements and notes for support of the MSA1000 in a multipath configuration are provided in the separate HP Multipath I/O Configurations section.
HP EVA 3000/5000 and EVA 4X00/6X00/8X00	Certified by SteelEye Technology with HP FCA2214 (QLA 2340) adapters in both single and multiple path configurations. Configuration requirements and notes for support of the EVA in a multipath configuration are provided in the separate HP Multipath I/O Configurations section.
HP MSA500 (formerly known as Smart Array Cluster Storage or SACS)	Certified by SteelEye Technology, Inc. with Smart Array 5i and 532 host adapters with the cciss driver. LifeKeeper <u>does</u> support the HP Modular Smart Array 500 system in a redundant controller configuration. This is not a multipath I/O solution, but it does eliminate all potential storage-related single points of failure.
HP MSA500 G2	Certified by SteelEye Technology, Inc. with the Smart Array 6i and 642 host adapter with the cciss driver. LifeKeeper <u>does</u> support the HP Modular Smart Array 500 G2 system in a redundant controller configuration with both the 2-port and 4-port EMU modules. This is not supported in a multipath I/O configuration, but it does eliminate all potential storage-related single points of failure. The 4-port module provides support for up to a 4-node cluster. LifeKeeper does not support the HP Smart Array Multipath Software for the MSA500 G2.
HP MSA2000fc	Certified by Hewlett-Packard Company with Fiber Channel in both single path and multipath configurations. Models tested were the MSA2012fc and the MSA2212fc with the QLogic QMH2462 HBA using driver version 8.01.07.25 in a single path configuration. The multipath configuration testing was completed using the same models with HP DMMP and the LifeKeeper DMMP Recovery Kit.
HP MSA2000i	Certified by Hewlett-Packard Company with iSCSI in a multipath configuration. The model used for testing was the MSA2012i with HP DMMP. Single path testing was not performed by HP; however, SteelEye supports single path configurations with HP DMMP and the LifeKeeper DMMP Recovery Kit.
HP MSA2000sa	Certified by Hewlett-Packard Company with SA in both single path and multipath configurations. The model used for testing was the MSA2012sa. Both single path and multipath configuration require the DMMP Recovery Kit and the HP DMMP software. HP supports direct connect configurations only at this time.
HP MSA 2300fc	Certified by Hewlett-Packard Company with Fiber Channel in both single and multipath configurations. The model tested was the MSA2324fc with the HP AE312A (FC2142SR) HBA using driver version 8.02.09-d0-rhel4.7-04 in a single path configuration. The multipath configuration testing was completed using the same model with HP DMMP and the LifeKeeper DMMP Recovery Kit.
IBM DS4000 Storage (formerly known as IBM FASTT)	Certified by SteelEye Technology, Inc. with QLogic 2200 and 2340 adapters in both single and multiple path configurations. Use the qla2200 or qla2300 driver, version 6.03.00 or later, as defined by IBM. When using IBM DS4000 storage arrays systems with Emulex FC adapters use the lpfc driver versions specified in the Emulex Drivers item

Item	Description
	<p>below.</p> <p><u>Single path (i.e. single loop) support:</u> In a single path configuration, a fibre channel switch or hub is required for LifeKeeper to operate properly.</p> <p><u>Multiple path (i.e. dual loop) support:</u> Multiple paths are supported with the DS4000 storage array models that are released with RDAC support (currently the DS4300, DS4400, and DS4500 models). Fibre channel switches and hubs are not required with multiple path configurations with RDAC. RDAC is a software package that handles path failovers so that an application is not affected by a path failure.</p> <p>The steps to install and setup RDAC are slightly different depending on the version being used. Refer to the IBM RDAC documentation for the instructions to install, build, and setup.</p>
IBM DS5000	<p>Certified by partner testing in a multipath configuration using IBM RDAC. Please consult the IBM website to obtain the supported RDAC drivers for your distribution.</p>
IBM DS3400 Storage	<p>Certified by SteelEye Technology, Inc. with QLogic 2300 adapters in both single and multiple path configurations. Use the qla2200 or qla2300 driver, version 6.03.00 or later, as defined by IBM.</p> <p>Please refer to the table entry for IBM DS4000 Storage for more information on single and multiple path support.</p>
IBM System Storage DS3300	<p>Certified by SteelEye Technology, Inc. with iSCSI Software Initiators. This storage device works in a two node LifeKeeper cluster in both single and multipath configurations. It is required that the IBM RDAC driver be installed on both servers for either single or multipath configurations.. If you are using a multipath configuration you must set SCSIHANGMAX to 50 in the /etc/default/LifeKeeper file.</p> <p>Please consult the IBM website to obtain the supported RDAC drivers for your distribution.</p>
IBM System Storage DS3200	<p>Certified by SteelEye Technology, Inc. with the IBM SAS HBA (25R8060). This storage device works in a two node LifeKeeper cluster in both single and multipath configurations. It is required that the IBM RDAC driver be installed on both servers for either single or multipath configurations.</p> <p>Please consult the IBM website to obtain the supported SAS and RDAC drivers for your Linux distribution.</p>

IBM EXP300 / EXP400 and ServeRAID Controllers

Certified by SteelEye Technology, Inc. in a shared storage configuration with the installation of the IPS/ServeRAID Recovery Kit and version 6.10 or later of the **ips** driver and BIOS. Supported controllers include the ServeRAID-4H, ServeRAID-4Lx, ServeRAID-4Mx, and ServeRAID-6M with the IBM EXP300 and EXP400. The IPS/ServeRAID Recovery Kit is installed via the LifeKeeper for Linux Installation Support CD and should only be selected for install if you have the supporting hardware and plan to use it in a clustered environment.

Before installing the IPS/ServeRAID Recovery Kit you must install the RaidManager package and copy the ipssend command line utility from the IBM ServeRAID CD to /usr/bin on each node in the cluster.

Configuring ServeRAID for clustering in a shared storage configuration for Linux follows the same steps as described in the IBM ServeRAID Software User's Guide for a Windows cluster. You must configure controller and partner names for the cluster. LifeKeeper uses these names, separated by a ":", to uniquely identify that resource, and thus restricts the use of ":" in the name. Additionally, each node in the cluster must be configured with a unique initiator id for the channel. Configure one as 6 and the other as 7.

When performing ServeRAID administration it is recommended that anything touching the shared configuration be performed in an out-of-service mode. The following steps should be used:

- Bring all resources in-service on one node in the cluster.
- Perform a normal system shutdown of the Out-of-Service node.
- On the remaining node perform lkstop -f to leave the resources in-service.
- Reboot the node using the ServeRAID CD.
- Perform administration.
- Reboot the node under Linux and start LifeKeeper.
- Reboot the second node and start LifeKeeper.

For data replication setups using the **ips** driver see the **IBM ServeRAID Controllers and Data Replication** topic below.

For additional information on IBM ServeRAID, please refer to the IBM ServeRAID Software User's Guide found on the IBM ServeRAID CD.

IBM DS400

Certified by SteelEye Technology, Inc. in single path configurations only. Use the firmware version 7.01 build 0838 or later, as defined by IBM.

IBM San Volume Controller (SVC)

Certified by partner testing in a single path configuration. Certified by SteelEye Technology, Inc. in multipath configurations using the SDD Recovery Kit and the Device Mapper Multipath Recovery Kit.

IBM ServeRAID Controllers and Data Replication

Version 4.80 or later of the **ips** driver and BIOS is required for LifeKeeper Data Replication to function properly. Data Replication can be used in conjunction with shared cluster support (see the **IBM EXP300 / EXP400 and ServeRAID Controllers** topic above) but replication resources should only be placed on non-shared LUNs in the cluster (use initiator ids of 206 or 207).

IBM eServer xSeries Storage Solution Server Type445-R / Type445-FR for SANmelody

Certified by partner testing with IBM TotalStorage FC2-133 Host Bus Adapters in multiple path configurations. Use the qla2300 driver, version 7.00.61 (non-failover) or later, as defined by IBM.

Multiple path support: Multiple paths are supported with the IBM eServer xSeries Storage Solution Server Type445-R / Type445-FR for SANmelody, using the Multipath Linux Driver for IBM SANmelody Solution Server, version 1.0.0 or later.

Dell PowerVault with Dell PERC

SteelEye Technology, Inc. has certified the Dell PowerVault storage array for use in a 2-node cluster with the Dell PERC 2/DC, Dell PERC 4/DC,

**and LSI Logic
MegaRAID
controllers**

and LSI Logic MegaRAID Elite 1600 storage controllers, as long as the following set of configuration requirements are met. (Note that the Dell PERC 3/DC is the OEM version of the MegaRAID Elite 1600.) These requirements are necessary because these host-based RAID controllers do not provide support for SCSI reservations and unique device IDs, which LifeKeeper normally requires.

1. The Dell PowerVault storage should not be mixed with any other types of shared storage to be managed by LifeKeeper within the same cluster.
2. Follow the instructions provided with your hardware for configuring the Dell PowerVault storage and the controllers for use in a cluster. Specifically, this includes getting into the controller firmware setup screens simultaneously on both systems, selecting the adapter properties page, setting "Cluster Mode" to "Enabled", and setting the "Initiator ID" to 6 on one system and to 7 on the other. You should then make sure that both controllers can see the same LUNs, and that the Linux **megaraid** driver is properly configured to be loaded.
3. Because this storage configuration does not support SCSI reservations, you must disable the use of SCSI reservations within LifeKeeper. This is accomplished by adding the option "RESERVATIONS=none" to the LifeKeeper defaults file, **/etc/default/LifeKeeper**, on both nodes in the cluster. Note that the use of this option is only supported for use in specifically certified configurations, and that this is the only currently certified configuration.
4. You must manually configure a unique ID for each LUN to be managed by LifeKeeper, using the **/opt/LifeKeeper/bin/lkid** utility. The assigned ID must be unique within the cluster, and should be sufficiently constructed to avoid potential future conflicts. The **lkid** utility will automatically generate a unique ID for you if desired. Refer to the **lkid(8)** man page for more details about the use of the utility, the IDs that it generates, where the ID is placed, and any possible restrictions. Also see the note regarding the use of lkid with LVM in the Known Issues section for the [LVM Recovery Kit](#).
5. Obtain and configure a STONITH device or devices to provide I/O fencing. This is required due to the lack of SCSI reservation support in this configuration. Refer to the white paper, [Implementing STONITH Support in LifeKeeper for Linux Clusters](#), located in the Downloads section of the SteelEye Technology, Inc. website for more information. Note that for this configuration, you should configure your STONITH devices to do a system "poweroff" command rather than a "reboot". You must also take care to avoid bringing a device hierarchy in-service on both nodes simultaneously via a manual operation when LifeKeeper communications have been disrupted for some reason.

**Dell | EMC
(CLARiiON)
CX200**

EMC has approved two QLogic driver versions for use with this array and the QLA2340 adapter: the `qla2x00-clariion-v6.03.00-1` and the `qla2x00-clariion-v4.47.18-1`. Both are available from the QLogic website at www.qlogic.com.

DELL MD3000

Certified by Partner testing in both single path and multipath configurations with DELL SAS 5/e adapters. This was specifically tested with RHEL4; however, there are no known issues using other LifeKeeper supported Linux distributions or versions.

RDAC is required for both single path and multipath configurations.

For single path configurations, use the HBA host type of "Windows MSCS Cluster single path".

For multipath configurations, use the HBA host type of "Linux".

ADTX ArrayMasStor L and FC-II	<p>These storage units were tested by a SteelEye Technology, Inc. partner organization, both in a single path configuration with a switch, and in a dual controller configuration with each server in a 2-node cluster directly connected to a separate controller in the array. In both configurations, the LifeKeeper behavior in a split-brain scenario is the same as that described above for the Hitachi HDS storage arrays, and the same hierarchy configuration precautions should be observed.</p> <p>The ArrayMasStor L was also tested and certified by our partner organization in a multipath configuration, using QLogic 2340 and 2310 host bus adapters and the QLogic failover driver, version 6.06.10.</p>
Fujitsu ETERNUS3000	<p>This storage unit was tested by a SteelEye Technology, Inc. partner organization in a single path configuration only, using the PG-FC106 (Emulex LP9001), PG-FC106 (Emulex LP9802), and PG-PC107 host bus adapters and the lpfc driver v7.1.14-3.</p>
Fujitsu ETERNUS 6000	<p>This storage unit was tested by a SteelEye Technology, Inc. partner organization, in a single path configuration only, using the PG-FC106 (Emulex LP9802) host bus adapter and the lpfc driver v7.1.14-3.</p>
Fujitsu FiberCAT S80	<p>This array requires the addition of the following entry to <i>/etc/default/LifeKeeper</i>:</p> <pre>ADD_LUN_TO_DEVICE_ID=TRUE</pre>
Fujitsu ETERNUS SX300	<p>This storage unit was tested by a SteelEye Technology, Inc. partner organization, in a multipath configuration only, using the PG-FC106 (Emulex LP9802) and PG-FC107 host bus adapters and the lpfc driver v7.1.14. The RDAC driver that is bundled with the SX300 is required.</p>
Fujitsu ETERNUS2000 Model 50	<p>This storage unit was tested by a SteelEye Technology, Inc. partner organization, in a multipath configuration with dual RAID controllers, using the PG-FC202 (LPe1150-F) host bus adapter with the EMPD multipath driver. Firmware version WS2.50A6 and driver version EMPD V2.0L12 were used in the testing. Testing was performed with LifeKeeper for Linux v6.2 using RHEL4 (kernel 2.6.9-67.ELsmp) and RHEL5 (kernel 2.6.18-53.el5).</p>
Fujitsu ETERNUS4000 Model 300	<p>This storage unit was tested by a SteelEye Technology, Inc. partner organization, in a multipath configuration with dual RAID controllers, using the PG-FC202 (LPe1150-F) host bus adapter with the EMPD multipath driver.</p>

**NEC iStorage
Storage Path
Savior Multipath
I/O**

Protecting Applications and File Systems That Use Multipath Devices:

In order for LifeKeeper to configure and protect applications or file systems that use SPS devices, the SPS recovery kit must be installed.

Once the SPS kit is installed, simply creating an application hierarchy that uses one or more of the multipath device nodes will automatically incorporate the new resource types provided by the SPS kit.

Multipath Device Nodes:

To use the SPS kit, any file systems and raw devices must be mounted or configured on the multipath device nodes (`/dev/dd*`), rather than on the native `/dev/sd*` device nodes.

Use of SCSI-3 Persistent Reservations:

The SPS kit uses SCSI-3 persistent reservations, with a "Write Exclusive" reservation type. This means that devices reserved by one node in the cluster will remain read-accessible to other nodes in the cluster, but those other nodes will be unable to write to the device. Note that this does not mean that you can expect to be able to mount file systems on those other nodes for ongoing read-only access.

LifeKeeper uses the `sg_persist` utility to issue and monitor persistent reservations. If necessary LifeKeeper will install the `sg_persist(8)` utility.

Hardware Requirements:

The SPS kit has been tested and certified with the NEC iStorage disk array, using Emulex LP952, LP9802, LP1050 HBAs and Emulex `lpfc` driver. This kit is expected to work equally well with other NEC iStorage D and S supported by SPS.

Multipath Software Requirements:

The SPS kit has been tested with SPS for Linux 3.3.001. There are no known dependencies on the version of the SPS package installed.

Installation Requirements:

SPS software must be installed prior to installing the SPS recovery kit.

Adding or Repairing SPS Paths:

When LifeKeeper brings a SPS resource into service, it establishes a persistent reservation registered to each path that was active at that time. If new paths are added after the initial reservation, or if failed paths are repaired and SPS automatically reactivates them, those paths will not be registered as a part of the reservation until the next LifeKeeper `quickCheck` execution for the SPSresource. If SPS allows any writes to that path prior to that point in time, reservation conflicts that occur will be logged to the system message file. The SPS driver will retry these IO's on the registered path resulting in no observable failures to the application. Once `quickCheck` registers the path subsequent writes will be successful.

**Newtech
SweeperStor
SATA and SAS**

This storage unit was tested by a SteelEye Technology, Inc. partner organization, in a multipath configuration with dual RAID controllers, using the QLogic PCI to Fibre Channel Host Adapter for QLE2462 (with Firmware version 4.03.01 [IP], Driver version 8.02.08) with storage firmware J200. Testing was performed with LifeKeeper for Linux v6.2 with DMMP Recovery Kit v6.2 using the following distributions and kernels:

RHEL4 DMMP	
Emulex LP 11002	8.0.16.32 or later
Emulux LPe 11002	8.0.16.32 or later
Qlogic QLA 2462	8.01.07 or later
Qlogic QLE 2462	8.01.07 or later
RHEL5 DMMP	
Emulex LP 11002	8.1.10.9 or later
Emulux LPe 11002	8.1.10.9 or later
Qlogic QLA 2462	8.01.07.15 or later
Qlogic QLE 2462	8.01.07.15 or later
SuSE9 DMMP	
Emulex LP 11002	8.0.16.32 or later
Emulux LPe 11002	8.0.16.32 or later
Qlogic QLA 2462	8.01.07 or later
Qlogic QLE 2462	8.01.07 or later
SuSE10 DMMP	
Emulex LP 11002	8.1.10.9 or later
Emulux LPe 11002	8.1.10.9 or later
Qlogic QLA 2462	8.01.07.15 or later
Qlogic QLE 2462	8.01.07.15 or later

Note: DMMP is required for multipath configurations.

**TID
MassCareRAID II**

This storage unit was tested by a SteelEye Technology, Inc partner organization in a multipath configuration using the Qlogic driver with SCSI-2 reservations with no Fiber Channel switches. Red Hat Enterprise Linux ES release 4 Update6 was used with the 2.6.9-67.ELsmp kernel. The FAILFASTTIMER setting in /etc/default/LifeKeeper needs to be changed from 5 to 30.

**Sun StorageTek
2540**

This storage unit was tested by a SteelEye Technology, Inc. partner organization, in a multipath configuration using RDAC with Dual RAID Controllers, using the StorageTek 4Gb PCI-E Dual FC Host Bus Adapter and the Sun StorageTek 4Gb PCI Dual FC Network Adapter.

QLogic Drivers

For other supported fibre channel arrays with QLogic adapters, use the **qla2200** or **qla2300** driver, version 6.03.00 or later.

Emulex Drivers

For the supported Emulex fibre channel HBAs, you must use the **lpfc** driver v7.1.13 or later for 2.4 Linux kernels, and v8.0.16 or later for 2.6 Linux kernels. The **lpfc** driver package is available from SourceForge.net.

**Adaptec 29xx
Drivers**

For supported SCSI arrays with Adaptec 29xx adapters, use the **aic7xxx** driver, version 6.2.0 or later, provided with the OS distribution.

**Consan
CRD5440**

It is recommended that you disable command queuing in order to avoid a problem with the controller in this array that has been observed with the "old" aic7xxx driver. This can be done several ways, such as by rebuilding the driver with it turned off or setting options in modules.conf to disable queuing.

**Datacore
SANsymphony**

This storage device was successfully tested with SUSE SLES 9 Service Pack 3, Device Mapper - Multipath and Qlogic 2340 adapters. We expect that it should work with other versions, distributions and adapters; however, this has not been tested. See Datacore for specific support for these and other configurations.

One issue was found during failover testing with heavy stress running where multiple server reboots would result in a server only configuring a single path. The test configuration consisted of a 3-node cluster where 2 servers would be killed simultaneously. After the 2 servers rebooted, about 50% of the time one server would only have a single path configured. A reboot of the server would resolve the problem. This issue was never seen when only a single server was rebooted. This issue has been reported to Datacore. This item is not considered a critical issue since at least one path continues to be available.

**Xiotech
Magnitude 3D**

This storage device was successfully tested with Red Hat EL 4 Update 3 and Qlogic 2340 adapters. We expect that LifeKeeper would also work with other versions, distributions and adapters; however, this has not been tested. See Xiotech for specific support for these and other configurations.

The Magnitude 3D was tested in a single path configuration.

During setup, one configuration issue was detected where only 8 LUNs were configured in the OS. This is due to the Magnitude 3D specifying in the SCSI inquiry data that it is a SCSI-2 device. The SCSI driver in the 2.6 kernel will not automatically address more than 8 LUNs on a SCSI-2 device unless the device is included in its exception list. The Magnitude 3D is not in that list. Xiotech provided a workaround for testing to issue a command to `/proc/scsi/scsi` to configure each LUN.

HP Multipath I/O Configurations

Item	Description
MSA1000 and MSA1500 Multipath Requirements with Secure Path	LifeKeeper supports Secure Path for multipath I/O configurations with the MSA1000 and MSA1500. This support requires the use of the Secure Path v3.0C or later.
EVA3000 and EVA5000 Multipath Requirements with Secure Path	<p>LifeKeeper requires the following in order to support the EVA3000 and EVA5000 in a multipath I/O configuration using Secure Path:</p> <ol style="list-style-type: none"> 1. EVA VCS v2.003, or v3.00 or later. For each server, use Command View v3.00 to set the Host OS type to Custom and the Custom Mode Number as hex <i>00000002200282E</i>. See the HP Secure Path Release Notes for detailed instructions. 2. HP Secure Path v3.0C or later.
Multipath Cluster Installation Using Secure Path	<p>For a fresh installation of a multiple path cluster that uses Secure Path, perform these steps:</p> <ol style="list-style-type: none"> 1. Install the OS of choice on each server. 2. Install the clustering hardware: FCA2214 adapters, storage, switches and cables. 3. Install the HP Platform Kit. 4. Install the HP Secure Path software. This will require a reboot of the system. Verify that Secure Path has properly configured both paths to the storage. See Secure Path documentation for further details. 5. Install LifeKeeper.
Multipath Support for MSA1000 and MSA1500 with QLogic Failover Driver	LifeKeeper for Linux supports the use of the QLogic failover driver for multipath I/O configurations with the MSA1000 and MSA1500. This support requires the use of the QLogic driver v7.00.03 or later.
Multipath Support for EVA with QLogic Failover Driver	LifeKeeper supports the EVA 3000/5000 and the EVA 4X00/6X00/8X00 with the QLogic failover driver. The 3000/5000 requires firmware version 4000 or higher. The 4000/6000/8000 requires firmware version 5030 or higher. The latest QLogic driver supplied by HP should be used. For 2.4 kernels v7.07.03 and 2.6 kernels v8.01.03 or later. The host connection must be "Linux". There is no restriction on the path/mode setting by LifeKeeper. Notice that previous restrictions for a special host connection, the setting of the preferred path/mode and the ports that can be used on the EVA do not exist for this version of firmware and driver.

Item	Description
Upgrading a Single Path MSA1000/ MSA1500 or EVA Configuration to Multiple Paths with Secure Path	<p>To upgrade a cluster from single path to multiple paths perform the following steps (this must be a cluster wide upgrade):</p> <ol style="list-style-type: none"> 1. Upgrade LifeKeeper to the latest version following the normal upgrade procedures. This step can be accomplished as a rolling upgrade such that the entire cluster does not have to be down. 2. Stop LifeKeeper on all nodes. The cluster will be down until the hardware upgrade is complete and step 5 is finished for all nodes. 3. Install/upgrade the HP Platform Kit on each node. 4. Install the HP Secure Path software on each node. This will require a reboot of the system. Verify that Secure Path has properly configured both paths to the storage. See Secure Path documentation for further details. 5. Start LifeKeeper. All hierarchies should work as they did before the upgrade. <p>Note: This is a change from how the previous version of LifeKeeper supported an upgrade.</p>
Secure Path Persistent Device Nodes	<p>Secure Path supports “persistent” device nodes that are in the form of /dev/spdev/spXX where XX is the device name. These nodes are symbolic links to the specific SCSI device nodes /dev/sdXX. LifeKeeper v4.3.0 or later will recognize these devices as if they were the “normal” SCSI device nodes /dev/sdXX. LifeKeeper maintains its own device name persistence, both across reboots and across cluster nodes, by directly detecting if a device is /dev/sda1 or /dev/sdq1 and then directly using the correct device node.</p> <p>Note: Support for symbolic links to SCSI device nodes was added in LifeKeeper v4.3.0.</p>
Active/Passive Controllers and Controller Switchovers	<p>The MSA1000 implements multipathing by having one controller active with the other controller in standby mode. When there is a problem with either the active controller or the path to the active controller, the standby controller is activated to take over operations. When a controller is activated it takes some time for the controller to become ready. Depending on the number of LUNs configured on the array this can take 30 to 90 seconds. During this time IO’s to the storage will be blocked until they can be rerouted to the newly activated controller.</p>
Single Path on Boot Up Does Not Cause Notification	<p>If a server can access only a single path to the storage when the system is loaded, there will be no notification of this problem. This can happen if a system is rebooted where there is a physical path failure as noted above, but transient path failures have also been observed. It is advised that any time a system is loaded that the administrator check that all paths to the storage are properly configured, and if not, take actions to either repair any hardware problems or reload the system to resolve a transient problem.</p>

EMC PowerPath Multipath I/O Configurations

Protecting Applications and File Systems That Use Multipath Devices	<p>In order for LifeKeeper to configure and protect applications or file systems that use EMC PowerPath devices, the PowerPath recovery kit must be installed.</p> <p>Once the PowerPath kit is installed, simply creating an application hierarchy that uses one or more of the multipath device nodes will automatically incorporate the new resource types provided by the PowerPath kit.</p>
Multipath Device Nodes	<p>To use the PowerPath kit, any file systems and raw devices must be mounted or configured on the multipath device nodes (/dev/emcpower*), rather than on the native /dev/sd* device nodes.</p>
Use of SCSI-3 Persistent Reservations	<p>The PowerPath kit uses SCSI-3 persistent reservations, with a "Write Exclusive" reservation type. This means that devices reserved by one node in the cluster will remain read-accessible to other nodes in the cluster, but those other nodes will be unable to write to the device. Note that <u>this does not mean</u> that you can expect to be able to mount file systems on those other nodes for ongoing read-only access.</p> <p>LifeKeeper uses the sg_persist utility to issue and monitor persistent reservations. If necessary LifeKeeper will install the sg_persist(8) utility.</p>
Hardware Requirements	<p>The PowerPath kit has been tested and certified with the EMC CLARiiON CX300 disk array, using QLogic QLA2340 HBAs with the EMC-recommended qla2xxx driver, and using Emulex LP10000 HBAs with the EMC-recommended lpfc driver. The PowerPath kit has also been tested and certified with the EMC CLARiX CX3-20 using Qlogic QLA2340 HBAs.</p> <p>This kit is expected to work equally well with other CLARiiON models from EMC or models OEM'd from EMC by Dell or other vendors.</p>
Multipath Software Requirements	<p>The PowerPath kit v6.4.0-2 requires PowerPath for Linux v5.3</p> <p>The PowerPath kit versions prior to v6.4.0-2 requires PowerPath for Linux v4.4.x, v4.5.x, v5.0.x, or v5.1.x</p>
Linux Distribution Requirements	<p>The PowerPath kit is only supported on distributions based on 2.6 kernels.</p>
Migrating to the PowerPath v5.3 driver	<p>Option A</p> <ol style="list-style-type: none"> 1. Upgrade to the PowerPath 5.3 driver by doing the following: <ol style="list-style-type: none"> a) Remove the old PowerPath driver b) Install the PowerPath 5.3 driver 2. Upgrade PowerPath 6.4.0-2 kit 3. Reboot the server <p>Note: When the server reboots the PowerPath 6.4.0-2 kit will be used for the LifeKeeper PowerPath resources. If there is a problem with the PowerPath 5.3 driver and the older PowerPath driver needs to be used, this option will require re-installing the version of the PowerPath kit that was used before the installation of the v6.4.0-2 kit.</p>

Option B

1. Upgrade to the PowerPath 5.3 driver by doing the following:
 - a) Remove the old PowerPath driver
 - b) Install the PowerPath 5.3 driver
 - c) Reboot the server

2. Upgrade to the PowerPath 6.4.0-2 kit and do one of the following to start the PowerPath resources using the upgraded Recovery Kit:
 - a) Option 1: Take the PowerPath resources out-of-service and then back in-service.
 Note: This will require that all applications using the PowerPath devices to be stopped and then restarted. This option allows the actions to be done serially and perhaps at different times to avoid a lot of change.

 - b) Option 2: Stop LifeKeeper (lkstop) and start LifeKeeper (lkstart). This will take all resources out-of-service and then back in-service.
 Note: As in option A, it will stop all applications but this option requires less user intervention as two commands will ensure that all PowerPath resources are using the new kit.

 - c) Option 3: Stop LifeKeeper quickly (lkstop -f) and start LifeKeeper (lkstart).
 Note: This will leave the applications running while LifeKeeper reloads how it is accessing the storage. There will be no application down-time.

IBM SDD Multipath I/O Configurations

Protecting Applications and File Systems That Use Multipath Devices

In order for LifeKeeper to configure and protect applications or file systems that use IBM SDD devices, the SDD recovery kit must be installed.

Once the SDD kit is installed, simply creating an application hierarchy that uses one or more of the multipath device nodes will automatically incorporate the new resource types provided by the SDD kit.

Multipath Device Nodes

To use the SDD kit, any file systems and raw devices must be mounted or configured on the multipath device nodes (/dev/vpath*), rather than on the native /dev/sd* device nodes.

Use of SCSI-3 Persistent Reservations

The SDD kit uses SCSI-3 persistent reservations, with a "Write Exclusive" reservation type. This means that devices reserved by one node in the cluster will remain read-accessible to other nodes in the cluster, but those other nodes will be unable to write to the device. Note that this does not mean that you can expect to be able to mount file systems on those other nodes for ongoing read-only access.

LifeKeeper uses the sg_persist utility to issue and monitor persistent reservations. If necessary LifeKeeper will install the sg_persist(8) utility.

Hardware Requirements	The SDD kit has been tested and certified with IBM ESS, 6800 and 8100 disk arrays, and IBM SAN Volume Controller (SVC), using Qlogic QLA2340 HBAs and the IBM-recommended qla2xxx driver. The kit is expected to work equally well with other IBM disk arrays and HBA adapters (Emulex) that are supported by the SDD driver. The IBM-recommended HBA drivers must be used in all cases.
Multipath Software Requirements	The SDD kit requires the IBM SDD driver v1.6.0.1-8 or later.
Linux Distribution Requirements	The SDD kit is only supported on distributions based on 2.6 kernels.
Adding or Repairing SDD Paths	When LifeKeeper brings a SDD resource into service, it establishes a persistent reservation registered to each path that was active at that time. If new paths are added after the initial reservation, or if failed paths are repaired and SDD automatically reactivates them, those paths will not be registered as a part of the reservation until the next LifeKeeper quickCheck execution for the SDD resource. If SDD allows any writes to that path prior to that point in time, reservation conflicts occur that will be logged in both the sdd log file as well as the system message file. The SDD driver will retry this IO's on the registered path resulting in no observable failures to the application. Once quickCheck registers the path subsequent writes will be successful.

Hitachi Dynamic Link Manager Software Multipath I/O Configurations

Protecting Applications and File Systems That Use Multipath Devices	<p>In order for LifeKeeper to configure and protect applications or file systems that use HDLM devices, the HDLM recovery kit must be installed.</p> <p>Once the HDLM kit is installed, simply creating an application hierarchy that uses one or more of the multipath device nodes will automatically incorporate the new resource types provided by the HDLM kit.</p>
Multipath Device Nodes	To use the HDLM kit, any file systems and raw devices must be mounted or configured on the multipath device nodes (/dev/sddl*), rather than on the native /dev/sd* device nodes.
Use of SCSI-3 Persistent Reservations	<p>The HDLM kit uses SCSI-3 persistent reservations, with a "Write Exclusive" reservation type. This means that devices reserved by one node in the cluster will remain read-accessible to other nodes in the cluster, but those other nodes will be unable to write to the device. Note that <u>this does not mean</u> that you can expect to be able to mount file systems on those other nodes for ongoing read-only access.</p> <p>LifeKeeper uses the sg_persist utility to issue and monitor persistent reservations. If necessary LifeKeeper will install the sg_persist(8) utility.</p>
Hardware Requirements	The HDLM kit has been tested and certified with the Hitachi AMS500 disk array, using QLogic QLA2340 HBAs and default qla2xxx driver. This kit is expected to work equally well with other Hitachi disk arrays. The HDLM kit has also been tested and certified with the SANRISE AMS series and the SANRISE USP. The HBA and the HBA driver must be supported by HDLM.
Multipath Software Requirements	<p>The HDLM kit has been tested with HDLM for Linux 05-80, 05-81, 05-90, 05-91, 05-92, 05-93, 05-94, and 6.0.0. There are no known dependencies on the version of the HDLM package installed.</p> <p>Note: The product name changed to "Hitachi Dynamic Link Manager Software (HDLM)" for HDLM 6.0.0 and later. Versions older than 6.0.0 (05-9x) are named "Hitachi HiCommand Dynamic Link Manager (HDLM)".</p>

**Linux
Distribution
Requirements**

The HDLM kit is supported in the following distributions:

RHEL 4 (AS/ES) (x86 or x86_64) Update 1, 2, 3, 4, Update 4 Security Fix (*1), and Update 5, Update5 Security Fix (*2) , Update 6 and Update7.

(*1) the following kernels are supported with RHEL4 Update 4 Security Fix (x86 or X86_64): 2.6.9-42.0.3.EL, 2.6.9-42.0.3.ELsmp,

x86: 2.6.9-42.0.3.ELhugemem

x86_64: 2.6.9-42.0.3.ELlargesmp

(*2) the following kernels are supported with RHEL4 Update 5 Security Fix.

x86: 2.6.9-55.0.12.EL, 2.6.9-55.0.12.ELsmp, 2.6.9-55.0.12.ELhugemem

x86_64: 2.6.9-55.0.12.EL, 2.6.9-55.0.12.ELsmp, 2.6.9-55.0.12.ELlargesmp

RHEL 5(x86/x86_64) and Update1, Update1 Security Fix (*3), Update2 , Update2 Security Fix (*4).

(*3) the following kernels are supported with RHEL5 Update1 Security Fix

x86: 2.6.18-53.1.13.el5, 2.6.18-53.1.13.el5PAE, 2.6.18-53.1.21.el5, 2.6.18-53.1.21.el5PAE

x86_64: 2.6.18-53.1.13.el5, 2.6.18-53.1.21. el5

(*4) the following kernels are supported with RHEL5 Update2 Security Fix

x86: 2.6.18-92.1.6.el5, 2.6.18-92.1.6.el5PAE

x86_64: 2.6.18-92.1.6.el5

**Installation
Requirements**

HDLM software must be installed prior to installing the HDLM recovery kit. Also, customers wanting to transfer their environment from SCSI devices to HDLM devices must run the Installation Support setup script after configuring the HDLM environment. Otherwise, sg3_utils will not be installed.

**Adding or
Repairing HDLM
Paths**

When LifeKeeper brings a HDLM resource into service, it establishes a persistent reservation registered to each path that was active at that time. If new paths are added after the initial reservation, or if failed paths are repaired and HDLM automatically reactivates them, those paths will not be registered as a part of the reservation until the next LifeKeeper quickCheck execution for the HDLM resource. If HDLM allows any writes to that path prior to that point in time, reservation conflicts that occur will be logged to the system message file. The HDLM driver will retry these IO's on the registered path resulting in no observable failures to the application. Once quickCheck registers the path subsequent writes will be successful. The status will be changed to "Offline(E)" if quickCheck detects a reservation conflict. If the status is "Offline(E)", customers will need to manually change the status to "Online" using the online HDLM command.

		OS version / Architecture										
		RHEL4						RHEL5				
		U1~ U4	U4 Securit y Fix	4. 5	4.5 Securit y Fix	4. 6	4.7	No	5. 1	5.1 Securit y Fix	5. 2	5.2 Security Fix
								Updat e				
x86/x86_64												
HDLM	05-80,05-81,05-90	X										
	05-91,05-92	X	X									
	05-93	X*1	X	X				X				
	05-94	X*1	X	X	X	X		X	X			
	6.0.0	X*1	X	X	X	X	X	X	X	X	X	X
	6.0.1	X*1	X	X	X	X	X	X	X	X	X	X
	6.1.0	X*1	X	X	X	X	X	X	X	X	X	X
LifeKeeper	v6.0(v6.0.1-2 or later)	X	X	X	X	X						
	v6.1(v6.1.0-5 or later)	X	X	X	X	X		X	X			
	v6.2(v6.2.0-5 or later)	X	X	X	X	X		X	X			
	v6.2(v6.2.2-1 or later)	X	X	X	X	X		X	X	X		
	v6.3(v6.3.2-1 or later)	X	X	X	X	X		X	X	X	X	X
	v6.4(v6.4.0-10 or later)	X	X	X	X	X	X	X	X	X	X	X
HDLM ARK	6.0.1-2	X	X	X	X	X						
	6.1.0-4	X	X	X	X	X		X	X			
	6.2.2-3	X	X	X	X	X		X	X	X		
	6.2.3-1	X	X	X	X	X	X	X	X	X	X	X

X = supported
blank = not supported
*1 RHEL 4 Update 2 is not supported

Device Mapper Multipath I/O Configurations

Protecting Applications and File Systems That Use Device Mapper Multipath Devices	<p>In order for LifeKeeper to operate with and protect applications or file systems that use Device Mapper multipath devices, the Device Mapper Multipath (DMMP) Recovery Kit must be installed.</p> <p>Once the DMMP Kit is installed, simply creating an application hierarchy that uses one or more of the multipath device nodes will automatically incorporate the new resource types provided by the DMMP Kit.</p>
Multipath Device Nodes	<p>To use the DMMP Kit, any file systems and raw devices must be mounted or configured on the multipath device nodes rather than on the native /dev/sd* device nodes. The supported multipath device nodes to address the full disk are /dev/dm-#, /dev/mapper/<uuid>, /dev/mapper/<user_friendly_name> and /dev/mpath/<uuid>. To address the partitions of a disk, use the device nodes for each partition created in the /dev/mapper directory.</p>
Use of SCSI-3 Persistent Reservations	<p>The Device Mapper Multipath Recovery Kit uses SCSI-3 persistent reservations, with a "Write Exclusive" reservation type. This means that devices reserved by one node in the cluster will remain read-accessible to other nodes in the cluster, but those other nodes will be unable to write to the device. Note that <u>this does not mean</u> that you can expect to be able to mount file systems on those other nodes for ongoing read-only access.</p> <p>LifeKeeper uses the sg_persist utility to issue and monitor persistent reservations. If necessary LifeKeeper will install the sg_persist(8) utility.</p>
Hardware Requirements	<p>The Device Mapper Multipath Kit has been tested by SteelEye with the EMC CLARiiON CX300, the HP EVA 8000, HP MSA1500, the IBM SAN Volume Controller (SVC), the IBM DS8100, the IBM DS6800, the IBM ESS, the Datacore SANsymphony, and the HDS 9980V. Check with your storage vendor to determine their support for Device Mapper Multipath.</p> <p>Enabling support for the use of reservations on the CX300 requires that the hardware handler be notified to honor reservations. Set the following parameter in /etc/multipath.conf for this array:</p> <pre>hardware_handler "3 emc 0 1"</pre> <p>The HP MSA1500 returns a reservation conflict with the default path checker setting (tur). This will cause the standby node to mark all paths as failed. To avoid this condition set the following parameter in /etc/multipath.conf for this array:</p> <pre>path_checker readsector0</pre> <p>For the HDS 9980V the following settings are required:</p> <ul style="list-style-type: none"> • Host mode: 00 • System option: 254 (must be enabled; global HDS setting affecting all servers) • Device emulation: OPEN-V <p>Refer to the HDS documentation "Suse Linux Device Mapper Multipath for HDS Storage" or "RedHat Linux Device Mapper Multipath for HDS Storage" v1.15 or later for details on configuring DMMP for HDS. This documentation also provides a compatible multipath.conf file.</p> <p>For the EVA storage with firmware version 6 or higher, DMMP Recovery Kit v6.1.2-3 or later is required. Earlier versions of the DMMP Recovery Kit are supported with the EVA storage with firmware versions prior to version 6.</p>

Multipath Software Requirements

For SUSE, multipath-tools-0.4.5-0.14 or later is required.

For Red Hat, device-mapper-multipath-0.4.5-12.0.RHEL4 or later is required.

It is advised to run the latest set of multipath tools available from the vendor. The feature content and the stability of this multipath product are improving at a very fast rate.

Linux Distribution Requirements

The Device Mapper Multipath kit is only supported on distributions based on 2.6 kernels.

Transient path failures

While running IO tests on Device Mapper Multipath devices it is not uncommon for actions on the SAN, for example a server rebooting, to cause paths to temporarily be reported as failed. In most cases this will simply cause one path to fail leaving other paths to send IO's down resulting in no observable failures other than a small performance impact. In some cases multiple paths can be reported as failed leaving no paths working. This can cause an application, such as a file system or database, to see IO errors. There has been much improvement in Device Mapper Multipath and the vendor support to eliminate these failures. However, at times these can still be seen. To avoid these situations consider these actions:

1. Verify that the multipath configuration is set correctly per the instructions of the disk array vendor.
2. Check the setting of the "failback" feature. This feature determines how quickly a path is reactivated after failing and being repaired. A setting of "immediate" indicates to resume use of a path as soon as it comes back online. A setting of an integer indicates the number of seconds after a path comes back online to resume using it. A setting of 10 to 15 generally provides sufficient settle time to avoid thrashing on the SAN.
3. Check the setting of the "no_path_retry" feature. This feature determines what Device Mapper Multipath should do if all paths fail. We recommend a setting of 10 to 15. This allows some ability to "ride out" temporary events where all paths fail while still providing a reasonable recovery time. The LifeKeeper DMMP kit will monitor IO's to the storage and if they are not responded to within 4 minutes LifeKeeper will switch the resources to the standby server. NOTE: LifeKeeper does not recommend setting "no_path_retry" to "queue" since this will result in IO's that are not easily killed. The only mechanism found to kill them is on newer versions of DM the settings of the device can be changed:

```
/sbin/dmsetup message -u 'DMid' 0 fail_if_no_path
```

This will temporarily change the setting for no_path_retry to fail causing any outstanding IO's to fail. However multipathd can reset no_path_retry to the default at times. When the setting is changed to fail_if_no_path to flush failed IO's it should then be reset to its default prior to accessing the device (manually or via LifeKeeper).

If "no_path_retry" is set to "queue" and a failure occurs LifeKeeper will switch the resources over to the standby server. However, LifeKeeper will not kill these IO's. The recommended method to clear these IO's is through a reboot but can also be done by an administrator using the dmsetup command above. If the IO's are not cleared then data corruption can occur if/when the resources are taken out of service on the other server thereby releasing the locks and allowing the "old" IO's to be issued.

Linux Configuration

Item	Description
Operating System	The default operating system must be installed to ensure that all required packages are installed. The minimal operating system install does not contain all of the required packages and therefore cannot be used with LifeKeeper.
Kernel updates	In order to provide the highest level of availability for a LifeKeeper cluster, the kernel version used on a system is very important. The table below lists each supported distribution and version with the kernel that has passed LifeKeeper certification testing.

Distribution/Version	Supported kernels
Red Hat Enterprise Linux 3.0 for x86 (AS and ES)	2.4.21-4.0.2.EL 2.4.21-9.EL (Update 1) 2.4.21-9.0.1.EL 2.4.21-15.EL (Update 2) 2.4.21-20.EL (Update 3) 2.4.21-27.EL (Update 4) 2.4.21-32.EL (Update 5) 2.4.21-32.0.1.EL 2.4.21-37.EL (Update 6) 2.4.21-40.EL (Update 7) 2.4.21-47.EL (Update 8) 2.4.21-50.EL (Update 9)
Red Hat Enterprise Linux 3.0 for AMD64/Intel EM64T (AS and ES)	2.4.21-15.EL (Update 2) (AMD64 only) 2.4.21-20.EL (Update 3) 2.4.21-27.EL (Update 4) 2.4.21-32.EL (Update 5) 2.4.21-32.0.1.EL 2.4.21-37.EL (Update 6) 2.4.21-40.EL (Update 7) 2.4.21-47.EL (Update 8) 2.4.21-50.EL (Update 9)
Red Hat Enterprise Linux 4 for x86 and AMD64/EM64T (AS and ES)	2.6.9-5.EL (default kernel) 2.6.9-5.0.3.EL 2.6.9-11.EL (Update 1) 2.6.9-22.EL (Update 2) 2.6.9-34.EL (Update 3) 2.6.9-42.EL (Update 4) 2.6.9-55.EL (Update 5) 2.6.9-67.EL (Update 6) 2.6.9-78.EL (Update 7)
Red Hat Enterprise Linux 5 and Red Hat Enterprise Linux 5 Advanced Platform for x86 and AMD64/EM64T	2.6.18-8.el5 2.6.18-8.1.1.el5 (default kernel) 2.6.18-53.el5 (Update 1) 2.6.18-92.el5 (Update 2) 2.6.18-128.el5 (Update 3)
SUSE SLES 9 for x86 and x86_64	2.6.5-7.97 (default kernel) 2.6.5-7.139 (SP1) 2.6.5-7.151 2.6.5-7.191 (SP2) 2.6.5-7.244 (SP3) 2.6.5-7.308 (SP4)

- Item
- Description

SUSE SLES 10 for x86 and x86_64	2.6.16.21-0.8 (default kernel) 2.6.16.46-0.12 (SP1) 2.6.16.60-0.21 (SP2) 2.6.16.60-0.23
Asianux 2.0 for x86 and x86_64	2.6.9-11.19AX
VMware ESX Server v3.0	2.4.21-37.0.2.ELvminix
Citrix XenServer Express Edition, Standard Edition, Enterprise Edition, or Platinum Edition v5.0	2.6.18-92.1.10.el5.xs5.0.0.394.644
Oracle Enterprise Linux 4 for x86 and x86_64	2.6.9-55.0.0.0.2.EL (Update 5) 2.6.9-67.0.0.0.1.EL (Update 6) 2.6.9-78.0.0.0.1.EL (Update 7)
Oracle Enterprise Linux 5 for x86 and x86_64	2.6.18-8.el5 2.6.18-53.0.0.0.1.el5 (Update 1) 2.6.18-92.0.0.0.1.el5 (Update 2) 2.6.18-128.0.0.0.1.el5 (Update 3)
The Community ENTERprise Operating System (CentOS) 4.0 for x86 and x86_64	2.6.9-55.EL (Update 5) 2.6.9-67.EL (Update 6) 2.6.9-78.EL (Update 7)
The Community ENTERprise Operating System (CentOS) 5.0 for x86 and x86_64	2.6.18-8.el5 2.6.18-53.el5 (Update 1) 2.6.18-92.1.10.el5 (Update 2)

Note: This list of supported distributions and kernels is for LifeKeeper only. You should also determine and adhere to the supported distributions and kernels for your server and storage hardware, as specified by the manufacturer.

Dynamic device addition

All devices should be powered on and ready during the loading of the Linux Operating System. Configuring devices after the system is loaded can cause devices to change their identity (e.g. move from being `/dev/sdc` to `/dev/sdf`) and Linux has a limit to the number of devices that can be dynamically or hot added. The 2.2 series of kernels has the limit set to 4 while the 2.4 series of kernel has the limit set to 40. The specific limit is defined in the kernel file `/usr/src/linux/drivers/scsi/hosts.h` in the `#define EXTRA_DEVS`. To increase the limit on 2.2 kernels, `hosts.h` must be manually edited to increase the define. To increase the limit on 2.4 kernels use `make config` to update a selection in the SCSI module called "Maximum number of SCSI disks that can be loaded as modules". **Note:** This issue does not apply to 2.6 kernels as they dynamically allocate the device structures.

Prior to LifeKeeper startup Linux must configure all devices. If a LifeKeeper protected device is configured after LifeKeeper is started then LifeKeeper must be stopped on each server that shares the device and restarted. This will enable the device detection and validation to confirm the configuration and enable LifeKeeper to access the device.

Refer to the **SCSI device nodes** topic below concerning issues that will occur when more than 8 SCSI devices are configured on a system.

Also refer to the **LUN support** topic below, which describes a common reason that devices are not configured during boot up.

• Item	• Description
SCSI device nodes	<p>Most Linux 2.2 and 2.4 based distributions only configure 8 SCSI generic nodes (/dev/sg0 through /dev/sg7 linked to /dev/sga through /dev/sgh) and 16 SCSI disk nodes (/dev/sda through /dev/sdp). Virtually all LifeKeeper configurations will exceed these limits. Without the proper number of nodes created on a system, devices will not be accessible or configured. Note: This is not an issue for distributions based on the 2.6 kernel as they dynamically allocate device nodes during device discovery.</p> <p>SCSI disk nodes: There needs to be a SCSI disk node (/dev/sd) for each disk to be accessed by a system. Each partition on a disk (/dev/sdp) and each LUN will also need its own disk node. Use mknod or the “setup” script on the Installation Support CD to create the appropriate number of nodes to address each disk, partition, and LUN.</p> <p>Generic nodes: LifeKeeper uses the Generic device nodes to configure and protect each disk/LUN. The generic driver addresses every SCSI device connected to a system whether it is a disk, tape, CDROM, disk array, etc. This means the SCSI generic driver must be compiled as a module or into the kernel and there should be enough generic nodes for every SCSI device connected to a system. Using the file <i>/proc/scsi/scsi</i>, verify that there are sufficient generic nodes. If there are a total of 20 unique devices listed in <i>/proc/scsi/scsi</i> then there should be at least 20 generic nodes. Use mknod or the “setup” script on the Installation Support CD to create the appropriate nodes.</p> <p>Note: The “setup” script on the LifeKeeper Installation Support CD will automatically create SCSI disk nodes up to /dev/sdaz and generic nodes up to /dev/sg255.</p>

• Item	• Description
LUN support	<p>The Linux SCSI driver has several parameters that control which devices will be probed for Logical Units (LUNs):</p> <ul style="list-style-type: none"> • List of devices that do not support LUNs – this list of devices are known to NOT support LUNs so the SCSI driver will not allow the probing of these devices for LUNs. • List of devices that do support LUNs – this list of devices is known to support LUNs well so always probe for LUNs. • Probe all LUNs on each SCSI device – if a device is not found on either list whether to probe or not. This parameter is configured by make config in the SCSI module section. <p>While most distributions (including SUSE) have the Probe all LUNs setting enabled by default, Red Hat has the setting disabled by default. External RAID controllers that are typically used in LifeKeeper configurations to protect data are frequently configured with multiple LUNs (Logical Units). To enable LUN support, this field must be selected and the kernel remade.</p> <p>To enable Probe all LUNs without rebuilding the kernel or modules set the variable <code>max_scsi_luns</code> to 255 (which will cause the scan for up to 255 LUNs). To set the <code>max_scsi_luns</code> on a kernel where the scsi driver is a module (e.g. Red Hat), add the following entry to <code>/etc/modules.conf</code>, rebuild the initial ramdisk and reboot loading that ramdisk:</p> <pre>options scsi_mod max_scsi_luns=255</pre> <p>To set the <code>max_scsi_luns</code> on a kernel where the scsi driver is compiled into the kernel (e.g. SUSE), add the following entry to <code>/etc/lilo.conf</code>:</p> <pre>append="max_scsi_luns=255"</pre> <p>Note: For some devices, scanning for 255 LUNs can have an adverse effect on boot performance (in particular devices with the <code>BLIST_SPARSELUN</code> defined). The Dell PV650F is an array where this has been experienced. To avoid this performance problem, set the <code>max_scsi_luns</code> to the maximum number of LUNs you have configured on your arrays such as 16 or 32. For example,</p> <pre>append="max_scsi_luns=16"</pre>
libstdc++ library requirement	<p>While running the LifeKeeper Installation Support CD setup script, you may encounter a message regarding a failed dependency requirement for a <code>libstdc++</code> library. This library is provided in one of several <code>compat-libstdc++</code> rpm packages, depending on the hardware platform and Linux distribution you are running. Even on 64-bit systems, LifeKeeper requires the use of the 32-bit architecture package, rather than the 64-bit version (<code>x86_64</code>) and will fail to start due to a missing required library if the 64-bit architecture version is installed.</p> <p>To avoid (or resolve) this problem, install the 32-bit architecture version of the <code>compat-libstdc++</code> package found on the OS installation media and run (or re-run) the I/S CD setup script. Note that some distributions also carry more than one 32-bit version of this package (e.g. <code>compat-libstdc++-296-2.96-132.7.2</code> and <code>compat-libstdc++-33-3.2.3-47.3</code>). In this situation, simply install both versions to ensure that the required library is installed.</p>
libXp and libXt library requirements	<p>Similar to the item above, you may also encounter installation messages regarding failed dependency requirements for the <code>libXp</code> and <code>libXt</code> libraries. LifeKeeper requires the 32-bit versions of these libraries, even on 64-bit platforms. On RHEL 3.0 both libraries can be found in the 32-bit version of the <code>XFree86-libs-4.3.0-68.EL</code> package. On RHEL 4.0 the 32-bit <code>libXp</code> can be found in <code>xorg-x11-deprecated-libs</code> and the 32-bit <code>libXt</code> can be found in <code>xorg-x11-libs</code>.</p>
Running yum update after LifeKeeper is installed	<p>When running <code>yum update</code>, you may encounter an error: <code>ksh</code> conflicts with <code>pdksh</code>. To resolve this problem, remove the <code>pdksh</code> rpm, run <code>yum update</code>, and then re-install <code>pdksh</code> from the LifeKeeper Installation Support CD image.</p>

Data Replication Configuration

Item	Description																								
Red Hat mdmonitor service	<p>In Red Hat Enterprise Linux 3.0 and Red Hat Linux 9.0, the mdmonitor service included in the mdadm packages earlier than version 1.5.0-9 will prevent LKDR resources from being taken out of service.</p> <p>Workaround:</p> <p>Upgrade the mdadm package to version 1.5.0-9 or later, or disable the mdmonitor service using the following procedure.</p> <ol style="list-style-type: none"> 1. Stop any currently running mdmonitor service: <pre># service mdmonitor stop</pre> 2. Unconfigure the automatic startup of the mdmonitor service for future system boots: <pre># chkconfig mdmonitor off</pre> 																								
SDR Feature/ Distribution Matrix	<p>LKDR Version 4 supports Linux kernel versions 2.4 and lower. SDR Version 6 supports Linux kernel versions 2.6 and higher. Several SDR 6 features have additional minimum kernel requirements.</p> <p>The table below lists each SDR feature with an "X" indicating which Linux distributions the feature is supported on.</p> <table border="1"> <thead> <tr> <th rowspan="2">SDR 6 Feature</th> <th colspan="2">Red Hat</th> <th colspan="2">SUSE</th> </tr> <tr> <th>RHEL 4</th> <th>RHEL 5</th> <th>SLES 9</th> <th>SLES 10</th> </tr> </thead> <tbody> <tr> <td>Multiple Target Support (kernel 2.6.7+)</td> <td>X</td> <td>X</td> <td></td> <td>X</td> </tr> <tr> <td>Bitmap Intent Logging (kernel 2.6.16+)</td> <td></td> <td>X</td> <td></td> <td>X</td> </tr> <tr> <td>Asynchronous (WAN) Replication (kernel 2.6.16+)</td> <td></td> <td>X</td> <td></td> <td>X</td> </tr> </tbody> </table>	SDR 6 Feature	Red Hat		SUSE		RHEL 4	RHEL 5	SLES 9	SLES 10	Multiple Target Support (kernel 2.6.7+)	X	X		X	Bitmap Intent Logging (kernel 2.6.16+)		X		X	Asynchronous (WAN) Replication (kernel 2.6.16+)		X		X
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SDR and LKDR documentation	<p>The Administration Guides for both Data Replication products are located on the SteelEye Technology, Inc. website, http://licensing.steeleye.com/documentation/. Please take care to select the appropriate document, based on the following guide:</p> <ul style="list-style-type: none"> • SDR.pdf - SteelEye Data Replication v6 Administration Guide • LKDRv4.pdf - LifeKeeper Data Replication v4 Administration Guide 																								

Network Configuration

Item	Description
IP Recovery Kit impact on routing table	<p>LifeKeeper-protected IP addresses are implemented on Linux as logical interfaces. When a logical interface is configured on Linux, a route to the subnet associated with the logical interface is automatically added to the routing table, even if a route to that subnet already exists (for example, through the physical interface). This additional route to the subnet could possibly result in multiple routing-table entries to the same subnet.</p> <p>If an application is inspecting and attempting to verify the address from which incoming connections are made, the multiple routing-table entries could cause problems for such applications on other systems (non-LifeKeeper installed) to which the LifeKeeper system may be connecting. The multiple routing table entries can make it appear that the connection was made from the IP address associated with the logical interface - rather than the physical interface.</p>
IP subnet mask	<p>For IP configurations under LifeKeeper protection, if the LifeKeeper-protected IP address is intended to be on the same subnet as the IP address of the physical interface on which it is aliased, the subnet mask of the two addresses must be the same. Incorrect settings of the subnet mask may result in connection delays and failures between the LifeKeeper GUI client and server.</p>
EEpro100 driver initialization	<p>The Intel e100 driver should be installed to resolve initialization problems with the eepr100 driver on systems with Intel Ethernet Interfaces. With the eepr100 driver, the following errors may occur when the interface is started at boot time, and repeat continuously until the interface is shut down.</p> <pre>eth0: card reports no Rx buffers eth0: card reports no resources</pre>

Application Configuration

Item **Description**

Supported SAP configurations The following table shows the combinations of SAP versions, distribution/kernel versions, and database options that are currently supported by LifeKeeper.

SAP Version	Red Hat		SUSE	
	RHEL 3.0	RHEL 4	SLES 9	SLES 10
4.7 (Web AS 6.20)	Oracle 9i DB2 v8.2	Oracle 9i DB2 v8.2	Oracle 9i DB2 v8.1 MaxDB 7.5	
NetWeaver '04 (Web AS 6.40)	Oracle 9i DB2 v8.2	Oracle 9i DB2 v8.2	Oracle 9i DB2 v8.1 MaxDB 7.5	
NetWeaver 2004s (Web AS 7.00)			Oracle 10g	Oracle 10g MaxDB 7.6

Application memory requirements

Contact your SteelEye sales representative regarding the availability of support for SAP configurations other than those listed.

On 2.4 kernels a server may hang if swap is in use frequently when the application is running. This is particularly a problem with Oracle because of its large memory usage. To work around this problem, additional memory can be added to avoid continuous swapping.

Database memory requirements

Based on testing by SteelEye Technology Inc., the minimum memory recommended for Oracle 9i and Oracle 10g is 512 MB.

Database support with glibc 2.2

Informix Dynamic Server 9.2 also uses glibc 2.1. Informix Dynamic Server 9.2.1 or later is required on distributions that use glibc 2.2.

Database initialization files

The initialization files for databases need to be either on a shared device and symbolically linked to specified locations in the local file system or kept on separate systems and manually updated on both systems when changes need to be implemented.

Localized Oracle mount points

Localized Oracle environments are different depending on whether you connect as *internal* or as *sysdba*. A database on a localized mount point must be created with "connect / as sysdba" if it is to be put under LifeKeeper protection.

Sendmail updates

Upgrading a LifeKeeper protected Sendmail application as part of upgrading the Linux operating system requires special instructions. LifeKeeper protected Sendmail hierarchies must be unextended before upgrading the Linux operating system. If symbolic links are used for the message queue (*/var/spool/mqueue*), and the receiving directory (*/var/spool/mail*), the operating system upgrade removes these links. They will need to be recreated after upgrade is completed.

Item	Description
Apache updates	<p>Upgrading a LifeKeeper protected Apache application as part of upgrading the Linux operating system requires that the default server instance be disabled on start up.</p> <p>If your configuration file (<i>httpd.conf</i>) is in the default directory (<i>/etc/httpd/conf</i>), the Red Hat upgrade will overwrite the config file. Therefore, you should make a copy of the file before upgrading and restore the file after upgrading.</p> <p>Also, see the Specific Configuration Considerations for Apache Web Server section in the <i>Apache Web Server Recovery Kit Administration Guide</i>.</p>

GUI Configuration

Item	Description
GUI client and server communication	The LifeKeeper GUI client and server use Java Remote Method Invocation (RMI) to communicate. For RMI to work correctly, the client and server must use resolvable hostnames or IP addresses. If DNS is not implemented (or names are not resolvable using other name lookup mechanisms), edit the <code>/etc/hosts</code> file on each client and server, to include the names and addresses of all other LifeKeeper servers.
GUI Server Java platform	<p>The LifeKeeper GUI server requires that the Java Runtime Environment (JRE) - Java virtual machine, the Java platform core classes, and supporting files - be installed. The JRE 5.0 for Linux is available on the LifeKeeper for Linux Installation Support CD (See the <i>LifeKeeper Planning and Installation Guide</i>) or it can be downloaded directly from http://java.sun.com/javase/downloads/index_jdk5.jsp.</p> <p>Note: By default, the LifeKeeper GUI server expects the JRE on each server to be installed in the directory <code>/usr/java/j2re1.5.0_07</code>. If this is not found, it will look in the directory <code>/usr/java/j2sdk1.5.0_07</code> for a Java Software Development Kit (JDK). If you want to use a JRE or JDK in another directory location, you must edit the PATH in the LifeKeeper default file <code>/etc/default/LifeKeeper</code> to include the directory containing the java interpreter, <code>java.exe</code>. If LifeKeeper is running when you edit this file, you should stop and restart the LifeKeeper GUI server to recognize the change. Otherwise, the LifeKeeper GUI will not be able to find the Java command.</p>
Java remote object registry server port	The LifeKeeper GUI server uses port 82 for the Java remote object registry on each LifeKeeper server. This should allow servers to support RMI calls from clients behind typical firewalls.
LifeKeeper administration web server	The LifeKeeper GUI server requires an administration web server for client browser communication. Currently, the LifeKeeper GUI server is using a public domain web server, <i>mhttpd</i> , for its administration web server. The installation of the LifeKeeper GUI installs and configures this web server, using port 81, which should be different from any public web server.
GUI client network access	LifeKeeper GUI clients require network access to all hosts in the LifeKeeper cluster. When running the LifeKeeper GUI client in a browser, you will have to lower the security level to allow network access for applets. Be careful not to visit other sites with security set to low values (e.g., change the security settings only for intranet or trusted sites).

GUI Limitations

Item	Description
Legacy GUI client incompatibility during upgrade	<p>With LifeKeeper GUI v5.2.0 or later, the GUI server is not compatible with LifeKeeper GUI clients prior to v5.2.0, because of security enhancements used to implement the roles. Earlier versions of the GUI client will be unable to connect to LifeKeeper GUI server v5.2.0 or later. Version 5.2.0 or later GUI clients are able to connect to server versions prior to v5.2.0, although these earlier servers will not be able to support non-administrative user roles until they are upgraded.</p> <p>Keep this in mind during rolling upgrades, where resources are moved in and out of service from one server to the next in order to minimize application down time. During rolling upgrades all the versions of the LifeKeeper GUI in a cluster are not the same until the upgrade of the each server in the cluster is complete. If you are doing a rolling upgrade to LifeKeeper version 5.2.0 or later, always run the GUI client from one of the servers that has already been upgraded.</p>
GUI interoperability restriction	<p>The LifeKeeper for Linux client may only be used to administer LifeKeeper on Linux servers. The LifeKeeper for Linux GUI will <i>not</i> interoperate with LifeKeeper for Windows.</p>

Restrictions or Known Issues

Included below are the restrictions or known issues open against LifeKeeper for Linux, broken down by functional area.

Installation

ID	Description
Iklin000418	<p>Installation error: lktest command not found</p> <p>When using kpackage or GnoRPM, the following error occurs if a Recovery Kit installation script references the lktest command before it has been installed by LifeKeeper.</p> <p>Error: /var/tmp/rpm-tmp.65502: lktest: command not found</p> <p>Workaround: Install LifeKeeper first, and then go back and install any Recovery Kits (i.e. do not perform a “batch” install). You may also use the install tool option that orders package installation based on dependencies.</p>
Iklin00000504	<p>Errors on removal of a relocated LifeKeeper core package</p> <p>With rpm versions later than rpm-3.0.3, removal of a relocated LifeKeeper core package and relocated distribution enabling packages fails to remove all directories. This is due to a problem with using the <code>--prefix</code> option to install with rpm-3.0.4 and 4.0.4 which causes an extra directory to be created one level above the relocation path.</p> <p>Workaround: Relocate these packages using <code>rpm --relocate</code> with the <code>--badreloc</code> option, or remove the directories associated with these packages manually.</p>
Iklin00001458	<p>Package check errors (rpm -V steeleye-lk) will occur on the core when installed on SUSE. The following errors will occur:</p> <p>Because of the way SUSE runs shutdown scripts (vs other Linux distributions), the following scripts are moved to another location after installation, so LifeKeeper will be shutdown when changing run levels or rebooting. These should be the only errors that occur when verifying the steeleye-lk package.</p> <p>Missing /etc/rc.d/rc0.d/K01lifekeeper Missing /etc/rc.d/rc1.d/K01lifekeeper Missing /etc/rc.d/rc6.d/K01lifekeeper</p>
Iklin00003687	<p>rpm -V command on Asianux 2.0 fails with some of the LifeKeeper Recovery Kits</p> <p>This problem is specific to Asianux 2.0 and appears to be related to the zero-length size of the .PARALLEL files. The kits include Oracle, DB2, SAP DB, and PostgreSQL. The failure message when <code>rpm -V</code> is run is:</p> <p>..?..... /opt/LifeKeeper/subsys/database/resources/db2/.PARALLEL</p>

LifeKeeper Core

ID	Description
Iklin00002100	<p>Language Environment Effects</p> <p>Some LifeKeeper scripts parse the output of Linux system utilities, and rely on certain patterns in order to extract information. When some of these commands run under non-English locales, the expected patterns are altered, and LifeKeeper scripts fail to retrieve the needed information. For this reason, the language environment variable LC_MESSAGES has been set to the POSIX "C" locale (LC_MESSAGES=C) in <i>/etc/default/LifeKeeper</i>. It is not necessary to install Linux with the language set to English (any language variant available with your installation media may be chosen); the setting of LC_MESSAGES in <i>/etc/default/LifeKeeper</i> will only influence LifeKeeper. If you change the value of LC_MESSAGES in <i>/etc/default/LifeKeeper</i>, be aware that it may adversely affect the way LifeKeeper operates. The side effects depend on whether or not message catalogs are installed for various languages and utilities, and if they produce text output that LifeKeeper doesn't expect.</p>
Iklin00003457	<p>ulimit package from SLES 9 CD 4 causes LifeKeeper LCD to crash</p> <p>If the file, <i>/etc/initscript</i>, which is delivered by the ulimit package is installed, the LifeKeeper LCD will crash. On SLES 9 this file is located on CD 4 in the noarch directory. If this package is installed, LifeKeeper currently will not work correctly.</p> <p>This ulimit package problem has been reported to SUSE (bug 49636).</p>
Iklin00003665	<p>During a SLES9 SP2 upgrade, Yast2 falsely detects a ksh dependency problem when a ksh based LK kit is installed</p> <p>This Yast2 problem has been reported to SUSE (bug 116191).</p>
Iklin00003765	<p>File system labels should not be used in large configurations</p> <p>The use of file system labels can cause performance problems during boot-up with large clusters. The problems are generally the result of the requirement that to use labels all devices connected to a system must be scanned. For systems connected to a SAN, especially those with LifeKeeper where accessing a device is blocked, this scanning can be very slow.</p> <p>To avoid this performance problem on Red Hat systems edit <i>/etc/fstab</i> and replace the labels with the path names. For SUSE systems that support labels (SLES 9 SP2) edit <i>/etc/sysconfig/boot</i> and change DISABLE_BLKID from "no" to "yes".</p>
Iklin00003994	<p>Cannot break reservation on QLogic driver (qla2xxx) running SUSE SLES 10 or SLES 9 SP4</p> <p>Failover does not work on a SUSE SLES 10 system using the QLogic driver (qla2xxx). On x86 boxes running SLES 10 with the stock QLogic driver, a failover does not work since we cannot break the reservation. It appears the qla2xxx driver delivered on SLES 10 will only issue a reset if there is a hung IO. NOTE: The qla2xxx driver delivered on SLES 10 SP1 corrects the problem.</p> <p>On SLES9 SP4 sometimes the qlongicfc driver is loaded by default instead of the qla2xxx driver. LifeKeeper does not support the qlongicfc driver. The qla2xxx driver must be loaded when using LifeKeeper.</p>

ID	Description
Iklin00004221	<p>CCISS device checking thread hung errors with the HP MSA 500</p> <p>Customers are seeing a problem with the HP MSA 500 with LifeKeeper. LifeKeeper is waiting on an I/O from the MSA 500 controller (via the cciss driver) and it is never received. Device checking thread hung errors are logged in the LifeKeeper log and LifeKeeper successfully fails the resources over to the backup server.</p>
Iklin00004361	<p>Syntax errors can occur with gen/app resources</p> <p>When the steeleye-lkGUI package is upgraded without upgrading the core a syntax error can occur with gen/app resources. The steeleye-lkGUI package contains updates to the gen/app GUI components that require the same version or later version of the core.</p> <p>NOTE: When upgrading LifeKeeper, both the GUI and the core packages should be upgraded to the latest versions. When the core is upgraded in conjunction with the GUI package no errors should occur.</p>
Iklin00004392	<p>Shutdown hangs on SLES10 systems</p> <p>When running shutdown on an Opteron system with SLES10 the system locks up and the shutdown does not complete. This has been reported to Novell via bug #294787. The lockup appears to be caused by the SLES10 powersave package.</p> <p>Workaround: remove the SLES10 powersave package to enable shutdown to complete successfully.</p>

GUI

ID	Description
Iklin00004276	<p>GUI login prompt may not re-appear when reconnecting via a web browser after exiting the GUI</p> <p>When you exit or disconnect from the GUI applet and then try to reconnect from the same web browser session, the login prompt may not appear.</p> <p>Workaround: Close the web browser, re-open the browser, and then connect to the server. When using the Firefox browser, close all Firefox windows and re-open.</p>
Iklin00004181	<p>IkGUIapp on RHEL5 reports unsupported theme errors</p> <p>When you start the GUI application client, you may see the following console message. This message comes from the RHEL 5 and FC6 Java platform look and feel, and will not adversely affect the behavior of the GUI client.</p> <p>/usr/share/themes/Clearlooks/gtk-2.0/gtkrc:60: Engine "clearlooks" is unsupported, ignoring</p>
Iklin00002316	<p>Selecting help -> contents on ML produces error about java40.jar</p> <p>When selecting help->contents from the GUI on MiracleLinux 2.0 produces the following error:</p> <p>Unable to start a java applet: Can't find 'java40.jar' in your CLASSPATH. Read your release notes and install 'java40.jar' properly before restarting.</p> <p>Workaround: In -s /usr/lib/netscape /usr/local/netscape</p>

ID	Description
Iklin00000477	<p>GUI does not immediately update IP resource state after network is disconnected and then reconnected.</p> <p>When the primary network between servers in a cluster is disconnected and then reconnected, the IP resource state on a remote GUI client may take as long as 1 minute and 25 seconds to be updated, due to a problem in the RMI/TCP layer.</p>
Iklin00003682	<p>LifeKeeper GUI does not always recognize text from keyboard</p> <p>When running with Asianux 2.0 and the default Java installed with LifeKeeper (j2re-1.4.2_04-fcs), there is an intermittent problem where keystrokes from the keyboard are not accepted.</p> <p>Workaround: Modify the PATH environment variable (in /etc/default/LifeKeeper) to specify the Java 1.5 path location prior to the Java 1.4.2 path location.</p>

Data Replication

ID	Description
Iklin00001536	<p>In symmetric active LKDR configurations with significant I/O traffic on both servers, the filesystem mounted on the netraid device (mirror) stops responding and eventually the whole system hangs.</p> <p>Due to the single threaded nature of the Linux buffer cache, the buffer cache flushing daemon can hang trying to flush out a buffer which needs to be committed remotely. While the flushing daemon is hung, all activities in the Linux system with dirty buffers will stop if the number of dirty buffers goes over the system accepted limit (set in /proc/sys/kernel/vm/bdflush).</p> <p>Usually this is not a serious problem unless something happens to prevent the remote system from clearing remote buffers (e.g. a network failure). LifeKeeper will detect a network failure and stop replication in that event, thus clearing a hang condition. However, if the remote system is also replicating to the local system (i.e. they are both symmetrically replicating to each other), they can deadlock forever if they both get into this flushing daemon hang situation.</p> <p>The deadlock can be released by manually killing the nbd-client daemons on both systems (which will break the mirrors). To avoid this potential deadlock entirely, however, symmetric active replication is not recommended.</p>

ID	Description
Iklin00003970	<p>Due to an issue in the SUSE SLES 10 2.6.16.21-0.8 kernel, write barriers can cause the replication (nbd) connection to break momentarily on SDR devices configured for asynchronous (WAN) replication.</p> <p>This problem is mainly cosmetic, as the recovery kit will re-establish the connection after a few seconds. However, we recommend that write barriers be disabled on all filesystems mounted on SDR devices.</p> <p>To disable barriers, mount the filesystem with these options: ext3: -o barrier=0 reiserfs: -o barrier=none (other filesystems either do not use barriers or will disable barriers automatically when mounted on an SDR device).</p> <p>Note: If you create an SDR resource using the “Replicate Existing Filesystem” or “New Replicated Filesystem” option in the LifeKeeper GUI, barriers will be disabled automatically. You should not need to disable barriers unless you have created a filesystem on an SDR device manually, outside of LifeKeeper.</p>
Iklin00004972	<p>res_state does not show proper state on SLES 10 SP2 system.</p> <p>This issue is due to a SLES 10 SP2 kernel bug and has been fixed in update kernel version 2.6.16.60-0.23. On SLES 10 SP2, the netstat is broken due to a new format in /proc/<PID>/fd.</p> <p>Solution: Please upgrade kernel version 2.6.16.60-0.23 if running on SLES 10 SP2.</p>

Oracle Recovery Kit

ID	Description
Iklin00000819	<p>The Oracle Recovery Kit does not include support for Connection Manager and Oracle Names features.</p> <p>The LifeKeeper Oracle Recovery Kit does not include support for the following Oracle Net features of Oracle: Oracle Connection Manager, a routing process that manages a large number of connections that need to access the same service; and Oracle Names, the Oracle-specific name service that maintains a central store of service addresses.</p> <p>The LifeKeeper Oracle Recovery Kit does protect the Oracle Net Listener process that listens for incoming client connection requests and manages traffic to the server. Refer to the <i>LifeKeeper for Linux Oracle Recovery Kit Administration Guide</i> for LifeKeeper configuration specific information regarding the Oracle Listener.</p>
Iklin00003290 Iklin00003323	<p>The Oracle Recovery Kit does not support the ASM or grid component features of Oracle 10g.</p> <p>The following information applies to Oracle 10g database instances only. The Oracle Automatic Storage Manager (ASM) feature provided in Oracle 10g is not currently supported with LifeKeeper. In addition, the grid components of 10g are not protected by the LifeKeeper Oracle Recovery Kit. Support for raw devices, file systems, and logical volumes are included in the current LifeKeeper for Linux Oracle Recovery Kit. The support for the grid components can be added to LifeKeeper protection using the gen/app recovery kit.</p>

NFS Server Recovery Kit

ID	Description
Iklin00000989	<p>Removing an NFS resource hierarchy does not remove the dependent file system.</p> <p>This is not consistent with other LifeKeeper Recovery Kits that remove the dependent resource when removing the application resource hierarchy.</p>
Iklin00001123	<p>Top level NFS resource hierarchy uses the switchback type of the hanfs resource.</p> <p>The switchback type which dictates whether the NFS resource hierarchy will automatically switch back to the primary server when it comes back into service after a failure, is defined by the hanfs resource.</p>
Iklin00003414	<p>Bug in SUSE SLES 9 kernel's fsid file handle implementation requires device nodes to be static</p> <p>On switchover or failover on SUSE SLES 9 systems, if the device node underlying an NFS exported file system is not the same device node as when the file system was originally NFS mounted by the client, stale file handle errors occur. If the device nodes are the same on both systems, everything is fine.</p> <p>This problem is due to a bug in the early 2.6 kernels that causes the "fsid=" export option to be ignored.</p> <p>Note: This applies only to the SUSE SLES 9 base kernel, 2.6.5-7.97. The problem has been fixed in the SUSE SLES 9 SP1 kernel.</p> <p>Workaround: Configure your systems such that the device nodes on which the NFS shares are mounted are the same across all systems, or upgrade to the SUSE SLES 9 SP1 kernel or later.</p>
Iklin00003427	<p>Some clients are unable to reacquire nfs file locks</p> <p>When acting as NFS clients, some Linux kernels do not respond correctly to notifications from an NFS server that an NFS lock has been dropped and needs to be reacquired. As a result, when these systems are the clients of an NFS file share that is protected by LifeKeeper, the NFS locks held by these clients are lost during a failover or switchover.</p> <p>The following kernel versions are known to work properly in this regard:</p> <ul style="list-style-type: none"> • RHEL 3.0, 2.4.21-15.EL and higher • Asianux 1.0, 2.4.21-9.27AX and higher <p>The base and SP1 kernels for SLES 9 do not work properly in this regard, but a fix for this problem is expected in an upcoming release of SLES 9. Current RHEL 4.0 clients also do not reacquire NFS locks properly; a prognosis for a fix is unknown at this time.</p>
Iklin00003988	<p>NFS ARK does not support NFS V4</p> <p>SLES 10 now provides NFS V4 support by default but the LifeKeeper for Linux NFS ARK does not support V4. The current recommendation is for SLES 10 servers to run with NFS V3 as well as any clients that connect to these servers.</p>

SAP Recovery Kit

ID	Description
Iklin00002532	<p>Failed delete or unextend of a SAP hierarchy.</p> <p>Deleting or unextending a SAP hierarchy that contains the same IP resource in multiple locations within the hierarchy can sometimes cause a core dump that results in resources not being deleted.</p> <p>To correct the problem, after the failed unextend or delete operation, manually remove any remaining resources using the LifeKeeper GUI. You may also want to remove the core file from the server.</p>

LVM Recovery Kit

ID	Description
Iklin00003844	<p>Use of IkID incompatible with LVM pvcreate on entire disk.</p> <p>When IkID is used to generate unique disk IDs on disks that are configured as LVM physical volumes, there is a conflict in the locations in which the IkID and LVM information is stored on the disk. This causes either the IkID or LVM information to be overwritten, depending on the order in which IkID and pvcreate are used.</p> <p>Workaround: When it is necessary to use IkID in conjunction with LVM, partition the disk and use the disk partition(s) as the LVM physical volume(s), rather than the entire disk.</p>

DMMP Recovery Kit

ID	Description
Iklin00004530	<p>DMMP: write issued on standby server can hang.</p> <p>If a write is issued to a DMMP device that is reserved on another server then the IO can hang indefinitely (or until the device is no longer reserved on the other server). If/when the device is released on the other server and the write is issued this can cause data corruption.</p> <p>The problem is due to the way the path checking is done along with the IO retries in DMMP. When "no_path_retry" is set to 0 (fail) this hang will not occur. When the path_checker for a device fails when the path is reserved by another server (MSA1000) then this also will not occur.</p> <p>Workaround: Set "no_path_retry" to 0 (fail). However, this can cause IO failures due to transient path failures.</p>
Iklin00005006	<p>Protecting a DMMP partition is not supported with DMMP with SLES9.</p> <p>When using the DMMP Recovery Kit in a SLES 9 environment, you must either protect the entire disk or use LVM on top of the entire disk. Protecting a partition on the disk is not supported.</p>

Citrix XenServer

ID	Description
Iklin00004663	LifeKeeper GUI application (lkGUIapp) doesn't run on a XenServer host XenServer doesn't include any of the X shared libraries, so nothing X Windows related is going to run on XenServer. Workaround: Use a browser to run the LifeKeeper GUI as an applet.
Iklin00004847	XEN host (dom0) failure causes very poor gui performance When connected to a XEN host via the LifeKeeper GUI applet through a web browser the performance of the GUI is extremely slow if one of the nodes in the cluster fails. Workaround: Close the browser session and restart the LifeKeeper GUI applet in another browser session.

PostgreSQL Recovery Kit

ID	Description
Iklin00004972	<p data-bbox="500 436 1273 491">On SLES 10 SP2 the PostgreSQL resource hierarchy fails with error the database is not running or has experienced a dbfail event.</p> <p data-bbox="500 527 1281 638">This issue is due to a SLES 10 SP2 kernel bug and has been fixed in update kernel version 2.6.16.60-0.23. On SLES 10 SP2, the netstat is broken due to a new format in /proc/<PID>/fd, The netstat utility is used in the PostgreSQL recovery kit to verify that the database is running.</p> <p data-bbox="500 674 1235 728">Solution: Please upgrade kernel version 2.6.16.60-0.23 if running on SLES 10 SP2.</p>

Documentation and Training

LifeKeeper Documentation List

The following is a list of LifeKeeper documentation that provides instructions for installing, configuring, administering, and troubleshooting LifeKeeper for Linux software:

Document	Available Media*
<i>Release Notes</i>	web, Documentation CD
<i>Online Product Manual**</i>	LifeKeeper Core CD, web, Documentation CD
<i>Planning and Installation Guide</i>	web, Documentation CD
<i>IP Recovery Kit Administration Guide</i>	web, Documentation CD
<i>Configuring LifeKeeper Clusters</i>	web only
<i>LifeKeeper for Linux Extender</i>	LifeKeeper Extender CD, LifeKeeper Staging CD
<i>Apache Web Server Recovery Kit Administration Guide</i>	web, Documentation CD
<i>ClearCase Recovery Kit Administration Guide</i>	web, Documentation CD
<i>DB2 Recovery Kit Administration Guide</i>	web, Documentation CD
<i>Oracle Recovery Kit Administration Guide</i>	web, Documentation CD
<i>Informix Recovery Kit Administration Guide</i>	web, Documentation CD
<i>MySQL Recovery Kit Administration Guide</i>	web, Documentation CD
<i>PostgreSQL Recovery Kit Administration Guide</i>	web, Documentation CD
<i>Sendmail Advanced Message Server Recovery Kit Administration Guide</i>	web, Documentation CD
<i>Logical Volume Manager (LVM) Recovery Kit Administration Guide</i>	web, Documentation CD
<i>NFS Server Recovery Kit Administration Guide</i>	web, Documentation CD
<i>Network Attached Storage Recovery Kit Administration Guide</i>	web, Documentation CD
<i>Samba Recovery Kit Administration Guide</i>	web, Documentation CD
<i>SAP Recovery Kit Administration Guide</i>	web, Documentation CD
<i>SAP DB / MaxDB Recovery Kit Administration Guide</i>	web, Documentation CD
<i>Software RAID (md) Recovery Kit Administration Guide</i>	web, Documentation CD

Document	Available Media*
<i>DRBD Recovery Kit Administration Guide</i>	web, Documentation CD
<i>SteelEye Data Replication Administration Guide</i>	web, Documentation CD
<i>LifeKeeper Data Replication Administration Guide</i>	web, Documentation CD
<i>VMware Virtual Machine Recovery Kit Administration Guide</i>	web, Documentation CD
<i>WebSphere MQ Recovery Kit Administration Guide</i>	web, Documentation CD
<i>SteelEye Protection Suite for Citrix Xen Server Administration Guide</i>	web, Documentation CD

* Documents on the web are available at: <http://licensing.steeleye.com/documentation/> and/or the LifeKeeper for Linux Documentation CD may be purchased.

** The HTML-based *Online Product Manual* is delivered in the **steeleye-*lkHLP*** package on the LifeKeeper Core CD, and installed in `/opt/LifeKeeper/htdoc/help`. The *Online Product Manual* may be accessed outside the LifeKeeper GUI by opening the URL for the product manual web page, `http://<server name>:81/help/lksstart.htm`, directly from your browser, where `<server name>` is the hostname of your LifeKeeper server.

LifeKeeper Documentation

To access the latest versions of the LifeKeeper Documentation, please go to the SteelEye Technology, Inc. website, <http://licensing.steeleye.com/documentation/>. Use the document date to determine the most recent version. Additionally, the LifeKeeper for Linux Documentation CD is available for purchase.

Man Pages

The reference manual pages delivered with LifeKeeper are in the package **steeleye-*lkMAN***, and are installed in `/opt/LifeKeeper/man`. The LifeKeeper man pages can be accessed by adding this directory to your MANPATH.

Third Party Documentation

Most solutions involving a LifeKeeper environment will also include third party products, e.g. Linux, TCP/IP, servers and miscellaneous peripherals, etc. For specific technical information on these third party products, refer to their documentation for installation, configuration and administrative tasks and procedures.

Training

LifeKeeper training is available through SteelEye Technology, Inc or through your LifeKeeper provider. For training schedules and contact information, visit the website at <http://licensing.steeleye.com/support/training.php>. For an introduction to LifeKeeper, see the LifeKeeper for Linux Tutorial on the website at www.steeleye.com/support.

Support

Support for LifeKeeper is provided by either SteelEye Technology, Inc. or your authorized LifeKeeper Reseller. You can contact SteelEye Support at:

1-877-457-5113 (Toll Free)

1-803-808-4270 (International)

Email: support@steeleye.com