FUJITSU Server PRIMEQUEST 2000 Series

Linux Design Guide

-Red Hat Enterprise Linux-

CA92344-0698-03

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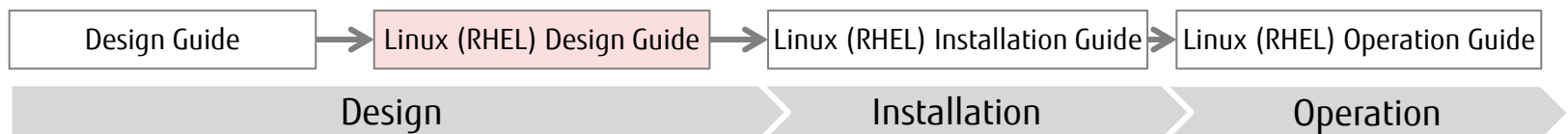
Preface

■ About This Manual

■ Contents of This Manual

This manual describes an outline for OS design and notes for those who want to install and use Red Hat Enterprise Linux (RHEL) on the PRIMEQUEST 2000 series.

- For details on the operation method, refer to the manuals for the PRIMEQUEST 2000 series main unit and RHEL.
- For details on the operating environment of the software, refer to the website of each software.

■ Organization of Manuals

The following figure shows the organization of manuals for the PRIMEQUEST 2000 series (for RHEL).

| Design Guide | → | Linux (RHEL) Design Guide | → | Linux (RHEL) Installation Guide | → | Linux (RHEL) Operation Guide |

| Design | Installation | Operation |

■ Symbol in This Manual

The following table shows the meaning of the symbol used in this manual.

Symbol	Meaning
👉	Indicates the page or document to refer to.

Preface

■ Abbreviations in This Manual

Name	Abbreviation	
PRIMEQUEST 2400E2	PRIMEQUEST 2000 series PRIMEQUEST	
PRIMEQUEST 2400E3		
PRIMEQUEST 2800B2		
PRIMEQUEST 2800B3		
PRIMEQUEST 2800E2		
PRIMEQUEST 2800E3		
Management Board	MMB	
System Board	SB	
Red Hat® Enterprise Linux® 6 (for Intel64)	RHEL6 (for Intel64) RHEL6	RHEL Linux
Red Hat® Enterprise Linux® 7 (for Intel64)	RHEL7 (for Intel64) RHEL7	
ETERNUS SF AdvancedCopy Manager	ETERNUS SF ACM ACM	
PRIMEQUEST 2000 Series General Description	General Description	
PRIMEQUEST 2000 Series Installation Manual	Installation Manual	
ServerView Suite ServerView Installation Manager User Guide	SVIM Manual	
PRIMEQUEST 2000 Series Design Guide	Design Guide	
PRIMEQUEST 2000 Series Linux Installation Guide -Red Hat Enterprise Linux-	Linux (RHEL) Installation Guide	
PRIMEQUEST 2000 Series Linux Operation Guide -Red Hat Enterprise Linux-	Linux (RHEL) Operation Guide	
PRIMEQUEST 2000 Series Cluster Design Guide -Linux/PRIMECLUSTER-	Cluster Design Guide -Linux/PRIMECLUSTER-	

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Preface

1. Linux Overview

This chapter provides an overview of Linux.

1.1 Available Distribution

Product name
Red Hat® Enterprise Linux® 6 (for Intel64)
Red Hat® Enterprise Linux® 7 (for Intel64)

■ For the latest information, contact your sales representative or refer to the following URL:

☞ "Kernel Version (PRIMEQUEST)"
http://www.fujitsu.com/global/products/computing/servers/mission-critical/primequest/software/pq2000-linux-kernel.html

■ Usable software may vary depending on the distribution used

Technical information for Red Hat Enterprise Linux with PRIMEQUEST can be obtained if you purchase the Support Ticket for this product.

1.2 RHEL6 Features and New Functions

■ **Functions Added and Enhanced in RHEL6**

- ■ Improvements to and addition of kernel functions

  Changed the control group function, support for the performance counter, scheduler, and syslog function, etc.

- ■ Improvements to the file system function

  Support for ext4

- ■ Enhanced syslog function

  Changed rsyslogd to the default syslog daemon.

- ■ Changed virtual machine function

  Changed from Xen to KVM.

- ■ Enhanced security

  Use of system security service daemon (SSSD)

- ■ Control group function

  New kernel function for managing tasks and their used resources

- ■ Performance Counter for Linux

  Collects hardware performance information for tasks and each CPU.

- ■ tickless function

  Reduces consumed energy when idle.

- ■ System Security Service Daemon (SSSD)

  Enables offline verification with the server and reduces server loads.

1.3 RHEL7 Features and New Functions

- **Functions Added and Enhanced in RHEL7**
  - Improvements to the file system function
    Supports XFS as the default file system
  - Enhanced management function
    Supports system management functions that integrate init and log functions by systemd
  - Enhanced virtual machine function
    Improved KVM performance
  - Enhanced pNFS (Parallel NFS) client
    Improved performance for high I/O load processing such as DB access
  - Online Defrag
    Fragmentation is resolved when online (mounted state) (targets: ext4 and XFS)
  - Commands
    - Support for the "ssm" command (system-storage-manager package)
      A management tool that absorbs differences in each of the logical volumes and file systems
    - Support for the "snapper" command (snapper package)
      Integrated management of logical volume snapshots

1.4 Supported Software

Software included in RHEL distribution (RHEL6 or RHEL7) and supported by PRIMEQUEST

Category	Use	Software name
Linux base system	Linux kernel	RHEL6 - kernel 2.6.x RHEL7 - kernel 3.10.x
	Boot loader	RHEL6 - GRUB RHEL7 - GRUB2
	Default C library	glibc
	Virtual machine function	KVM
Server software	Super server	RHEL6 - xinetd RHEL7 - systemd
	WWW server	apache
	NFS server	NFS
	NIS server	NIS
	PC file server	samba
	Remote login	in.telnetd, telnet
	File transfer	vsftpd, ftp
	E-mail receiving server	dovecot, imap, pop
	Mail delivery agent	procmail
	E-mail sending server	RHEL6 - sendmail RHEL7 - postfix

Category	Use	Software name
Server software	DNS server	bind
	DHCP server	DHCP
	Cache server	squid
	Secure shell	ssh
	Default time server	RHEL6 - ntp RHEL7 - chrony, ntp
	Firewall	RHEL6 – iptables RHEL7 - firewalld, iptables
	Network monitoring	net-snmp
	Logical volume manager	lvm2
	Disk limitations	quota
	Log analysis system	logwatch, logrotate
	Directory server	OpenLDAP
	Software RAID	multiple device (md)
	Multipath function	device mapper multipath (dm-mp)
Desktop	X window	X.Org

1.5 Software Bundled With Hardware

Make sure to install the software bundled with hardware.

* If you are using ServerView Installation Manager (SVIM), the software bundled with hardware is installed automatically.

☞ For details, refer to "3.3 Bundled software" in "General Description".

2. Linux System Design

This chapter describes preliminary designs for each Linux setting.
For details, refer to the related RHEL manuals provided by Red Hat.

2.1 Linux System Design Workflow

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- **Installation Design With SVIM**
  - ☞ Refer to "2.2 Installation Design With SVIM".
    - Package selection design
    - Verification design
- **Security Design**
  - ☞ Refer to "2.3 Security Design".
- **Hard Disk Operation Design**
  - ☞ Refer to "2.4 Hard Disk Operation Design".
    - Disk partition design
    - Estimated space for each partition
- **Network Operation Design**
  - ☞ Refer to "2.5 Network Operation Design".
- **Device Name Conflict Prevention Design**
  - ☞ Refer to "2.6 Device Name Conflict Prevention Design".
  - Reasons for and measures against device name conflicts
- **Log File Operation Design**
  - ☞ Refer to "2.7 Log File Operation Design".
  - Necessity of log rotation
- **Dump Environment Design**
  - ☞ Refer to "2.8 Dump Environment Design".
  - Memory dump function

Key Points of Design

- Estimate the swap area, dump device, and dump saving area based on the memory capacity

  Select Customized to configure the options.

- Make sure to set a root password

- Make sure to set a boot loader password

  If you used SVIM to install the OS by selecting Typical, the password is not set. By selecting Customized, the password can be set during installation. To ensure security, renew the password after installation is complete.

- Set the DNS server as necessary

Tools that can be installed with SVIM

ServerView Suite (monitoring software) and other tools

👉 For details, refer to "SVIM Manual".

2.2 Installation Design With SVIM (2/2)

■ Package Selection Design

The following packages are selected by default:

- X Window System
- GNOME Desktop Environment

■ Verification Design

■ Using MD5

Use MD5 for user passwords. Normally, enable MD5.

If you do not use MD5, DES is used instead but the password is limited to 8 alphanumeric characters.

* MD5: A hash function used in verification and digital signatures. This function detects file manipulation.

DES: 56-bit secret key encryption algorithm

■ Using a shadow password

Use shadow passwords for user passwords. Normally, enable shadow passwords.

* Shadow password: Stores the encrypted user password in /etc/shadow and only allows root to read the file. In /etc/passwd, the user password is stored with characters such as "x".

■ Firewall

Set the protocol and port numbers for allowing access from a different computer.

For details, refer to "SVIM Manual".

2.3 Security Design

Take the following measures.

■ OS Security Measures

☞ For details, refer to "Security Guide". To access this guide, go to the Red Hat Customer Portal (https://access.redhat.com/), and then click [Products & Services]. Under [Documentation], click on [Red Hat Enterprise Linux].

■ Applying Modifications

☞ For details, refer to "4.1 Overview of Applying Modifications".

* For information about the security software (ISV product), contact your sales representative.

Disk Partition Design

Design item	Description
Mounting point	Set the path for each disk partition. 　/ : root directory 　/boot : Area for files used in the bootstrap process and the OS kernel 　swap : Area used as a virtual memory area when the system memory is insufficient
File system type	Set the file system type. The main file systems are shown below. [Available file systems for RHEL6] 　ext2: This file system was used by many distributors as the default file system until ext3 was released. 　ext3: This file system adds a journaling function to ext2 　　　The maximum file system size is 16TB and the maximum file size is 2TB. 　ext4: This file system has the same journaling function as ext3 　　　The maximum file system size is 16TB and the maximum file size is 16TB. [Available file systems for RHEL7] 　XFS: The file system that became the default type from RHEL7. 　　　Supports large file systems; the maximum file system size is 500TB. 　ext4: The maximum file system size is 50TB and the maximum file size is 16TB. 　ext2, ext3: These file systems can also be used for RHEL7.
Drive	Set the drive to create disk partitions. E.g., sda: First internal hard disk drive 　　　sdb: Second internal hard disk drive

☞ For details, refer to Red Hat "Storage Administration Guide".

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■ Estimated Capacity for Each Partition

Partition	Recommended capacity		Key points
	RHEL6	RHEL7	
/ (root directory)	20GB or more	10GB or more	Ensure capacity that can be used to save log files, apply revision patches, and add functions for optional software
/ boot	256MB	500MB or more	-

swap	Memory is 2GB or less:
	    Twice the size of the memory capacity
	
	Memory is more than 2GB, 8GB or less:
	    Same size as the memory capacity
	
	Memory is more than 8GB, 64GB or less:
	    Half the size of the memory capacity
	
	Memory is more than 64GB:
	    4GB
			Set based on the system memory load

For details, refer to Red Hat "Storage Administration Guide".

2.5 Network Operation Design

■ Key Points for Design

- ■ Pay attention to the OS recognition order for the Network Interface Card (NIC) for the management LAN and the NIC for the operation LAN

- ■ Disable the STP function for switches connected to the management LAN (used for communication with the MMB)

- ■ Assign IP addresses for each LAN while considering the following points

  - If separating the management LAN and the operation LAN, separate the subnets

  - For the maintenance LAN, set a subnet different from the other LANs (management LAN, operation LAN, internal LAN, and cluster LAN)

  - The internal LAN is assigned automatically, but set the subnet different from the other LANs (management LAN, operation LAN, maintenance LAN, and cluster LAN)

  - Set the console redirection IP address to the same subnet as the management LAN
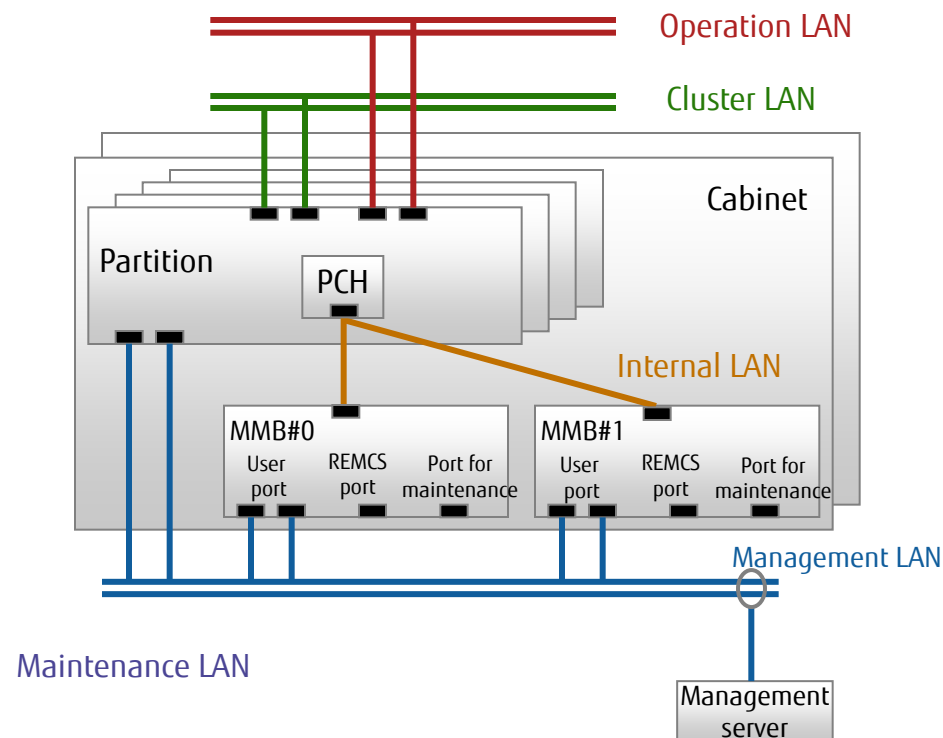
2.6 Device Name Conflict Prevention Design

■ Reasons For and Measures Against Device Name Conflicts

Type	Cause	Cause (Examples)	Measures
Disk-related device name conflicts	Software changes	• A driver was applied while the kernel was being updated.	• Prevention using hardware (RAID configuration, automatic stop of system starts during a hardware failure) • Prevention using OS functions (using label names, udev, or UUID) • Prevention using middleware functions (Installing products such as PRIMECLUSTER GDS)
	Hardware configuration changes	• Disks (removable disks) or storage devices were added or removed. • Cards in PCI slots were added or removed.	
	Hardware failure	• Disk failure • Card failure • Storage device failure, power loss, cable failure	
Network-related device name conflicts	Addition or failure of NICs	• A network device name was changed during addition or failure of NICs.	• Fixed network device name by designated MAC address

2.7 Log File Operation Design (1/2)

■ Necessity of Log Rotation

To prevent logs from being lost, multiple log files are put on rotation for operation.

■ System log file operation

Design item	Description
Implementation method	Start the logrotate command with the timing of the rotation operation Select from the following start times • Start at any time from the command line input or the script • Periodically start using the scheduler setting (using a schedule management program such as cron or Systemwalker)
Schedule	Avoid times with heavy loads from system log file output, and schedule a rotation when it will not affect operation
Switching cycle and number of held generations	Design so that the total capacity of system log files is appropriate for system operation (Default is replacement once per week (Weekly) and holding 4 generations (file after log replacement).)
Backup	We recommend that you backup the replaced system log file.

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2.7 Log File Operation Design (2/2)

■Operating User-specific Log Files

Design item	Description		
Target log file	Determine the target log files to rotate		
Executing user	Determine which user ID to execute the rotation with based on the log file permissions		
Rotation execute command	Determine the command that executes the log rotation (the system default is "logrotate")		
Operating method (for the logrotate command)	Check if the application that outputs the log has a reload function, and determine the operation method		
	Is there a reload function?	**Operation method**	**Designation method**
	Yes	Replaces and saves the user-specific log file itself	Write the "create" directive in the logrotate setting file
	No	Saves a copy of the user-specific log file	Write the "copytruncate" directive in the logrotate setting file

2.8 Dump Environment Design

■ Memory Dump Function

■ kdump function

RHEL's default dump function.
Acquires the contents of the memory if an error occurs during operation.

■ sadump function

Dump function that is specific to PRIMEQUEST.
Acquires the contents of the memory if the kdump function cannot or fails to acquire the dump.

■ Key Points of Design

■ Memory capacity

The following memory area must be reserved for the memory dump function in addition to the memory capacity for the system operations.

Intel 64: 256MB (Fixed)

Keep the above in mind when designing memory capacity to be used for the system operations.

■ Hard disk capacity

- The memory dump function requires a great amount of disk capacity. Design it keeping in mind the disk capacity taken up solely by the memory dump function.

- For iSCSI- and FCoE-connected hard disks, the memory dump cannot be acquired with the kdump function.
  Prepare an internal hard disk for acquiring the memory dump.

■ sadump device

- If performing a hot replacement for a disk used for the dump device, the disk must be backed up after performing sadump initial settings. Prepare the same number of disks as those prepared for the dump device.

- If there is no local tape device and the dump cannot be extracted onto a local tape, the dump acquired on the dump device must be temporarily converted into a file. When converting it into a file, prepare another file system with the same amount of free space as the dump device.

3. High Availability Design

This chapter describes the key points for system redundancy.
For details, refer to "Design Guide".

3.1 Key Points for Hard Disk Redundancy (1/2) FUJITSU

Flexibly manage storage and improve data availability and reliability by using the following functions.

- **Logical Volume Manager (LVM)**

    Create logical volumes as a partition handled by users. Conceals the existence of physical disks and improves the flexibility of disk device management.

- **PRIMECLUSTER Global Disk Services (GDS)**

    👉 Refer to "3.2 Software RAID Types and Features".

    Combine multiple hard disks to achieve continued operation in the event of a disk failure, prevent data loss, and distribute disk I/O loads.

- **Multi Disk (MD)**

    👉 Refer to "3.2 Software RAID Types and Features".

    Combine multiple hard disks to prevent data loss in the event of a disk failure and achieve improved processing speed for disk access.

- **Symantec Storage Foundation**

    👉 Refer to "3.2 Software RAID Types and Features".

    In addition to data loss prevention and operational continuity during a disk failure, power consumption and installation cost reductions are realized (with MAID and Thin Provisioning).

3.1 Key Points for Hard Disk Redundancy (2/2)

- ■ Device-Mapper Multipath (DM-MP)

  Integrate access paths to disk array devices with redundancy, and achieves system operation continuity that is prepared for access path failures.

- ■ Dynamic Multi-Pathing (DMP)

  Integrates access paths to disk array devices with redundancy, and achieves system operation continuity that is prepared for access path failures.

  (Bundled with Symantec Storage Foundation products)

3.2 Software RAID Types and Features

- **Fujitsu Middleware**
  - PRIMECLUSTER Global Disk Services (GDS)
    - Provides a redundancy function specialized for RAID-1
    - Simple design in units of disks
    - Simple and assured operation management through a GUI
    - Reduces not only disk failures but also trouble from operation mistakes through its excellent management function

- **OS Default**
  - Multi Disk (MD)
    - Software included in RHEL
    - RAID (RAID 0/1/10) can be configured in the driver layer

- **ISV product**
  - Symantec Storage Foundation
    - A large number of software RAID functions (such as RAID 0/1/5/01/10) are supported
    - Online storage management functions (such as disk swapping, resizing, and changing RAID) are supported
    - Configuring RAID between storage cabinets is possible
    - Simple and assured operation management through a GUI
    - Sharing user data with other OSs (Solaris) is possible

Contact your sales representative about the support status of each product for RHEL7.

👉 For details about hardware RAID, refer to "Design Guide".

3.3 Software RAID Comparison

Function	PRIMECLUSTER GDS	MD	Symantec Storage Foundation
RAID 0 (Striping)	Yes*	Yes*	Yes*
RAID 1 (Mirroring)	Yes	Yes*	Yes*
RAID 01 (Stripe mirroring)	Yes*	-	Yes*
RAID 10 (Mirror striping)	-	Yes*	Yes*
RAID 4	-	-	-
RAID 5	-	-	Yes*
RAID 6	-	-	-
Concatenation	Yes*	Yes*	Yes*
Hot spare	Yes*	Yes*	Yes*
Hot replacement	Yes	Yes*	Yes*
Acceleration for mirror recovery after a system down	Yes	-	Yes*
Mirror continuation through write back during a read error	Yes	-	-
Data protection from disk accesses by mistaken operations	Yes	-	-
Online volume expansion	Yes	-	Yes*
Volume reduction	-	-	Yes*
Snapshot	Yes (*1)	-	Yes*
GUI	Yes	-	Yes*

Yes: Supported on system disks and disks for user data

Yes*: Supported only on disks for user data

- : Not supported

(*1) Requires the optional product, "PRIMECLUSTER GDS Snapshot"

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■ Targets for LAN Redundancy (Duplication)

Management LAN, Operation LAN

■ Software Selection Policy

Network reliability can be increased by using duplication software.

■ PRIMECLUSTER Global Link Services (GLS) (Recommended optional software)

Achieve higher reliability than the bonding driver (Can immediately resume and continue operations, determine and recover failed location).

☞ Refer to "Selection Policy for PRIMECLUSTER GLS and Bonding Based on High Reliability Standards" on the next page.
For details about PRIMECLUSTER GLS, refer to "PRIMECLUSTER Global Link Services Configuration and Administration Guide Redundant Line Control Function (for Linux)".

■ "bonding" driver (OS default)

Has limited functions compared to PRIMECLUSTER GLS.

Function	PRIMECLUSTER GLS (NIC switching method)	bonding driver (mode1)
Limit on switch to be used	Yes (*1)	Yes
Detection of LAN card failures	Yes	Yes
Detection of network failures	Yes	Yes* (*2)
Multi-platform support	Yes	- (*3)
Provision form	Product for sale	OS default bundled software
Linking with PRIMECLUSTER	Yes	No

Yes: Supported

Yes*: Supported in some cases

No: Not supported

-: Not applicable

(*1) The IP address must be allotted to either switch as the network monitoring target via the GLS ping

(*2) Only detects at neighboring switches

(*3) Teaming is possible for Solaris and Windows using an OS default function

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■ Selection Policy for PRIMECLUSTER GLS and Bonding Based on High Reliability Standards

Conditions for high reliability	Immediately resume and continue operations		Identify and recover failed location	
	PRIMECLUSTER GLS	bonding	PRIMECLUSTER GLS	bonding
Increasing the reliability of application transmissions at the physical server	Applicable Detects router failures and can switch over if necessary.	Not applicable When mode1 is used for the bonding driver, router failures cannot be detected, and switching over may not be possible depending on the network configuration.	Applicable Monitors each network device and easily identifies and recovers the failed location.	Not applicable When mode1 is used for the bonding driver, because only the physical adaptor's status (link status and packet transmission status) is monitored, the failed location in the network cannot be identified.
Increasing the reliability of application transmissions in a virtual environment (Guest OS)	Applicable In addition to the above, after switching networks, the guest OS's transmission can be immediately resumed.	Not applicable Transmission may not be possible for several minutes.		

Note: Only bonding may be available for use, such as when installing Oracle DB.

👉 For details about clusters, refer to "Cluster Design Guide -Linux/PRIMECLUSTER-".

■ Cluster Configuration Using PRIMECLUSTER

We recommend using PRIMECLUSTER (cluster configuration software) for configuring a cluster in Linux.

PRIMECLUSTER has the following features:

■ Wizard function

Can easily construct cluster systems.

■ High availability

Quickly takes over a node so that operation does not stop when an error occurs. By employing high multiplicity for transmission paths, communication can be continued even when there is a network error or a network device failure.

■ Expandability

One or more applications can be processed simultaneously on multiple nodes. This allows for parallel operations that use parallel databases, load sharing, and load balancing.

👉 For details, refer to "3.4 Key Points for Cluster Configurations" in "Design Guide", as well as the ServerView Manual.

■ Cluster Configuration that uses Symantec Cluster Server

When emphasizing world wide achievements, and when already using Symantec Cluster Server (*) regardless of the platform, the merits for recommending Symantec Cluster Server are as follows

■ High availability

- With the real time monitoring function for resources, reducing the time for fault detection (= failover start) is possible

- With SFCFSHA (*), high speed failover (and downtime reduction) is possible

■ Scalability

Scalable up to a maximum of 64 nodes
By using SFCFSHA, configuring NFS server for scale-out is possible

■ Flexibility

Configuring a flexible cluster system is possible because of sufficient features such as the failover policy, the link function with the cluster and the event notice function

(*) Symantec Cluster Server includes the following products

- Symantec Storage Foundation Standard HA (SFHA)
- Symantec Storage Foundation Enterprise Cluster File System HA (SFCFSHA)

Note: SFHA6.2 and later, and SFCFSHA6.2 and later support RHEL7.

3.5 Key Points for System Redundancy (Cluster) (3/3) FUJITSU

■ Key Points for Cluster Configurations (PRIMECLUSTER)

- ### ■ Application monitoring

  PRIMECLUSTER cannot monitor application statuses (normal, sleep, hung-up, etc.), but this is possible by installing the various wizard products provided by PRIMECLUSTER.

- ### ■ OS hang-ups

  With Linux, even if the OS is hung up, the system may not be able to detect node errors. To detect them, set the watchdog timer value for ServerView.

■ Key Points for Cluster Configurations (Symantec Cluster Server)

- ### ■ Application monitoring

  Monitoring is possible using Symantec Cluster Server standard Application Agent (generic Agent) or an Agent created by an application development vendor or by the customer.

- ### ■ Clusters between dissimilar equipment

  Clusters between dissimilar equipment are also supported, however the cluster service must be set to withstand even bias to the server models with low performance.

👉 For details, refer to "3.4 Key Points for Cluster Configurations" in "Design Guide", as well as the ServerView Manual.

4. OS Operation Management Design

This chapter provides an overview of Linux operation management design.

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■ Type of Modification

Type of modification	Description	Acquire from:
errata	Major error modifications for OS (including security patches)	Red Hat's Red Hat Customer Portal (https://access.redhat.com/)
Minor releases	Releases provided periodically that include support for new hardware, additional functions, and error patches	

■ Application Method for Modifications

■ Standard application method [For the latest operation]

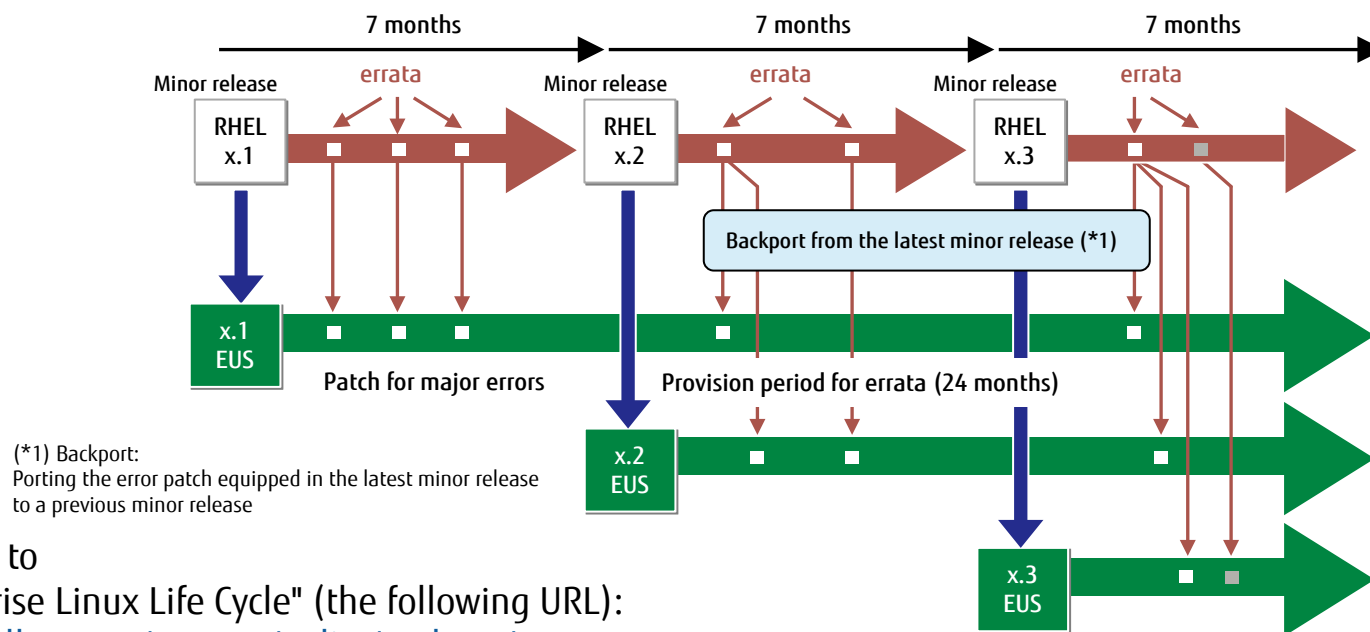Errata is provided only with the latest minor release.
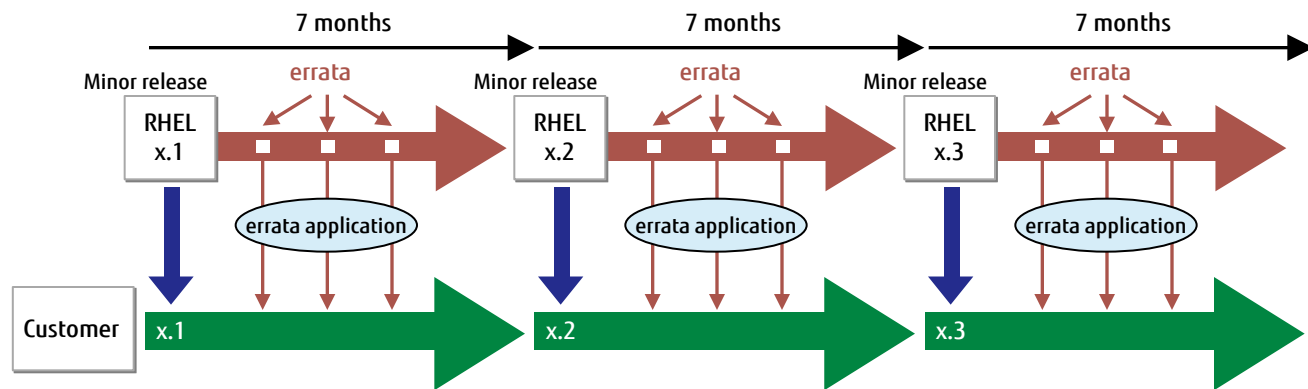
👉 For details, refer to "Red Hat Enterprise Linux Life Cycle" (the following URL):
https://access.redhat.com/support/policy/updates/errata

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■ **Application method for Extended Update Support (EUS) [For planned maintenance]**

- Provides errata for particular minor releases continually over a longer period of time than the standard application method

  - Particular minor releases: For RHEL6, all minor releases
    For RHEL7 (7.1 or later), all minor releases

  - Provision period for errata: 24 months after the release of the said minor release

- Allows for a reasonable maintenance plan for ensuring a sufficient amount of preparation time for periodic maintenance

7 months　　　　7 months　　　　7 months

Minor release — errata — RHEL x.1 — Minor release — errata — RHEL x.2 — Minor release — errata — RHEL x.3

Backport from the latest minor release (*1)

x.1 EUS — Patch for major errors — Provision period for errata (24 months)

x.2 EUS

x.3 EUS

(*1) Backport:
Porting the error patch equipped in the latest minor release to a previous minor release

☞ For details, refer to
"Red Hat Enterprise Linux Life Cycle" (the following URL):
https://access.redhat.com/support/policy/updates/errata

To protect your resources and data from risks such as natural disasters, periodically perform backups so that you can restore the data in the event of an emergency.

- **Backup Including System Volume**

  - Online backup

    Requires confirmation in advance that the product supports online backups and that there will be no effect on operation.

  - Offline backup

    - Requires a stop in operations (The time for stopping operations is proportional to the backup capacity)
    - Simpler to perform than the online backup
    - 3 different methods: Full backup, differential backup, and incremental backup

Method, software	Type	Online	Offline
dump/restore command	OS default utility	Not supported	Supported
SystemcastWizard Professional	Image backup software developed by Fujitsu	Not supported	Supported
PRIMECLUSTER GDS Snapshot	PRIMECLUSTER GDS optional software	Supported	Supported
ETERNUS SF AdvancedCopy Manager	Fujitsu software that supports the SAN boot	Not supported	Supported
NetVault Backup 11	Dell Software	Not supported	Supported

* The software support information is as of June 2016.
   For the latest software information, contact your sales representative.

👉 For details, refer to the manuals for each tool.

■ Data Volume Backup Only

- ■ NetBackup

  Symantec Corporation software

- ■ NetWorker

  EMC Corporation software

- ■ Symantec Storage Foundation FlashSnap (*)

  Symantec Corporation software

  (*)Flash Snap is included in the following products

  - Symantec Storage Foundation Enterprise

 - Symantec Storage Foundation Enterprise Cluster File System HA

👉 For details, refer to the manuals for each software.

Execute the dump/restore command from the OS console of the system partition you want to perform the backup or restore for.

Merits	Demerits
• Is an OS default utility, and does not require the purchase of special software • Does not require a backup server • Can backup and restore the system volume (* Use of rescue mode)	• Requires separate operation for each partition • Only supports the single unit as a save area • Cannot perform a DB online backup

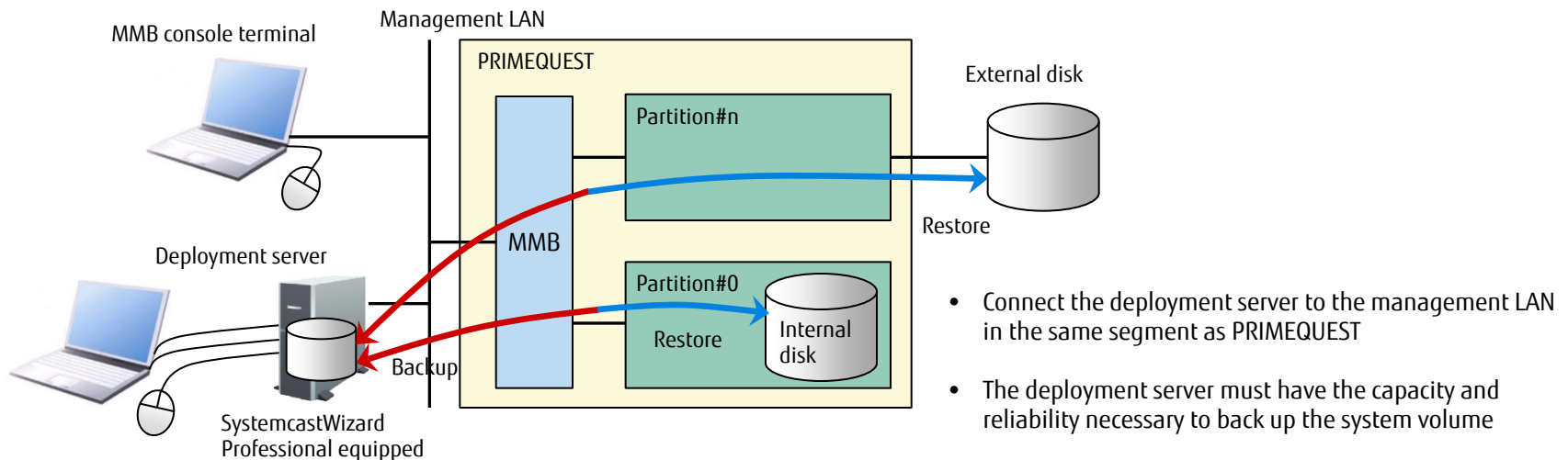[Local backup using the default utility]
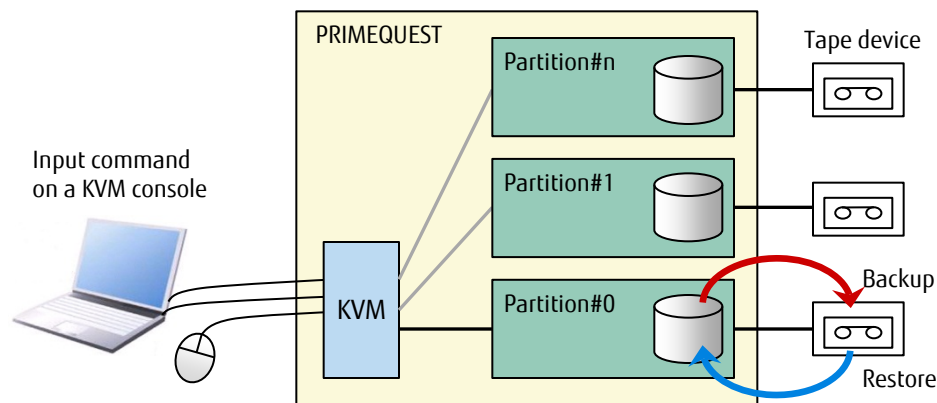
KVM: Keyboard, Video, Mouse

4.3 Backup and Restoration – SystemcastWizard Professional

Saves the hard disk image of the system to be backed up on the deployment server via the network, and recovers and deploys the target system.

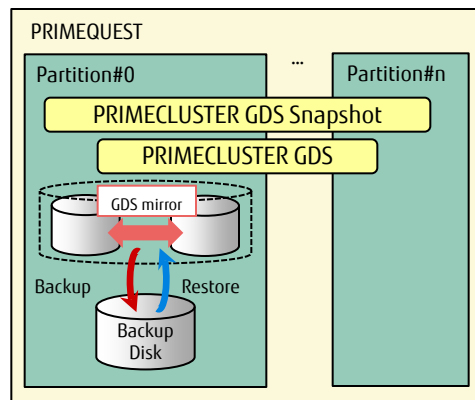| Merits	Demerits
• Can automatically perform backups or restorations for multiple partitions • Can be done using remote operation • Can be executed by GUI operation	• Requires a separate deployment server • Cannot perform differential or incremental backups • Does not have an automatic generation management function for backup data • Partition must be stopped before the backup • Basically backs data up on a hard disk. To back up to a secondary memory device, separate backup software that operates on Windows is necessary

[Configuration of backup using SystemcastWizard Professional]

- Connect the deployment server to the management LAN in the same segment as PRIMEQUEST

- The deployment server must have the capacity and reliability necessary to back up the system volume

High-speed Backups and Restorations

Merits	Demerits
• Can create snapshots in units of disks and in units of volumes managed by PRIMECLUSTER GDS • Can use the system disk snapshot function to perform system backups and apply patches in advance during operation • Automatically selects the optimal snapshot method based on the volume configuration and functions the storage device has • If restoring the snapshot data created with the high-speed copy function, for configurations that cannot use the high-speed copy function, the system automatically switches the copy method to the software copy function and performs the high-speed restore	• PRIMECLUSTER GDS is necessary to use PRIMECLUSTER GDS Snapshot • PRIMECLUSTER GDS Snapshot is necessary for all servers that share the common disk device

[Example backup configuration using an internal disk]   [Example backup configuration using ETERNUS]
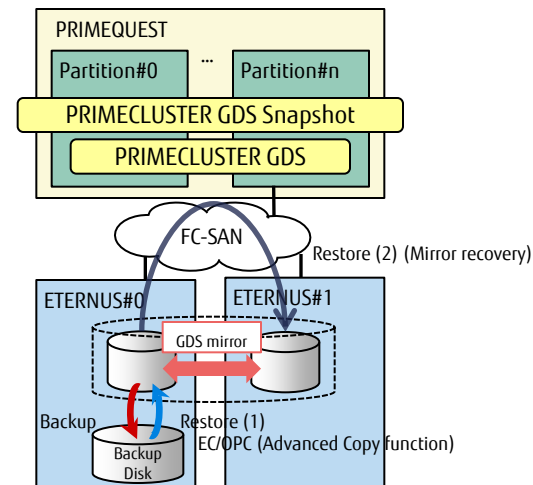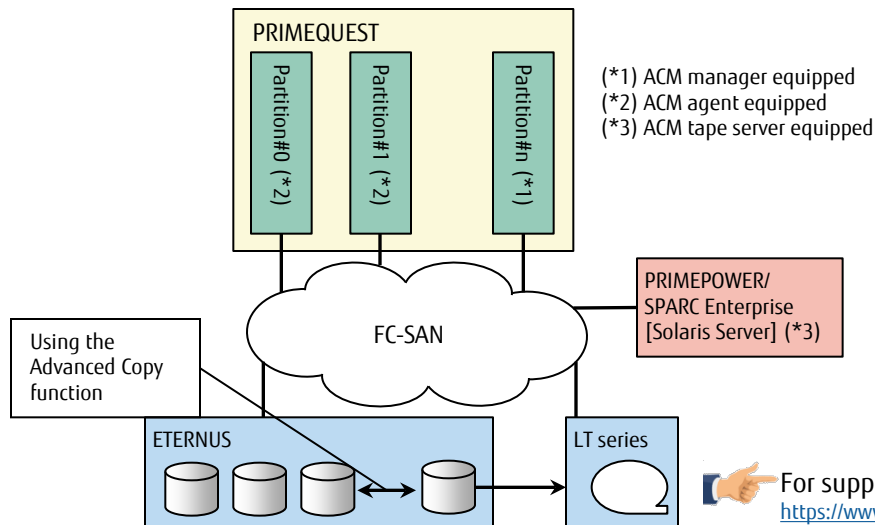

• The backup disk must be the same size or larger than the disk being backed up

4.3 Backup and Restoration - ETERNUS SF ACM

- ■ **Use in combination with a disk array device (ETERNUS)**
- ■ **Can back up and restore the disk array data without going through an operation server or LAN**

Merits	Demerits
• Can perform backups or restorations without putting a load on the operation server or LAN • Can perform high-speed backups or restorations with little operation stoppage time (* Using the ETERNUS Advanced Copy function) • Can perform remote, high-speed replication (* Using the ETERNUS Remote Advanced Copy function) • Can perform a low-energy backup that reduces the power consumed by ETERNUS • Can do an online backup for DB (Oracle, Symfoware) • Can perform system volume backups or restorations during the SAN boot	• Does not support backups for the internal disk

PRIMEQUEST

Partition#0 (*2)　Partition#1 (*2)　Partition#n (*1)

(*1) ACM manager equipped
(*2) ACM agent equipped
(*3) ACM tape server equipped

FC-SAN

PRIMEPOWER/
SPARC Enterprise
[Solaris Server] (*3)

Using the
Advanced Copy
function

ETERNUS

LT series

[Configuration of the data backup on ETERNUS using ACM]

- • ACM agent
  Controls the ETERNUS Advanced Copy function.
  Install on the operation server to be backed up or restored.

- • ACM manager
  Centrally manages device information and policies for all ACM agents.

For supported OSs of the ETERNUS SF ACM, refer to "Technical Details" on the following URL:
https://www.fujitsu.com/global/products/computing/storage/software/eternus-sf/

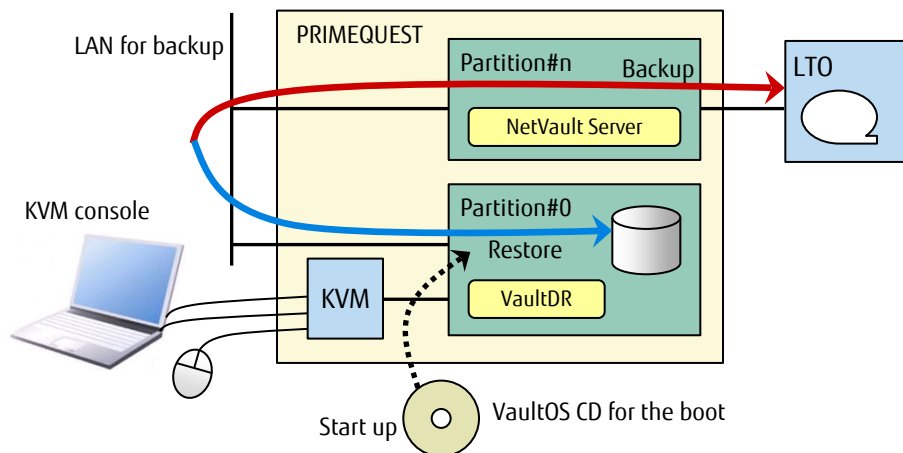# 4.3 Backup and Restoration - NetVault Backup

Software with the No.1 share of the Linux server backup market in Japan

Merits	Demerits
• Can define schedules for backups, making processing automatic • Can perform synthetic backups for differential data (*1) • Can be controlled by a common GUI, even on different OSs • Highly compatible with PRIMECLUSTER • Can do an online backup for DB (Oracle) (Requires optional product) • Can do backups and restore the system volume (Requires optional product) • Can do backups with a mix of different OSs (Linux and Windows) • Provides long-term product support (up to seven years with an extended support contract) (*2)	• Optional products are required to perform system backups of the operation server

(*1) Integrates a differential backup with the full backup, creating a backup equivalent to the latest full backup
(*2) In addition to "basic support", an extension of the support period is available with "long-term support".

[Example configuration connected to a KVM console]

Mechanism for system volume backup using NetVault Backup
- When starting up the server from a VaultOS CD, connect the KVM console to the system partition you want to restore
- Control with a remote console via MMB
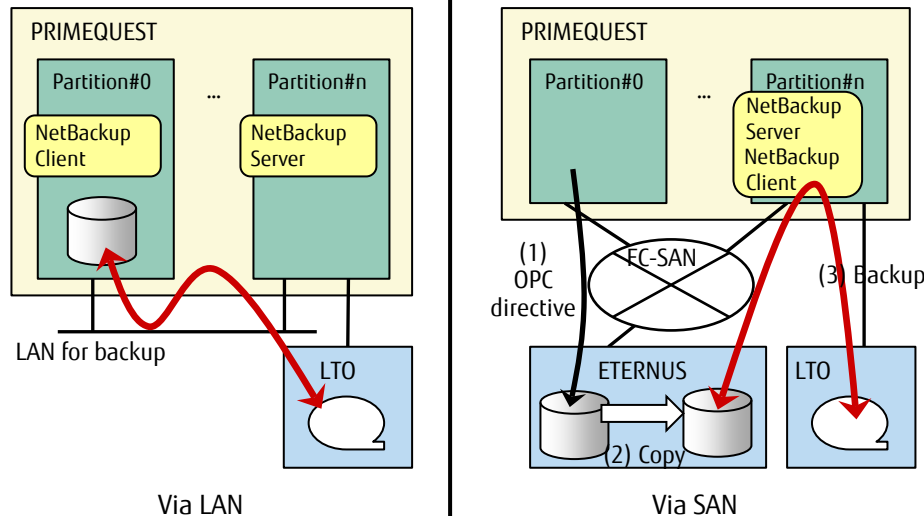
4.3 Backup and Restoration - NetBackup

Software with proven results for backups in large-scale systems

Merits	Demerits
• With deduplication backups, the storage usage is reduced (*1) • Speed up full backups with an accelerator (*1) • Online backups by automatically detecting instances of Oracle DB (*1) • Auto replication to remote locations with Auto Image Replication (AIR) (*1) • Management with only one server even in environments where multiple platforms co-exist • High-speed backups using "Snapshot Client" even in environments where many files exist • Synthetic backups for differential data (*2)	• Cannot back up and restore the system volume

(*1)The option license is required.
(*2) Integrates a differential backup with the full backup, creating a backup equivalent to the latest full backup

[Data backup using NetBackup]

Via LAN

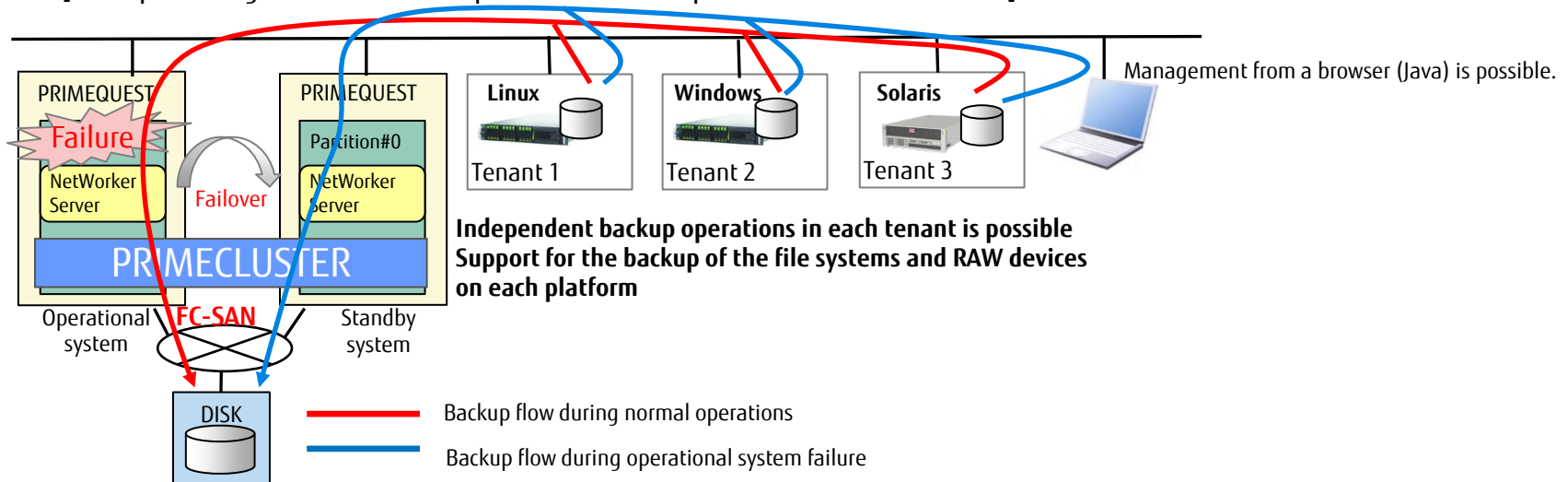Via SAN

4.3 Backup and Restoration - NetWorker

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Backup software that is No. 1 for affinity with PRIMECLUSTER

Merits	Demerits
• Affinity with PRIMECLUSTER is high (the results are abundant with UNIX Solaris, and optimal when migrating from Solaris) • Support for multiple tenants (independent backup operations in each tenant is possible) • Online backups (VADP) of Linux guest OSs in VMware are possible (Requires optional product) • Backups of mixed OSs (Linux, Windows, Solaris) are possible (including raw devices) • Even with different OSs, operations are possible with the unified GUI • Since backup schedule definitions are possible, the process can be performed automatically • High-speed backups in environments where massive amounts of files exist (ex. 100 thousand files) (*1) • Online backups of DB (Oracle) is possible (Requires optional product) • Synthetic backup of differential data is possible (*2)	• Cannot back up and restore the system volume (Using the OS's standard backup utility is recommended)

(*1) Backups are automatically divided to use the OS resources efficiently (which is called Parallel Save Streams)
(*2) Integrates a differential backup with the full backup, creating a backup equivalent to the latest full backup

[Example configuration that incorporates the backup server in PRIMECLUSTER]

Management from a browser (Java) is possible.

Independent backup operations in each tenant is possible
Support for the backup of the file systems and RAW devices on each platform

Backup flow during normal operations
Backup flow during operational system failure

PRIMEQUEST — Failure — NetWorker Server — PRIMECLUSTER — Operational system — FC-SAN — Standby system — Partition#0 — NetWorker Server — Failover — DISK — Linux Tenant 1 — Windows Tenant 2 — Solaris Tenant 3
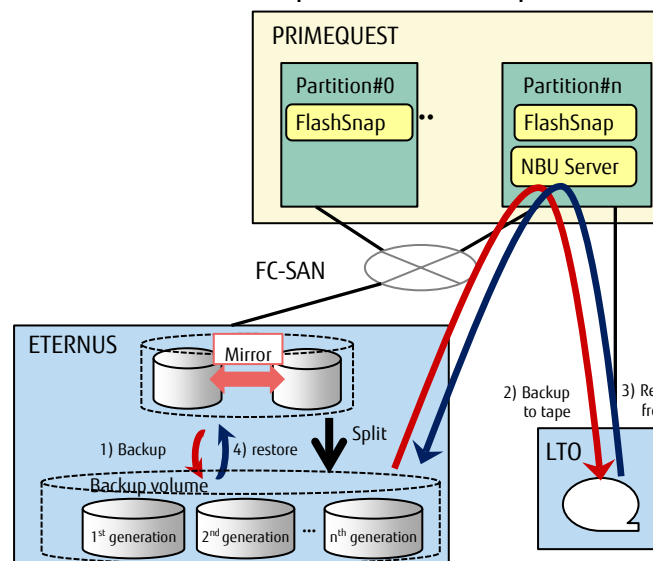
High speed backups with flexibility

Merits	Demerits
• The synchronization process is omitted for unused areas when snapshots are created with volume units but not for disk units. • Including the backup source volume, a maximum of up to 32 generations can be managed • With high speed resynchronization and the Split/Join function for the disk group, off-host processes such as off-host backups are possible • Mirror disconnect method (equivalent to EC for ETERNUS) and instant snapshot method (equivalent to OPC for ETERNUS) can be selected • If the storage is within the range of the supported storage, the storage combination for the backup source and backup destination is unrestricted • Local snapshots, such as with file and directory units are possible but not volume units	• When compared with the storage side copy function, load is applied to the operation server and I/O path during disconnection and reconnection • Does not support internal disks

[Data backups with FlashSnap]
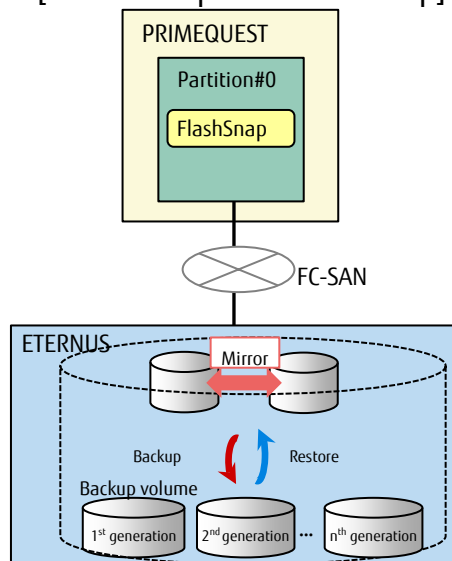
[Off-host backups with FlashSnap and NetBackup]

• Backup volumes can even be in different storage cabinets
• SFHA6.2 and later, and SFCFSHA6.2 and later support RHEL7.

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■ NTP Settings

- ■ Make sure to perform an NTP operation when using reserved SBs or configuring a partition with multiple (two or more) SBs

- ■ Targets for setting the time with an NTP operation

  ☞ For details, refer to "Design Guide" and "Installation Manual".

  - • MMB

    Becomes an NTP client and synchronizes with the external NTP server

  - • Each partition

    Correction based on the OSs NTP client settings

- ■ Key points for settings

  - • Designate three or more NTP servers for each partition.

  - • If the MMB is operating with NTP, designate the same NTP server as the MMB for each partition.

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Applying Time in Linux

When starting the system

The time acquired from the hardware clock is set as the system clock.

During system operation

The hardware clock and the system clock advance separately.
(During NTP operation, only the system clock is corrected.)

During a system stop

The hardware clock reflects the system clock time.

Time correction settings

☞ For details, refer to "General Description".

It is recommend that the hardware clock and the system clock be synchronized by periodically executing the hwclock command.

> **During long-term system operation, the system clock and hardware clock are both timed independently and are not synchronized.**

System clock: Software clock that uses a timer interrupt during system operation to manage time

Hardware clock: Clock equipped in the hardware that keeps time, driven by a battery even when the system is stopped

Revision Record

Date	Revised location	Description
2014-02-18	-	Created the first edition
2014-08-30	All	Added RHEL7 information
2014-10-14		
2016-05-06	All	Updated with the latest information
2016-04-19	All	Added new models Updated with the latest information
2016-06-06	4.2, 4.3	Updated the NetVault Backup related information

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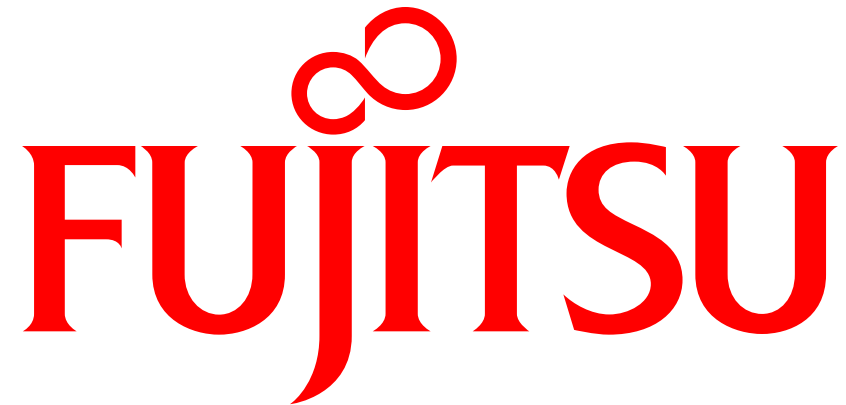
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