

# What's New in SUSE<sup>®</sup> Linux Enterprise 11

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## Summary

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SUSE® Linux Enterprise 11 from Novell delivers interoperability and mission-critical support for the complete computing environment, to help you reduce cost, complexity and risk. This version delivers significant advances and has been especially designed for:

- **Interoperability**—The most interoperable Linux turns boundaries into bridges to help make your IT work as one. You can increase Linux interoperability with Windows and UNIX to simplify your environment and better leverage your existing investments. You'll benefit from the Novell and Microsoft collaboration to run Windows virtualized on SUSE Linux Enterprise and vice versa, with full support from both vendors. You'll be able to manage SUSE Linux Enterprise from your existing Windows management tools, or leverage open standards to manage SUSE Linux Enterprise, Windows and UNIX side by side. And you can even run ASP.NET applications on Linux to reduce costs and improve performance.
- **Mission-critical computing**—The Linux built for mission-critical computing delivers the power and reliability you need to migrate from UNIX and build a resilient infrastructure. Powerful high availability clustering provides enterprise reliability with the affordability of open source. Green IT capabilities keep your enterprise lean and efficient. Low latency computing delivers guaranteed performance. And if help is needed, a new supportability infrastructure provides enhanced problem resolution.
- **Ubiquity**—SUSE Linux Enterprise powers your complete environment. You can run the desktop to data center platform built on a common code base. Deploy physical and virtual servers with the greatest of ease and outstanding performance, and run key applications from the leading ISVs. With SUSE Linux Enterprise, you can tailor your systems, or run virtual appliances for simplicity and speed. From x86 to mainframe, and from thin client to netbook to thick desktop, SUSE Linux Enterprise delivers proven capabilities for your entire infrastructure.

With the release of SUSE Linux Enterprise 11, Novell continues to set the standard in enterprise Linux\* technology.

### Highest-quality Engineering

Novell creates the SUSE Linux Enterprise platform with AutoBuild, a unique Novell development and testing methodology. AutoBuild ensures that all Linux software code from Novell meets the highest technical standards for reliability and integrity. Using AutoBuild, Novell can create and deliver important software updates in hours, rather than days or weeks. AutoBuild also allows Novell to create SUSE Linux Enterprise for multiple platforms simultaneously. As a result, you can configure a more efficient IT infrastructure, running and managing the same Linux operating system on all your mainframes, grids, clusters, workstations and desktops.

### Hardware and Drivers

SUSE Linux Enterprise is supported by all leading hardware vendors. Whether you want to run it on servers, clients, single-processor whitebox systems, multicore systems, blades or the largest mainframes, you'll find that SUSE Linux Enterprise is certified on the architectures you need. Novell works closely with chip manufacturers like Intel and AMD and supports 32-bit and 64-bit architectures as well as the latest single, dual and multi core processors. SUSE Linux Enterprise is fully certified on the latest servers, workstations, desktops and laptops from IBM, Dell, Fujitsu, HP, Lenovo, Silicon Graphics, Sun, Unisys and others. These vendors have partnered closely with Novell engineering teams throughout the design and creation of SUSE Linux Enterprise. Such tight

collaboration enables SUSE Linux Enterprise to take full advantage of the platforms where it is deployed, giving you the best possible performance—from your desktops to your data center.

SUSE Linux Enterprise 11 supports many new hardware components. It also adds support for a number of network and storage drivers as well as support for new audio and graphics devices. Continued improvements and enhancements have been made to:

- Hardware plug and play
- Printer standards support
- File standards support
- Network standards support
- Support for new processor technologies from Intel and AMD

## **Software Subscription Management**

Managing your SUSE Linux Enterprise subscriptions and support entitlements is made easier with Novell Customer Center and the Subscription Management Tool for SUSE Linux Enterprise. Novell Customer Center is an intuitive Web portal that makes it easy to manage business and technical interactions with Novell. From one location, you can review the status of all Novell products, subscriptions and services—and obtain critical Linux updates and support. Novell Customer Center helps you to ensure licensing compliance, simplify patch management and update processes, and reduce systems management costs. Included with any subscription, the Subscription Management Tool for SUSE Linux Enterprise is a fully supported proxy system for Novell Customer Center that helps you manage your updates while maintaining corporate firewall policy and allowing a more secure centralized deployment.

## **Subscription Benefits**

When you choose SUSE Linux Enterprise, you're subscribing to the best-engineered Linux platform in the world. SUSE Linux Enterprise 11 is backed by a seven-year lifecycle guarantee. During that time, via your access to the Novell Customer Center, you'll receive the latest software improvements, bug fixes and security patches through regular updates. This ensures that you always have the newest functionality and the best hardware support. Throughout the term of your subscription, Novell will work with leading hardware and software vendors to ensure that their latest products and enhancements are fully supported. You will also have access to numerous support services. Depending on your subscription level, your level of support can range from electronic assistance (via the Web and e-mail), to three tiers of telephone support or even the daily expertise of an onsite dedicated support professional.

## **World-class Support and Services**

Adopt and manage your SUSE Linux Enterprise based solutions with complete confidence, knowing you're backed by the world-class Novell Services organization. Whether you run a small business or a global enterprise, Novell delivers the resources you need to build and manage your IT environment. Leverage the expertise of our consulting experts, obtain industry leading training, and access our award-winning support organization to ensure you get the most from your IT investment. Novell has unmatched experience, expertise, and quest for quality that have been recognized by the industry and by customers. And Novell has a broad technology and

services partner network, all of whom can help you deploy SUSE Linux Enterprise no matter the size of your organization. You can count on Novell and its partners to provide the support you need so you can focus on what matters most—your business.

## **Release Notes and Package Descriptions**

The SUSE Linux Enterprise 11 release notes and package lists for each product contain detailed information about all new features, version numbers, package specifications and modifications.

At time of General Availability, you will find the release notes at:

- [www.novell.com/linux/releasenotes/](http://www.novell.com/linux/releasenotes/)

or in the docu directory of the DVD 1 ISO files of each product.

Also at the time of the official release, the current versions and descriptions of each package for SUSE Linux Enterprise Server and SUSE Linux Enterprise Desktop can be found at the following URLs:

- SUSE Linux Enterprise Server 11: [www.novell.com/products/server/techspecs.html](http://www.novell.com/products/server/techspecs.html)
- SUSE Linux Enterprise Desktop 11: [www.novell.com/products/desktop/techspecs.html](http://www.novell.com/products/desktop/techspecs.html)

## **Enhanced and New Features in SUSE Linux Enterprise 11**

This document provides an overview of new features and product enhancements that ship with SUSE Linux Enterprise 11. However, it does not intend to provide a comprehensive list of features. Please note that the actual contents might be subject to change.

For more detailed information about changes in SUSE Linux Enterprise 11, please check the ChangeLog file in the top level of DVD 1 of each product for a chronological log of all changes made to the updated packages.

With so many enhancements and new features, it's easy to see why organizations choose SUSE Linux Enterprise from Novell. To discover more about the platform for mission-critical computing for your complete physical and virtual environment, from desktop to data center, please visit [www.novell.com/linux](http://www.novell.com/linux)

## Manageability and Supportability

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<i>Feature or Function</i>	<i>Description</i>
YaST enhancements	<p>YaST supports a wide range of management tasks and provides a consistent administrative experience across all SUSE Linux Enterprise platforms. Its scalable design makes it easy to add hardware and software configurations and new administrative plug-ins to the frame set.</p> <p>YaST enhancements in SUSE Linux Enterprise 11:</p> <ul style="list-style-type: none"><li>• Completely rewritten and enhanced package management subsystem (ZYpp)</li><li>• Enhanced set of low-level system management libraries (libzypp)</li><li>• Enhanced YaST partitioner: Redesign which features a navigation tree with all available storage devices on the left side and displays information on the right side along with buttons to perform appropriate actions</li><li>• Support for add-on products, including third-party products</li><li>• New functionalities added to the YaST CD creator</li><li>• Facelift of several configuration modules</li></ul>
AutoYaST enhancements	<p>AutoYaST provides fully customizable, automatic, and remote Linux installation for large numbers of systems that share a similar environment and similar (but not necessarily identical) hardware, and that perform similar tasks. AutoYaST supports templates and hierarchical classes in the description files. AutoYaST dramatically shortens installation times and reduces administration costs for enterprise software rollouts.</p> <p>With SUSE Linux Enterprise 11, AutoYaST sees enhancements in the usability of the user interface and the storage options for AutoYaST profiles.</p>
Software management subsystem (ZYpp)	<p>ZYpp is the core of the new software management stack powering YaST, Zypper, and Novell ZENworks with powerful package management and a convenient, standards-based package management API.</p> <p>Features:</p> <ul style="list-style-type: none"><li>• Built on top of SAT solver (a satisfiability solver to compute package dependencies) which makes libzypp fast, light and gives it a simple and powerful dependency solving algorithm</li><li>• Supports rpm-md (Rpm Metadata), YaST2 and Novell Update, and plain</li></ul>

	<p>directories as repository types</p> <ul style="list-style-type: none"> <li>• Stores known repositories in .repo files (used by some package managers to allow one click adding of repositories) compatible with Yum</li> <li>• Powers the package management tool Zypper</li> <li>• Supports signed repositories, delta packages, package updates, and much more</li> </ul> <p>Benefits:</p> <ul style="list-style-type: none"> <li>• The fastest update stack available on any enterprise distribution</li> <li>• Saves costly administrator time</li> <li>• DeltaRPM technology reduces download time</li> <li>• Supports community standards: PackageKit UI and API support built-in</li> </ul>
<p>Software management library (libzypp)</p>	<p>Libzypp, the package manager resolver library, has been updated to version 6.1.0. This enhanced version provides all the functionality for a package manager:</p> <ul style="list-style-type: none"> <li>• An API for package repository management, supporting most common repository metadata formats and signed repositories</li> <li>• An API for managing packages, products, patterns dependencies, and patches (installation, removal, update and distribution upgrade operations) with additional features like locking</li> <li>• An API for committing the transaction to the system over an rpm target and supporting deltarpm calculation, media changing and installation order calculation</li> <li>• An API for browsing available and installed software, with some facilities for programs with a user interface</li> <li>• A suite of maintained solving test cases representing common and uncommon operations on Linux software management</li> </ul>
<p>Command line package manager</p>	<p>Zypper is an easy to use command line package manager using the software package management library libzypp.</p> <p>SUSE Linux Enterprise uses rpm as its package format. The basic tool for this is the RPM (RPM Package Manager) program, it handles installation, removal and querying of packages.</p> <p>Zypper is able to manipulate package repositories (like the Build Service), search for packages, install, remove, or update packages and more. It can be used as standalone application or in scripts or other applications.</p>
<p>Common Information Model (CIM) management</p>	<p>SUSE Linux Enterprise has adopted the open CIM industry standard as a vendor-independent, robust and descriptive framework for system management.</p>

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It delivers interoperability, allowing CIM-enabled system management solutions to easily target SUSE Linux Enterprise systems.

New key components for CIM management:

- SUSE Linux Enterprise 11 comes with the Small Footprint CIM Broker (SFCB) a CIM server or CIMOM conforming to the CIM Operations over HTTP protocol. A CIMOM manages communication between providers, which interact with the hardware, and a CIM client, where the administrator manages the system. SFCB is highly configurable and robust, with low resource consumption, and is therefore specifically suited for embedded and resource constrained environments. SFCB supports providers written against the Common Manageability Programming Interface (CMPI) and Web-Based Enterprise Management (WBEM). It is capable of supporting all or selected DMTF specifications.
- The storage management provider (SMI-S providers for volume management and snapshot, libstorage) contains the providers to instrument the volumes and snapshots on the Linux file system. These are based on SNIA's SMI-S Volume Management profile and copy services profile, respectively.
- Virtualization management provider (libvirt)
- Power management provider
- **Tech preview**—*Software management provider PackageKit: PackageKit is a system designed to make installing and updating software on your computer easier. The primary design goal is to unify all the software graphical tools used in different distributions, and use some of the latest technology like PolicyKit to make the process more smooth.*

Novell Customer Center

Novell Customer Center is a Web-based portal that provides one location for organizations to easily obtain updates and support for the SUSE Linux Enterprise 11 product line. Novell Customer Center provides:

Subscription and entitlement management

- Product and system registration, as well as management of subscriptions
- Interactive or automatic machine registration
- Provisional update service entitlement for installation

Role-based account management

- Manage users and roles of the account over time

Integrated support services

- Support Knowledgebase, electronic support, requests, downloads
- Value-added service offerings

Novell ZENworks Linux Management compatibility

- Package and patch management
  - Product and pattern management
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	<p>Intuitive Web interface</p> <ul style="list-style-type: none"> <li>• Views tailored to account user role</li> <li>• Modularly expands with each subscription</li> <li>• Basic one-to-one management</li> </ul>
<p>Subscription Management Tool for SUSE Linux Enterprise</p>	<p>The Subscription Management Tool for SUSE Linux Enterprise is included with every SUSE Linux Enterprise subscription. The tool supports SUSE Linux Enterprise 11 as a client at SUSE Linux Enterprise 11 General Availability.</p> <p>The Subscription Management Tool for SUSE Linux Enterprise is a proxy system that helps customers manage their SUSE Linux Enterprise software updates while maintaining corporate firewall policy and regulatory compliance requirements. It is integrated with Novell Customer Center and provides a repository and registration target that is synchronized with Novell Customer Center and maintains all of its capabilities while allowing a more secure centralized deployment.</p>
<p>Novell Support Link</p>	<p>Novell Support Link is a new supportability infrastructure component of SUSE Linux Enterprise 11. This component uses supportconfig to securely transfer support diagnostic information submitted by customers back to Novell Technical Services through the YaST interface. Supportconfig is a package tool that gathers troubleshooting information and organizes system information to reduce problem resolution time for SUSE Linux Enterprise support issues.</p>
<p>Enablement for Novell Support Advisor</p>	<p>Novell Support Advisor is a support automation and self-help tool used to support and diagnose SUSE Linux Enterprise based products. This tool provides customers with a streamlined way to perform both proactive and reactive system diagnostic tasks typically provided by Novell Technical Services, but in a local and automated fashion.</p> <p>The Novell Support Advisor consists of a client that runs on SUSE Linux Enterprise Desktop 11 (or later versions), SUSE Linux Enterprise Server 11 (or later versions), openSUSE 10.3 (or later versions), Microsoft Windows XP SP2 (or later versions), Microsoft Windows Vista or Microsoft Windows Server 2003. The client needs to be installed on a system that can both communicate with the Novell update server and with servers within your local environment. The self-help and health diagnosis portion of the Novell Support Advisor allows the administrator to select the system(s) for which they would like to run a support health check. When a health check is executed on a system, it will gather the</p>

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needed configuration and log files from the system to be analyzed by the Novell Support Advisor client. Based upon the installed products and the type of health checks being performed, the Novell Support Advisor uses a set of Novell Support Diagnostic Patterns to determine the current health state and provide recommended solutions to repair potential issues.

Features of Novell Support Advisor 1.0 as of March 2009:

- Novell Support Advisor client supports the following platforms:
    - SUSE Linux Enterprise Server 11 or later
    - SUSE Linux Enterprise Desktop 11 or later
    - openSUSE 10.3 or later
    - Microsoft Windows XP SP2 or later
    - Microsoft Windows Server 2003
    - Microsoft Vista
  - System discovery based upon IP address, IP range, or DNS name
  - SUSE Linux Enterprise Server Health Diagnosis, with recommended solutions
  - Authentication support for Novell Customer Center
  - Automated client and Support Diagnostic Pattern (SPD) updates
  - Centralized Novell Technical Services links
  - Flexible server authentication via ROOT user, SUDO user or SSH key certificate
  - Ability to select and execute support diagnostic patterns by product category
  - Pattern reporting and feedback to ensure validity and refinement of existing patterns
  - New and enhanced support diagnostic patterns (including security vulnerability alerts) released as available
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## Serviceability

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<b><i>Feature or Function</i></b>	<b><i>Description</i></b>
Intelligent Platform Management Interface (IPMI)	<p>OpenIPMI, updated to version 2.0.14, delivers an extensible and open standard for monitoring, logging, recovery and inventory as well as control of system hardware, sensors and events.</p> <p>OpenIPMI consists of two main parts: a device driver that is included in the Linux kernel and a user-level library that provides a higher-level abstraction of IPMI and generic services that can be used on any operation system.</p> <p>The OpenIPMI package contains the user-level library part. The OpenIPMI library also includes the ipmicmd program, a small program that allows a user to execute direct IPMI commands (such as registering for incoming commands or setting a source IPMI address).</p>
IPMItool	<p>SUSE Linux Enterprise 11 includes the enhanced IPMItool version 1.8.11. It manages and configures devices that support IPMI specifications.</p> <p>This utility is designed to communicate with IPMI-enabled devices by either using a system interface (as provided by a kernel device driver such as OpenIPMI) or over the Remote Management Control Protocol (RMCP) LAN protocol defined in the IPMI specification.</p>
Debugging: ltrace	<p>ltrace provides a debugging program that runs a specified command until it exits. SUSE Linux Enterprise 11 includes ltrace version 0.4.</p> <p>While commands are executing, ltrace intercepts and records the dynamic library calls initiated by the executed process and the signals received by that process. It can also intercept and print system calls executed by the program. The program to be traced does not need to be recompiled, so you can use it on binaries for which you don't have the source readily available.</p> <p>This utility is very useful in helping you quickly trace the failure point of an executable program.</p>
Debugging: cross-crash	<p>Cross-architecture version of crash (tool to debug kernel dump files)</p> <p>The core analysis suite is a self-contained tool that can be used to investigate either live systems, kernel core dumps created from the netdump and diskdump packages, the mCore kernel patch offered by Mission Critical Linux, or the LKCD kernel patch.</p>

	<p>This package contains a cross-architecture capable version of crash. With this version you can open dumps from another architecture.</p>
<p><i>Performance Monitoring:</i> <i>PerfMon2</i></p>	<p><i>This package provides a tool, called pfmon, which monitors performance on unmodified binaries or for an entire system. On each supported processor, it exploits the Performance Monitoring Unit (PMU) which implements the hardware counters. This package uses the perfmon2 kernel support interface to access the PMU and the libpfm library.</i></p>
<p><b>Technical Preview</b></p>	
<p>System Tracing: SystemTap</p>	<p>SUSE Linux Enterprise Server 11 updates SystemTap to version 0.7.1. SystemTap is a tracing and probing tool that allows users to study and monitor the activities of the operating system (particularly, the kernel) in fine detail.</p>
<p>Monitoring: Nagios</p>	<p>Nagios is an open source host, service and network monitoring program. SUSE Linux Enterprise Server 11 updates Nagios to version 3.0.6.</p>

## Virtualization

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<b><i>Feature or Function</i></b>	<b><i>Description</i></b>
Xen	<p>Xen is a hypervisor for x86 environments that supports multiple guest operating systems with unprecedented levels of execution performance and resource isolation. In SUSE Linux Enterprise 11, Xen is updated to version 3.3.1.</p> <p>Successfully partitioning a machine to support the concurrent execution of multiple operating systems poses several challenges. First, virtual machines must be isolated to prevent the execution of one from adversely affecting the performance of another. This is particularly true when virtual machines are owned by mutually untrusting users. Second, the virtualization layer must support a variety of guest operating systems to accommodate the heterogeneity of popular applications. Third, the performance overhead introduced by virtualization should be small.</p> <p>Xen uses a technique called paravirtualization in which the guest OS is modified, mainly to enhance performance. The Xen hypervisor (microkernel) provides no hardware device drivers except for CPU and memory. This job is left to the privileged kernel running in domain 0, which has full hardware access and is started immediately after Xen starts up. Other domains access hardware through virtual interfaces provided by Xen and the domain 0 kernel.</p> <p>In addition to this package, running paravirtualized guest systems requires of the kernel-xen and xen-tools packages. Xen 3.3.1 also supports full virtualization of unmodified guests if appropriate hardware is present and the xen-tools-ioemu package has been installed.</p>
Virtual Machine Driver Pack	<p>Xen-KMP 3.3.1 contains the 32-bit and 64-bit paravirtualized network, bus and block drivers for fully virtualized guests for the following platforms:</p> <ul data-bbox="539 1495 935 1692" style="list-style-type: none"><li>• Windows Server 2003 on Xen</li><li>• Windows 2000 on Xen (32-bit only)</li><li>• Windows XP on Xen</li><li>• Red Hat Enterprise Linux 4 on Xen</li><li>• Red Hat Enterprise Linux 5 on Xen</li></ul> <p>and for enlightened guests for the following platforms:</p> <ul data-bbox="539 1797 880 1864" style="list-style-type: none"><li>• Windows Server 2008 on Xen</li><li>• Windows Vista on Xen</li></ul>

<p>VMI-enabled kernel</p>	<p>SUSE Linux Enterprise 11 comes with an additional kernel which is designed to run over a virtual machine interface layer (VMI).</p> <p>With this kernel SUSE Linux Enterprise 11 supports the benefits of the VMI as used by VMware infrastructure. The delivery of a dedicated VMI kernel flavor gives you the choice to use the right kernel depending on their infrastructure, requirements and system architecture.</p>
<p>VM management tool</p>	<p>virt-manager is updated to version 0.5.3</p> <p>Virtual Machine Manager is a desktop interface virtual machine management tool. It presents a summary view of all live domains with current performance and resource utilization statistics. A detailed graphical view shows performance and utilization over time. Ultimately the application will support new domain creation with centralized configuration, resource allocation, performance monitoring and management. Finally, an embedded VNC client viewer provides a complete graphical console for the guest domain.</p>
<p>libvirt Library</p>	<p>The libvirt Library has been updated to version 0.5.1.</p> <p>Libvirt is a C toolkit to interact with the virtualization capabilities Linux. Virtualization of the Linux Operating System means the ability to run multiple instances of Operating Systems concurrently on a single hardware system where the basic resources are driven by a Linux instance. The library aims to provide long term stable C API initially for the Xen paravirtualization but is able to integrate other virtualization mechanisms if needed.</p> <p>Currently it supports:</p> <ul style="list-style-type: none"> <li>• Xen hypervisor (Linux and Solaris hosts)</li> <li>• QEMU emulator</li> <li>• KVM Linux hypervisor</li> <li>• LXC Linux container system</li> <li>• OpenVZ Linux container system</li> <li>• User Mode Linux paravirtualized kernel</li> <li>• Storage on IDE/SCSI/USB disks, FibreChannel, LVM, iSCSI, NFS and filesystems</li> </ul> <p>Libvirt provides for:</p> <ul style="list-style-type: none"> <li>• Remote management using TLS encryption and x509 certificates and remote management authenticating with Kerberos and SASL</li> <li>• Local access control using PolicyKit and zero-conf discovery using Avahi multicast-DNS</li> <li>• Management of virtual machines, virtual networks and storage</li> <li>• portable client API for Linux, Solaris and Windows</li> </ul>

## Security

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<b><i>Feature or Function</i></b>	<b><i>Description</i></b>
AppArmor	<p>AppArmor has been updated to the latest version 2.3.</p> <p>AppArmor is the most effective and easy-to-use security system for Linux applications available today. It's a security framework that proactively protects the operating system and applications from external or internal threats, even zero-day attacks, by enforcing good program behavior and preventing even unknown software flaws from being exploited. Security profiles completely define what system resources individual programs can access, and with what privileges. A number of default policies are included, along with learning-based tools and advanced statistical analytics that simplify the development of customized policies, even for very complex applications.</p>
YaST security module	<p>With SUSE Linux Enterprise 11, the YaST security module has been enhanced to consolidate the various security settings of the system and to give an overview of the "security health status" for the following services:</p> <ul style="list-style-type: none"><li>• File permissions</li><li>• Login settings</li><li>• Boot settings</li><li>• Password settings</li><li>• Firewall</li></ul> <p>This enhancement makes the management of the security settings much easier, as it provides a single consolidated access point to all security setting information.</p>
Trusted Computing enablement: Trusted Platform Module	<p>SUSE Linux Enterprise Server 11 comes with support for Trusted Computing technology.</p> <p>Trusted Computing (TC) is a technology developed and promoted by the Trusted Computing Group. The term is taken from the field of trusted systems and has a specialized meaning. With Trusted Computing, the computer will consistently behave in specific ways, and those behaviors will be enforced by hardware and software. Enforcing this trusted behavior is achieved by loading the hardware with a unique ID and unique master key and denying even the owner of computer knowledge and control of their own master key.</p> <p>The TPM support is entirely passive, meaning that measurements are being performed, but no action is taken based on any TPM-related activity. TPM chips manufactured by</p>

	<p>Infineon, NSC and Atmel are supported, in addition to the virtual TPM device for Xen. To enable your system's TPM chip to be used, make sure that the "security chip" option of your BIOS is selected.</p>
<p>Virtual private network (VPN)  strongSwan</p>	<p>SUSE Linux Enterprise 11 includes strongSwan 4.2.8 which provides a robust implementation of IP Security (IPsec) that is ideally suited to VPN deployments. New features in the updated version of strongSwan are</p> <ul style="list-style-type: none"> <li>• Fully tested support of IPv6 IPsec tunnel connections</li> <li>• strongSwan Manager—a graphical management interface for IKEv2</li> </ul>
<p>Pluggable authentication modules (PAM)</p>	<p>Pluggable authentication modules (PAMs) provide for better system security by allowing system administrators to set authentication policies without having to recompile programs that perform authentication. Many authentication mechanisms are available through PAM, including password, Kerberos and LDAP.</p> <p>With the new package pam-config, SUSE Linux Enterprise 11 provides a command-line utility to maintain the common PAM configuration files included by most PAM application configuration files. It can be used to configure a system for different network- or hardware-based authentication schemes. pam-config can also add, adjust or remove other PAM modules and their options.</p>
<p>Encrypted file system:  eCryptfs  <b>Technology Preview:</b></p>	<p>eCryptfs is a POSIX-compliant, enterprise-class, stacked cryptographic file system for Linux.</p> <p>SUSE Linux Enterprise 11 ships with the kernel modules and the user space utilities and provides a preview of a stacked cryptographic file system for Linux that is not supported at this stage.</p> <p>Provides advanced key management and policy features. eCryptfs stores cryptographic metadata in the header of each file written, so that encrypted files can be copied between hosts; the file will be decryptable with the proper key, and there is no need to keep track of any additional information aside from what is already in the encrypted file itself.</p>

## Storage

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<b><i>Feature or Function</i></b>	<b><i>Description</i></b>
Device Mapper Multipathing (MPIO)	<p>SUSE Linux Enterprise Server 11 contains the latest and most stable Linux multipathing implementation. Multipath I/O is a fault-tolerance and performance enhancement technique whereby there is more than one physical path between the CPU in a computer system and its mass storage devices through the buses, controllers, switches, and bridge devices connecting them. The device-mapper serves as a generic framework to map one block device onto another.</p> <p>Novell worked with storage vendors on having certified SUSE Linux Enterprise Server 11 for their systems at GA. All kernel drivers and software are already included in the operating system.</p>
ext3	<p>This is the default file system in SUSE Linux Enterprise 11. The ext3 file system is a journaling file system originally developed as an extension to the standard ext2 file system on Linux.</p> <p>Journaling dramatically reduces file system crash-recovery time and is widely used in high-availability sites with shared disks.</p>
XFS	<p>XFS is a high-performance journaling file system originally developed by SGI for use in its IRIX systems. It combines advanced journaling technology with full 64-bit addressing and scalable structures and algorithms.</p> <p>It is completely multithreaded and can support large files and large file systems, extended attributes, and variable block sizes. It is extent based and makes extensive use of Btrees (directories, extents, and free space) to aid both performance and scalability.</p>
I/O barrier	<p>SUSE Linux Enterprise 11 has I/O barrier support switched on by default; this guarantees the ordering to write requests to the storage. This helps to ensure data integrity even in critical situations.</p> <p>The ordering of write requests is meaningful for things like journal checkpoints. All requests queued before a barrier request must be finished (i.e., they reached the physical medium) before the barrier request is started. All requests queued after the barrier request must be started only after the barrier request is finished (again, they must have reached the physical medium).</p>

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<p><i>ext4</i></p> <p><b>Technology Preview</b></p>	<p>I/O barriers secure disk I/O operations and assure that journaling file systems can trust the journal. Barriers can be disabled to speed up disk I/O depending on the infrastructure design.</p> <p><i>The ext4 file system is a journaled file system developed as the successor to ext3. In SUSE Linux Enterprise 11 it is shipped as an unsupported Technology Preview.</i></p> <p><i>The ext4 file system mainly provides for enhanced 64-bit storage limits and performance as well as reliability improvements in general.</i></p>
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## Performance and Scalability

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<b>Feature or Function</b>	<b>Description</b>
CPU scalability	<p>SUSE Linux Enterprise 11 ships Linux kernel 2.6.27</p> <p>It ensures better scalability, up to 4,096 CPUs on IA-64 systems (default kernel). On POWER 64-bit (PPC-64) it scales up to 1,024 CPUs, and on x86-64 systems, it scales up to 512 CPUs.</p> <p>With SUSE Linux Enterprise 11, we ensure that your systems provide enterprise-class scalability.</p>
Memory limits	<p>SUSE Linux Enterprise 11 delivers large-scale memory support through efficient memory management. With Linux kernel 2.6.27, the memory limits for the supported hardware architectures are as follows (max. RAM theoretical/certified)</p> <ul style="list-style-type: none"> <li>• x86: 64/16 GiB</li> <li>• ia64: 1 PiB/4 TiB</li> <li>• x86_64: 64 TiB/512 GiB</li> <li>• s390x: 4 TiB/256 GiB</li> <li>• ppc64: 1 PiB/512 GiB</li> </ul>
Resource management: Control groups	<p>Control groups, a new kernel feature starting with Linux kernel 2.6.24, provide a file system interface to manipulate and control the details on task grouping, including creation of new task groups (control groups), permission handling and task assignment.</p> <p>There are multiple efforts to provide process aggregations in the Linux kernel, mainly for resource tracking purposes. Such efforts include cpusets, CKRM/ResGroups, and virtual server name spaces. These all require the basic notion of a grouping/partitioning of processes, with newly forked processes ending in the same group (cgroup) as their parent process.</p> <p>The cgroup feature provides the minimum essential kernel mechanisms required to efficiently implement such groups. It has minimal impact on the system fast paths, and provides hooks for specific subsystems such as cpusets to provide additional behavior as desired.</p>
Kernel resource management Cpuset System	<p>Cpuset System (CPUSETS) is a processor and memory placement mechanism. It provides lightweight objects in the Linux kernel that enable users to partition their multiprocessor machines by creating execution areas. A virtualization layer has</p>

	<p>been added, so you can split a machine in terms of CPUs as well as memory.</p> <p>With SUSE Linux Enterprise 11, CPUSETS is based on cgroups.</p> <p>The main purpose of this feature is to give the Linux kernel full CPU-administration capabilities. CPUSETS is a strong jail, and a process running inside this predefined area won't be able to run on unauthorized processors. CPUSETS can be useful in the following domains:</p> <ul style="list-style-type: none"> <li>• Servers running different applications (for instance, a Web server and a database)</li> <li>• High-performance computing (HPC) applications, especially in Non-Uniform Memory Architecture (NUMA) machines</li> </ul>
<p>Kernel resource management: Command-line tool Cpuset</p>	<p>Cpuset is a command-line tool to make using the CPUSETS facilities in the Linux kernel easier.</p> <p>The actual included command is called cset and it allows manipulation of CPUSETS on system and provides higher level functions such as implementation and control of a basic CPU shielding setup.</p>
<p>System activity</p>	<p>SUSE Linux Enterprise Server ships the updated sysstat package, version 8.1.15, which contains sar and iostat commands for Linux.</p> <p>The sar commands for Linux command collects and reports system activity information.</p> <p>The iostat command reports CPU statistics and I/O statistics for TTY devices and disks. Information collected by sar and iostat can be saved in a binary file for future inspection. Both commands now support SMP machines when displaying CPU utilization.</p>
<p>Resource management: Tickless idle</p>	<p>Tickless idle is a new kernel feature in SUSE Linux Enterprise Server 11.</p> <p>The Linux kernel uses periodic timer events, called timer ticks, for each CPU to facilitate process accounting, scheduler load balancing, and maintaining per-CPU timer events. One drawback is that when systems are idle, these periodic ticks wake up the system and bring it out of its power saving "sleep" state—roughly every millisecond for newer kernels operating at 1000 Hz—causing unnecessary power consumption.</p> <p>With tickless idle in SUSE Linux Enterprise Server 11, the periodic timer tick has been eliminated when the CPU is idle. This allows the CPU to remain in power saving states for longer periods of time, reducing overall system power consumption and saving money.</p>

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<p>Memory allocation: Swap over NFS</p>	<p>SUSE Linux Enterprise 11 provides support for using the network file system (NFS) over Internet protocols (IP) to leverage remote storage for local server needs. No longer restricted to local storage for swap space, you can utilize less costly hardware and storage, use more dense systems, and simplify server administration, reducing acquisition, implementation, administration and management costs.</p> <p>By using swap over NFS, you can cost effectively protect your systems against expensive application restarts.</p>
<p>Memory allocation: Hot-add of memory</p> <p><b>Technology Preview</b></p>	<p>SUSE Linux Enterprise 11 provides for hot-add of memory. However, this function is currently only supported on the following machines:</p> <ul style="list-style-type: none"><li>• IBM eServer xSeries x260, single node x460, x3800, x3850, single node x3950</li><li>• Certified systems based on recent Intel Xeon Architecture</li><li>• Certified systems based on recent Intel IPF Architecture</li><li>• All IBM System p servers with POWER5 or POWER6 processor and recent firmware</li></ul> <p>This function allows memory to be added while the server is still running. It gives you more flexibility in resource planning, and prevents from additional downtime for maintenance or upgrade tasks.</p>

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## Network

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<b>Feature or Function</b>	<b>Description</b>
OpenFabrics Enterprise Distribution	<p>SUSE Linux Enterprise 11 ships with OpenFabrics Enterprise Distribution (OFED) 1.4, the most current open source InfiniBand software stack offered by the OpenFabrics Alliance. OFED 1.4 includes 10 gigabit Ethernet drivers and MPICH2 MPI libraries.</p> <p>This helps to maximize your investment in blade server infrastructure with higher density configurations and to reduce the time, cost and complexity of delivering high-bandwidth connections for high-performance computing.</p>
Support for traceroute over TCP	<p>SUSE Linux Enterprise 11 includes tcptraceroute 1.2, a traceroute implementation using TCP SYN packets, instead of the more traditional UDP or ICMP ECHO packets.</p> <p>traceroute is a network tool used to determine the route taken by packets across an IP network. The advantage of tcptrace is its ability to trace through many common firewall filters.</p>
Fibre Channel over Ethernet (FCoE)	<p>SUSE Linux Enterprise ships with Open-FCoE version 1.0.4. Open-FCoE is an implementation of the Fibre Channel over Ethernet working draft. Fibre Channel over Ethernet is the encapsulation of Fibre Channel frames in Ethernet packets.</p> <p>It allows users with an FCF (Fibre Channel over Ethernet Forwarder) to access their existing Fibre Channel storage using an Ethernet adapter. When leveraging Data Center Bridging (DCB) PFC technology to provide a lossless environment, Open-FCoE can run SAN and LAN traffic over the same link.</p>
Data Center Bridging (DCB)	<p>Data Center Bridging (DCB) is a collection of Ethernet enhancements designed to allow network traffic with differing requirements (highly reliable, no drops vs. best effort vs. low latency) to operate and coexist on Ethernet. Current DCB features are:</p> <ul style="list-style-type: none"> <li>• Enhanced Transmission Selection (Priority Grouping)—Provides a framework for assigning bandwidth guarantees to traffic classes.</li> <li>• Priority-based Flow Control (PFC)—Provides a flow control mechanism which can work independently for each 802.1p priority.</li> <li>• Congestion Notification—Provides a mechanism for end-to-end congestion control for protocols that do not have built-in congestion management.</li> </ul>
IPv6 improvements	<p>IPv6, the next generation of the protocol, offers many advantages, such as quality-of-</p>

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service (QoS) control and a much larger address space, while mobile IPv6 adds roaming capabilities.

On behalf of the US federal government, the Office of Management and Budget issued a policy mandating that all federal government agencies upgrade their network infrastructure to IPv6 and interface each agency network with this infrastructure. Being on the IPv6 Approved Products List (APL) will become a Department of Defense and US federal government equipment purchase requirement.

SUSE Linux Enterprise Server was the first Linux distribution to be added to the APL, and it can be installed in an IPv6 environment and run with IPv6 applications.

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## Application and Developer Services

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<b>Feature or Function</b>	<b>Description</b>
Software Development Kit	<p>SUSE Linux Enterprise Software Development Kit provides tools to assist developers in customizing SUSE Linux Enterprise 11 to fit their needs.</p> <p>The Software Development Kit for SUSE Linux Enterprise 11 contains libraries, development environments and tools along the following patterns:</p> <ul style="list-style-type: none"><li>• Perl development</li><li>• Web development</li><li>• Java development</li><li>• Python development</li><li>• .NET development</li><li>• Ruby development</li><li>• Ruby on Rails development</li><li>• C/C++ development</li><li>• GNOME/GTK+ development</li><li>• KDE development</li><li>• Qt 4 development</li><li>• Linux kernel development</li><li>• Version control systems</li><li>• YaST development</li><li>• Certification</li><li>• Programming libraries</li><li>• Documentation tools</li></ul> <p>The SUSE Linux Enterprise 11 Software Development Kit gives developers the flexibility to create applications on either SUSE Linux Enterprise Server or SUSE Linux Enterprise Desktop and target them for desktop or server deployment. The development kit features a wealth of tools, application programming interfaces (APIs) and documentation, making it easy to deliver applications for Linux. Developers can create, debug and test applications with ease. The more, it enables ISVs to develop and deliver software for Linux according to the Linux Standard Base.</p> <p>To consolidate the development tools to one product, SUSE Linux Enterprise Server 11 and SUSE Linux Enterprise Desktop 11 will no longer contain development packages beyond the core development packages necessary to compile kernel modules.</p>

<p>IBM WebSphere Application Server Community Edition</p>	<p>IBM WebSphere Application Server Community Edition is a lightweight J2EE application server available for free. With SUSE Linux Enterprise 11 it is shipped in version 2.1.1.1.</p> <p>Built on Apache Geronimo technology, it harnesses the latest innovations from the open source community to deliver an integrated, readily accessible and flexible foundation for developing and deploying Java applications. Through the use of best-of-breed, open source applications such as Eclipse, Apache Tomcat, and Apache Derby, WebSphere Application Server Community Edition delivers a clear path to the advanced capabilities of the WebSphere middleware portfolio.</p> <p>To get technical support for WebSphere Application Server Community Edition you need to have an annual subscription.</p>
<p>Java Runtime Environment</p>	<p>SUSE Linux Enterprise 11 supports Java development and applications on the network. Java is a strongly object-oriented development language. Java enables cross-platform and application server development.</p> <p>SUSE Linux Enterprise 11 ships with IBM Java 1.4.2 and IBM Java 1.6.</p>
<p>.NET Runtime Environment</p>	<p>Mono provides interoperable support for .NET client and server applications for heterogeneous environments. The project will implement various technologies that have been submitted to the ECMA for standardization. SUSE Linux Enterprise 11 ships with Mono version 2 which supports the following features:</p> <p>Microsoft compatible APIs:</p> <ul style="list-style-type: none"> <li>• API for accessing databases</li> <li>• API for developing Web-based applications</li> <li>• API to create desktop applications</li> <li>• API to manipulate XML documents</li> <li>• Support for the Language Integrated Query (LINQ)</li> <li>• A LINQ provider for XML</li> <li>• A portable graphics rendering API</li> </ul> <p>Mono APIs:</p> <ul style="list-style-type: none"> <li>• A binding to the Gtk+ 2.12 and GNOME libraries for creating desktop applications on Linux, Windows and Mac OS X</li> <li>• A library to manipulate ECMA CLI files (the native format used for executables and libraries)</li> <li>• A binding to the Cairo Graphics library to produce 2D graphics and render them into a variety of forms (images, windows, postscript and PDF)</li> <li>• A library to create and consume databases created with SQLite</li> </ul>

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	<ul style="list-style-type: none"><li>• A library to access Linux and UNIX specific functionality from your managed application—with both a low-level interface as well as higher level interfaces</li></ul> <p>Mono enables developers to use their existing .NET knowledge and skills to develop Linux-compatible applications.</p>
GNU Compiler Collection (GCC)	<p>The GNU Compiler Collection (GCC) is a set of programming language compilers developed by the GNU Project. It is:</p> <ul style="list-style-type: none"><li>• The key component of the GNU toolchain</li><li>• The standard compiler for Linux operating systems</li><li>• A collection that supports multiple architectures and diverse environments</li></ul> <p>It includes front-ends C, C++ (SDK only), Fortran, and other languages, as well as libraries for these languages.</p> <p>SUSE Linux Enterprise 11 ships with version 4.3.2.</p>
GNU GLIBC	<p>Provides the most important standard libraries used by nearly all programs: the standard C library, the standard math library and the POSIX thread library.</p> <p>Version 2.9 is shipped with SUSE Linux Enterprise 11.</p>
GDB, the GNU debugger	<p>With GDB, you can trace kernel execution, establish breakpoints and examine the kernel's memory and data structures. GDB can execute the following actions to help you catch bugs in the act:</p> <ul style="list-style-type: none"><li>• Start your program, specifying anything that might affect its behavior</li><li>• Make your program stop on specified conditions</li><li>• Examine what has happened when your program has stopped</li><li>• Change things in your program, so you can experiment with correcting the effects of one bug and go on to learn about another</li></ul> <p>Read more about GDB at <a href="http://sourceware.org/gdb/">http://sourceware.org/gdb/</a></p>

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## New Architecture-specific Features for System z

<b><i>Feature or Function</i></b>	<b><i>Description</i></b>
Processor degradation	<p>The newer z9 and z10 systems may reduce processor speed if cooling issues occur. In this case, a Signal Channel Link Protocol (SCLP) event is issued. This feature triggers a <i>uevent</i> and issues a warning to Syslog. This enables automation software to observe the machine state and act based on policies, as applicable.</p> <p>This functionality is a prerequisite for automation software to take self-healing actions and increase system availability.</p>
Large page support in IBM System z	<p>This functionality provides the possibility for processes to allocate process memory in chunks of 2 MB instead of 4 KB.</p> <p>Large page support is implemented through the package <code>hugetlbfs</code>, using both hardware large page support if available (IBM System z10), and software large page emulation (with shared <code>hugetlbfs</code> page tables) on older hardware.</p> <p>Exploitation of the IBM System z10 hardware large page support is only available when running Linux on System z in an LPAR.</p> <p>The benefit of this functionality is greater performance as better system throughput is achieved when leveraging large page support, with the IBM java virtual machine, or databases (DB2, Oracle, etc).</p>
Linux CPU node affinity	<p>Linux CPU node affinity optimizes the Linux scheduling according to the CPU node topology.</p> <p>Newer hardware (such as IBM System z10 Enterprise Class) supports an interface that can be used to get information about the CPU topology of an LPAR. This can be used to optimize the Linux scheduler which bases its decisions on which process gets scheduled to which CPU on the CPU topology.</p> <p>This feature increases cache hits and, therefore, overall performance as well.</p>
Hardware	<p>Hardware features include:</p> <ul style="list-style-type: none"> <li>• Improved handling of dynamic subchannel mapping</li> <li>• Multipath IPL (IPL through IFCC)</li> <li>• Decimal floating point and z10 instructions support</li> </ul>

	<ul style="list-style-type: none"> <li>• Automatic adapt CPU and/or memory: The feature cpuplugd is a daemon that manages CPU- and memory-resources based on a set of rules. This functionality allows to adapt the number of CPUs and the amount of memory a VM-Linux-guest is using. Depending on the workload CPUs can be enabled or disabled. The amount of memory can be increased or decreased exploiting the Cooperative Memory Management (CMM1) feature. The daemon looks every 60 seconds to see if one of the rules of the config file applies. According to the parameters in the config file CPUs and memory are freed or allocated if the rules apply.</li> <li>• Vertical CPU management: With this feature it is possible to switch between horizontal and vertical CPU polarization via a sysfs attribute. If vertical CPU polarization is active, the hypervisor will dispatch certain CPUs for a longer time than other CPUs for maximum performance. There are three different types of vertical CPUs: high, medium and low. Low CPUs get hardly any real CPU time, while high CPUs get a full real CPU; medium CPUs get something in between. This support is available only on z10, running Linux on System z in an LPAR.</li> <li>• Standby memory add via sclp: This functionality enables you to attach and use standby memory that is configured for a logical partition or z/VM guest. With the new SCLP-tools (lschp and chchp), the configuration state of an I/O channel path can be changed from "standby" to "configured" or from "configured" to "standby." Using this functionality when running Linux on System z as a VM guest requires z/VM 5.4 plus the PTF for APAR VM64524.</li> </ul>
z/VM	<ul style="list-style-type: none"> <li>• Dynamic memory attach/detach: This functionality provides the architecture-specific back end and sysfs interfaces needed for memory detach (will also detach standby memory that was added via SCLP) and memory attach. Using this functionality when running Linux on System z as a VM guest requires z/VM 5.4 plus the PTF for VM64524.</li> <li>• Monitoring: The updated s390-tools contain the package mon_statd which starts two different daemons <ul style="list-style-type: none"> <li>• mon_fsstatd, the daemon that writes file system utilization data to the z/VM monitor stream</li> <li>• mon_procd, the daemon that writes process information data to the z/VM monitor stream</li> </ul> </li> <li>• Extra kernel parameter via VMPARM</li> <li>• Provide CMS script for initial SUSE Linux Enterprise Server 11 installation under z/VM</li> </ul>
Storage	<ul style="list-style-type: none"> <li>• FICON HyperPAV exploitation: Parallel access volumes (PAV) is a storage server feature, that allows you to start multiple channel programs on the same Direct Access Storage Device (DASD) in parallel. It defines alias devices that can be used as alternative paths to the same disk. With the old base-PAV support, there was only rudimentary functionality in the DASD device driver. As the mapping between base and alias devices was static, one just had to export an identifier (uid) and could leave the combining of devices to external layers like a device mapper multipath. Now HyperPAV removes the requirement to dedicate alias devices to specific base devices. Instead, each alias device can be combined with multiple base devices on a per request basis. This requires full support by the DASD device driver as now each channel program itself has to identify the target base device.</li> <li>• FCP automatic port discovery</li> </ul>

Network	<ul style="list-style-type: none"> <li>• FCP LUN discovery tool</li> <li>• Updated FCP HBA (Horst Bus Adapter) API</li> </ul>
Security	<ul style="list-style-type: none"> <li>• Support has been added for the new OSA card that supports two ports per chip ID</li> <li>• HiperSocket Layer3 support for Ipv6 (for z/OS communication)</li> <li>• Merged CTC/CTCMPC driver CTCM: The CTCM driver supports the channel-to-channel connections of the old CTC driver plus an additional MPC protocol to provide SNA connectivity (which was formerly provided via the separate CTCMPC driver).</li> <li>• Exploitation of long random numbers: This allows user space applications to access large amounts of truly random data. The random data source is the built-in hardware random number generator on the CEX2C cards.</li> <li>• New HW Crypto Cards enablement</li> </ul>
Reliability, availability, serviceability	<ul style="list-style-type: none"> <li>• Kernel message catalog: This feature adds support for automatic message tags to the printk macro families dev_xyz and pr_xyz. The message tag consists of a component name and a 24 bit hash of the message text. For each message that is documented in the included kernel message catalog a man page can be created with a script (which is included in the patch). The generated man pages contain explanatory text that is intended to help understand the messages.</li> <li>• Shutdown actions interface and tools: The new shutdown actions interface allows you to specify for each shutdown trigger (halt, power off, reboot, panic) one of the five available shutdown actions (stop, ipl, reipl, dump, vmcmd). A sysfs interface under /sys/firmware is provided for that purpose. Possible use cases are to specify that a vmdump should be automatically triggered in case of a kernel panic, or that the z/VM logoff command should be executed on halt.</li> <li>• FCP enhanced trace facility</li> <li>• Enhanced FCP performance analysis</li> <li>• FCP adapter statistics: The FCP adapter statistics provide a variety of information about the virtual adapter (subchannel). In order to collect this information, the zfcpc device driver is extended on one side to query the adapter and on the other side to summarize certain values which can then be fetched on demand. This information is made available via files (attributes) in the sysfs filesystem.</li> </ul>

## New Architecture-specific Features for POWER

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<b><i>Feature or Function</i></b>	<b><i>Description</i></b>
Active memory sharing	A new capability for IBM's PowerVM virtualization software enables administrators to share virtual system memory between partitions. It works the same as the sharer of virtual processors.
Hotplug memory remove	With CPU and I/O hotplug, this feature is a key enabler for the Dynamic Logical Partitioning (DLPAR) feature. In order for an administrator to reduce such a partition's resource usage, the operating system must support hot memory removal.
Flexible large page	<p>SUSE Linux Enterprise Server supports now also 64 K large pages in addition to traditional 4 K page size. Large pages enhance performance, but are not optimal for all usages. Customers need the ability to deploy this feature flexibly.</p> <p>The IBM POWER5+ and POWER6 processors add support for two new page sizes in their memory management hardware: 64 KB and 16 GB.</p>
N_port ID virtualization	N_Port ID Virtualization (NPIV) provides direct access to Fibre Channel adapters from multiple client partitions, simplifying the management of Fibre Channel SAN environments. For customers using a SAN for their storage, NPIV simplifies their data center by allowing them to manage all their storage from the SAN.

## High Availability Extension

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A modular extension to SUSE Linux Enterprise Server, the High Availability Extension integrates relevant open source technologies, and bundles them into a single offering for added value and convenience, and an affordable upgrade path.

<b><i>Feature or Function</i></b>	<b><i>Description</i></b>
Oracle Cluster File System 2 (OCFS2)	<p>Oracle Cluster File System 2 (OCFS2) is a POSIX-compliant shared-disk cluster file system for Linux. OCFS2 is developed under GPL. New features included in OCFS2 with this product release are:</p> <ul style="list-style-type: none"> <li>• Access Control Lists (ACL)</li> <li>• Quota support</li> <li>• POSIX conform file locking</li> </ul> <p>With these features OCFS2 can be used as generic file system for common use without previous limitations to specific workloads.</p> <p>The High Availability Extension also ships with OCFS2 Tools, a collection of utility programs that create, manage, debug and repair the OCFS2 file system which also includes a GUI.</p>
Scalable high-availability cluster resource manager: Pacemaker	<p>Pacemaker is an advanced, scalable high-availability cluster resource manager for Linux-HA (Heartbeat) and/or OpenAIS.</p> <p>It supports n-node clusters with significant capabilities for managing resources and dependencies. It will run scripts at initialization, when machines go up or down and when related resources fail, and can be configured to periodically check resource health.</p> <p>Components:</p> <ul style="list-style-type: none"> <li>• STONITHd ("Shoot the other node in the head" daemon)—The Heartbeat fencing subsystem</li> <li>• Local Resource Management Daemon (lrm)—Non-cluster aware daemon that presents a common interface to the supported resource types. It interacts directly with resource agents (scripts).</li> <li>• Policy Engine (pengine)—Computes the next state of the cluster based on the current state and the configuration. It also produces a transition graph containing a list of actions and dependencies.</li> <li>• Cluster Information Base (cib)—Contains definitions of all cluster options, nodes, resources, their relationships to one another and current status. Synchronizes updates to all cluster nodes.</li> <li>• Cluster Resource Management Daemon (crmd)—A message broker for the PE, TE and LRM. It also elects a leader to coordinate the</li> </ul>

	<p>activities of the cluster.</p> <ul style="list-style-type: none"> <li>• Consensus Cluster Membership (ccm)—the Heartbeat membership layer</li> <li>• OpenAIS messaging and membership layer</li> <li>• Heartbeat messaging layer (heartbeat)—An alternative to OpenAIS</li> </ul> <p>Pacemaker also includes a server/client GUI and an SNMP plugin to help to manage and monitor a pacemaker-based HA solution.</p> <p>Pacemaker makes use of your cluster infrastructure (either OpenAIS or Heartbeat) to stop, start and monitor the health of the services or resources you want the cluster to provide. It can do this for clusters of practically any size and comes with a powerful dependency model that allows the administrator to accurately express the relationships (both ordering and location) between the cluster resources.</p>
OpenAIS	<p>OpenAIS, which stands for “Open Source Initiative Certified Implementation of the Service Availability Forum Application Interface Specification,” is a cluster communication protocol for server and storage clustering. More information about SAF and AIS can be found here:</p> <p><a href="http://www.saforum.org/home">http://www.saforum.org/home</a></p> <p>The High Availability Extension ships with a package that contains the OpenAIS executive, service handlers, default configuration files and init script.</p> <p>OpenAIS is a standards-based, widely adopted cluster messaging infrastructure, which provides virtual synchrony and other features. It replaces the legacy messaging service in Heartbeat 2.x. The intent is to make the cluster stack more reliable, easier to maintain by leveraging a standard library, and easier to integrate with other software also using OpenAIS (like some device mapper storage targets and other cluster-aware applications).</p>
Heartbeat	<p>Heartbeat is a subsystem that adds failover functionality to a system. It allows two Linux servers (a primary and a backup) to determine if the other is "alive"; if the primary isn't, Heartbeat sends failover resources to the backup. It is one of the foundational technologies of the High Availability Linux Project (<a href="http://linux-ha.org/">http://linux-ha.org/</a>)</p> <p>The High Availability Extension ships with Heartbeat2 which provides core cluster membership, I/O isolation and messaging infrastructure, powerful high-availability resource management for up to 16 nodes (supported, not a technical limitation), and both node and service monitoring. New features included with this release are:</p> <ul style="list-style-type: none"> <li>• a Graphical User Interface (GUI) that makes cluster management much easier for less experienced administrators</li> <li>• a unified command line which eases system setup, managing, and integration for experienced administrators</li> </ul>

Cluster Logical Volume Manager (CLVM)	<p>The Cluster Logical Volume Manager (CLVM) provides a cluster-wide version of LVM2. CLVM provides the same capabilities as LVM2 on a single node, but makes the volumes available to all nodes of the system or cluster. The High Availability Extension contains the package <code>lvm2-clvm</code> version 2.02.39, a daemon for using LVM2 Logical Volumes in a clustered environment.</p> <p>The key component in CLVM is a daemon (<code>clvmd</code>) that provides clustering extensions to the standard LVM2 tool set and allows LVM2 commands to manage shared storage. It runs in each cluster node and distributes LVM metadata updates in a cluster, while presenting each cluster node with the same view of the logical volumes.</p>
Distributed Replicated Block Device (DRBD)	<p>DRBD, shipped in version 8.2.7, is a networked disk-management tool. It is designed to build high-availability clusters. DRBD builds single partitions from multiple disks that mirror each other. The partition size can be changed at runtime.</p> <p>Enhancements in DRDB 8 include:</p> <ul style="list-style-type: none"> <li>• Only changed data is synchronized after a loss of communication</li> <li>• Faster resynchronization</li> <li>• Less time until full redundancy</li> </ul> <p>You can use data replication to make your data available even in the case of a site failure. This feature is often implemented as a hardware solution tightly coupled with the storage system. Such hardware related solutions are often priced per capacity and are not able to work cross vendor or technique. Software based data replication helps customers to escape the hardware vendor lock-in. Based on a higher system layer, the software based data replication can handle scenarios with different hardware vendors, storage techniques and replication paths.</p>
Load balancing Capabilities: Support for Linux Virtual Server	<p>Linux Virtual Server, also known as a "load balancing server cluster," is a highly scalable and highly available network server built on a cluster of real servers. The individual or real servers are under the control of a director—or load balancer—that runs a Linux kernel patched to include the <code>ipvs</code> code. The <code>ipvs</code> code running on the load balancer is <i>the</i> essential feature of LVS.</p> <p>The architecture of the server cluster is fully transparent to end users, and the users interact as if it were a single high-performance virtual server. The real servers and the load balancers can be interconnected by either high-speed LANs or by geographically dispersed WANs. The load balancers can dispatch requests to the different servers and make parallel services of the cluster to appear as a virtual service on a single IP address, and request dispatching can use IP load balancing technologies or application-level load balancing technologies.</p>

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Administration of Linux Virtual Server	Ipvsadm is a utility that administers the IP virtual server services offered by the Linux kernel with Linux Virtual Server support. The scheduler is the part of the ipvs kernel code that decides which real server will get the next new connection.
SCSI reservation	The High Availability Extension ships with scsires, a resource agent that is used for issuing SCSI-2 reservation and release commands, and for controlling exclusive access to a SCSI device that is shared between more than one SCSI host adapter.
YaST Modules for High Availability	The High Availability Extension includes YaST modules for the configuration of DRDB, Heartbeat, and OCFS2. With this module you can configure a distributed storage system, frequently used on high availability (HA) clusters.

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## SUSE Linux Enterprise Mono® Extension

The SUSE Linux Enterprise Mono Extension, a .NET development framework, enables organizations to run their Microsoft .NET-based server applications on Linux.

<b><i>Feature or Function</i></b>	<b><i>Description</i></b>
Mono (version 2.4)	<p>SUSE Linux Enterprise Mono Extension includes a .NET compatible runtime, which is compatible with the desktop and server components of version 2.0 of the Microsoft .NET framework, as well as portions of version 3.5 of the .NET framework, including C# 3.0 and LINQ.</p> <p>This includes many libraries that provide support for ASP.NET, ADO.NET and many other .NET Framework components, as well as many new APIs that provide additional functionality for developers targeting Mono and Linux.</p>
Mono Migration Analyzer (MoMA)	<p>SUSE Linux Enterprise Mono Extension comes with an analytical tool for .NET-to-Linux migrations that demonstrates Mono's .NET API compatibility</p> <p>Approximately half of the .NET applications that were analyzed with the Mono Migration Analyzer were able to run on Mono with no changes, while another 20 percent of the same group of .NET applications were able to run on Mono with minimal changes.</p>
Packages - SUSE Linux Enterprise Mono Extension	<p>The following list contains the most important packages included in SUSE Linux Enterprise Mono Extension:</p> <ul style="list-style-type: none"><li>• apache2-mod_mono-addon</li><li>• mono-addon-libgdiplus0</li><li>• mono-addon-core</li><li>• mono-addon-data</li><li>• mono-addon-data-npgsql</li><li>• mono-addon-data-sqlite</li><li>• mono-addon-debugger</li><li>• mono-addon-devel</li><li>• mono-addon-web</li><li>• mono-addon-winforms</li><li>• mono-addon-xsp</li></ul>

## Desktop

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<b><i>Feature or Function</i></b>	<b><i>Description</i></b>
Enhanced 3-D accelerated graphics	<p>Through Novell contributions to the open source graphics subsystem (e.g. Compiz), a special user experience is available in SUSE Linux Enterprise Desktop. Features include:</p> <ul style="list-style-type: none"><li>• Application tiling—provides a snap shot of all open applications</li><li>• Alt tabbing—includes thumbnails views of open applications</li><li>• Three-dimensional desktop—provides more desktop space for more efficient use of your desktop</li></ul> <p>With SUSE Linux Enterprise Desktop 11, the Compiz Fusion packages are included, which add more functionalities to the Compiz compositing window manager by extending it with more plugins, tools and libraries.</p>
Accessibility	<p>SUSE Linux Enterprise Desktop provides a wide range of new tools that make it easier for users with disabilities to access applications. Some of these tools are:</p> <ul style="list-style-type: none"><li>• Orca—a free, open source, flexible, and extensible screen reader for the GNOME desktop environment that provides access to the graphical desktop via user-customizable combinations of speech, Braille, and/or magnification.</li><li>• kdeaccessibility3—tools for visually impaired people to use the KDE desktop environment GUI (screen magnification, text- to-speech output, automated mouse click, etc.)</li></ul> <p>Organizations that are required to meet assistive technology standards such as US Federal Section 508, can do so with SUSE Linux Enterprise Desktop.</p>
GNOME Desktop	<p>SUSE Linux Enterprise Desktop ships with the GNOME desktop environment version 2.24.</p> <p>GNOME provides an intuitive and attractive desktop environment for office workers and end users with a complete set of desktop tools and applications.</p>
K Desktop Environment (KDE)	<p>SUSE Linux Enterprise Desktop includes the new KDE version 4.1.3.</p> <p>KDE is a powerful graphical desktop environment for Linux that provides a complete set of desktop tools and applications and combines ease of use, contemporary functionality and outstanding graphical design with the technological superiority of the operating system.</p>

OpenOffice.org 3.0 Novell Edition	<p>OpenOffice.org Novell Edition is a full office productivity suite, supported by Novell, which provides word processing, spreadsheet, presentation, drawing and database capabilities.</p> <p>With OpenOffice.org 3.0 Novell Edition, enterprises can dramatically lower costs while gaining the key functionality of Microsoft Office and interoperability with Microsoft Office file formats. OpenOffice.org 3.0 Novell Edition contains key enhancements not found in the upstream version of OpenOffice.org, including:</p> <ul style="list-style-type: none"> <li>• Microsoft file compatibility: It offers a complete office suite of productivity applications based on the OpenDocument file format, which is compatible with the Microsoft Office data format. SUSE Linux Enterprise Desktop 11 provides a set of TrueType fonts from AGFA that are metrically equivalent to the standard Microsoft Office fonts.</li> <li>• Macro support: The Novell Edition of OpenOffice.org ships with an enhanced OpenOffice.org Visual Basic macro interpreter which provides support for spreadsheets that include Visual Basic for Applications (VBA) macros. The Visual Basic macro interpreter eliminates one of the largest barriers to OpenOffice.org adoption.</li> <li>• OpenDocument support: This edition fully supports Office Open XML and the OpenDocument file format, the public standard for document files. OpenDocument support eliminates vendor lock-in by ensuring information saved in spreadsheets, documents and presentations is freely accessible to any application supporting OpenDocument format.</li> </ul>
Mozilla Firefox Web browser	<p>Mozilla Firefox is a free, open source Web browser for Windows, Linux and Mac OS X based on the Mozilla codebase. SUSE Linux Enterprise Desktop includes Firefox 3.0, which comes with features such as integrated search, one-click bookmarking, smart location toolbars, and advanced security and privacy tools.</p> <p>Furthermore, Novell includes Microsoft Silverlight, Adobe Flash, Java, and smartcard support in Firefox. Via broad standards support and compatibility features, Mozilla Firefox works with most Web pages and applications that would otherwise require Microsoft Internet Explorer.</p>
Banshee media management	<p>Banshee delivers a media management and playback application that supports a wide range of open-source and licensed media types. With Banshee, you can import CDs, create and play music playlists, and synchronize with a wide range of portable media players (such as an iPod) and smartphones.</p> <p>New in SUSE Linux Enterprise Desktop 11 is support for AAC encoding. In addition, Banshee has advanced video capabilities and allows you to subscribe to a variety of multimedia sources including streaming music (such as Last.fm) as well as audio and video podcasts.</p> <p>Backed by Novell, Banshee is the leading open source media management and player application that provides you with everything you need to use and manage your music or</p>

	media collection.
Additional media players	<p>SUSE Linux Enterprise Desktop features additional multimedia players for enhanced multimedia support:</p> <ul style="list-style-type: none"> <li>• Moonlight Media Player provides support for Microsoft media formats such as .wmv and .wma files, and provides a Firefox plugin that supports Windows media file streaming and Silverlight.</li> <li>• Totem is a movie player for the GNOME Desktop based on GStreamer. It features a playlist, a full-screen mode, seek and volume controls, and complete keyboard navigation. It also includes a Mozilla plug-in (in a separate package) and a Nautilus thumbnailer and properties page.</li> </ul>
Multimedia support	<p>SUSE Linux Enterprise Desktop 11 provides support for a wide range of media types to provide maximum compatibility and make it easy to view multimedia files and streaming audio or video feeds, create CDs or DVDs, and more.</p> <p>It includes the following video drivers:</p> <ul style="list-style-type: none"> <li>• NVIDIA</li> <li>• ATI</li> <li>• 3DLABS</li> <li>• Intel</li> </ul> <p>It supports the following Codecs:</p> <p>Audio codecs</p> <ul style="list-style-type: none"> <li>• Advanced Audio Codec (AAC) (decode and encode)</li> <li>• MPEG (decode)</li> <li>• Ogg Vorbis (Ogg) (decode and encode)</li> <li>• Windows Media Audio (WMA) (separate download)</li> </ul> <p>Video codecs</p> <ul style="list-style-type: none"> <li>• MPEG</li> <li>• Ogg Theora (Ogg)</li> <li>• Windows Media Video (WMV, AVI) (separate download)</li> <li>• Windows Streaming Media (separate download)</li> </ul>
Nomad	<p>SUSE Linux Enterprise Desktop features Nomad—a suite of remote desktop protocol tools—which delivers near-native graphics performance when customers access SUSE Linux Enterprise Desktop as a virtual desktop from the data center or in the cloud.</p> <p>This allows enterprises to dramatically cut costs by considering desktop virtualization and other server-based computing solutions, without compromising the high quality and performance they would expect from a local desktop experience.</p>

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Suspend	<p>SUSE Linux Enterprise Desktop supports several tools for hibernation (suspend-to-disk) and suspend/sleep mode (suspend-to-RAM or standby) out-of-the-box and comes with improvements to related user-controlled activities.</p> <p>When placed in this sleep mode, aside from the RAM required to restore the machine's state, the computer attempts to cut power to all unneeded parts of the machine.</p>
Dynamic frequency scaling	<p>SUSE Linux Enterprise Desktop provides for CPU throttling, means the hard drive is switched off when not needed, and the display is dimmed when idle.</p> <p>CPU throttling makes a processor run at a less-than-maximum frequency in order to conserve power. It is commonly used in laptops and other mobile devices, where energy comes from a battery and is limited</p>
Power history interface	<p>SUSE Linux Enterprise Desktop 11 comes with a new power history interface that provides battery monitoring, CPU frequency control and suspend/standby triggers, and other power management features.</p> <p>This makes the green IT experience very visual, letting users see how their usage behavior is impacting battery life and how the operating system is adapting to this usage.</p>

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# Hardware Support

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<b><i>Feature or Function</i></b>	<b><i>Description</i></b>
Common code base	<p>The common code base ensures complete hardware platform independence and compatibility within the SUSE Linux Enterprise 11 family.</p> <p>AutoBuild, the SUSE Linux Enterprise screening, manufacturing and quality-assurance process, ensures that products based on SUSE Linux Enterprise 11 are identical on all platforms. It also provides an ideal development environment.</p> <p>The common code base means greater flexibility and cost-savings for IT decision makers. Administrators can:</p> <ul style="list-style-type: none"> <li>• Utilize the same IT staff skills across all platforms</li> <li>• Use the same comfortable management tools</li> <li>• Leverage a unified standard support</li> <li>• Apply unified software updates</li> <li>• Enjoy low training costs for all Linux systems</li> <li>• Enjoy a simpler porting process of all applications to hardware architectures</li> </ul>
Support for emerging technologies	<p>SUSE Linux Enterprise 11 provides support and optimizations for the latest CPU technology, including virtualization (Intel VT, AMD-V) and multi-core.</p>
Hardware architectures	<p>SUSE Linux Enterprise 11 runs on the following architectures:</p> <p>Desktop:</p> <ul style="list-style-type: none"> <li>• X86</li> <li>• AMD64 and Intel 64 (x86_64)</li> </ul> <p>Server:</p> <ul style="list-style-type: none"> <li>• X86</li> <li>• AMD64 and Intel 64 (x86_64)</li> <li>• Itanium 2 Processor Family</li> <li>• IBM POWER</li> <li>• IBM System z</li> </ul>
Support for latest hardware	<p>SUSE Linux Enterprise 11 uses the latest open source drivers to support the following hardware:</p> <ul style="list-style-type: none"> <li>• Network hardware</li> <li>• Platform management (Intelligent Platform Management Interface [IPMI]) and power</li> </ul>

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Hardware plug and play	<p>management hardware</p> <ul style="list-style-type: none"><li>• USB devices, IEEE-1394 (FireWire)</li><li>• Storage</li><li>• HW Redundant Array of Inexpensive Disks (RAID) solutions</li><li>• Serial Attached SCSI (SAS)</li><li>• Serial Attached ATA (SATA)</li><li>• Fibre Channel</li><li>• Multipathing</li><li>• Desktop (graphics, audio, Bluetooth)</li></ul> <p>SUSE Linux Enterprise 11 supports new hardware for USB and Bluetooth devices. It provides an intuitive and easy-to-use hotplug system for peripheral devices, from memory sticks and scanners to digital cameras and portable music players.</p>
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## Update-Related Information

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Migration is supported from SUSE Linux Enterprise Server 10 SP2 to SUSE Linux Enterprise Server 11 via bootable media, including PXE boot.

With SUSE Linux Enterprise Server 11, the kernel RPMs are split in different packages. The package ***kernel-flavor-base*** contains very reduced hardware support, and is intended to be used in virtual machine images. The package ***kernel-flavor*** extends the base package and contains all supported kernel modules. The package ***kernel-flavor-extra*** includes all other kernel modules which may be useful, but which are not supported; this package is not installed by default.

If you are updating from SUSE Linux Enterprise Server 10 SP2 to SUSE Linux Enterprise Server 11 in a system where alternative bootloaders (where **GRUB** is not the bootloader program) are installed in the MBR (Master Boot Record), this might override the MBR, and place GRUB as the primary bootloader into the system. In such a scenario, you should choose to do a fresh installation. Please don't forget to backup your data. It is always appropriate to keep your data separated from the system software. In other words, /home, /srv, ... and other volumes containing data should be on a separate partition, volume group or logical volume. The YaST partitioning module will propose doing this.

SuSEfirewall2 is enabled by default. That means that by default you cannot log in from remote systems. This also interferes with network browsing and multicast applications, such as SLP and Samba ("Network Neighborhood"). You can fine-tune the firewall settings using YaST.

Upgrading from SUSE Linux Enterprise Server 10 SP2 to SUSE Linux Enterprise Server 11 with the Xen Hypervisor may contain incorrect network configuration. If you install SUSE Linux Enterprise Server 11 and configure Xen, you get a bridged setup through YaST. However, if you upgrade from SUSE Linux Enterprise Server 10 SP2 to SUSE Linux Enterprise Server 11, the upgrade does not configure the bridged setup automatically. Please start the "YaST Control Center", choose "Virtualization" and then "Install Hypervisor and Tools" to start the bridge proposal for networking. Alternatively you can call `yast2 xen` on the command line. Furthermore, upgrading from SUSE Linux Enterprise Server 10 SP2 to SUSE Linux Enterprise Server 11 with the Xen Hypervisor does not preserve xen configuration options. Due to changes in default settings, the Xen Management Daemon (xend) configuration file is replaced during upgrade. Customizations are saved to `/etc/xen/xend-config.sxp.rpm` save for merging with the new configuration file.

## Conclusion

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SUSE Linux Enterprise 11 from Novell is the most interoperable Linux platform for mission-critical computing from the desktop to the data center. Built for your entire environment, from physical to virtual, and configurable to appliance, it delivers the innovation you need to build your agile next-generation IT infrastructure.

With SUSE Linux Enterprise 11, your organization can easily implement the latest technical advances. New features and major enhancements have been added for systems management, RAS, cross-platform virtualization, interoperability, green IT, security, networking, high availability and clustering, usability, .NET compatibility and supportability.

Leading organizations from around the world participated in the SUSE Linux Enterprise 11 beta program, and were deeply involved in testing and usability assessment. The advances and improvements in this release are a direct result of customer collaboration and Novell commitment. As enterprise Linux adoption expands and accelerates, so do the pace and scale of Linux development and innovation.

For more information about SUSE Linux Enterprise 11, please see the following:

- Read the release notes at <http://www.novell.com/linux/releasenotes/>
- Check the ChangeLog file in the top level of each product's DVD1 ISO file for a chronological log of all changes made to the updated packages.
- Additional information can be found in the docu directory of DVD1 of the SUSE Linux Enterprise 11 DVD ISO files for each product. These directories include PDF versions of the most important guides such as Installation Quick Starts, Administration Guides, Deployment Guides, and Storage Administration Guides.
- Visit <http://www.novell.com/documentation/> to find additional or updated documentation for SUSE Linux Enterprise 11 based products.
- Visit <http://www.novell.com/linux/> for the latest SUSE Linux Enterprise product news from Novell, including pricing, subscription and support options
- Visit <http://www.novell.com/linux/source/> for additional information on the source code of SUSE Linux Enterprise products.

Note: The features described in this document are based on a beta build of SUSE Linux Enterprise 11. They are subject to change. Novell, Inc. reserves the right to amend or remove features even if they are mentioned in this document.

The current version and description of each package can be found at the following URLs:

- SUSE Linux Enterprise Server 11: [www.novell.com/products/server/techspecs.html](http://www.novell.com/products/server/techspecs.html)
- SUSE Linux Enterprise Desktop 11: [www.novell.com/products/desktop/techspecs.html](http://www.novell.com/products/desktop/techspecs.html)

The GPL requires that Novell make available certain source code that corresponds to those GPL-licensed materials. The SUSE Linux Enterprise Product Sources are available for download at [www.novell.com/linux/source](http://www.novell.com/linux/source)