Technical White Paper
LINUX OPERATING SYSTEMS

www.novell.com

SUSE® Linux Enterprise 10 SP1: Virtualization Technology Support

Novell®

Content and modifications. The contents of this document are not part of the specifications or product documentation for the SUSE Linux Enterprise 10 platform, SUSE Linux Enterprise Server and SUSE Linux Enterprise Desktop software or any third-party product or code included in SUSE Linux Enterprise software. Nothing in this document is a warranty or commitment by Novell to release a specific product, module or update, or to support a specific product, module or update. Novell may modify or remove the content in this document to update information, correct errors or reflect modifications in its plans due to market changes, product changes or other business reasons.

The contents of this document are not suitable for use in all situations, and any use of the contents is at your own risk. Novell will not be liable for any direct or indirect, special or consequential damages (including loss of profits, business or data) that may result from use of this information.

Warranty and liability disclaimer. See your license or purchase agreement with Novell for any applicable warranties regarding products or services you receive from Novell. The information in this document is provided "AS IS" without any warranties or representations. Novell expressly disclaims any warranties or representations as to the accuracy, currency or completeness of the contents, and disclaims any implied warranties of merchantability or fitness for a particular purpose.

Table of Contents:

2 . . . . . Overview

3 . . . Upgrade Path: SUSE Linux Enterprise Server 10 to SUSE Linux Enterprise Server 10 SP1

3 . . . Novell Technical Service Offerings for SUSE Linux Enterprise Server 10 SP1

3 . . . . . Software-based Virtualization

3. . . Supported Novell Virtualization Technologies

5. . . Paravirtualization and Full Virtualization OS Support

6. . . Feature Support for VHS

8 . . Other Supported Virtualization Products

9 . . . . . Hardware-based Virtualization

9 . . . Supported Hardware Virtualization Technologies

9 . . . . . Outlook

Overview

SUSE® Linux Enterprise Server 10 provides integrated Xen-based virtualization, which can be used to provision, de-provision, install, monitor and manage multiple virtual machines (VMs) on a single physical system. Out of the box, it can create VMs running both modified, highly tuned, paravirtualized operating systems and unmodified operating systems.

Xen* serves as the hypervisor, or VM monitor. It is a layer of software that runs directly on the server hardware and controls platform resources, sharing them among multiple VMs and their operating systems by presenting virtualized hardware interfaces to each VM.

SUSE Linux Enterprise Server 10 is the first enterprise-class Linux* server to:

- *Fully support Xen virtualization on both 32- and 64-bit x86-based hardware architectures (x86 [32bit], Physical Address Extension, or PAE, x86 [32bit] and x86-64 [64bit])*
- *Support full virtualization, allowing you to run unmodified operating systems*

  Full virtualization requires the presence of either Intel Virtualization Technology (VT) or AMD Virtualization* (AMD-V*).*

  Note: *The use of paravirtualized device drivers for fully virtualized machines is recommended to enhance network and storage I/O performance. These drivers are available as a separate Novell® offering for different operating systems.*
- *Offer fully graphical and command-line VM and operating system installation, lifecycle management and monitoring tools*

Novell provides support for SUSE Linux Enterprise Server 10 with Xen operating as a virtualization host server (VHS) to host VMs with respective operating systems. The Novell VM architecture consists of one combined I/O and system management VM (VHS) and allows many application-hosting VMs. For additional information and access to paravirtualized device drivers please visit: www.novell.com/virtualization/

Support for the various combinations of VHSs and VMs is verified by Novell certification programs (i.e., Novell YES Certified™ program, Novell Ready Application Compatibility Logo Program, SUPPORTED compatibility logo).Certified systems and their combinations are listed in certification bulletins at http://developer.novell.com/yessearch/Search.jsp (search for SUSE LINUX Enterprise Server 10 with Xen).

Novell Technical Services support offerings require certified system configurations and comprise several different service level agreements (SLAs).

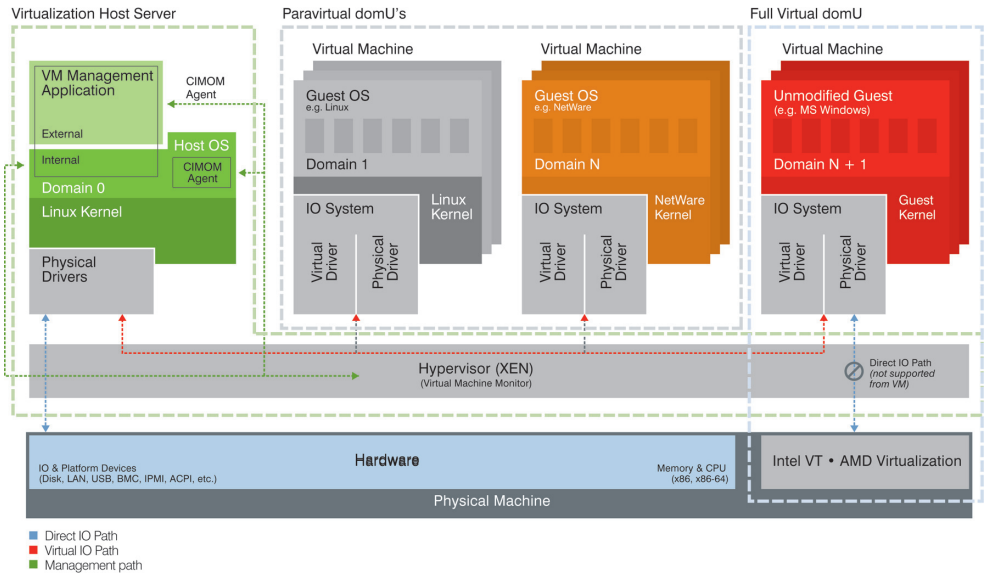

Figure 1. *Novell virtualization host server architecture: hardware, hypervisor, management domain provide the foundation to host virtual machines*

Upgrade Path: SUSE Linux Enterprise Server 10 to SUSE Linux Enterprise Server 10 SP1

1. Upgrade all virtualization host servers (VHSs) running SUSE Linux Enterprise Server 10 to run SUSE Linux Enterprise Server 10 SP1.
2. Upgrade all VMs to run SUSE Linux Enterprise Server 10 SP1 after upgrading the VHS. The upgrade is backward compatible: SUSE Linux Enterprise Server 10 VMs can run on a SUSE Linux Enterprise Server 10 SP1 VHS. The upgrade is required for future support entitlement.
3. The VM config file also needs to be updated. See the Novell online virtualization documentation for more details.

Novell Technical Service Offerings for SUSE Linux Enterprise Server 10 SP1

Novell Technical Services offers different levels of service: basic, standard, priority and Premium (Premium 1000–5000). Please find the latest information at: www.novell.com/products/server/howtobuy.html and www.novell.com/services/premium

Running on a physical machine or IBM* System z* Integrated Facility for Linux (IFL), the first SUSE Linux Enterprise Server OS instance requires a paid service offering, even if it is being used as a VHS to host VMs with any type of virtualization technology. Each additional VM running on that physical system or IFL receives the same service entitlement as the physical server: VMs do not require additional entitlements. *(See also www.novell.com/products/server/virtualization.html)*

Software-based Virtualization

Supported Novell Virtualization Technologies

SUSE Linux Enterprise 10 SP1 includes Xen 3.0.4 (with additional patches = 3.0.4+) and fully supports Xen virtualization on both 32- and 64-bit x86-based architectures.

SP1 and Xen 3.0.4+ x86 32-bit. These types of systems can address up to 3.5–4 GB of physical memory (RAM). Please check your hardware-specific information for the limits of supported physical memory.

Novell certification bulletins list the amount of memory the system contained when successfully completing the certification.

SP1 and Xen 3.0.4+ PAE x86 32-bit. Please check your hardware-specific information for the limits of supported physical memory. Systems supporting PAE will also be able to operate with memory less than 4 GB. Please consult Novell certification bulletins for certified combinations and configurations. To make use of PAE, a different Xen-enabled kernel (kernel-xenpae) needs to be used with the PAE-enhanced Xen (xen-pae). This combination is installed automatically if PAE system support is detected and memory is 4 GB or more.

SP1 and Xen 3.0.4+ x86-64 64-bit (AMD64 and Intel 64). Please check your hardware-specific information for the limits of supported physical memory and consult Novell bulletins for certified combinations and configurations.

SP1 VHS and VM Generic Technical Support Limits

The first table contains generic limits for Xen support offered by Novell Technical Services. Xen might function with extended parameters, but Novell support is limited to the values listed below. Please consider that the virtualization host server needs at least 512 MB of memory. If adding VMs, you must add additional memory to this base requirement.

VHS limits	Xen 3.0.4+ x86 32-bit	Xen 3.0.4+ PAE x86 32-bit	Xen 3.0.4+ x86-64 64-bit
CPUs[1]	1–32	1–32	1–32
Logical hardware thread support (LHT)	1–32	1–32	1–32
Physical memory	512 MB–4 GB	512 MB–16 GB	512 MB–128 GB
Block devices	up to 12,000 SCSI logical units	up to 12,000 SCSI logical units	up to 12,000 SCSI logical units
iSCSI devices	up to 128	up to 128	up to 128
Network cards	1–8	1–8	1–8
VMs per CPU core	up to 8	up to 8	up to 8
VMs per VHS	up to 64	up to 64	up to 64

[1]Up to 32 CPUs (CPU cores or logical CPUs) are supported. Processors are processing devices hot pluggable into the available sockets of the system's motherboard. Intel and AMD processors can feature one, two or more CPU cores. CPU cores can provide logical CPUs if supported by the CPU design with Intel Hyperthreading Technology (HT). Xen supports LHTs, which map to the number of logical CPUs (with HT), CPU cores (without HT) and single-core CPUs or sockets in a system. Enabling HT usually exposes two logical CPUs per core. Each logical CPU per core accounts for one logical hardware thread, so two cores with HT account for four LHTs. Novell support is limited to 32 LHTs. Novell recommends disabling Hyperthreading to allow the best performance with Xen.*

The second table contains the generic limits for VMs running with Xen supported by Novell Technical Services.

Virtual machine limits per VM	Xen 3.0.4+ x86 32-bit	Xen 3.0.4+ PAE x86 32-bit	Xen 3.0.4+ x86-64 64-bit
Virtual CPUs, paravirtualization (PV)	1–8	1–8	1–8
Virtual CPUs, full virtualization (FV)[2]	1	1	1
Virtual memory	128 MB–2 GB	128 MB–15 GB	128 MB–30 GB
Virtual block devices PV	up to 16	up to 16	up to 16
Virtual block devices FV	up to 4	up to 4	up to 4
Virtual network cards	up to 3	up to 3	up to 3

[2]Symmetric multiprocessing (SMP) with more than one virtual CPU is technically working, but not recommended or supported for production.

Note: *Virtual memory requirements may vary with the purpose of the overall VM configuration, including operating systems and application solution stacks. For installation of SUSE Linux Enterprise Server, a minimum of 256 MB is required, and 512 MB is recommended. After installation, the amount of memory can be adjusted dynamically for paravirtualized VMs with a) the administrative user interface, b) by using the command line, c) statically adding the required entries in the VM configuration file or d) setting the persistent xenstore database values via the Xen daemon. Xen technically supports up to 32 virtual CPUs at present. However, Novell support is currently limited to eight virtual CPUs per VM for paravirtualized VMs and one virtual CPU for fully virtualized VMs.*

For vendor system-specific limits please consult Novell YES certification pages at www.novell.com/yes (e.g., SMP [i.e., more than one vCPU] for FV VMs is not supported at the time of release of this document).

Paravirtualization and Full Virtualization OS Support

Paravirtualized OS support (VMs for VHS)

VHS	Xen 3.0.4+ x86 32-bit **SUSE Linux Enterprise Server 10 SP1 x86**	Xen 3.0.4+ PAE x86 32-bit **SUSE Linux Enterprise Server 10 SP1 PAE x86**	Xen 3.0.4+ x86-64 64-bit **SUSE Linux Enterprise Server 10 SP1 x86-64**
VM (32-bit)	SUSE Linux Enterprise Server 10 SP1 x86 Novell Open Enterprise Server 2 Linux x86[3] Open Enterprise Server 2 NetWare 6.5 x86 SP7[3]		
VM (32-bit w/ PAE)		SUSE Linux Enterprise Server 10 SP1 PAE x86 Open Enterprise Server 2 Linux PAE x86[3] Open Enterprise Server 2 NetWare 6.5 x86 SP7[3]	SUSE Linux Enterprise Server 10 SP1 PAE x86 Open Enterprise Server 2 Linux PAE x86[3] Open Enterprise Server 2 NetWare 6.5 x86 SP7[3]
VM (64-bit)			SUSE Linux Enterprise Server 10 SP1 x86-64 Open Enterprise Server 2 Linux x86-64[3]

[3]*Novell Open Enterprise Server 2 (Linux and NetWare) support is planned with the release of Open Enterprise Server 2.*

Paravirtualized OS Support (VMs for VHS) (Technical Preview)

VHS	Xen 3.0.4+ x86 32-bit **SUSE Linux Enterprise Server 10 SP1 x86**	Xen 3.0.4+ PAE x86 32-bit **SUSE Linux Enterprise Server 10 SP1 PAE**	Xen 3.0.4+ x86-64 64-bit **SUSE Linux Enterprise Server 10 SP1 x86-64**
VM (32-bit)	SUSE Linux Enterprise Server 9 SP3 x86 SUSE Linux Enterprise Desktop 10 SP1 x86[4]		
VM (32-bit w/ PAE)		SUSE Linux Enterprise Server 9 SP3 PAE x86 SUSE Linux Enterprise Desktop 10 SP1 PAE x86[4]	SUSE Linux Enterprise Server 9 SP3 PAE x86 SUSE Linux Enterprise Desktop 10 SP1 PAE x86[4]
VM (64-bit)			SUSE Linux Enterprise Server 9 SP3 x86-64 SUSE Linux Enterprise Desktop 10 SP1 x86-64[4]

Technical preview: the listed operating system has been tested to install and run successfully. Bugs can be reported to and will be tracked by Novell Technical Services, but no support commitments or service level agreements apply. Potential fixes and patches will be evaluated for future inclusion.

[4]*SUSE Linux Enterprise Desktop 10 SP1 VM support is limited to test and demo deployment.*

Fully Virtualized OS Support (VMs for VHS)

VHS	Xen 3.0.4+ x86 32-bit SUSE Linux Enterprise Server 10 SP1 x86	Xen 3.0.4+ PAE x86 32-bit SUSE Linux Enterprise Server 10 SP1 PAE x86	Xen 3.0.4+ x86-64 64-bit SUSE Linux Enterprise Server 10 SP1 x86-64
VM (32-bit)	SUSE Linux Enterprise Server 10 SP1 x86[5] SUSE Linux Enterprise Server 9 SP3 x86[5] Windows Server* 2003 x86[5] Windows* 2000 Server x86[6] Windows XP x86[6] Red Hat* Enterprise Linux 4 x86[6] Red Hat Enterprise Linux 5 x86[6]	SUSE Linux Enterprise Server 10 SP1 x86[5] SUSE Linux Enterprise Server 9 SP3 x86[5] Windows Server 2003 x86[5] Windows 2000 Server x86[6] Windows XP x86[6] Red Hat Enterprise Linux 4 x86[6] Red Hat Enterprise Linux 5 x86[6]	SUSE Linux Enterprise Server 10 SP1 x86[5] SUSE Linux Enterprise Server 9 SP3 x86[5] Windows Server 2003 x86[5] Windows 2000 Server x86[6] Windows XP x86[6] Red Hat Enterprise Linux 4 x86[6] Red Hat Enterprise Linux 5 x86[6]
VM (32-bit w/ PAE)		SUSE Linux Enterprise Server 10 SP1 PAE x86[5] SUSE Linux Enterprise Server 9 SP3 PAE x86[5] Windows Server 2003 x86[5] Windows 2000 Server x86[6] Windows XP x86[6] Red Hat Enterprise Linux 4 x86[6] Red Hat Enterprise Linux 5 x86[6]	SUSE Linux Enterprise Server 10 SP1 PAE x86[5] SUSE Linux Enterprise Server 9 SP3 PAE x86[5] Windows Server 2003 x86[5] Windows 2000 Server x86[6] Windows XP x86[6] Red Hat Enterprise Linux 4 x86[6] Red Hat Enterprise Linux 5 x86[6]
VM (64-bit)			SUSE Linux Enterprise Server 10 SP1 x86-64[5] SUSE Linux Enterprise Server 9 SP3 x86-64[5] Windows Server 2003 x86-64[5] Red Hat Enterprise Linux 4 x86-64[6] Red Hat Enterprise Linux 5 x86-64[6]

[5]*Targeted for Novell YES certification*
[6]*Targeted for Novell SUPPORTED certification*

See Novell certification Web pages for current status. Novell recommends the use of Novell paravirtualized drivers to enhance fully virtualized VM performance. These drivers are available as a separate offering from Novell.

Feature Support for VHS

SUSE Linux Enterprise Server 10 SP1 Feature Support—VHS (PV)

	Xen 3.0.4+ x86 32-bit	Xen 3.0.4+ PAE x86 32-bit	Xen 3.0.4+ x86-64 64-bit
VHS network and block device hotplugging	yes	yes	yes
VHS physical CPU hotplugging	no	no	no
VHS virtual CPU hotplugging	yes	yes	yes
VHS virtual CPU pinning	yes	yes	yes
VHS virtual CPU capping	yes	yes	yes

Note: *Addition or removal of physical CPUs at runtime is not supported, but virtual CPUs can be added or removed for each VM. CPU pinning allows logical-CPU-to-virtual-CPU assignment for a specific VM.*

SUSE Linux Enterprise Server 10 SP1 Feature Support—VM (PV)

	Xen 3.0.4+ x86 32-bit	Xen 3.0.4+ PAE x86 32-bit	Xen 3.0.4+ x86-64 64-bit
VM virtual CPU hotplugging	yes	yes	yes
VM virtual CPU capping	yes	yes	yes
VM virtual CPU overcommitment	yes	yes	yes
VM dynamic virtual memory resize	yes	yes	yes
VM virtual network and virtual block device hotplugging	yes	yes	yes
VM save and restore	yes 32-bit _ 32-bit	yes 32-bit PAE _ 32-bit PAE	yes 64-bit _ 64-bit
VM live migration	yes 32-bit _ 32-bit	yes 32-bit PAE _ 32-bit PAE	yes 64-bit _ 64-bit

Note: *Virtual CPU capping allows you to set vCPU capacity to 1–100 percent of the physical CPU capacity.*

Virtual CPU overcommitment is the capability to assign more virtual CPUs to VMs than the actual number of physical CPUs present in the physical system. This procedure does not increase the overall performance of the system, but might be useful for testing purposes.

For live migration, both source and target system architectures need to match; that is, both source and target systems must be either 32-bit or 64-bit, and the vendors (AMD or Intel) must be the same. The target should feature the same as or a more recent processor revision than the source. If VMs are moved among different systems, the same rules apply for each move. To avoid failing optimized code at runtime or application startup, source and target CPUs need to expose the same processor extensions. Xen exposes the physical CPU extensions to the VMs transparently.

Novell Open Enterprise Server 2 combines NetWare® and SUSE Linux Enterprise Server. Open Enterprise Server 2 services based on virtualized SUSE Linux Enterprise Server 10 SP1 will inherit the VM feature support of SUSE Linux Enterprise Server 10 SP1. Open Enterprise Server 2 services based on virtualized NetWare will not support CPU hotplugging, dynamic memory resize or I/O and network device hotplugging. These features are planned for a future release.

SUSE Linux Enterprise Server 10 SP1 Feature Support—Virtual Machine (FV)

	Xen 3.0.4+ x86 32-bit	Xen 3.0.4+ PAE x86 32-bit	Xen 3.0.4+ x86-64 64-bit
VM virtual CPU hotplugging	no	no	no
VM virtual CPU overcommitment	yes	yes	yes
VM dynamic virtual memory resize	no	no	no
VM virtual network and virtual block device hotplugging	no	no	no
VM save and restore	no	no	no
VM live migration	no	no	no

Other Supported Virtualization Products

Supported VMware Products

For details and the latest support status for Novell products, please review VMware's product pages online. Search for specific VMware* products and supported OS/hardware combinations. The following list is only an excerpt from the list of Novell products supported by VMware as of May 2007, and might change over time.

VMware Workstation 5.5.x. Supported products: Novell Linux Desktop 9 x86, SUSE Linux Enterprise Server 9 x86, SUSE Linux Enterprise Server 9 AMD64 and Intel EM64T, Novell Open Enterprise Server and NetWare 6.5

VMware GSX Server 3.x. Supported products: SUSE Linux Enterprise Server 9 x86 and NetWare 6.5

VMware Server 1.x. Supported products: SUSE Linux Enterprise Server 10 x86, SUSE Linux Enterprise Server 9 x86 and NetWare 6.5

Experimental: *SUSE Linux Enterprise Server 9 AMD64 and Intel EM64T (please check latest status online)*

VMware ESX Server 3.0.x. Supported products: SUSE Linux Enterprise Server 10 x86, SUSE Linux Enterprise Server 10 AMD64 and Intel EM64T, Novell Open Enterprise Server, NetWare 6.5 and SUSE Linux Enterprise Server 9 x86 *(please check latest status online)*

VMware Infrastructure 3. Supported products: SUSE Linux Enterprise Server 10 x86, SUSE Linux Enterprise Server 10 AMD64 and Intel EM64T, Novell Open Enterprise Server, NetWare 6.5 and SUSE Linux Enterprise Server 9 x86 *(please check current status online)*

IBM z/VM 4.x, 5.x

SUSE Linux Enterprise Server 10 and SUSE Linux Enterprise Server 9 have both been successfully tested and certified to run on IBM zSeries* and IBM System z.

SUSE Linux Enterprise Server 10 is supported on each IBM System z featuring a 64-bit processor, in both logical partition (LPAR) and z/VM* versions 4.x and 5.x. *Please see "Supported Hardware Virtualization Technologies" below for more details.*

Technically Non-supported Software Virtualization Technologies

Some of these technologies or features might be technically available in future releases. *Please see "Outlook" below for a summary of future statements of direction.*

Xen is not available or supported with SUSE Linux Enterprise Server 10 SP1 for POWER* and Itanium* Processor Family (IPF) hardware. Resource virtualization can be achieved for IPF by using CPUSETs. IBM POWER provides a different technology called dynamic logical partitions (DLPARs) to operate VMs. SUSE Linux Enterprise Server 9 SP3 or SUSE Linux Enterprise Server 10 SP1 are supported configurations for IBM POWER DLPARs.

Novell does not plan to release and support a VHS based on SUSE Linux Enterprise Server 9. However, fully virtualized SUSE Linux Enterprise Server 9 running on SUSE Linux Enterprise Server 10 SP1 as the host is available today, and Novell supports this configuration when exploiting the virtualization capabilities of AMD-V and Intel VT hardware. Novell recommends the use of paravirtualized device drivers to enhance performance of fully virtualized machines. These drivers will be available as a separate offering from Novell.

Xen VMs directly accessing physical devices are not supported at this time. All I/O and device access needs to be routed through the VHS.

Virtuozzo* and OpenVZ are not included in SUSE Linux Enterprise Server 10 SP1. Special offers are available either from Novell or SWsoft*. Please contact SWsoft for information on specific product and support offerings.

Hardware-based Virtualization

Supported Hardware Virtualization Technologies

IBM POWER

SUSE Linux Enterprise Server 10 SP1 and SUSE Linux Enterprise Server 9 SP3 have both been tested successfully and certified to run on IBM POWER DLPARs (IBM System p*, IBM System i*). Check Novell YES certification bulletins for validated systems.

IBM zSeries / IBM System z

SUSE Linux Enterprise Server 10 SP1 and SUSE Linux Enterprise Server 9 SP1 have both been successfully tested and certified to run with IBM System z.

SUSE Linux Enterprise Server 10 SP1 is supported on each IBM System z featuring a 64-bit processor, in both LPAR and z/VM 4.x/5.x. SUSE Linux Enterprise Server 10 SP1 features a 32-bit application environment to deploy legacy 32-bit applications.

SUSE Linux Enterprise Server 9 SP3 is supported on each IBM System z featuring a 64-bit processor and a 32-bit processor (the S/390*) in both LPAR and z/VM environments. SUSE Linux Enterprise Server 9 SP3 for IBM zSeries (64-bit) features a 32-bit application environment to deploy legacy 32-bit applications.

Outlook

Future versions of SUSE Linux Enterprise 10 and Xen are planned for 2007/2008 that will extend support to the following features, technologies and configurations:

- *Novell Xen support beyond 32 LHT (Xen 3.0.4 would have to be enhanced to include this support)*

www.novell.com

Contact your local Novell Solutions Provider, or call Novell at:

1 800 714 3400 U.S./Canada
1 801 861 1349 Worldwide
1 801 861 8473 Facsimile

Novell, Inc.
404 Wyman Street
Waltham, MA 02451 USA

462-002061-001 | 06/07 | © 2007 Novell, Inc. All rights reserved. Novell, the Novell logo, the N logo, NetWare and SUSE are registered trademarks, and YES Certified is a trademark of Novell, Inc. in the United States and other countries.

*Linux is a registered trademark of Linus Torvalds. All other third-party trademarks are the property of their respective owners.

Novell®