

# SUSE<sup>®</sup> Linux Enterprise 10 SP2: Virtualization Technology Support

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# 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*
- *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 required for support. These drivers enhance network and storage I/O performance and are available in SUSE Linux Enterprise Virtual Machine Driver Pack. For SUSE Linux*

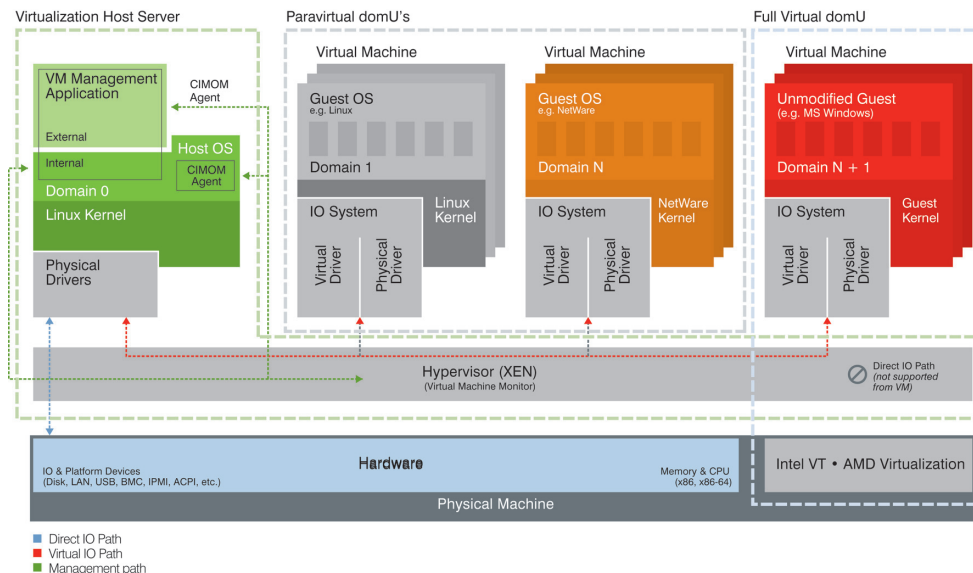
*Enterprise Server 10 these drivers are already included in the product themselves.*

- *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/](http://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> (select under Novell product "SUSE Linux Enterprise Server 10 for x86 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 SP1 to SUSE Linux Enterprise Server 10 SP2**

1. Some existing VMs will need to be modified prior to upgrading the virtualization host server to SUSE Linux Enterprise Server 10 SP2. See the Novell online virtualization documentation for more details.
2. Upgrade all virtualization host servers (VHSs) running SUSE Linux Enterprise Server 10 SP1 to run SUSE Linux Enterprise Server 10 SP2.
3. Verify that any custom networking scripts are compatible with the SUSE Linux Enterprise Server 10 SP2 networking infrastructure, and make changes as required.
4. Upgrade all VMs to run SUSE Linux Enterprise Server 10 SP2 after upgrading the VHS. The upgrade is backward compatible: SUSE Linux Enterprise Server 10 SP1 VMs can run on a SUSE Linux Enterprise Server 10 SP2 VHS. (The upgrade is required for future support entitlement.)
5. Depending on the guest type, the VM configuration file may need to be updated. See the Novell online virtualization documentation for more details.

**Novell Technical Service Offerings for SUSE Linux Enterprise Server 10 SP2**

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](http://www.novell.com/products/server/howtobuy.html) and [www.novell.com/services/premium](http://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](http://www.novell.com/products/server/virtualization.html))

**Software-based Virtualization**

**Supported Novell Virtualization Technologies**

SUSE Linux Enterprise 10 SP2 includes Xen 3.2 and fully supports Xen virtualization on both 32- and 64-bit x86-based architectures.

### SP2 and Xen 3.2 x86 32-bit (non PAE).

These types of systems can address up to 3.5–4 GB of physical memory (RAM). **With SP2, Novell is no longer supporting this offering. Domain0 and the hypervisor must be 32-bit PAE or 64-bit as described below.** All existing 32-bit paravirtualized guests must be modified to use the 32-bit PAE kernel and 32-bit PAE hypervisor for continued operation with SP2.

**SP2 and Xen 3.2 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.

**SP2 and Xen 3.2 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.

### SP2 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 3.2 PAE x86 32-bit	Xen 3.2 x86-64 64-bit
Hypervisor hardware thread support (physical CPUs) <sup>1</sup>	1–32	1–64
Domain 0 Virtual CPUs	1–32	1–32
Physical memory	512 MB–16 GB	512 MB–1.6TeraByte
Block devices	up to 12,000 SCSI logical units	up to 12,000 SCSI logical units
iSCSI devices	up to 128	up to 128
Network cards	1–8	1–8
VMs per CPU core	up to 8	up to 8
VMs per VHS	up to 64	up to 64
Virtual network cards	up to 64 across all VMs in the system	up to 64 across all VMs in the system

<sup>1</sup>Up to 64 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. Logical CPUs are often referred to as logical hardware threads (LHT). Novell recommends disabling Hyperthreading (in old-style dual core hyperthreaded processors) 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 3.2 PAE x86 32-bit	Xen 3.2 x86-64 64-bit
Virtual CPUs, paravirtualization (PV)	1–32	1–32
Virtual CPUs, full virtualization (FV)	1–4	1–4
Virtual memory minimum	Guest Specific <sup>2</sup>	Guest Specific <sup>2</sup>
Virtual NIC	1–8 per VM	1–8 per VM
Virtual block devices PV	up to 16	up to 16
Virtual block devices FV	up to 4	up to 4

<sup>2</sup>Note: Virtual memory minimums are specific to each guest. See online documentation for guest-specific guidelines.

**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,

or c) statically adding the required entries in the VM configuration file. Xen technically supports up to 32 virtual CPUs at present. However, Novell support is currently limited to four virtual CPUs for fully virtualized VMs and 32 virtual CPUs per VM for paravirtualized VMs.

For vendor system-specific limits please consult Novell YES certification pages at: [www.novell.com/yes](http://www.novell.com/yes)

### Paravirtualization and Full Virtualization OS Support

#### Paravirtualized OS support (VMs for VHS)

VHS	Xen 3.2 PAE x86 32-bit	Xen 3.2 x86-64 64-bit
	SUSE Linux Enterprise Server 10 SP2 PAE x86	SUSE Linux Enterprise Server 10 SP2 x86-64
VM (32-bit w/ PAE)	SUSE Linux Enterprise Server 9 SP4 PAE x86 SUSE Linux Enterprise Server 10 SP1/SP2 PAE x86 Open Enterprise Server 2 Linux PAE x86 Open Enterprise Server 2 x86 NetWare SP7/SP8	SUSE Linux Enterprise Server 9 SP4 x86 SUSE Linux Enterprise Server 10 SP1/SP2 PAE x86 Open Enterprise Server 2 Linux PAE x86 Open Enterprise Server 2 x86 NetWare SP7/SP8
VM (64-bit)		SUSE Linux Enterprise Server 9 SP4 x86-64 SUSE Linux Enterprise Server 10 SP1/SP2 x86-64 Open Enterprise Server 2 Linux x86-64

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

VHS	Xen 3.2 PAE x86 32-bit	Xen 3.2 x86-64 64-bit
	SUSE Linux Enterprise Server 10 SP2 PAE	SUSE Linux Enterprise Server 10 SP2 x86-64
VM (32-bit w/ PAE)	SUSE Linux Enterprise Desktop 10 SP2 PAE x86 <sup>3</sup>	SUSE Linux Enterprise Desktop 10 SP2 PAE x86 <sup>3</sup>
VM (64-bit)		SUSE Linux Enterprise Desktop 10 SP2 x86-64 <sup>3</sup>

**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.

<sup>3</sup>SUSE Linux Enterprise Desktop 10 SP2 VM support is limited to test and demo deployment.

## Fully Virtualized OS Support (VMs for VHS)

VHS	Xen 3.2 PAE x86 32-bit	Xen 3.2 x86-64 64-bit
	SUSE Linux Enterprise Server 10 SP2 PAE x86	SUSE Linux Enterprise Server 10 SP2 x86-64
VM (32-bit w/ PAE)	SUSE Linux Enterprise Server 9 SP3/SP4 PAE x86 <sup>4</sup> SUSE Linux Enterprise Server 10 SP1/SP2 PAE x86 <sup>4</sup>  Windows 2000 Server x86 <sup>5</sup> Windows Server 2003 x86 <sup>4</sup> Windows Server 2008 x86 <sup>4</sup> Windows XP x86 <sup>5</sup> Windows Vista x86 <sup>5</sup>  Red Hat Enterprise Linux 4 x86 <sup>5</sup> Red Hat Enterprise Linux 5 x86 <sup>5</sup>	SUSE Linux Enterprise Server 9 SP3/SP4 PAE x86 <sup>4</sup> SUSE Linux Enterprise Server 10 SP1/SP2 PAE x86 <sup>4</sup>  Windows 2000 Server x86 <sup>5</sup> Windows Server 2003 x86 <sup>4</sup> Windows Server 2008 x86 <sup>4</sup> Windows XP x86 <sup>5</sup> Windows Vista x86 <sup>5</sup>  Red Hat Enterprise Linux 4 x86 <sup>5</sup> Red Hat Enterprise Linux 5 x86 <sup>5</sup>
VM (64-bit)		SUSE Linux Enterprise Server 9 SP3/SP4 x86-64 <sup>4</sup> SUSE Linux Enterprise Server 10 SP1/SP2 x86-64 <sup>4</sup>  Windows 2000 Server x86-64 <sup>5</sup> Windows Server 2003 x86-64 <sup>4</sup> Windows Server 2008 x86-64 <sup>4</sup> Windows XP x86-64 <sup>5</sup> Windows Vista x86-64 <sup>5</sup>  Red Hat Enterprise Linux 4 x86-64 <sup>5</sup> Red Hat Enterprise Linux 5 x86-64 <sup>5</sup>

<sup>4</sup>Targeted for Novell YES certification

<sup>5</sup>Targeted for Novell SUPPORTED certification

See Novell certification Web pages for current status. For support Novell requires the use of Novell paravirtualized drivers to enhance fully virtualized VM performance. These drivers are available in SUSE Linux Enterprise Virtual Machine Driver Pack. If you want to run fully virtualized workloads, you should purchase SUSE Linux Enterprise Virtual Machine Driver Pack.

## Feature Support for VHS

### SUSE Linux Enterprise Server 10 SP2 Feature Support—VHS (PV Domain 0)

	Xen 3.2 PAE x86 32-bit	Xen 3.2 x86-64 64-bit
VHS network and block device hotplugging	yes	yes
VHS physical CPU hotplugging	no	no
VHS virtual CPU hotplugging	yes	yes
VHS virtual CPU pinning	yes	yes
VHS virtual CPU capping	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 SP2 Feature Support—VM (PV)

	Xen 3.2 PAE x86 32-bit	Xen 3.2 x86-64 64-bit
VM virtual CPU hotplugging	yes	yes
VM virtual CPU capping	yes	yes
VM virtual CPU overcommitment	yes	yes
VM dynamic virtual memory resize	yes	yes
VM virtual network and virtual block device hotplugging	yes	yes
VM save and restore	yes Between like virtual host systems with similar resources (i.e., from 32 PAE to 32 PAE)	yes Between like virtual host systems with similar resources (i.e., from 64 to 64)
VM migration	yes Between like virtual host systems with similar resources (i.e., from 32 PAE to 32 PAE)	yes Between like virtual host systems with similar resources (i.e., from 64 to 64)
PCI Pass Through	yes	yes

**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. To summarize, guests can be 32- or 64-bit, but the virtual host servers must be identical.

Novell Open Enterprise Server 2 SP1 combines NetWare® and SUSE Linux Enterprise Server. Open Enterprise Server 2 services based on virtualized SUSE Linux Enterprise Server 10 SP2 will inherit the VM feature support of SUSE Linux Enterprise Server 10 SP2. Open Enterprise Server 2 SP1 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 SP2 Feature Support—Virtual Machine (FV)

	Xen 3.2 PAE x86 32-bit	Xen 3.2 x86-64 64-bit
VM virtual CPU hotplugging	no	no
VM virtual CPU overcommitment	yes	yes
VM dynamic virtual memory resize	no	no
VM virtual network and virtual block device hotplugging	no	no
VM save and restore	yes Between like virtual host systems with similar resources (i.e., from 32 PAE to 32 PAE)	yes Between like virtual host systems with similar resources (i.e., from 64 to 64)
VM live migration	yes Between like virtual host systems with similar resources (i.e., from 32 PAE to 32 PAE)	yes Between like virtual host systems with similar resources (i.e., from 64 to 64)
PCI Pass Through <sup>6</sup>	yes	yes

<sup>6</sup>Requires Intel VT-d hardware

## **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*)

**VMI Interface.** *SUSE Linux Enterprise Server 10 contains support for running on VMI.*

### **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.

Xen is not available or supported with SUSE Linux Enterprise Server 10 SP2 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 SP4 or SUSE Linux Enterprise Server 10 SP2 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 SP2 as the host is available today, and Novell supports this configuration when exploiting the virtualization capabilities of AMD-V and Intel VT hardware. For support Novell requires the use of paravirtualized device drivers to enhance performance of fully virtualized machines.

Virtuozzo\* and OpenVZ are not included in SUSE Linux Enterprise Server 10 SP2. 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 SP2 and SUSE Linux Enterprise Server 9 SP4 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 SP2 and SUSE Linux Enterprise Server 9 SP4 have

both been successfully tested and certified to run with IBM System z.

SUSE Linux Enterprise Server 10 SP2 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 SP2 features a 32-bit application environment to deploy legacy 32-bit applications.

SUSE Linux Enterprise Server 9 SP4 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 SP4 for IBM zSeries (64-bit) features a 32-bit application environment to deploy legacy 32-bit applications.

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