

SUSE® Linux Enterprise Server: Virtualization Technology Support

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Get Virtualization Support Today

¹ Novell strongly recommends using paravirtualized device drivers for fully virtualized machines. These drivers enhance network and storage I/O performance. For SUSE Linux Enterprise Server they are included directly in the operating system, and for Windows on Xen they are available in the SUSE Linux Enterprise Server Virtual Machine Driver Pack. For additional information on paravirtualized device drivers for Windows, please visit: www.novell.com/products/vmdriverpack

SUSE Linux Enterprise Server 11 SP1 provides integrated virtualization, which can be used to provision, deprovision, install, monitor and manage multiple virtual machines (VMs) on a single physical system. Out of the box, SUSE Linux Enterprise Server can create VMs running both modified, highly tuned, paravirtualized operating systems and fully virtualized, unmodified operating systems. Full virtualization¹ allows the guest OS to run unmodified and requires the presence of either Intel Virtualization Technology (Intel VT) or AMD Virtualization (AMD-V).

The primary component of the operating system virtualization is a hypervisor (or virtual machine monitor, VMM), a layer of software that runs directly on the server hardware. It controls platform resources, sharing them among multiple VMs and their operating systems by presenting virtualized hardware interfaces to each VM.

SUSE Linux Enterprise Server 11 SP1 is an enterprise-class Linux server that offers two types of hypervisors, Xen* and KVM*, the latter one having recently been included in SUSE Linux Enterprise Server 11 SP1. Xen supports virtualization on both 32- and 64-bit x86-based hardware architectures. However, it should be noted that the 32-bit Xen host is deprecated in SUSE Linux Enterprise Server 11 SP1 and will be discontinued in the upcoming release. Users are strongly recommended to use a 64-bit Xen host only. KVM supports only 64-bit x86-based hardware architectures and only full virtualization mode.

SUSE Linux Enterprise Server 11 SP1 with Xen or KVM acts as a virtualization host server (VHS) that supports VMs with disparate operating systems. The Novell VM architecture consists of one combined I/O and system management VM (known as dom0) and many application-hosting VMs (known as domU).

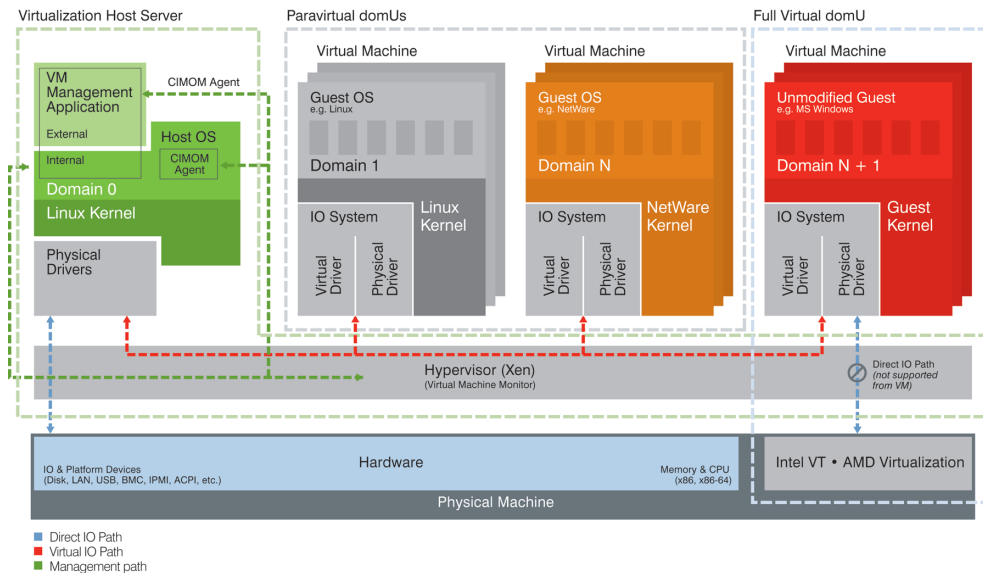


Figure 1. SUSE Linux Enterprise Server with Xen virtualization host server architecture: Hardware, hypervisor and management domain provide the foundation to host virtual machines.

Support for the various combinations of virtualization host and guest OS 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/yesssearch/Search.jsp> (under Novell Product, select “SUSE Linux Enterprise Server 11 for x86 with Xen” or “SUSE Linux Enterprise Server 11 for AMD64 and Intel EM64T with Xen” or “SUSE Linux Enterprise Server 11 for AMD64 and Intel EM64T with KVM”).

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

If you want to upgrade from a previous version of SUSE Linux Enterprise Server to the latest service pack, several different options are available:

Upgrade Path: *SUSE Linux Enterprise Server 11 to SUSE Linux Enterprise Server 11 SP1*

1. Upgrade all virtualization host servers (VHSs) running SUSE Linux Enterprise Server 11 to run SUSE Linux Enterprise Server 11 SP1.
2. Upgrade all VMs to run SUSE Linux Enterprise Server 11 SP1 after upgrading the host server. The upgrade is backward compatible: SUSE Linux Enterprise Server 11 VMs can run on a SUSE Linux Enterprise Server 11 SP1 host.

Upgrade Path: *SUSE Linux Enterprise Server 10 SP3 to SUSE Linux Enterprise Server 11 SP1*

1. If your SUSE Linux Enterprise Server 10 SP3 is currently running the deprecated 32-bit, non-PAE hypervisor (xen.gz), then you will need to complete the following:

- Verify that your hardware supports 32-bit Physical Address Extensions (PAEs). If not, SUSE Linux Enterprise Server 11 SP1 with Xen will not run on your hardware.
- Install the PAE-enabled kernel into each of your existing paravirtualized VMs. Modify the VM configuration file for these VMs to use the PAE enabled kernel (*kernel-xenpae*). See the Novell online virtualization documentation for more details.

2. Upgrade all VHSs running SUSE Linux Enterprise Server 10 SP3 to run SUSE Linux Enterprise Server 11 SP1.
3. Since the use of Xen network scripts is deprecated in SUSE Linux Enterprise Server 11 SP1, use YaST® (or other tools) to set up any custom networking configuration using standard sysconfig networking scripts. See the Novell online virtualization documentation for more details.
4. Upgrade all VMs to run SUSE Linux Enterprise Server 11 SP1 after upgrading the host server. The upgrade is backward compatible: SUSE Linux Enterprise Server 10 SP3 VMs can run on a SUSE Linux Enterprise Server 11 SP1 host.

**Novell Technical Services™—
Support Offerings for SUSE Linux
Enterprise Server 11 SP1**

Novell Technical Services offers different levels of subscriptions and services: Basic, Standard, Priority and Enterprise. Some services include a Service Account Manager and dedicated Premium Service Engineers. For the latest information, visit:

- www.novell.com/products/server/howtobuy.html
- http://support.novell.com/support_options.html

When deployed on IBM* System z*, SUSE Linux Enterprise Server requires a paid subscription per Integrated Facility for Linux (IFL) or CP to be entitled for service.

- 2 Up to 64 CPU cores or logical CPUs are supported for 32-bit. Processors are 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 Hyper-threading (in old-style dual core hyperthreaded processors) to allow the best performance with Xen.
- 3 See online documentation for guest-specific guidelines. Also, Virtual block devices for FV guests would increase with PV drivers.

Each additional IFL or CP that runs SUSE Linux Enterprise Server requires an additional subscription. Any number of SUSE Linux Enterprise Server instances (using multiple LPARs or z/VM) can run on the entitled IFLs or CPs (also see www.novell.com/products/server/virtualization.html).

Software-based Virtualization

Supported Novell Virtualization Technologies

SUSE Linux Enterprise 11 SP1 includes Xen 4.0 and KVM 0.12.5+ and fully supports virtualization on 64-bit x86-based architectures. Xen on 32-bit x86-based architectures is deprecated in SUSE Linux Enterprise Server 11 SP1 and will be discontinued in the upcoming release.

Please consult Novell certification bulletins for certified combinations and configurations. Please check your hardware-specific information for the limits of supported physical memory and consult Novell bulletins for certified combinations and configurations.

As it relates to dom0 compatibility, only x86 (32-bit) dom0 is officially supported on x86 (32-bit) Xen hosts while x86-64 (64-bit) dom0 is supported only on x86-64 hosts, both for Xen and KVM. Irrespective of the architectural bits of the deployed Xen host, it is highly recommended that dom0 has a minimum of two CPUs at its disposal. We also recommend to disable ballooning and giving dom0 an explicit amount of memory.

SUSE Linux Enterprise Server 11 SP1 Host and VM Generic Technical Support Limits

The first table contains generic limits for Xen support offered by Novell Technical Services. Xen might work well with extended parameters, but the Novell support is limited to the values listed below. Please consider that the virtualization host server needs at least 512 MB of memory. If you are adding VMs, you must add additional memory to this base requirement. The limits for KVM are equal to the limits for SUSE Linux Enterprise Server 11 SP1.

VHS Limits	Xen 4.0 x86 (32-bit)	Xen 4.0 x86-64 (64-bit)
Dom 0 CPUs ²	32	64
Logical CPUs	32	255 (theoretical)
Physical memory	16 GB (dom0), 16 GB (Xen)	500 GB (dom0), 2 TB (Xen)
Block devices	12,000 SCSI logical units	12,000 SCSI logical units
iSCSI devices	128	128
Network cards	8	8
VMs per CPU core	8	8
VMs per host	64	64
Virtual devices per host	256	2,048

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

Virtual machine limits per VM	Xen 4.0 x86 (32-bit)	Xen 4.0 x86-64 (64-bit)	KVM
Virtual CPUs, paravirtualization (PV)	32	32	—
Virtual CPUs, full virtualization (FV)	16	16	16
Virtual memory (min.)	Guest specific ³	Guest specific ³	Guest specific ³
Virtual memory (max.)	32 GB	256 GB	512 GB
Virtual NIC	8 per VM	8 per VM	8 per VM
Virtual block devices PV	16	100	—
Virtual block devices FV	4 (100 with PV drivers)	4 (100 with PV drivers)	4 (20 with PV drivers)

Note: Virtual memory requirements may vary with the purpose of the overall VM configuration, including operating systems and application solution stacks. For an 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 either a) with the administrative user interface, b) by using the command line, or c) by statically adding the required entries in the VM configuration file. Xen technically supports up to 32 virtual CPUs per VM. However, Novell support is currently limited to 16 virtual CPUs for fully virtualized VMs and 32 virtual CPUs for paravirtualized VMs.

For vendor system-specific limits please consult the Novell YES Certification page at: www.novell.com/yes

Paravirtualization and Full Virtualization OS Support

Paravirtualized OS Support (VMs for SUSE Linux Enterprise Server 11 SP1 Host)

4 Supported by Novell with best effort.

VM Host →	Xen 4.0 x86 (32-bit) SUSE Linux Enterprise Server 11 SP1 x86	Xen 4.0 x86-64 (64-bit) SUSE Linux Enterprise Server 11 SP1 x86-64
32-bit VM	SUSE Linux Enterprise Server 11 SUSE Linux Enterprise Server 11 SP1 SUSE Linux Enterprise Server 10 SP3 SUSE Linux Enterprise Server 9 SP4 Novell Open Enterprise Server 2 SP2 NetWare® 6.5 SP8 Red Hat* Enterprise Linux 4 x86 ⁴ Red Hat Enterprise Linux 5 x86 ⁴	SUSE Linux Enterprise Server 11 SUSE Linux Enterprise Server 11 SP1 SUSE Linux Enterprise Server 10 SP3 SUSE Linux Enterprise Server 9 SP4 Novell Open Enterprise Server 2 SP2 NetWare 6.5 SP8 Red Hat Enterprise Linux 4 x86 ⁴ Red Hat Enterprise Linux 5 x86 ⁴
64-bit VM		SUSE Linux Enterprise Server 11 SUSE Linux Enterprise Server 11 SP1 SUSE Linux Enterprise Server 10 SP3 SUSE Linux Enterprise Server 9 SP4 Novell Open Enterprise Server 2 SP2 Red Hat Enterprise Linux 4 x86 ⁴ Red Hat Enterprise Linux 5 x86 ⁴

Paravirtualized OS Support (Technology Preview)

VM Host →	Xen 4.0 x86 (32-bit) SUSE Linux Enterprise Server 11 SP1 x86	Xen 4.0 x86-64 (64-bit) SUSE Linux Enterprise Server 11 SP1 x86-64
32-bit VM	SUSE Linux Enterprise Desktop 11 SP1	SUSE Linux Enterprise Desktop 11 SP1
64-bit VM		SUSE Linux Enterprise Desktop 11 SP1

Full Virtualization OS Support (Technology Preview)

VM Host →	KVM x86_64 (64-bit) SUSE Linux Enterprise Server 11 SP1 x86_64
32-bit VM	SUSE Linux Enterprise Desktop 11 SP1
64-bit VM	SUSE Linux Enterprise Desktop 11 SP1

Note: Technology preview only: 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.

Fully Virtualized OS Support (VMs for SUSE Linux Enterprise Server 11 SP1 Xen Host)

VM Host →	Xen 4.0 x86 (32-bit) SUSE Linux Enterprise Server 11 SP1 x86	Xen 4.0 x86-64 (64-bit) SUSE Linux Enterprise Server 11 SP1 x86-64
32-bit VM	SUSE Linux Enterprise Server 11 SUSE Linux Enterprise Server 11 SP1 SUSE Linux Enterprise Server 10 SP3 SUSE Linux Enterprise Server 9 SP4 Windows* Server 2008 SP2 (Enlightened) Windows Server 2003 SP2 Windows Vista SP2 ⁵ Windows 7 (Enlightened) ⁵ Windows XP (Uniprocessor only) ⁵ Red Hat Enterprise Linux 4 x86 ⁵ Red Hat Enterprise Linux 5 x86 ⁵	SUSE Linux Enterprise Server 11 SUSE Linux Enterprise Server 11 SP1 SUSE Linux Enterprise Server 10 SP3 SUSE Linux Enterprise Server 9 SP4 Windows Server 2008 SP2 (Enlightened) Windows Server 2003 SP2 Windows Vista SP2 ⁵ Windows 7 (Enlightened) ⁵ Windows XP (Uniprocessor only) ⁵ Red Hat Enterprise Linux 4 x86 ⁵ Red Hat Enterprise Linux 5 x86 ⁵
64-bit VM		SUSE Linux Enterprise Server 11 SUSE Linux Enterprise Server 11 SP1 SUSE Linux Enterprise Server 10 SP3 SUSE Linux Enterprise Server 9 SP4 Windows Server 2008 SP2 (Enlightened) Windows Server 2008 R2 (Enlightened) Windows Server 2003 SP2 Windows Vista SP2 ⁵ Windows 7 (Enlightened) ⁵ Windows XP (Uniprocessor only) ⁵ Red Hat Enterprise Linux 4 x86 ⁵ Red Hat Enterprise Linux 5 x86 ⁵

Fully Virtualized OS Support (VMs for SUSE Linux Enterprise Server 11 SP1 KVM Host)

VM Host →	KVM x86-64 (64-bit) SLES 11 SP1 x86-64
32-bit VM	SUSE Linux Enterprise Server 11 SUSE Linux Enterprise Server 11 SP1 SUSE Linux Enterprise Server 10 SP3 SUSE Linux Enterprise Server 9 SP4 Windows Server 2008 SP2 (Enlightened) ⁵ Windows Server 2003 SP2 ⁵ Windows Vista SP2 ⁵ Windows 7 (Enlightened) ⁵ Windows XP (Uniprocessor only) ⁵ Red Hat Enterprise Linux 4 x86 ⁵ Red Hat Enterprise Linux 5 x86 ⁵
64-bit VM	SUSE Linux Enterprise Server 11 SUSE Linux Enterprise Server 11 SP1 SUSE Linux Enterprise Server 10 SP3 SUSE Linux Enterprise Server 9 SP4 Windows Server 2008 SP2 (Enlightened) ⁵ Windows Server 2008 R2 (Enlightened) ⁵ Windows Server 2003 SP2 ⁵ Windows Vista SP2 ⁵ Windows 7 (Enlightened) ⁵ Windows XP (Uniprocessor only) ⁵ Red Hat Enterprise Linux 4 x86 ⁵ Red Hat Enterprise Linux 5 x86 ⁵

For the current support status, please visit the Novell certification web pages. Novell strongly recommends the use of Novell paravirtual drivers to enhance fully virtualized VM performance. The drivers for Windows on Xen are available as an add-on product called SUSE Linux Enterprise Virtual Machine

Driver Pack. The drivers for Windows for KVM are included in the ISO file in the kvm.rpm package.

Also, any guest OS support is valid as long as the original vendor supports that OS as part of the product lifecycle.

Feature Support for VHS

SUSE Linux Enterprise Server 11 SP1 Feature Support—Host (dom0)

	Xen 4.0 x86 (32-bit)	Xen 4.0 x86-64 (64-bit)
Network and block device hotplugging	Yes	Yes
Physical CPU hotplugging	No	No
Virtual CPU hotplugging	Yes	Yes
Virtual CPU pinning	Yes	Yes
Virtual CPU capping	Yes	Yes
Intel VT-x2: FlexPriority, FlexMigrate (<i>Migration constraints apply to dissimilar CPU architectures</i>)	Yes	Yes
Intel VT-d2 (<i>DMA remapping with interrupt filtering and queued invalidation</i>)	Yes	Yes
AMD IOMMU (<i>I/O Page Table with guest-to-host physical address translation</i>)	Yes	Yes

The supported features for a KVM host are essentially the same as the supported features for SUSE Linux Enterprise Server 11 SP1.

Note: *The addition or removal of physical CPUs at runtime is not supported; however, virtual CPUs can be added or removed for each VM on Xen. CPU pinning allows logical CPU to virtual CPU assignment for a specific VM.*

- 6 For machines that have Intel FlexMigration, CPU-ID masking allows more flexibility in cross-CPU migration.
- 7 QCOW2 disk image format required for all writable disks.
- 8 Specific guests excluded are NetWare and SUSE Linux Enterprise Server 9 SP4.

SUSE Linux Enterprise Server 11 SP1 Feature Support—Paravirtualized Guest

	Xen 4.0 x86 (32-bit)	Xen 4.0 x86-64 (64-bit)
Virtual network and virtual block device hotplugging	Yes	Yes
Virtual CPU hotplugging	Yes	Yes
Virtual CPU overcommitment	Yes	Yes
Dynamic virtual memory resize	Yes	Yes
VM save and restore	Yes (Excludes SUSE Linux Enterprise Server 9 SP4 in multiprocessor mode)	Yes (Excludes SUSE Linux Enterprise Server 9 SP4 in multiprocessor mode)
VM live migration	Yes, between like virtual host systems with similar resources (i.e., from 32 PAE to 32 PAE, 64-bit to 64-bit) ⁶ (Excludes SUSE Linux Enterprise Server 9 SP4 in multiprocessor mode)	Yes, between like virtual host systems with similar resources (i.e., from 32 PAE to 32 PAE, 64-bit to 64-bit) ⁶ (Excludes SUSE Linux Enterprise Server 9 SP4 in multiprocessor mode)
VM snapshot	Yes ⁷	Yes ⁷
Advanced debugging with GDB	Yes	Yes
Dom0 metrics visible to VM	Yes	Yes
Memory ballooning	Yes	Yes
PCI pass through⁸	Yes	Yes

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

Virtual CPU over-commitment 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, the source and destination of migration need to be essentially the same. For Xen, the source and target systems must be either 32-bit or 64-bit, and the processors (AMD or Intel) must be the same. Unless CPU ID masking is used, such as Intel's

FlexMigration, the target should feature the same processor revision 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.

SUSE Linux Enterprise Server 11 SP1 Feature Support—Full Virtualization Guest

	Xen 4.0 x86 (32-bit)	Xen 4.0 x86-64 (64-bit)	KVM x86-64 (64-bit)
Virtual network and virtual block device hotplugging	Yes	Yes	No
Virtual CPU hotplugging	No	No	No
Virtual CPU overcommitment	Yes	Yes	Yes
Dynamic virtual memory resize	Yes	Yes	Shrinking only
VM save and restore	Yes	Yes	Yes
VM live migration	Yes, between like virtual host systems with similar resources (i.e., from 32-bit to 32-bit, 64-bit to 64-bit) ⁹	Yes, between like virtual host systems with similar resources (i.e., from 32-bit to 32-bit, 64-bit to 64-bit) ⁹	Yes
VM snapshot	Yes ¹⁰	Yes ¹⁰	No
Advanced debugging with GDB	Yes	Yes	Yes
Dom0 metrics visible to VM	Yes	Yes	Yes
PCI pass through ¹¹	Yes	Yes	Yes

For KVM a detailed description of supported limits, features, recommended settings and scenarios and other useful information is maintained in the `kvm-supported.txt` document, available as a part of the `kvm` package, and located at `/usr/share/doc/packages/kvm` path on an installed SUSE Linux Enterprise Server 11 SP1 system.

⁹ For machines that have Intel FlexMigration, CPU-ID masking allows more flexibility in cross-CPU migration.

¹⁰ QCOW2 disk image format required for all writeable disks.

¹¹ PCI pass through requires underlying support from the hardware (e.g., Intel-VT or AMD-V).

Other Supported Platforms

Supported Software Virtualization Technologies

SUSE Linux Enterprise Server 11 SP1 has been optimized to function as a performance tuned guest OS on various hypervisors, such as VMware ESX, Citrix XenServer and Microsoft Hyper-V. The paravirtualized SUSE Linux Enterprise Server kernel (both 32-bit and 64-bit) extracts better response times in the interactions with Citrix XenServer. Also, Novell has partnered with Microsoft to develop a shim (or hypercall adapter) that translates Xen-specific calls from the paravirtualized SUSE Linux Enterprise Server kernel into Hyper-V compatible calls, thus allowing SUSE Linux Enterprise Server 11 SP1 to run as a paravirtualized guest. SUSE Linux Enterprise Server 11 SP1, in various forms, is a supported guest OS on these leading host platforms with YES Certification assurances on some of them.

Supported Hardware Virtualization Technologies

SUSE Linux Enterprise Server 11 SP1 is supported on z9, z10 and z196 IBM System z, in both logical partition (LPAR) and z/VM* versions 5.3, 5.4., 6.0, 6.1. SUSE Linux Enterprise Server 11 SP1 (64-bit) features a 32-bit application environment to deploy legacy 31-bit applications.

Non-supported Virtualization Technologies

Xen is not available or supported with SUSE Linux Enterprise Server 11 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.

Virtuozzo* and OpenVZ are not included in SUSE Linux Enterprise Server 11 SP1. Special offers are available either from Novell or Parallels*. Please contact Parallels for information on specific product and support offerings.



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