Virtualization Support in SUSE Linux Enterprise Server

KVM virtualization support in SUSE Linux Enterprise Server defines supported hardware architectures, hypervisor limits and compatible guest operating systems. By establishing clear hardware requirements and feature support matrices across x86_64, AArch64, IBM Z and POWER platforms, SUSE Linux Enterprise Server enables enterprise consolidation, optimized resource utilization and high-performance virtual machine deployment without compromising system stability.

Prerequisites

- Hardware virtualization support (AMD-V, Intel VT-x, Armv8-A or Power10+) enabled in BIOS or firmware
- Basic knowledge of Linux system administration and virtualization concepts

Publication Date: 05 Nov 2026

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1 Virtualization Limits and Support

Virtualization limits and support



Important

QEMU is only supported when used for virtualization together with the KVM hypervisors. The TCG accelerator is not supported, even when it is distributed within SUSE products. Users must not rely on QEMU TCG to provide guest isolation, or for any security guarantees. See also https://qemu-project.gitlab.io/qemu/system/security.html.

1.1 Architecture support

1.1.1 KVM hardware requirements

SUSE supports KVM full virtualization on AMD64/Intel 64, AArch64, IBM Z, IBM LinuxONE and POWER hosts.

- On the AMD64/Intel 64 architecture, KVM is designed around hardware virtualization features included in AMD* (AMD-V) and Intel* (VT-x) CPUs. It supports virtualization features of chipsets and PCI devices, such as an I/O Memory Mapping Unit (IOMMU) and Single Root I/O Virtualization (SR-IOV). You can test whether your CPU supports hardware virtualization with the following command:

  ```
  > egrep '(vmx|svm)' /proc/cpuinfo
  ```

  If this command returns no output, your processor either does not support hardware virtualization, or this feature has been disabled in the BIOS or firmware.
  The following Web sites identify AMD64/Intel 64 processors that support hardware virtualization: https://ark.intel.com/Products/VirtualizationTechnology (for Intel CPUs), and https://products.amd.com/ (for AMD CPUs).

- On the Arm architecture, Armv8-A processors include support for virtualization.

- On the Arm architecture, we only support running QEMU/KVM via the CPU model `host` (it is named `host-passthrough` in Virtual Machine Manager or `libvirt`).
- On the POWER architecture, KVM is supported as an additional virtualization option for a Power10 or later system running inside a PowerVM logical partition (LPAR). The LPAR must use dedicated CPUs with processor sharing set to `Never Allow` and run in Radix MMU mode. The CPU type presented to the LPAR must be Power10 or later; if the LPAR uses a processor compatibility mode, set the compatibility mode to Power10 or later as well. The following minimum firmware and Hardware Management Console (HMC) levels are required:
  - Power10: firmware FW1060.10 or later
  - Power11: firmware FW1110 or later
  - HMC: V10 R3 SP1060 or later, if the LPAR is managed by an HMC

  If the system is not managed by an HMC, select *Linux KVM* as the default partition environment in the system's Advanced System Management Interface (ASMI) instead.



Note: KVM kernel modules not loading

The KVM kernel modules only load if the CPU hardware virtualization features are available.

However, additional RAM for each virtualized guest is needed. It should at least be the same amount that is needed for a physical installation. It is also strongly recommended having at least one processor core or hyper-thread for each running guest.



Note: AArch64

AArch64 is a continuously evolving platform. It does not have a traditional standards and compliance certification program to enable interoperability with operating systems and hypervisors. Ask your vendor for the support statement on SUSE Linux Enterprise Server.



Note: POWER

KVM on POWER is supported only inside a PowerVM LPAR that meets the requirements above. Bare-metal POWER hosts without PowerVM remain unsupported. For the full enablement procedure, see the IBM documentation on KVM in a PowerVM LPAR (https://www.ibm.com/docs/en/linux-on-power-systems?topic=servers-kvm-in-powervm-lpar).

Important: SAP workloads on POWER

This does not extend to running SAP workloads inside a KVM guest on POWER.

1.2 Hypervisor limits

New features and virtualization limits for KVM are outlined in the Release Notes (https://www.suse.com/releasenotes/) for each Service Pack (SP).

Only packages that are part of the official repositories for SUSE Linux Enterprise Server are supported. Conversely, all optional subpackages and plug-ins (for QEMU, `libvirt`) provided at packagehub (https://packagehub.suse.com/) are not supported.

For the maximum total virtual CPUs per host. The total number of virtual CPUs should be proportional to the number of available physical CPUs.

1.2.1 KVM limits

Supported (and tested) virtualization limits of a SUSE Linux Enterprise Server 16.1 host running Linux guests on AMD64/Intel 64. For other operating systems, refer to the specific vendor.

TABLE 1: KVM VM LIMITS

Maximum virtual CPUs per VM	768
Maximum memory per VM	8 TiB



Note

KVM host limits are identical to SUSE Linux Enterprise Server (see the corresponding section of release notes), except for:

- *Maximum virtual CPUs per VM*: see recommendations in the *Virtualization Best Practices Guide* regarding the overcommitment of physical CPUs. The total virtual CPUs should be proportional to the available physical CPUs.

1.3 AMD SEV-SNP confidential computing VM restrictions

The following limitations apply only to guest VMs running with AMD SEV-SNP (Secure Encrypted Virtualization-Secure Nested Paging) confidential computing enabled. These restrictions are inherent to the SEV-SNP architecture and do not affect standard (non-confidential) virtual machines.

- **Secure Boot (AMD side):** Secure Boot functionality is not supported on the AMD platform for guest VMs within this secure environment. This means that guest VMs cannot leverage the UEFI Secure Boot mechanism to verify the digital signatures of boot components, which typically helps prevent the loading of unauthorized or malicious software during the boot process. Users should consider alternative methods for ensuring software integrity post-boot.
- **VM migration:** The live migration of virtual machines between hosts is currently not supported. This implies that planned maintenance, load balancing, or disaster recovery scenarios requiring VM movement without downtime will need to involve a full shutdown and restart of the guest VM on the new host. This limitation is often a consequence of maintaining the cryptographic isolation and attestation state of secure VMs.
- **Suspend/restore:** The ability to suspend a VM's execution state to disk and later restore it is not available. This impacts operational flexibility, as VMs cannot be paused and resumed seamlessly. Any interruption to a guest VM's operation will require a full shutdown and a fresh boot cycle, losing the immediate operational state.
- **Pass-through devices:** Direct pass-through of host devices (such as GPUs, network cards, or storage controllers) to the guest VM is not supported. This limitation restricts scenarios where guest VMs require exclusive, high-performance access to specific hardware components. Workloads that heavily rely on direct hardware interaction, like certain graphical applications or specialized I/O operations, may experience reduced performance or incompatibility.

- **VM reboot:** The internal reboot functionality for guest VMs is not supported. If a guest VM requires a restart, it must be fully shut down and then started again from the host management interface. This ensures that the secure state of the VM is properly re-established upon each boot, rather than relying on an internal reset that might bypass certain security checks.
- **Memory ballooning:** Memory ballooning, which allows dynamic adjustment of VM memory by reclaiming unused guest memory back to the host, is not supported. This means that the allocated memory for a guest VM will remain fixed, regardless of its actual usage. Consequently, memory overcommitment strategies, where the sum of allocated VM memory exceeds the physical host memory, cannot be effectively utilized, potentially leading to less efficient memory utilization on the host.
- **Hotplug CPU/memory:** The hotplugging (adding or removing) of CPU cores or memory modules while the VM is running is not supported. Any changes to the vCPU or memory configuration of a guest VM will require a full shutdown and a restart of the VM for the changes to take effect. This affects the agility and flexibility in dynamically scaling resources for running workloads.
- **Virtio graphics:** Only Virtio block devices (for storage) and network devices are supported. Virtio graphics are not available for guest VMs in this environment. This implies that guest VMs will rely on basic graphics emulation, which may not provide optimal performance for graphically intensive applications, user interfaces, or remote desktop protocols requiring accelerated graphics.
- **Huge pages:** The use of huge pages for memory allocation within the guest VM is not supported. Huge pages can improve performance by reducing Translation Lookaside Buffer (TLB) misses, especially for applications with large memory footprints. Without huge page support, memory management might incur slightly higher overhead, which could subtly impact the performance of memory-intensive applications.
- **vCPU limit (AMD SNP):** The number of virtual CPUs (vCPUs) that can be assigned to a guest VM is limited to 255 when utilizing AMD Secure Nested Paging (SNP). This specific limitation is imposed by the AMD SNP architecture to maintain the integrity and performance characteristics of the secure execution environment. Workloads requiring more than 255 vCPUs cannot be deployed on these secure VMs.

1.4 Supported host environments (hypervisors)

This section describes the support status of SUSE Linux Enterprise Server 16.1 running as a guest operating system on top of different virtualization hosts (hypervisors).

TABLE 2: THE FOLLOWING SUSE HOST ENVIRONMENTS ARE SUPPORTED:

SUSE Linux Enterprise Server	Hypervisors
SUSE Linux Enterprise Server 12 SP5	KVM (using `virt-manager`)
SUSE Linux Enterprise Server 15 SP3 to SP7	KVM
SUSE Virtualization (Harvester)	KVM
SUSE Linux 16.0	KVM

THE FOLLOWING THIRD-PARTY HOST ENVIRONMENTS ARE SUPPORTED:

- Nutanix Acropolis Hypervisor with AOS (https://portal.nutanix.com/page/documents/compatibility-matrix/guestos)
- Oracle VM Server 3.X (https://www.oracle.com/virtualization/technologies/vm/downloads/ovm-downloads.html)
- Oracle Linux KVM 7, 8 (https://www.oracle.com/linux/)
- VMware ESXi 6.7, 7.0, 8.0 (https://www.vmware.com/products/esxi-and-esx.html)
- Windows Server 2019, 2022, 2025

You can also search in the SUSE YES certification database (https://www.suse.com/yessearch/Search.jsp).

THE LEVEL OF SUPPORT IS AS FOLLOWS:

- Support for SUSE host operating systems is full L3 (both for the guest and host), according to the respective product lifecycle (https://www.suse.com/lifecycle/).
- SUSE provides full L3 support for SUSE Linux Enterprise Server guests within third-party host environments.
- Support for the host and cooperation with SUSE Linux Enterprise Server guests must be provided by the host system's vendor.

1.5 Supported guest operating systems

This section lists the support status for guest operating systems virtualized on top of SUSE Linux Enterprise Server 16.1 for KVM hypervisors.



Important

Microsoft Windows guests can be rebooted by `libvirt`/**`virsh`** only if paravirtualized drivers are installed in the guest. Refer to https://documentation.suse.com/sle-vmdp/ for more details on downloading and installing PV drivers. See *Section 1.5, "Supported guest operating systems"* for the current list of supported Windows Server versions.

THE FOLLOWING GUEST OPERATING SYSTEMS ARE FULLY SUPPORTED (L3):

- SUSE Linux Enterprise Server 12 SP5
- SUSE Linux Enterprise Server 15 SP3, 15 SP4, 15 SP5, 15 SP6, 15 SP7
- SUSE Linux Enterprise Server 16.0
- SUSE Linux Enterprise Server for SAP applications 15 SP3, 15 SP4, 15 SP5, 15 SP6, 15 SP7, 16.0
- SUSE Linux Enterprise Micro 6.0, 6.1, 6.2
- Windows Server 2022, 2025
- Oracle Linux 7, 8

THE FOLLOWING GUEST OPERATING SYSTEMS ARE SUPPORTED AS A TECHNOLOGY PREVIEW (L2, FIXES IF REASONABLE):

- SLED 15 SP3
- Windows 10 / 11

RED HAT AND CENTOS GUEST OPERATING SYSTEMS ARE FULLY SUPPORTED (L3) IF THE CUSTOMER HAS PURCHASED SUSE MULTI-LINUX SUPPORT.

- Refer to the SUSE Multi-Linux Support documentation at https://documentation.suse.com/liberty. The list of available combinations and supported releases is provided in the Introduction section of the guide for your SUSE Multi-Linux Support version. In other cases, they are supported on a limited basis (L2, fixes if reasonable).

ALL OTHER GUEST OPERATING SYSTEMS

- In other combinations, L2 support is provided but fixes are available only if feasible. SUSE fully supports the host OS (hypervisor). The guest OS issues need to be supported by the respective OS vendor. If an issue fix involves both the host and guest environments, the customer needs to approach both SUSE and the guest VM OS vendor.

- All guest operating systems are supported both fully virtualized and paravirtualized. The exception is Windows systems, which are only supported fully virtualized (but they can use PV drivers: https://documentation.suse.com/sle-vmdp/; see *Section 1.5, "Supported guest operating systems"* for supported versions), and OES operating systems, which are supported only paravirtualized.
- All guest operating systems are supported both in 32-bit and 64-bit environments, unless stated otherwise.

1.5.1 Availability of paravirtualized drivers

To improve the performance of the guest operating system, paravirtualized drivers are provided when available. Although they are not required, it is strongly recommended to use them.

The paravirtualized drivers are available as follows:

Red Hat

Available since Red Hat Enterprise Linux 5.4. Starting from Red Hat Enterprise Linux 7.2, Red Hat removed the PV drivers.

Windows

SUSE has developed Virtio-based drivers for Windows, which are available in the Virtual Machine Driver Pack (VMDP). For more information, see https://documentation.suse.com/sle-vmdp/. See *Section 1.5, "Supported guest operating systems"* for the current list of supported Windows Server versions.

1.6 Supported VM migration scenarios

SUSE Linux Enterprise Server supports migrating a virtual machine from one physical host to another.

1.6.1 Offline migration scenarios

SUSE supports offline migration, powering off a guest VM, then moving it to a host running a different SLES product, from SLES 12 to SLES 15 SP*X*. The following host operating system combinations are fully supported (L3) for migrating guests from one host to another:

TABLE 3: SUPPORTED OFFLINE MIGRATION GUESTS

Target SLES host / Source SLES host	12 SP3	12 SP4	12 SP5	15 GA	15 SP1	15 SP2	15 SP3	15 SP4	15 SP5	15 SP6
12 SP3	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗
12 SP4	✗	✓	✓	✓[1]	✓	✗	✗	✗	✗	✗
12 SP5	✗	✗	✓	✗	✓	✓	✗	✗	✗	✗
15 GA	✗	✗	✗	✗	✓	✓	✓	✗	✗	✗
15 SP1	✗	✗	✗	✗	✓	✓	✓	✗	✗	✗
15 SP2	✗	✗	✗	✗	✗	✓	✓	✓	✗	✗
15 SP3	✗	✗	✗	✗	✗	✗	✓	✓	✓	✓
15 SP4	✗	✗	✗	✗	✗	✗	✗	✓	✓	✓
15 SP5	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓
15 SP6	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓

✓ Fully compatible and fully supported

✓[1] Supported for KVM hypervisor only

✗ Not supported

1.6.2 Live migration scenarios

This section lists support status of live migration scenarios when running virtualized on top of SLES. The following host operating system combinations are fully supported (L3 according to the respective product life cycle (https://www.suse.com/lifecycle)).

Note: Live migration

- SUSE always supports live migration of virtual machines between hosts running SLES with successive service pack numbers. For example, from SLES 16 to 16.1.
- SUSE strives to support live migration of virtual machines from a host running a service pack under LTSS to a host running a newer service pack, within the same major version of SUSE Linux Enterprise Server. SUSE only performs minimal testing of LTSS-to-newer migration scenarios and recommends thorough on-site testing before attempting to migrate critical virtual machines.

Important: Confidential Computing

For information about Confidential computing, refer to the release notes: https://documentation.suse.com/releasenotes/sles/16.1/index.html#v160-confidential-computing↗.

TABLE 4: SUPPORTED LIVE MIGRATION GUESTS

Target SLES host / Source SLES host	15 SP7	16
15 SP7	✓	✗
16	✗	✓[2]

✓ Fully compatible and fully supported

✓[2] When available

✗ Not supported

1.7 Feature support

Important: Nested virtualization: technology preview

Nested virtualization allows you to run a virtual machine inside another VM while still using hardware acceleration from the host. It has low performance and adds more complexity while debugging. Nested virtualization is normally used for testing purposes. In SUSE Linux Enterprise Server, nested virtualization is a technology preview. It is only provided for testing and is not supported. Bugs can be reported, but they are treated with low priority. Any attempt to live migrate or to save or restore VMs in the presence of nested virtualization is also explicitly unsupported.

Important: Post-copy live migration: technology preview

Post-copy is a method to live migrate virtual machines that is intended to get VMs running as soon as possible on the destination host, and have the VM RAM transferred gradually in the background over time as needed. Under certain conditions, this can be an optimization compared to the traditional pre-copy method. However, this comes with a major drawback: An error occurring during the migration (especially a network failure) can cause the whole VM RAM contents to be lost. Therefore, we recommend using pre-copy only in production, while post-copy can be used for testing and experimentation in case losing the VM state is not a major concern.

1.7.1 Guest feature support

Note: Windows guest

Hotplugging of virtual network and virtual block devices, and resizing, shrinking and restoring dynamic virtual memory are supported in KVM only when PV drivers are used (VMDP (https://documentation.suse.com/sle-vmdp/)). See *Section 1.5, "Supported guest operating systems"* for the current list of supported Windows Server versions.

Note: Intel FlexMigration

For machines that support Intel FlexMigration, CPU-ID masking and faulting allow for more flexibility in cross-CPU migration.



Tip

For KVM, a detailed description of supported limits, features, recommended settings and scenarios, and other useful information is maintained in `kvm-supported.txt`. This file is part of the KVM package and can be found in `/usr/share/doc/packages/qemu-kvm`.

TABLE 5: GUEST FEATURE SUPPORT FOR KVM

Features	KVM FV guest		
Virtual network and virtual block device hotplugging	✓		
Virtual CPU Hotplug	✗		
Virtual CPU Overcommit	✓		
Dynamic virtual memory resize	✓		
VM save and restore	✓		
VM Live Migration	✓		
VM snapshot	✓		
Advanced debugging with GDBC	✓		
Memory ballooning	✗		
PCI pass-through	✓		
AMD SEV ans SEV-SNP	✓ [3]		

✓ Fully compatible and fully supported

✗ Not supported

[1] NetWare guests are excluded.

[2] See https://documentation.suse.com/sles/html/SLES-amd-sev/article-amd-sev.html.

2 For more information

For further steps in virtualization, refer to the following sources:

- Managing virtual machines with `libvirt` (https://documentation.suse.com/smart/virtualization-cloud/html/concept-manage-virtual-machines-libvirt/concept-manage-virtual-machines-libvirt.html)
- Configuring Virtual Machines with Virtual Machine Manager (https://documentation.suse.com/smart/virtualization-cloud/html/task-configure-virtual-machine-manager/task-configure-virtual-machine-manager.html)
- Assigning Host Devices to Virtual Machines (https://documentation.suse.com/smart/virtualization-cloud/html/vm-assign-pci-device/vm-assign-pci-device.html)
- Configuring a Virtual Disk Cache Mode (https://documentation.suse.com/smart/virtualization-cloud/html/virtual-disk-cache-mode-configure/virtual-disk-cache-mode-configure.html)
- Converting VMware Virtual Machines to KVM with virt-v2v (#virt-v2v-vmware-migration)

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