

Virtualization

WHAT?

By means of virtualization, you can run multiple virtual machines on a single bare-metal host.

WHY?

Sharing host hardware between multiple virtualized guests significantly saves resources.

EFFORT

It takes less than 15 minutes of your time to understand the concept of virtualization.

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1 Introduction to virtualization

Virtualization is a technology that provides a way for a machine (VM Host Server) to run another operating system (VM Guest) on top of the host operating system.

1.1 How does virtualization work?

The primary component of VM Host Server that enables virtualization is a *hypervisor*. A hypervisor is a layer of software that runs directly on VM Host Server's hardware. It controls platform resources, sharing them among multiple VM Guests and their operating systems by presenting virtualized hardware interfaces to each VM Guest. SUSE Linux Enterprise Server offers two types of hypervisors: KVM and Xen.

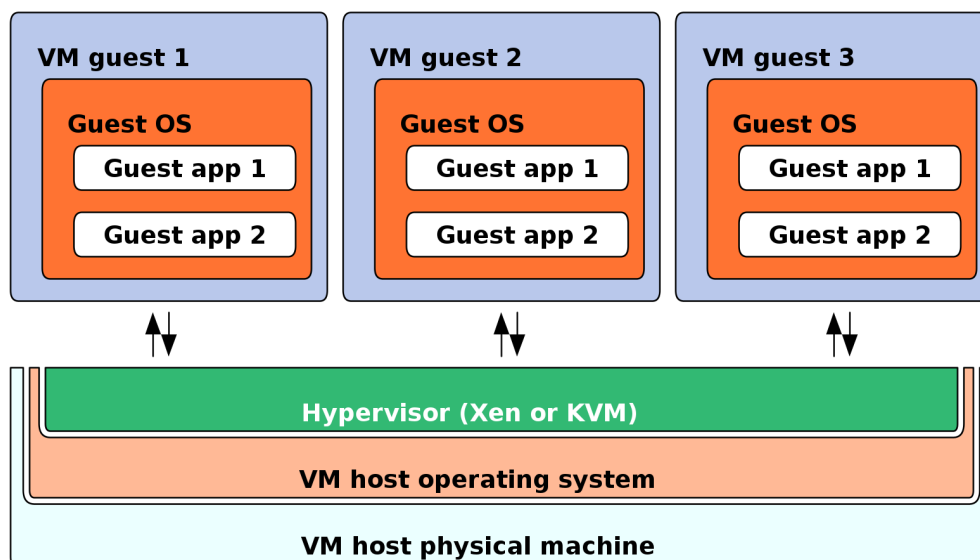


FIGURE 1: A GENERAL SCHEMA OF VIRTUALIZATION

1.2 Benefits of virtualization

Virtualization brings a lot of advantages while providing the same service as a hardware server.

Virtualization reduces the cost of your infrastructure. Servers are mainly used to provide a service to a customer. A virtualized operating system can provide the same service but with the following advantages:

- Less hardware: you can run several operating systems on one host, therefore all hardware maintenance is reduced.
- Less power/cooling: less hardware means you do not need to invest more in electric power, backup power, and cooling if you need more service.
- Save space: your data center space is saved because you do not need more hardware servers (fewer servers than services running).
- Less management: using a VM Guest simplifies the administration of your infrastructure.
- Agility and productivity: virtualization provides *migration* capabilities, *live migration* and *snapshots*. These features reduce downtime and bring an easy way to move your service from one place to another without any service interruption.

2 Virtualization modes

Virtualization is a technology that provides a way for a machine (VM Host Server) to run another operating system (VM Guest) on top of the host operating system. There are two basic modes of hosting VM Guests on virtual machines—*full virtualization* mode and *paravirtual* mode.

Full virtualization (FV)

FV lets virtual machines run unmodified operating systems. It uses either Binary Translation or hardware-assisted virtualization technology, such as AMD* Virtualization or Intel* Virtualization Technology, to improve performance on processors that support it. In FV mode, VM Guest is also called the *Hardware Virtual Machine* (HVM).



Tip

Certain guest operating systems hosted in full virtualization mode can be configured to use drivers from the SUSE Virtual Machine Drivers Pack (VMDP) instead of drivers included in the operating system. Running virtual machine drivers improves performance on guest operating systems, such as Windows Server 2003.

Paravirtualization (PV)

PV normally requires that guest operating systems are modified for the virtualization environment. VM Guests running in paravirtual mode have better performance than those running under full virtualization. Operating systems currently modified to run in paravirtual mode are called *paravirtualized* operating systems and include SLES.

PV on HVM (PVHVM)

PVHVM enhances HVM (see *Full virtualization (FV)*) with paravirtualized drivers, and handling of paravirtualized interrupts and timers.

3 Virtualization scenarios

Virtualization is a technology that provides a way for a machine (VM Host Server) to run another operating system (VM Guest) on top of the host operating system.

Virtualization can provide the following capabilities:

Server consolidation

Many servers can be replaced by one physical server, so that hardware is consolidated, and guest operating systems are converted to virtual machines. This also supports running legacy software on new hardware.

- Better use of not fully utilized resources.
- Fewer server locations needed.
- More efficient use of computer resources with multiple workloads on the same server.
- Simplifies data center infrastructure.
- Simplifies moving workloads to other hosts, avoiding service downtime.
- Faster and more agile virtual machine provisioning.
- Multiple guest operating systems can run on a single host.

Isolation

Guest operating systems are fully isolated from the host running them. Therefore, if there are problems inside virtual machines, the host is not harmed. Also, problems inside one VM do not affect other VMs. No data is shared between VMs.

- Secure Boot can be used for VMs.
- KSM should be avoided.
- Individual CPU cores can be assigned to VMs.
- Hyper-threading (HT) should be disabled to avoid potential security issues.
- VMs should not share networks, storage, or network hardware.
- Using advanced hypervisor features, such as PCI pass-through or NUMA, adversely affects VM migration capabilities.
- Using paravirtualization and virtio drivers generally improves VM performance and efficiency.

AMD provides specific features regarding the security of virtualization.

Disaster recovery

The hypervisor can make snapshots of VMs, enabling restoration to a known good state, or to any desired earlier state. Since virtualized operating systems are less dependent on hardware configuration than those running directly on bare metal, these snapshots can be restored onto different server hardware so long as it is running the same hypervisor.

Dynamic load balancing

Live migration can be used to load balance your services across your infrastructure by moving VMs from busy hosts to those with spare capacity, on demand.

4 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>) ↗
- Creating Customized Virtual Machines Using virt-scenario (<https://documentation.suse.com/smart/virtualization-cloud/html/virt-scenario-creating-customized-vm-guests/index.html>) ↗

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