What is a Virtual Machine?

June 27, 2019  Robert Gibb

Definition

A virtual machine (VM) is a software-defined computer with its own operating system that runs on a host server with a different underlying operating system.

Overview

Virtual hosts are able to share resources between multiple guests, or virtual machines, each with their own operating system instance. The two basic types of virtual machines are process and system VMs.

- A **process virtual machine** allows you to run a single process as an application on a host machine. An example of a process virtual machine is the Java Virtual Machine (JVM) which allows any system to run Java applications as if they were native to the system.
- A **system virtual machine** is a fully virtualized VM designed to be a substitute for a physical machine. It runs on a different host machine by utilizing a hypervisor such as VMware ESXi to access the underlying machine's resources.

Server virtualization

When it comes to servers, a single host can potentially run hundreds of virtual machines, each with independent operating systems. Keeping operating systems separate means that one host can support both Linux and Windows servers simultaneously.

A virtual host can be configured to use thin provisioning as well, which means virtual machines only use resources they absolutely need at that time. This allows administrators to optimize resource allocation and reduce the amount of hardware that a business needs to own.

How a Virtual Machine Works

Virtual machine architecture can be separated into four different components, listed from the bottom up:

- An underlying system which includes the physical machine and its operating system. Bare metal hypervisors do not require an underlying operating system at this layer.
- A hypervisor which acts as a communication and translation layer.
- Multiple virtual machines that use the host's resources by communicating with the hypervisor.
- Applications and processes that run on each guest's operating system.

The hypervisor needs to be appropriately configured before deploying any virtual machines. Using KVM, an open source virtualization technology built into Linux, administrators can create virtual machines from a command line interface.

Below are a few samples of code that can be run from the command line to create new virtual machines.

- Create a virtual machine using an ISO image:

```
# virt-install --name=linuxconfig-vm \
```

```
--vcpus=1 \
--memory=1024 \
--cdrom=/tmp/debian-9.0.0-amd64-netinst.iso \
--disk size=5 \
--os-variant=debian8
```

- Create a virtual machine by cloning an existing one:

```
# virt-clone \
--original=linuxconfig-vm \
--name=linuxconfig-vm-clone \
--file=/var/lib/libvirt/images/linuxconfig-vm.qcow2
```

Virtual machines at the edge

Edge computing allows virtual machines to localize data processing without the latency of connecting to a public cloud. Providers will generally handle any configuration and maintenance at the hardware and hypervisor level, freeing up application developers to focus on developing and saving businesses from investing in costly hardware. VMs run at the network edge are fittingly called edge VMs.

Examples of Virtual Machines

Virtualizing machines allows developers to test applications on a multitude of systems without having to make expensive hardware purchases. While this is particularly useful for cross-platform development, it can also help ensure applications are compatible with old or new operating systems. A virtual machine can be spun up for testing and then decommissioned just as quickly.

Snapshots and backups

Virtual machines are more lightweight than physical machines. Using virtualization management software, users can take a snapshot of a VM moments before a change takes place. If the change fails, the server can be restored to its previous state with a single click.

Backup software such as Tivoli Storage Manager can be configured on virtual machines and, since they are so lightweight, incremental backups can be taken very quickly. With virtual machine snapshots and a mature backup policy critical systems should never be lost.

Key Takeaways

- Virtual machines reduce the amount of physical hardware organizations have to purchase and allow them to run multiple operating systems on one underlying host.
- Running multiple virtual machines on a physical host can optimize the use of system resources.
- Testing applications in different environments can be done quickly and cost-free by spinning up and decommissioning virtual machines.

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Sales
sales@stackpath.com
+1 (877) 629-2361 (US)
+1 (323) 313-1206 (International)

Corporate Office
2021 McKinney Ave. Suite 1100
Dallas, TX 75201

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