13.1.4 Linux Cloud and Virtualization Facts

As a Linux administrator, you should be able to describe cloud and virtualization concepts and compare different cloud and virtualization technologies.

This lesson covers the following topics:

- Virtualization and hypervisors
- Types of virtualization
- Container virtualization
- Comparison of containers and virtual machines
- Cloud service categories

Virtualization and Hypervisors

The traditional computing model involves an operating system that interacts directly with the computer hardware. This model is inefficient. Virtualization improves the efficiency of a server.

Virtualization:

- Pools multiple operating systems on the same physical hardware.
    - Each operating system runs independently and runs its own set of applications.
    - The independent operating systems are called virtual machines, or VMs.
- Is implemented by hypervisor software.
    - A Type 1 Hypervisor:
        - Is also called a native or bare-metal hypervisor.
        - Runs directly on the computer's hardware to manage the guest VMs.
    - A Type 2 Hypervisor is a software application that runs on top of a conventional operating system to manage the guest VMs.

Types of Virtualization

There are three types of virtualization environments:

Virtualization Environment	Description
Full Virtualization	Full virtualization: • Presents a virtual hardware environment, which emulates a physical hardware environment. • Provides the best isolation and security for VMs.

	• Requires extra time and processing power to provide virtual hardware emulation.
Paravirtualization	Paravirtualization: • Improves performance by allowing the guest operating system to communicate directly with some of the host's physical hardware. • Is implemented by modifying the guest operating system with special device drivers.
Hardware-Assisted Virtualization	Hardware-assisted virtualization: • Greatly improves a full virtualization environment. • Handle some of the virtualization processing the hypervisor would normally perform.

Container Virtualization

Containers are defined as consistent runtime environments. You create containers using special software called a container engine.

Each container:

- Includes:
  - Applications
  - Libraries
  - Other binaries
  - Configuration files
- Is isolated from other applications running in other containers.
- Can be saved and easily ported to other container environments.

Comparison of containers and virtual machines

Containers and virtual machines have benefits and shortcomings.

Virtualization Characteristic	Containers	Virtual Machines
Size	Smaller	Larger

Resource use	Use fewer hardware and software resources	Use more hardware and software resources
Portability	Ports to same family of operating system	Ports to other operating systems and hypervisors
Startup	Quick startup	Longer bootup
Modularity	Simple applications easily added and removed to build larger systems	Operating system, applications added to one system

Cloud Service Categories

Cloud services are services that are obtained from a location that is not local, that is, in the *cloud*. The cloud can be defined as the hardware, networks, storage devices, and interfaces that deliver computing as a service. You can divide cloud services into categories.

Cloud Service	Description

IaaS	Infrastructure as a Service (IaaS) is the delivery of traditional computer hardware as a service. It provides
	• Client storage
	  ◦ Block storage is like traditional drive space. It might be offered like a network drive or as a drive that's accessed by a cloud computing resource. Block storage stores files in directories in the same fashion as any other local file system.
	  ◦ Blob is short for binary large object. You don't store and retrieve blob data in the same way you would on a network drive. Instead, blob storage is managed from a dashboard or webpage.
	• Computing Power
	  ◦ You can use computing power from the cloud instead of buying a new server to do a particular job. You rent time from an IaaS cloud service provider instead of purchasing new hardware.

PaaS	Platform as a Service (PaaS) offers a complete development environment that you can use to create cloud-ready business applications. PaaS provides: • A set of software to build an application. • A web hosting platform. • A development platform. • Deployment tools.

SaaS	Software as a Service (SaaS) is designed for an average end user. SaaS provides applications that end users need to do their day-to-day work. Instead of installing the applications locally on their hard drive, users can run applications from the cloud, usually within a web browser.