



Virtualization



Learning Objectives

The learning objectives are to

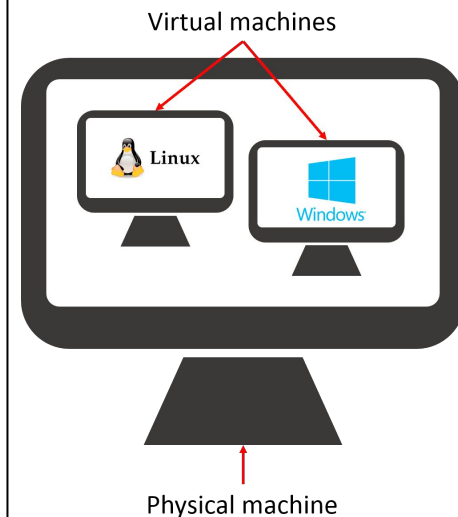
- To describe types of virtualization
- To explain the significance of virtualization in DevOps
- To explain the relationship between cloud computing and DevOps
- To explain various uses cases of virtualization in DevOps





What is Virtual Machine?

- From the perspective of software running on the virtual machine, a virtual machine is a “bare metal” computer i.e. there is no difference
- Making a virtual machine look like a bare metal computer is accomplished
 - Hardware – primarily address translation
 - Software – a specialized operating system called a “hypervisor”.





Fundamental Characteristics

Abstraction

VM abstracts physical hardware, allowing multiple virtual instances to run on a single physical machine.

This abstraction includes the CPU, memory, storage, and network resources.

Isolation

Each virtual instance operates independently, isolated from others, which means issues in one instance do not affect others.

This isolation enhances security and stability.

Resource Sharing

Multiple virtual machines (VMs) can coexist on the same physical server, efficiently using resources based on demand.

Emulation

Virtualization can emulate various hardware components, enabling the use of different operating systems and software on a single physical machine.

Snapshots

Virtualization allows for the creation of snapshots, which are point-in-time images of a virtual instance.

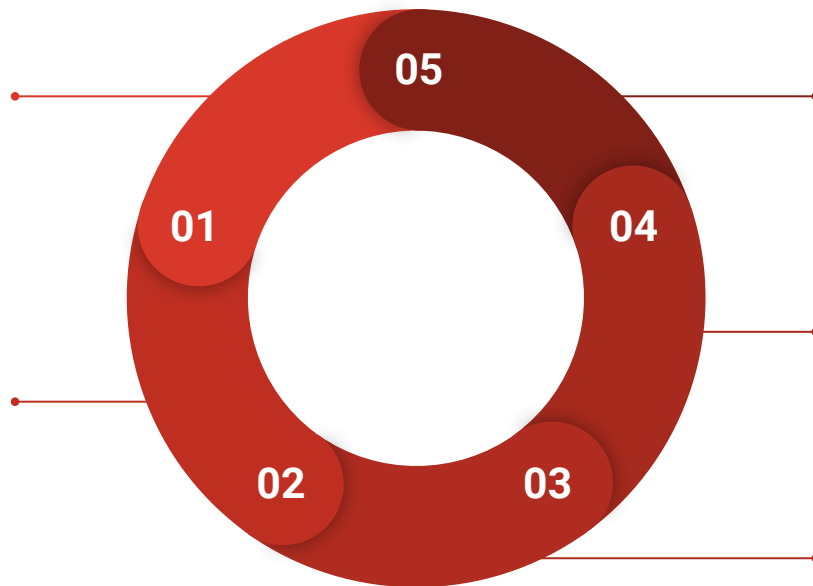
Snapshots are useful for backup, recovery, and testing purposes.



Significance of Virtualization to DevOps

Resource Optimization.

Environment isolation



Disaster Recovery

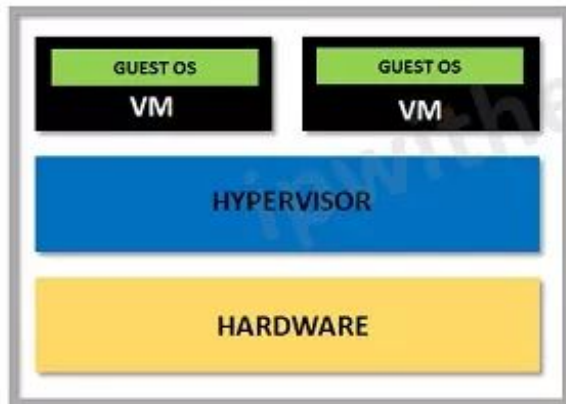
Rapid Development

Sandbox Testing

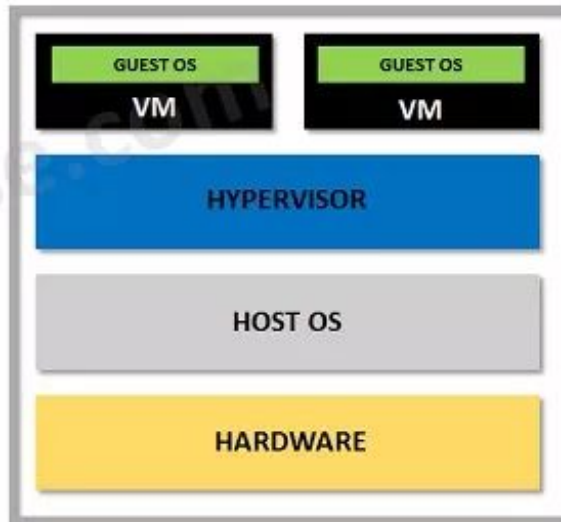


TYPE-1 VS TYPE-2 HYPERVISORS

TYPE 1 HYPERVISOR
(BARE-METAL ARCHITECTURE)



TYPE 2 HYPERVISOR
(HOSTED ARCHITECTURE)



networkinterview.com

(An Initiative By ipwithease.com)



VM Infrastructure

Operating System

- Each VM can have its own operating system
- Interactions between VMs on the same host is the same as interaction between VMs on different hosts

File System

- Host Computer manages file system for VMs
- Each VM thinks it has its own disk
- File system is an arrangement on that disk

Network

- Each VM has access to the network managed by the Host Computer
- Outgoing messages are tagged with a VM identifier
- Incoming messages are routed by Hypervisor to correct VM



Virtual Machine Images

Definition

A virtual machine image is set of bits that reside on a disk file.

Who Creates it

Hypervisor creates VM and reads in the bits of an image.

Size

OS executable is ~ 1GB(yte).

Transfer

Loading a VM image across a network takes minutes.



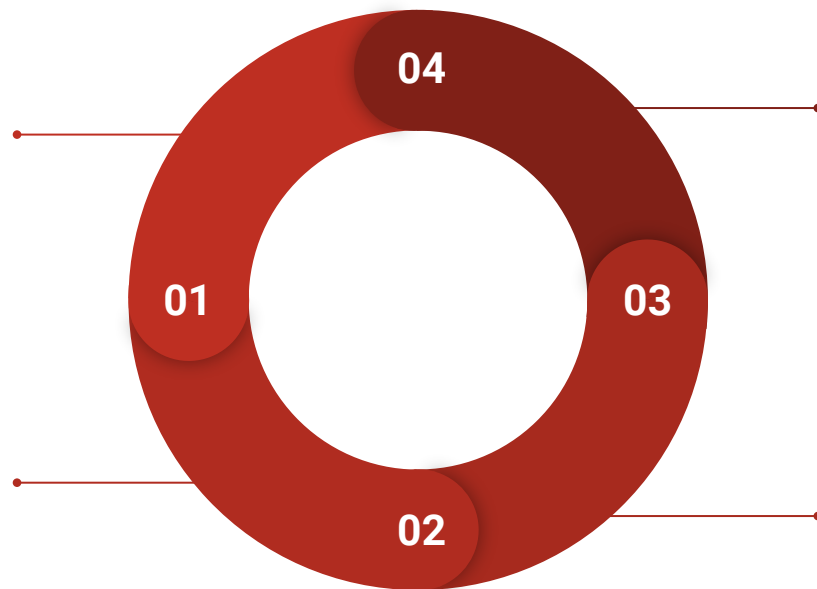
Virtualization and Cloud Computing



Virtualization and IaaS

**Virtual Machine
as a Computing
resource.**

**Elasticity and
Scaling.**



Hypervisors

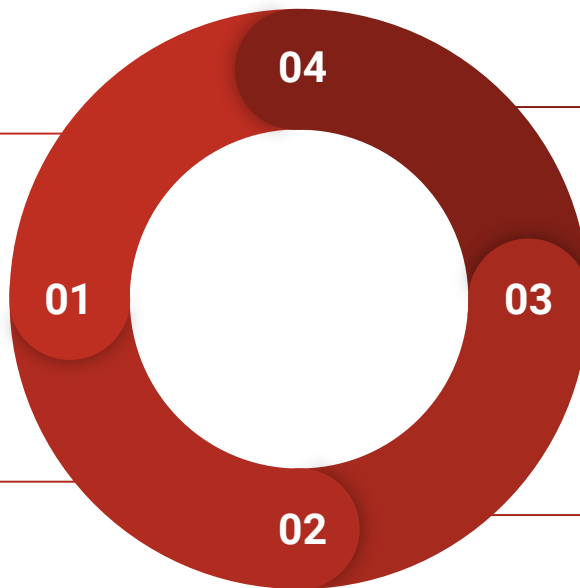
**Resource
Isolation**



Virtualization and PaaS

Containerization

**Managed
Runtime**



**Scalability and
Load balancing**

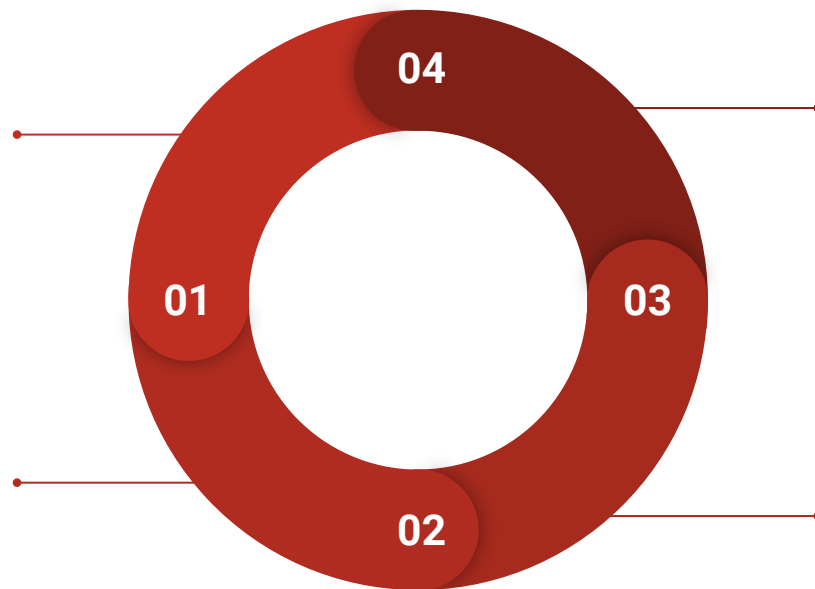
**Database as a
Service**



Virtualization and SaaS

Multi-tenancy

Resource Pooling



Reliability and Availability

Security isolation



Virtualization use case in DevOps Ecosystem



Continuous Integration/Continuous Deployment (CI/CD) Pipelines

Problem

Managing and maintaining a diverse set of environments for testing and deploying applications across different platforms.

Solution

Virtualization is employed to create isolated environments for each stage of the CI/CD pipeline.

Tools like Jenkins, GitLab CI, and Travis CI use virtualization to create test environments, ensuring consistency and reproducibility



Test Environments

Problem

Ensuring that development and testing environments mirror the production environment accurately.

Solution

Virtualization allows DevOps teams to create replica test environments using tools like Vagrant or Docker. Developers and testers can launch these environments on-demand, minimizing discrepancies between development, testing, and production environments.



Infrastructure Provisioning

Problem

Swiftly provisioning and scaling infrastructure to accommodate changing workload

Solution

DevOps teams leverage tools like Terraform or Ansible to automate the provisioning of virtual machines and infrastructure.

Virtualization enables rapid scaling up or down based on demand, optimizing resource usage.



Disaster Recovery and Redundancy

Problem

Ensuring high availability and quick recovery in case of system failures or disasters.

Solution

Virtualization support features like live migration and replication, making it easier to implement disaster recovery plans.

Virtual machines can be migrated to alternate hosts seamlessly, minimizing downtime.



Microservices Architecture:

Problem

Isolating and deploying microservices independently while maintaining consistency.

Solution

Containers, a form of lightweight virtualization, are commonly used in microservices architecture. Technologies like Docker enable the packaging of each microservice and its dependencies into containers, ensuring consistency across development, testing, and production.



Dev and Ops Collaboration

Problem

Bridging the gap between development and operations teams, ensuring a common understanding of the infrastructure.

Solution

Virtualization provides a standardized environment that can be easily shared between development and operations. Infrastructure as Code (IaC) tools, such as Terraform, enables the versioning of infrastructure in a code-like manner, promoting collaboration and consistency.



Application Compatibility Testing:

Problem

Verifying the compatibility of applications across different operating systems and environments.

Solution

Virtualization allows the creation of VMs with different operating systems for testing purposes. DevOps teams can use tools like VirtualBox or VMware to set up a range of environments for compatibility testing.



Resource Optimization:

Problem

Efficiently using hardware resources in a data center.

Solution

Virtualization helps consolidate multiple workloads onto fewer physical servers. This consolidation reduces hardware costs, power consumption, and improves resource utilization.



Quiz time

One of the major difference between type 1 and type 2 VM is

1. Hardware
2. Hypervisor
3. Host operating system
4. All of the above





Quiz time

Elasticity and scaling means

1. Adjusting the number and capacity of VMs in IaaS platform to suit user demand
2. Modifying software on run time
3. Changing hypervisor installed on in IaaS
4. Removing installed request upon customer request





Quiz time

Multi-tenancy is important characteristic of

1. IaaS
2. PaaS
3. SaaS
4. IaC
5. DBaaS





Quiz time

Ensuring that development and testing environments mirror the production environment accurately is possible through VM

1. True
2. False

