# Virtualization: An In-Depth Explanation

Key points:

**1) Physical server comes with huge amount of compute, so we need hypervisor that divide compute capacity into number of parts.**

**2) \* Indicating the mandatory resource in Azure.**

**3) We have compute intensive or memory intensive resource.**

## Background

In traditional computing, a single physical server runs a single operating system, and applications are installed directly on that OS. This approach has limitations, such as underutilization of hardware resources, difficulty in managing multiple servers, and lack of flexibility in scaling.

Virtualization addresses these challenges by introducing a layer of abstraction between the hardware and the operating system. It enables the creation of multiple virtual instances, each running its own operating system and applications, on a single physical server. This technology has become fundamental in modern data centers and cloud computing environments.

## Components of Virtualization

1. Hypervisor (Virtual Machine Monitor):

- The hypervisor is a crucial component of virtualization. It sits between the hardware and the operating systems, managing and allocating resources to virtual machines (VMs).

- There are two types of hypervisors: Type 1 (bare-metal) runs directly on the hardware, while Type 2 (hosted) runs on top of an existing operating system.

2. Virtual Machines (VMs):

- VMs are the instances created by the hypervisor. Each VM operates as an independent computer with its own virtualized hardware, including CPU, memory, storage, and network interfaces.

- Multiple VMs can run on a single physical server, allowing for efficient resource utilization.

## Key Concepts in Virtualization

1. Server Virtualization:

- In server virtualization, a physical server is divided into multiple VMs, each running its own OS. This allows for better utilization of hardware resources and easier management of servers.

2. Resource Pooling:

- Virtualization enables the pooling of physical resources, such as CPU, memory, and storage. These resources can be dynamically allocated to VMs based on demand.

3. Isolation:

- VMs operate independently of each other. This isolation ensures that issues in one VM do not affect others, providing a more secure and stable environment.

4. Snapshotting and Cloning:

- Virtualization allows the creation of snapshots, which capture the state of a VM at a specific point in time. This facilitates easy backup and recovery. Cloning enables the rapid duplication of VMs for scalability.

## Benefits of Virtualization

1. Server Consolidation:

- Multiple VMs can run on a single physical server, reducing the need for a large number of physical machines. This leads to cost savings and energy efficiency.

2. Flexibility and Scalability:

- Virtualization allows for the easy creation, modification, and scaling of VMs. This flexibility is essential in dynamic computing environments.

3. Disaster Recovery:

- Virtualization simplifies disaster recovery by enabling the quick restoration of VMs from snapshots or backups.

4. Resource Optimization:

- Resources can be allocated and deallocated dynamically based on workload, optimizing resource utilization.

5. Testing and Development:

- Virtualization provides a sandbox for testing and development. VMs can be easily created, modified, and discarded without affecting the production environment.

# Types of Virtual Machines on Azure

Azure provides a variety of virtual machine (VM) offerings to cater to different workload requirements. Each VM type is designed with specific hardware configurations to meet diverse performance and scalability needs.

## General Purpose VMs

Example: Standard\_D2s\_v3

- Description: General-purpose VMs are well-balanced machines suitable for a variety of workloads. They offer a good balance of CPU-to-memory ratio and are suitable for development, testing, and small to medium-sized databases.

- Use Case: Hosting websites, lightweight applications, or development and testing environments.

## Compute Optimized VMs

Example: Standard\_F2s\_v2

- Description: Compute optimized VMs are designed for compute-intensive workloads that require high CPU power. They provide a high CPU-to-memory ratio, making them suitable for data analytics and computational tasks.

- Use Case: Batch processing, gaming applications, and other CPU-intensive workloads.

## Memory Optimized VMs

Example: Standard\_E16s\_v3

- Description: Memory optimized VMs are tailored for memory-intensive applications. They provide a high memory-to-CPU ratio, making them suitable for databases, in-memory caching, and analytics.

- Use Case: Running large databases, in-memory caching, and analytics applications.

## Storage Optimized VMs

Example: Standard\_L8s\_v2

- Description: Storage optimized VMs are designed for workloads that require high storage throughput and I/O performance. They provide high local disk throughput, making them suitable for big data and large databases.

- Use Case: Big data applications, data warehousing, and large-scale databases.

## GPU VMs

Example: Standard\_NC6s\_v3

- Description: GPU (Graphics Processing Unit) VMs are equipped with powerful graphics processors, suitable for graphics-intensive applications and parallel processing tasks.

- Use Case: Machine learning, graphics rendering, and simulations that require GPU acceleration.

## High-Performance Compute VMs

Example: Standard\_H16r

- Description: High-Performance Compute VMs are designed for demanding, parallel processing and high-performance computing (HPC) applications.

- Use Case: Simulations, modeling, and scenarios that require massive parallel processing.

## Burstable VMs

Example: B1s

- Description: Burstable VMs provide a baseline level of CPU performance with the ability to burst above the baseline for a certain period. They are cost-effective for workloads with varying CPU usage.

- Use Case: Development and testing environments, small websites, and applications with variable workloads.

# References

### Azure Virtual Machine Series

<https://azure.microsoft.com/en-in/pricing/details/virtual-machines/series/>

### Jenkins Installation Steps

<https://github.com/iam-veeramalla/Jenkins-Zero-To-Hero>

### Download Git Bash

<https://git-scm.com/downloads>

link: <https://learn.microsoft.com/en-us/azure/virtual-machines/windows/quick-create-portal>









