

# Coaching Server - Virtualization - Network

Cloud Infrastructure Engineering

**Nanyang Technological University  
& Skills Union - 2022/2023**

# Course Content

- Recap Server Virtualization
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# Recap

- Virtualization
  - Types
    - Full virtualization
    - Para-virtualization
    - Hardware-assisted virtualization
    - OS-level virtualization
    - Hypervisor virtualization
  - Containerization on top of OS-level virtualization
    - Docker

# Recap

- Server Clustering
  - Load Balancer
    - Application Load Balancer
    - Network Load Balancer
    - Gateway Load Balancer
- Whitelist
- Blacklist

# Server Virtualization



# Server Virtualization

Process of **using software to divide physical hardware into separate unique virtual servers.**

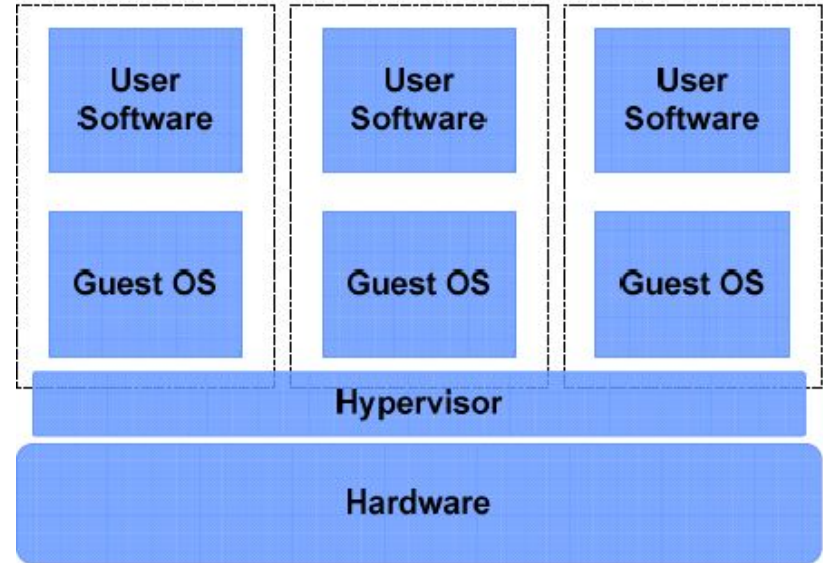
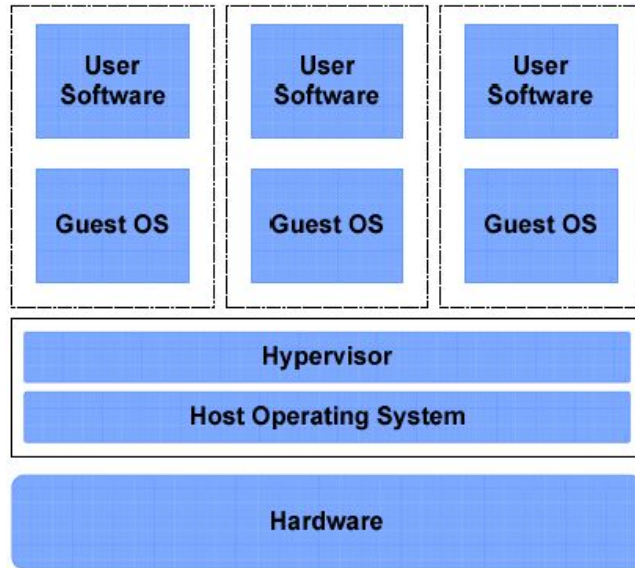
Each **virtual server will be able to host a different operating system** without any compatibility issues.

# Types of Server Virtualization

- Full virtualization
- Para-virtualization
- Hardware-assisted virtualization
- \*\*OS-level virtualization
- Hypervisor virtualization

# Differentiation of Full virtualization

## Para-virtualization





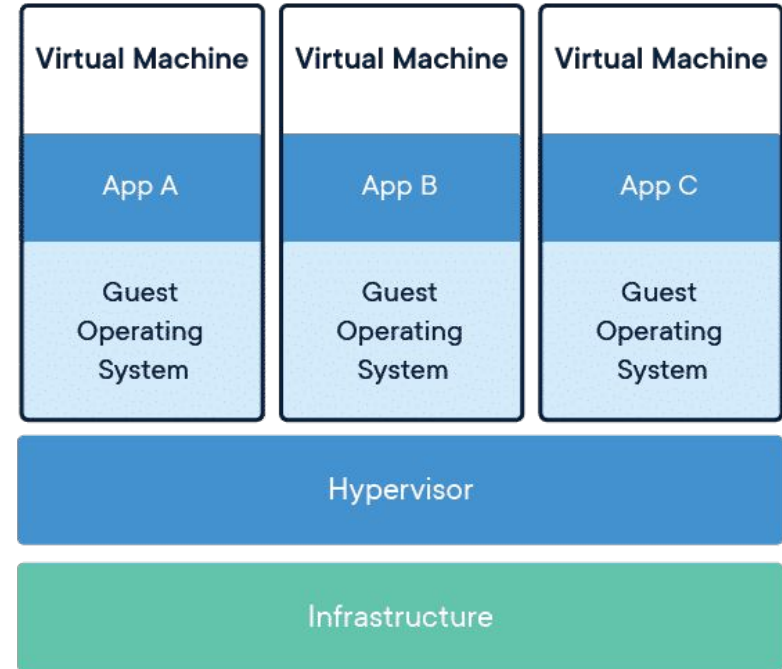
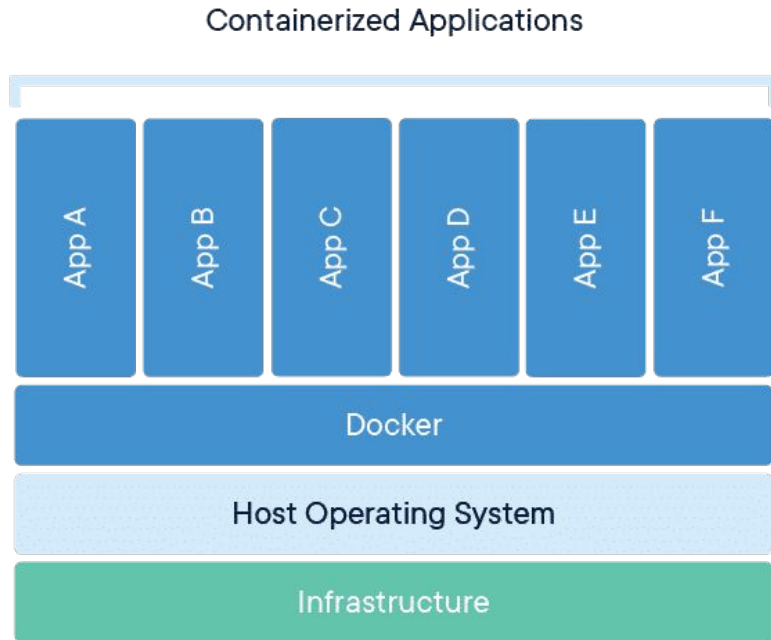
# What Is Containerization?

Containerization is a **form of virtualization**.

Virtualization aims to run multiple OS instances on a single server, whereas containerization runs a single OS instance, with multiple user spaces to isolate processes from one another.

This means containerization makes sense for one AWS cloud user that plans to **run multiple processes simultaneously**.

# Containerization vs Virtualization



# Containerization vs Virtualization

## 1. Isolation

Virtualization results in a **fully isolated OS and VM instance**, while containerization **isolates the host operating system machine and containers from one another**.

## 2. Different OS

Virtualization can **host more than one complete operating system**, each with its own kernel, whereas containerization **runs all containers via user mode on one OS**.

## 3. Deployment

Virtualization means **each virtual machine has its own hypervisor**. With containerization, either **Docker is used to deploy an individual container**, or Kubernetes is used to orchestrate multiple containers across multiple systems.

# Containerization vs Virtualization

## 4. Portability:

Virtualization: **VMs are portable**, but they require a hypervisor to run, which may limit portability across different cloud platforms and environments.

Containerization: **Containers are highly portable** since they encapsulate all the dependencies and runtime environment needed to run an application. They can run consistently across various platforms and environments.

## 5. Use Cases:

Virtualization: Virtualization is suitable for running multiple different operating systems or legacy applications that require full OS isolation.

Containerization: Containerization is ideal for modern microservices-based applications, where portability, scalability, and rapid deployment are crucial.

# Server Networking & Clustering



# What is Server Clustering?

When **several servers collaborate on a single system** to give users improved availability, this is referred to as **server clustering**.

By allowing a different server to take over in the event of an **outage**, these clusters are utilized to **minimize downtime and outages**.

# Blacklisting & Whitelisting



# What is Server Clustering?

Blacklisting and whitelisting are two cybersecurity measures used to **control access** to resources, networks, or systems **based on** predefined **criteria**.

They are commonly employed to enhance security and manage the flow of information in various contexts.



# Blacklisting

Blacklisting is a security approach where specific items, such as IP addresses, domains, email addresses, or applications, are identified as known threats or unauthorized entities. These blacklisted items are blocked or denied access to the network or system.

Function: When a device or entity is blacklisted, it is prohibited from accessing the resources or services within a network or system. Blacklisting is often used to prevent malicious or suspicious activities, such as cyberattacks, spam emails, or unauthorized access attempts.

Implementation: Blacklists are curated lists maintained by security administrators or cybersecurity tools. These lists are continuously updated with new threats or unauthorized entities based on ongoing monitoring and threat intelligence.

# Whitelisting

Whitelisting is a security approach where specific items, such as IP addresses, domains, email addresses, or applications, are identified as trusted and authorized. These whitelisted items are allowed access to the network or system, while everything else is blocked.

Function: When a device or entity is whitelisted, it is granted permission to access the resources or services within a network or system. Whitelisting is often used to restrict access to only known and approved entities, reducing the attack surface and preventing unauthorized access.

Implementation: Whitelists are curated lists maintained by security administrators or cybersecurity tools. Only entities listed in the whitelist are permitted access, and any other connections or requests are automatically blocked.

# Comparison

Blacklisting focuses on identifying and blocking known threats or unauthorized entities.

Whitelisting focuses on identifying and allowing access to trusted and approved entities.

Blacklisting is more suitable for scenarios where the majority of entities are considered safe, and only a few known threats need to be blocked.

Whitelisting is more suitable for scenarios where a strict access control policy is required, and only specific trusted entities should be allowed.

# Topic Discussion

- **1. Advantages and Disadvantages of Virtualization**

Discuss the benefits and drawbacks of virtualization, such as resource optimization, increased flexibility, and potential security concerns.

- **2. Container Orchestration Platforms**

Compare and contrast popular container orchestration platforms like Kubernetes, Docker Swarm, and Apache Mesos, and their use cases. Including their advantages and disadvantages.

- **Microservices Architecture**

Explore the relationship between microservices architecture and containerization, and how containerization facilitates the implementation of microservices.

- **Security in Virtualized and Containerized Environments**

Address security concerns related to virtualization and containerization, including isolation, privilege escalation, and securing container images.

- **3. Stateful vs. Stateless Containers**

Explore the differences between stateful and stateless containers and the challenges of managing stateful applications in containerized environments.

- **4. Monitoring and Logging in Containerized Environments**

Delve into monitoring and logging best practices for containerized applications and how these practices aid in troubleshooting and performance optimization.

# AWS Account Creation



# Briefing of Capstone Project

