By Maha Rana

CS505 Finalterm Subjective Solved

1. Full Virtualization vs. Para Virtualization (Comparison Table)

Feature	Full Virtualization	Para Virtualization
Guest OS Modification	No modifications required	Guest OS needs modification
Performance	Slightly slower due to OS translation	Faster due to direct hardware access
Hypervisor Role	Emulates full hardware	Uses hyper calls instead of full emulation
Hardware Utilization	Higher overhead due to translation	More efficient as it avoids full hardware emulation
Examples	VMware ESXi, Microsoft Hyper-V	Xen, KVM

2. Containerization vs. Virtualization (Comparison Table)

Feature	Virtualization	Containerization
Definition	Creates virtual machines (VMs) with OS	Creates lightweight containers sharing the host OS
Performance	Requires more system resources	Lightweight and faster
OS Requirement	Each VM has its own OS	Containers share the host OS kernel
Security & Isolation	Stronger isolation as each VM runs separately	Weaker isolation compared to VMs
Examples	VMware, Hyper-V, VirtualBox	Docker, Kubernetes

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3. Scenario: Running 3 Different Operating Systems

If you need to run **3 different operating systems** (e.g., Windows, Linux, macOS) on a single machine, you will need **3 Virtual Machines (VMs)**. Each VM will have its own OS, running independently on a **hypervisor (Type 1 or Type 2).**

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4. Uses of VirtualBox

- Running multiple **operating systems** on one computer
- **Testing and development** environments
- Learning and practicing **Linux, Windows, or macOS**
- Creating **snapshots and backups** of VMs
- **Cross-platform compatibility** (Windows apps on Linux, etc.)

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5. ESXi Related Questions

- **What is ESXi?**
  - ESXi is a **Type 1 Hypervisor** by VMware used for **server virtualization**.
- **How does ESXi manage resources?**
  - ESXi allocates CPU, RAM, storage, and network resources to VMs.
- **What are the key features of ESXi?**
  - Supports **multiple VMs**, offers **high availability**, and provides **centralized management**.
- **What is vCenter Server in ESXi?**
  - A tool used to manage multiple ESXi hosts in a data center.

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6. Hyper-V Related Questions

- **What is Hyper-V?**
  - A **Type 1 Hypervisor** by Microsoft for **virtualization of Windows and Linux VMs**.
- **How do you enable Hyper-V?**
  - Go to **Control Panel → Turn Windows Features On/Off** → Select **Hyper-V** → Restart.
- **What is the difference between Hyper-V and VMware ESXi?**
  - Hyper-V is **Microsoft-based**, while ESXi is **VMware-based**; both provide virtualization but differ in features and licensing.
- **What are the three types of Hyper-V virtual switches?**
  - **External**, **Internal**, and **Private** switches for different network configurations.

Short Questions

1. **If a Virtual Machine (VM) is created and another VM is built on top of it, where will ESXi allocate resources from?**
   - ESXi will allocate resources from the **physical host machine**. However, running a VM inside another VM (**Nested Virtualization**) can reduce performance due to resource overhead.
2. **What is VirtualBox?**
   - VirtualBox is a **Type 2 Hypervisor** developed by Oracle that allows users to run multiple **virtual machines** on a host OS.

3. **Containers – Which important software is not part of it?**
    - A **full operating system** is not part of a container. Containers share the **host OS kernel** and do not require a separate OS instance like Virtual Machines.
4. **VMware Related Questions**
    - **What is VMware?** → A company that provides **virtualization** and **cloud computing solutions**.
    - **What is VMware ESXi?** → A **Type 1 Hypervisor** used for **server virtualization**.
    - **What is VMware Workstation?** → A **Type 2 Hypervisor** used for **desktop virtualization**.

Long Questions

1. **Para Virtualization vs. Full Virtualization (Comparison Table)**

Feature	Full Virtualization	Para Virtualization
Guest OS Modification	Not required	Required
Performance	Slower due to OS translation	Faster due to direct hardware access
Hypervisor Role	Fully emulates hardware	Uses "hyper calls" instead of emulation
Security	More isolated and secure	Slightly less isolated
Examples	VMware ESXi, Microsoft Hyper-V	Xen, KVM

2. **Four Demerits of Containers**
    - **Security Risks** – Containers share the host OS, making them vulnerable to security breaches.

- **Limited OS Compatibility** – Containers require **Linux-based OS kernels**, making Windows/macOS support difficult.
- **Data Persistence Issues** – Managing storage in containers is complex due to their **stateless nature**.
- **Networking Complexity** – Setting up **container networking** is more challenging than VM networking.

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3. **Key Components of VMware**
    - **ESXi Hypervisor** – The core virtualization platform that allows multiple VMs to run on a single physical server.
    - **vCenter Server** – A centralized management tool for VMware environments.
    - **vMotion** – Enables **live migration** of VMs without downtime.
    - **VMFS (Virtual Machine File System)** – A file system optimized for storing VM data.
    - **Snapshots & Cloning** – Features for backing up and duplicating VMs.

1. What is VirtualBox?

VirtualBox is a **Type 2 Hypervisor** developed by **Oracle** that allows users to run multiple **Virtual Machines (VMs)** on a host operating system. It supports various guest operating systems such as **Windows, Linux, macOS, and Solaris**.

Key Features:

- Open-source and free to use

- Supports **hardware & software virtualization**
- Runs on **Windows, Linux, and macOS**
- Provides **snapshot & cloning** options

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2. Four Demerits of Virtual Machines (VMs)

1. **High Resource Usage** – VMs consume a lot of **CPU, RAM, and disk space**, reducing performance.
2. **Slower Performance** – Running multiple VMs on one host can cause **performance bottlenecks**.
3. **Single Point of Failure** – If the **physical host crashes**, all VMs running on it **fail**.
4. **Complex Management** – VMs require **proper configuration, updates, and maintenance**, making management difficult.

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3. Difference Between ESXi and VMware Workstation

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Feature	ESXi	VMware Workstation
Type	Type 1 Hypervisor (Bare-metal)	Type 2 Hypervisor (Hosted)
Installation	Installed directly on physical hardware	Installed on an existing OS (Windows/Linux)
Usage	Used for **enterprise** server virtualization	Used for **personal use, testing, and development**
Performance	High performance, directly manages hardware resources	Slightly slower due to running on a host OS
Management	Managed via **vCenter Server**	Managed via GUI on the host machine
Example Use Case	Data centers and cloud infrastructure	Running multiple OS on a PC for testing

4. What is Paravirtualization?

Paravirtualization is a **virtualization technique** where the **guest OS is modified** to work efficiently with the **hypervisor**. Instead of **emulating hardware**, the guest OS communicates directly with the hypervisor using **hyper calls**.

Key Features:

- Reduces **virtualization overhead**, improving performance
- Requires **guest OS modification**
- Used in **Xen and KVM hypervisors**

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5. Separate NoSQL Databases

NoSQL databases store data in a **non-relational format** and are optimized for **scalability and performance**.

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Types of NoSQL Databases & Examples:

1. **Key-Value Stores** – Redis, DynamoDB
2. **Document Databases** – MongoDB, CouchDB
3. **Column-Family Stores** – Cassandra, HBase
4. **Graph Databases** – Neo4j, ArangoDB

Short Questions:

1. What are Containers?

Containers are **lightweight, portable, and self-sufficient** environments that package **applications and their dependencies** together. Unlike Virtual Machines, containers **share the host OS kernel** but run independently.

Key Features:

- Faster than VMs (Boots in seconds)
- Uses fewer resources (No separate OS needed)
- Provides **application-level isolation**
- Works across different environments (Windows, Linux, Cloud)

Examples: Docker, Kubernetes, LXC

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2. VirtualBox (Related Question)

VirtualBox is an **open-source Type 2 Hypervisor** developed by **Oracle** that allows users to **run multiple operating systems (Windows, Linux, macOS) on a single host**.

Key Features:

- Free and cross-platform
- Supports **snapshots and cloning**
- Can run multiple VMs simultaneously
- Used for software testing, development, and learning

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3. VMware (Related Question)

VMware is a company that provides **virtualization solutions**. It offers different hypervisors, including:

- **VMware Workstation** (Type 2) – For personal use and development
- **VMware ESXi** (Type 1) – Enterprise-grade hypervisor for data centers
- **VMware vSphere** – A complete **virtualization management** suite
- **VMware vCenter** – Used for managing multiple ESXi servers

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4. NoSQL Databases

NoSQL databases are **non-relational** databases designed for **scalability and flexibility**.

Types of NoSQL Databases & Examples:

- **Key-Value Stores** – **Redis, DynamoDB**
- **Document Stores** – **MongoDB, CouchDB**
- **Column-Family Stores** – **Cassandra, HBase**

- **Graph Databases – Neo4j, ArangoDB**

Long Questions:

1. Full Virtualization vs. Para Virtualization (Comparison Table)

Feature	Full Virtualization	Para Virtualization
Guest OS Modification	Not required	Required
Performance	Slower due to OS translation	Faster due to direct hardware access
Hypervisor Role	Fully emulates hardware	Uses "hyper calls" instead of emulation
Security	More isolated and secure	Slightly less isolated
Examples	VMware ESXi, Microsoft Hyper-V	Xen, KVM

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2. Demerits of Virtual Machines

1. **High Resource Usage** – VMs consume a lot of **CPU, RAM, and storage**, reducing performance.
2. **Slower Performance** – Running multiple VMs on one host can cause **performance bottlenecks**.
3. **Single Point of Failure** – If the **physical host crashes**, all VMs running on it **fail**.
4. **Complex Management** – VMs require **proper configuration, updates, and maintenance**.
5. **Security Risks** – If the **hypervisor is compromised**, all VMs are at risk.

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3. VMware Key Points

- **VMware ESXi** – A **Type 1 hypervisor** that runs directly on hardware
- **VMware Workstation** – A **Type 2 hypervisor** for personal and testing use
- **VMware vSphere** – Enterprise **virtualization management software**
- **VMware vCenter** – Centralized management tool for **ESXi hosts**
- **VMware vMotion** – Allows **live migration** of VMs without downtime
- **VMware VMFS** – **File system** for storing VM-related files

Short Questions:

1. What is VirtualBox?

VirtualBox is a **Type 2 Hypervisor** developed by **Oracle** that allows users to **run multiple operating systems (Windows, Linux, macOS) on a single host machine**. It is widely used for **software testing, development, and training**.

Key Features:

- Free and open-source
- Supports **snapshots and cloning**
- Runs on **Windows, Linux, and macOS**
- Allows running **multiple virtual machines (VMs) simultaneously**

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2. Demerits of Virtualization

1. **High Initial Cost** – Setting up a virtualization environment requires **powerful hardware and software licenses**.
2. **Performance Overhead** – VMs share resources, leading to **lower performance compared to physical machines**.
3. **Single Point of Failure** – If the host machine fails, **all VMs running on it stop working**.
4. **Security Risks** – If the **hypervisor is compromised**, all virtual machines on that system are at risk.
5. **Complex Management** – Managing **multiple VMs, backups, and security policies** can be challenging.

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3. Difference Between Full Virtualization and Para Virtualization

Feature	Full Virtualization	Para Virtualization
Guest OS Modification	Not required	Required
Performance	Slower due to OS translation	Faster due to direct hardware access
Hypervisor Role	Fully emulates hardware	Uses "hyper calls" instead of emulation
Security	More isolated and secure	Slightly less isolated
Examples	VMware ESXi, Microsoft Hyper-V	Xen, KVM

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4. What is a Data Center?

A **Data Center** is a facility that houses **servers, storage systems, and networking devices** to store, process, and distribute large amounts of data.

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Key Purposes of a Data Center:

- **Data Storage & Management** – Securely stores business and application data.
- **Hosting Applications & Websites** – Runs cloud-based services.
- **Disaster Recovery** – Provides **backups and failover solutions**.
- **Business Continuity** – Ensures **24/7 availability** of critical data and services.

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5. NoSQL Database Examples

NoSQL databases are used for handling **large-scale, unstructured, or semi-structured data**.

Examples:

- **Key-Value Stores** – **Redis, DynamoDB**
- **Document Stores** – **MongoDB, CouchDB**
- **Column-Family Stores** – **Cassandra, HBase**
- **Graph Databases** – **Neo4j, ArangoDB**

1. Uses of VirtualBox

VirtualBox is a **Type 2 Hypervisor** used for:

- **Running multiple OS** (Windows, Linux, macOS) on a single host
- **Software development & testing** (e.g., testing apps on different OS)

- **Learning & training** (experimenting with different OS without affecting the host machine)
- **Taking snapshots & cloning** VMs for backup and recovery
- **Cross-platform compatibility** (running Windows apps on Linux, etc.)

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2. Demerits of VirtualBox

- **Performance Overhead** – Slower than Type 1 hypervisors (ESXi, Hyper-V)
- **High Resource Usage** – Requires a powerful host machine
- **Limited Enterprise Use** – Not ideal for large-scale data centers
- **Hardware Compatibility Issues** – May not support all physical hardware efficiently
- **Security Concerns** – Less secure compared to bare-metal hypervisors

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3. Virtual Machine (VM) Related Question

- A **Virtual Machine (VM)** is a software-based computer that runs an **independent OS using virtualized hardware** (vCPU, vRAM, vDisk).
- **Example:** Running Windows inside Linux using VirtualBox or VMware Workstation.
- **Key Features:**
    - Isolated environment
    - Supports multiple OS on a single host
    - Uses virtualized hardware

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4. Table: Virtualization vs. Containerization

Feature	Virtualization	Containerization
Definition	Creates **Virtual Machines (VMs)** with full OS	Creates **lightweight containers** without OS
Resource Usage	Requires more **RAM, CPU, and disk**	Uses fewer resources
Boot Time	Slower (minutes)	Faster (seconds)
Isolation	Strong isolation	Less isolation
Examples	VMware, Hyper-V, VirtualBox	Docker, Kubernetes

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6. VirtualBox vs. VMware (Comparison Points)

Feature	VirtualBox	VMware Workstation
Developer	Oracle	VMware
Hypervisor Type	Type 2	Type 2
Cost	Free & Open-source	Paid (Workstation Pro)
Performance	Slightly slower	More optimized
Enterprise Use	Limited use	More enterprise features

6. Hypervisor Type 2 Related Questions

Q1: What is a Type 2 Hypervisor?

- A **Type 2 Hypervisor** runs **on top of a host OS**, rather than directly on hardware.

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- **Examples:** VirtualBox, VMware Workstation

Q2: How is a Type 2 Hypervisor different from Type 1?

Feature	Type 1 Hypervisor	Type 2 Hypervisor
Installation	Directly on hardware	Installed on an OS
Performance	Faster (better resource management)	Slower due to OS layer
Use Case	Enterprise servers	Personal and development use

7. Relational Database Related Question

- A **Relational Database (RDBMS)** stores data in **tables** with rows and columns.
- Uses **Structured Query Language (SQL)** for data management.
- **Examples:** MySQL, PostgreSQL, Oracle DB, Microsoft SQL Server

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8. Windows-Related Conceptual Question

(Not sure exactly what it was, but here are some possible Windows virtualization-related topics):

- **Windows Hyper-V** – Microsoft's **Type 1 hypervisor**
- **Windows Subsystem for Linux (WSL)** – Allows Linux to run on Windows
- **Windows Virtual Machines** – Windows can be run as a **guest OS** on VirtualBox or VMware

1. Can VirtualBox Run Without an Operating System?

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- **No**, VirtualBox **cannot run without an operating system** because it is a **Type 2 Hypervisor** that requires a **host OS** (Windows, Linux, or macOS) to function.
- Unlike **Type 1 hypervisors (e.g., VMware ESXi, Microsoft Hyper-V)**, which run directly on hardware, VirtualBox needs an **installed OS** before creating and managing virtual machines.

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2. Purpose of NIC Teaming

NIC Teaming (Network Interface Card Teaming) is a **technique used to combine multiple physical network adapters** into a single logical interface to improve:

1. **Increased Bandwidth** – Multiple NICs work together, increasing network speed.
2. **Redundancy & Failover** – If one NIC fails, traffic is rerouted through another NIC.
3. **Load Balancing** – Distributes network traffic efficiently across multiple NICs.
4. **Improved Performance** – Ensures better utilization of network resources.
5. **Better Network Reliability** – Reduces downtime due to network failures.

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3. Proposed Requirements for a Hypervisor

To run a **hypervisor efficiently**, a system should meet the following **hardware and software requirements**:

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Hardware Requirements:

- **Processor** – Multi-core **64-bit CPU** with **virtualization support (Intel VT-x / AMD-V)**
- **RAM** – Minimum **8GB (Recommended: 16GB or more)**
- **Storage** – **SSD (Preferred) or HDD with at least 100GB free space**
- **Network** – **Gigabit Ethernet (for virtual networking & cloud setups)**

Software Requirements:

- **Type 1 Hypervisor:** Direct installation on hardware (e.g., VMware ESXi, Hyper-V)
- **Type 2 Hypervisor:** Requires a **host OS** (e.g., VirtualBox, VMware Workstation)
- **Operating System Compatibility:** Must support **guest OS installations**

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4. Five Uses of a Virtual Machine

1. **Running Multiple Operating Systems** – Run Windows, Linux, or macOS on a single machine.
2. **Software Development & Testing** – Test apps in different environments without affecting the host OS.
3. **Server Virtualization** – Run multiple virtual servers on a single physical machine.
4. **Cybersecurity & Sandboxing** – Isolate applications to test viruses and malware safely.

5. **Disaster Recovery & Backup** – Easily create snapshots for system recovery.

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5. Choose the 4 Correct Options Regarding Para-Virtualization

Correct Options	✅ True / ❌ False
The guest OS is **aware** it is running in a virtualized environment.	✅ True
The guest OS **needs modification** to work with the hypervisor.	✅ True
Para-virtualization uses **full hardware emulation** like full virtualization.	❌ False
It provides **better performance** than full virtualization by avoiding OS translation.	✅ True
It does not require a **hypervisor** to function.	❌ False
Uses **hyper calls** instead of direct hardware access.	✅ True

Short Questions:

1. Enlist 3 NoSQL Databases

- **MongoDB** (Document-based)
- **Cassandra** (Column-family)
- **Redis** (Key-value store)

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2. Uses of VirtualBox

1. **Running Multiple Operating Systems** – Run Windows, Linux, and macOS on a single machine.

2. **Software Testing & Development** – Test applications in different OS environments.
3. **Networking & Security Testing** – Create isolated virtual environments for testing.
4. **Education & Training** – Used for learning OS installation and configuration.
5. **Snapshots & Backup** – Easily restore a system state when needed.

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3. Difference Between Running and Pause State in a Virtual Machine

State	Description
Running State	The VM is actively executing and using CPU, RAM, and other resources.
Paused State	The VM is **temporarily stopped**, but its state is stored in RAM, allowing it to resume instantly.

Key Difference: In **Paused State**, no CPU is used, but RAM is still allocated, whereas in **Running State**, both CPU and RAM are actively in use.

4. Is Hypervisor Type 2 Suitable for Testing and Production Environments? Justify.

- **No**, Type 2 Hypervisors **(e.g., VirtualBox, VMware Workstation)** are **not suitable for production environments** because:
  - **Runs on a Host OS** → Adds an extra software layer, reducing performance.
  - **Less Secure** → More vulnerable since it depends on the host OS.
  - **Not Scalable** → Cannot efficiently handle enterprise workloads.

    - **Better for Development & Testing** → Suitable for small-scale testing, learning, and debugging.
- **For production environments**, **Type 1 Hypervisors** (VMware ESXi, Microsoft Hyper-V) are preferred due to **better performance, security, and resource management**.

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5. Why Do Containers Boot Faster Than Virtual Machines?

- **Containers share the host OS kernel**, while VMs require a full OS boot.
- No need for **hardware emulation** (Hypervisor overhead).
- Containers use **less memory and CPU**, making startup faster.
- **Lightweight architecture** → Containers are only a few MBs, while VMs are in GBs.
- Example: **Docker containers boot in seconds**, while a VM may take minutes.

Long Questions:

1. Standard Switch – Any 5 Components

1. **I/O Interfaces** – Handles incoming and outgoing network traffic.
2. **Switch Fabric** – Transfers data between different ports inside the switch.
3. **Processor** – Manages switching decisions and controls the network traffic.
4. **Memory (Buffering & Caching)** – Stores data temporarily before forwarding.
5. **Management Interface** – Allows configuration using CLI or GUI tools.

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2. Separate VMware and VirtualBox Points

Feature	VMware	VirtualBox
Developer	VMware Inc.	Oracle
Hypervisor Type	Both Type 1 (ESXi) & Type 2 (Workstation)	Type 2
Enterprise Use	Used for large-scale virtualization	More suited for personal use
Cost	Paid (except VMware Workstation Player)	Free & Open-source
Performance	More optimized for business environments	Less optimized, but flexible for testing

3. Enlist Any 5 Types of Databases

1. **Relational Database** (MySQL, PostgreSQL) – Stores data in tables with relationships.
2. **NoSQL Database** (MongoDB, Cassandra) – Stores unstructured/semi-structured data.
3. **Key-Value Store** (Redis, DynamoDB) – Uses key-value pairs for fast access.
4. **Graph Database** (Neo4j, ArangoDB) – Best for **connected data** like social networks.
5. **Columnar Database** (HBase, Apache Cassandra) – Stores data in columns, optimized for fast analytics.

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4. Top 5 Resources of a Virtual Machine

1. **vCPU (Virtual CPU)** – Processes instructions and executes tasks.

2. **vRAM (Virtual Memory)** – Allocates memory for running applications.
3. **vDisk (Virtual Storage)** – Stores the operating system, files, and applications.
4. **vNIC (Virtual Network Interface Card)** – Enables network connectivity.
5. **GPU (Graphics Processing Unit - Virtualized)** – Provides graphical processing power for high-performance applications.

Short Questions:

1. What is VirtualBox?

VirtualBox is a **Type 2 Hypervisor** developed by **Oracle** that allows users to run **multiple operating systems (Windows, Linux, macOS)** on a single host machine. It is mainly used for **software testing, development, and training.**

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2. If We Use Full Virtualization Instead of Para-Virtualization, What Problems Might We Face?

- **Performance Overhead** – Full virtualization requires **hardware emulation**, making it **slower** than para-virtualization.
- **Higher Resource Usage** – More **CPU and RAM** consumption due to **OS translation overhead**.
- **Complex Hypervisor Management** – Full virtualization uses a **binary translation technique**, making **hypervisor management more difficult**.
- **Less Efficient Communication** – Para-virtualization uses **hyper calls**, allowing direct communication with the hypervisor, whereas **full virtualization does not**.

- **If a company wants to virtualize multiple physical servers into a single platform, what solution can they use?**
    - **Answer:** VMware **ESXi**, a **Type 1 Hypervisor**, is ideal for enterprise-level virtualization as it allows running multiple virtual machines efficiently on a single physical server.
- **If a company wants to migrate VMs between ESXi hosts without downtime, what feature should they use?**
    - **Answer: VMware vMotion** enables live migration of running VMs between ESXi servers.

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4. Two Examples of Time-Series Databases

- **InfluxDB** – Designed for high-speed time-series data processing.
- **OpenTSDB** – Optimized for handling large-scale time-series data sets.

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5. Difference Between Running VM and Paused VM

State	Description
Running VM	The VM is actively executing tasks and using CPU, RAM, and storage.
Paused VM	The VM is temporarily stopped, using **RAM but not CPU**, allowing it to resume instantly.

Long Questions:

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1. Advantages of Containerization

1. **Lightweight** – Containers share the host OS kernel, reducing resource usage.
2. **Faster Boot Time** – Starts in **seconds**, unlike VMs which take minutes.
3. **Portability** – Can run **on any platform** (Windows, Linux, Cloud).
4. **Efficient Resource Usage** – Requires less **RAM and CPU** than VMs.
5. **Better Scalability** – Easily scales **up and down** based on demand.

---

2. Four Demerits of Virtualization

1. **High Initial Cost** – Requires expensive **hardware and software licenses**.
2. **Performance Overhead** – Running multiple VMs on a single machine **reduces efficiency**.
3. **Security Risks** – If the **hypervisor is attacked**, all VMs on that system are affected.
4. **Complex Management** – **Maintaining, updating, and securing** multiple VMs can be difficult.

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3. Choosing 5 Points Related to VirtualBox (Out of 7 Given)

- **Type 2 Hypervisor** – VirtualBox requires a **host OS** to run.
- **Supports Multiple OS** – Can run Windows, Linux, macOS as **guest OS**.
- **Free & Open-Source** – Available for free under **Oracle's license**.
- **Snapshots & Cloning** – Allows users to **save and restore VM states**.

- **Cross-Platform Compatibility** – Can be installed on **Windows, Linux, and macOS**.

----------THE END----------

By Maha Rana

May Allah grant you success, ease your efforts, and bless you with wisdom and perseverance. Keep your faith strong, for with prayer, every challenge becomes an opportunity. And please remember me in your prayers.

I hope this file helps you a lot; I have tried my best to find the most relevant and authenticated answers for the questions. However, in some cases, the questions might slightly differ from the ones in your slides. I recommend that every student kindly verify the answers on their own before using them. I am not responsible for any discrepancies.

Best wishes for Finals!