Cloud Federation and VM Migration – Revision Notes

🚀 Cloud Federation – Quick Revision

☑ Definition

- **Cloud Federation**: Union of internal and external cloud services managed together to meet business needs.
- **Federation**: Integration of multiple smaller units to act as one.

☑ Motivation

- CSPs collaborate to:
  - Maximize resource usage
  - Reduce power consumption
  - Load balancing
  - Global reach
  - Enhance utility

☑ Key Characteristics

- Solves cloud limitations: service interruption, interoperability issues, service degradation.
- Inter-cloud organizations with voluntary participation.
- Emphasizes **geographical separation**, **marketing systems**, and **federal agreements**.

🏗 Federation Architectures

1. Loosely Coupled Federation

- Minimal interoperation.
- Example: Private cloud uses resources from public cloud.
- Limited VM control & monitoring.

2. Partially Coupled Federation

- CSPs have agreements.
- Some control over VM placement, detailed monitoring.
- Advanced networking (e.g., cross-site virtual networks).

3. Tightly Coupled Federation

- Common admin across clouds.
- Full control over VMs, monitoring, and features like:
  - VM placement
  - Cross-site migration
  - Virtual storage

4. Hybrid / Bursting Architecture

- Local infra (private) + external public cloud for peak loads.
- Loosely coupled.

5. Broker Architecture

- Broker selects/deploys VMs on public clouds.
- Optimization-based decisions (cost, performance).
- Loosely coupled.

6. Aggregated Architecture

- Partner clouds combine resources.
- Usually partially coupled.
- Coupling depends on ownership (same corp = tighter).

7. Multitier Architecture

- Hierarchical control (top/root cloud OS).
- Tightly coupled.
- Full control across sites, uniform access, useful for:
  - HA
  - Load balancing
  - Fault tolerance

💻 VM Migration – Quick Revision

☑ Definition

- Moving running VMs/apps between physical servers.
- Transfers CPU state, memory, storage, network connections.

☑ Purpose

- Load balancing
- Maintenance

🔄 Types of VM Migration

1. Cold (Non-Live) Migration

- VM is **turned off** during migration.
- Longer downtime.

2. Hot (Live) Migration

- VM **continues running** during migration.
- Used in real-time apps.

🚚 **Live VM Migration Approaches**

1. Pre-copy Migration

- Memory copied while VM runs.
- **Phases**:
  - **Pre-copy phase**: Copy memory over multiple rounds.
  - **Pre-copy termination**: Based on thresholds (rounds, memory, dirtied pages).
  - **Stop-and-copy**: Suspend VM, copy remaining data & CPU state.
  - **Restarting**: Resume VM on destination.

2. Post-copy Migration

- **Stop source VM**, copy CPU state, restart on destination.
- **On-demand memory copy** as accessed.
- Saves bandwidth (unused pages skipped).

🔄 **Multiple VM Migration**

☑ **1. Serial Migration**

- One VM migrated at a time.
- Remaining VMs paused after 1st enters stop phase.
- **Higher downtime**.

☑ **2. Parallel Migration**

- All VMs migrate together.
- Shared bandwidth (R/m).
- **Low downtime**, same start-end for stop phase.

📌 **Important MCQ Keywords**

- **Federation types**: loosely, partially, tightly coupled
- **Architectures**: hybrid, broker, aggregated, multitier
- **Live migration phases**: pre-copy, stop-and-copy, restart
- **Migration types**: cold vs hot, pre-copy vs post-copy
- **Serial vs Parallel migration**
- **Purpose of VM migration**: maintenance, load balance
- **Broker role**: deploys VMs, makes cost/performance decisions