UNIT-III

CLOUD MANAGEMENT -

1. Resiliency -
   It is the capacity to rapidly adapt and respond to risks, as well as opportunities. This maintains continuous business functions that support growth and operate in potential adverse conditions.

   Cloud resilience services are -
   (1) Systematically and automatically backup data which increases availability and recovery rate in adverse situation.
   (2) Archiving documents which improves the efficiency of storing and retrieving information as needed, whether of regulatory compliance or business need.
   (3) Enable faster recovery of application without the high cost

   Resiliency capabilities -
   The framework combines multiple points to mitigate risks and improve business resilience -
   (1) From a facility perspective, you may need to implement power protection
   (2) From security perspective, to protect applications and data
   (3) From business perspective, you may implement identification and documentation of most critical business processes.
   (4) From organizational perspective, geographical diversity, backup of data, network data
   (5) From strategy and vision perspective, you would want to have a CRM's management.

3. Provisioning - (means to secure)
   Cloud provisioning is the process of allocating a cloud provider's resources to the customer.

   Whenever a cloud provider accepts the customer request, it needs to establish the appropriate number of VMs and allocate resources for supporting them. This process is carried out in three ways -
   (1) Dynamic Provisioning - In this, the provider allocates more resources as per requirement and removes them when they are not needed. The customer
is charged according to pay-per-use basis. If this dynamic provisioning is used to create a hybrid cloud, then it is referred as cloud bursting.

(2) **Advance Provisioning** - In this, the customer undertakes a contract with the provider for the required resources and the cloud provider reserves the appropriate resources before beginning the service. The customer is billed a flat fee or on a monthly basis.

(3) **User Self-Provisioning (Cloud self-service)** - In this process, the customer reserves the required resources from the provider with the help of a web form by creating a customer account and then paying for the resources through credit card. The cloud provider's resources are made available for customers to use within a span of a few hours.

3. **Asset Management** -

   This task is to manage all the assets, such as network, hardware, and software that make the cloud infrastructure. The main aim of asset management is to secure organizational assets.

   Asset management strategy includes:

   (1) **Software Packaging** - The output from software package will be used during the installation and configuration of the various software packages requested by customers.

   (2) **Incident Management** - Used to track any interruptions or issues to the asset management service.

   (3) **Pool Management** - It works with asset management to make sure that the products requested are available on the requested date and for specific duration.

   (4) **System Management** - It is both a process and a service. In order to integrate with asset management, it provides all of the information on the attributes of OS, middleware, components need to be managed.

   (5) **Release Management**

   (6) **Configuration Management**

   (7) **Backup Management**
Concepts of MapReduce -

MapReduce is a software framework that allows developers to write programs that process massive amounts of unstructured data in parallel across a distributed cluster of processors or standalone computers. It was developed by Google for indexing web pages and replace their original indexing algorithms and heuristics in 2004.

The framework is divided into two parts:

1. **Map** - A function that parcel out work to different nodes in the distributed cluster.

2. **Reduce** - Another function that collates the work and resolves the results into a single value.

The MapReduce framework is fault-tolerant because each node in the cluster is expected to report back periodically with committed work and status updates. If a node remains silent for longer than the expected interval, a master node makes note and re-assigns the work to other nodes.
5. **Cloud Governance**

   It is the process of controlling the access to the service with the help of policies, tracking service usage, repositories, and logging and monitoring the execution of those services.

   The main aim of cloud services governance is to protect data and applications which are located remotely.

   At this point, the following actions are taken:

   (1) Setting company policy for cloud computing
   (2) Risk management
   (3) Assigning responsibilities for enforcing & monitoring of policy compliance
   (4) Set corrective actions for non-compliance
   (5) Improve productivity

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**Compliance**

**Intellectual Property**

**Data Resolution**

**Service Level**

**Reversibility**

**Identity Federation**

**Interoperability**

**Governance**

**Cost Benefit Analysis**

**Audits**

**Monitoring**

**Standards, Policies**

**Performance Indicators**

**Security Policy**

6. **High Availability and Disaster Recovery**

   While high availability systems are designed to withstand any single failure, occasionally disaster events cause multiple systems to fail simultaneously.

   As these events overwhelm high availability mechanisms, an additional tier of business continuity planning and disaster recovery is often deployed to protect critical services.

   Disaster recovery planning focuses on two key objectives:

   (1) **Recovery Time Objective (RTO)** — It is the target time between when disaster is declared and when service is restored on backup site.
   (2) **Recovery Point Objective (RPO)** — It is the most recent point in time to which system state can be recovered onto backup site.
Although the RTO and RPO for critical failures are generally seconds or minutes, while RTO and RPO for disaster events are often hours or days.

**Virtualization**

1. **Virtualization** is defined as an abstraction of computer resources. It creates a virtual form of a device or any computer resource, like storage device, network, server, and an operating system in which the framework partitions the resource into one or more execution environments.

2. **Compute Virtualization** -

   It is a technique for masking or abstracting the physical hardware from the operating system. It enables multiple operating systems to run concurrently on single or clustered physical machines.

   ![Virtualization Diagram](image)

   - VMM → Virtual Machine Manager
   - VM → Virtual Machine
   - Virtualization layer resides between hardware and VM also called Hypervisor

**Advantages** -

1. Run multiple OS concurrently
2. Make OS and application, hardware independent
3. Isolate VM from each other, no conflict
4. Improves resource utilization
5. Offers flexible infrastructure at low cost
Storage Virtualization (Cloud Storage)

It is the process of decommissioning physical storage devices which act like a single storage device. It allows the storage administrator to perform different tasks such as backup, recovery, achieving very easily, and that too in a short span of time.

Storage virtualization is structured in three ways:
1. **Network-based** - In this, storage virtualization is treated as a network-based device.
2. **Host-based** - Physical drives are under the control of the traditional device drivers in which a software layer exists above it intercepts I/O requests which finds metadata, and redirects I/O.
3. **Storage device-based** - The primary storage controller, considers pooling and manages metadata, which allows the direct attachment of any other storage controllers.

**Advantages**
1. Storage management is easy.
2. Low energy usage.
3. Prolongation of storage space is possible.
4. Ability to migrate data.
5. Increase storage utilization.

**Disadvantages**
1. Does not allow vendors to easily introduce new frequently.
2. Network system is highly complicated.
3. If a single server gets infected, the whole network is compromised.

Network Virtualization

It is a process of logically segmenting or grouping physical network and making them operate as a single or multiple independent networks.

*My companion*
called virtual networks.

Network virtualization involves virtualization of both physical and virtual machine networks.

**Physical Network** - It may consist of network adapters, switches, routers, bridges, repeaters, hubs. It provides connectivity -
1. Among physical servers running Hypervisor.
2. Between physical servers and clients.
3. Between physical servers and storage.

**Virtual Network** - It allows inside a physical server, It includes logical switches. It provides connectivity -
1. Among VMs inside a physical server.
2. To Hypervisor kernel.
3. Connects to physical network.

![Network Diagram]

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**Advantages** -
1. Enhance security
2. Enhance performance
3. Improves manageability
4. Improves utilization
5. Reduce capital expenditure

**Disadvantages** -
1. Highly complex
2. Requires thoughtful planning

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**Desktop Virtualization** -

It provides a user with an operating environment that is separate from their local physical system. It consists of the server, virtualization...
There are two types of desktop virtualization:

1. **Server-hosted desktop virtualization** - The operating environment will be hosted on a server manually located in a data centre and accessed by the end-user over the LAN or WAN.

2. **Client-hosted desktop virtualization** - The operating environment runs locally on the user’s system hardware which includes hypervisor software that allows one desktop to run multiple OS’s.

**Advantages** -

1. Accessing desktop from anywhere.
2. Enhanced security as administration is centralized.
3. Faster, easier, and reliable backup/maintenance of data.
4. Reduced TCO (Total Cost of Ownership).

**Disadvantages** -

1. Because for OS, applications etc. still needs to be bought.
2. Needs extra bandwidth to handle all remote users.
3. Difficult to handle graphics or high-definition video.

6. **Application virtualization** -

   It is the technique of providing an application to an end-user without any installations, integration or dependencies on the underlying computing platform.
Two forms of application virtualization: one -
1. Remote application virtualization - Remote application are used to run on a server. It is possible for the end-users to view and interact with the required applications through a network via some remote display protocol.
2. Streaming application virtualization - Whenever an application is requested by the end-users, the components get downloaded to the local system based on the requirement. Once the downloading process is finished, the streamed application will work properly without any need of internet connectivity.

Advantages -
1. No installation required
2. Application rollout simplified
3. No new application conflicts
4. Simplifies OS integration
5. Multiple runtime environments

Disadvantages -
1. Single point of failure
2. Very high cost
3. High bandwidth required

Sever Virtualization

It is the marking of server resources including the number and identity of individual physical servers, processors and operating systems from server virtualization runs. The server administrator uses a software application to divide one physical server into multiple isolated virtual environments.

Server virtualization can be viewed as part of an overall virtualization trend in enterprise IT that includes storage virtualization, network virtualization and workload management.

There are three types of server virtualization -
1. Para-virtualization - It provides several OSs to run on a single set of hardware by making use of system resources very effectively.
2. Hypervisor - Requires the guest OS to be modified.
(2) Operating system virtualization - It involves a standard OS to run various applications which are controlled by different users on a single system at a time.

**Advantages**
- Choice of OS is limited.
- Hardware emulation - It is used when there is a need to run an unsupported OS within a VM. It is used to debug & verify a system which is under design.
- Need to install and update device drivers.

**Disadvantages**
- (1) Reduce the number of users.
- (2) Reduce IT cost.
- (3) More application can be used.
- (4) Continuity in business.
- (5) Above OS on a single hardware platform.

(8) **Virtualization Benefits**
- (1) Most mature, proven and comprehensive platform.
- (2) High application availability.
- (3) Hybrid-based guides for ease of installation.
- (4) Simple and streamlined management.
- (6) Security features.
- (7) Greater resource.
- (8) Affordability.

(3) **Block level storage virtualization**

Storage capacity is made available to the OS or the applications in the form of virtual disk(s). 

The task of the virtualization entity is to map these virtual blocks to the physical blocks of the real storage devices.
File level storage virtualization

The virtualization entity provides virtual storage to the OS or applications in the form of files and directories.

Advantages of block level storage virtualization -
1. It is suitable if the storage is to be virtualized for as many as different OS and applications as possible.
2. Actually necessary when dealing with applications that handle their storage on block level and cannot work on file level.

Advantages of file level storage virtualization -
1. Absolutely necessary for those who want to establish data sharing between several servers.
2. File system management is done by the storage virtualization.

Hypervisor management software -

Hypervisor is a compute virtualization software that enables multiple OS to run on a physical machine concurrently. It interacts directly with the physical resources of the compute system.

Hypervisor has two components -
1. Kernel - provides the same functionality as other OS, like process creation, file system management, process scheduling, etc.
2. It also
(2) **VMM (Virtual Machine Manager)** - It is a management solution for the virtualized data center, enabling you to configure and manage your virtualization host, networking, and storage resources.

Hypervisor can be divided into two types -

1. **Type 1 (Native or Low-metal Hypervisor)** - These are installed directly onto the hardware just like a regular OS gets installed on a single server.
   - Example: Microsoft Hyper-V, VMware ESXi, etc.

2. **Type 2 (Hosted Hypervisor)** - These are installed and run as an application on the top of the OS.
   - Example: Oracle VirtualBox, Microsoft Virtual PC, etc.

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<thead>
<tr>
<th>TYPE-1</th>
<th>TYPE-2</th>
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<tbody>
<tr>
<td>VM1</td>
<td>APP</td>
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<tr>
<td>VM2</td>
<td>VNM</td>
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<tr>
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<td>OS</td>
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<td>HARDWARE</td>
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Hypervisor provides functions such as create VM, delete VM, move VM.

**Infrastructure Requirements** -

Virtualization products have strict requirements on backend infrastructure components including storage, backup, system management, security, and time synchronization.

Ensuring that these components are of required configuration is critical for successful implementation.

**Server virtualization suitability assessment** -

One of the key advantages of virtualization is greater utilization of physical server resources. To ensure that existing servers will operate in a shared environment, detailed hardware inventory and performance utilization information must be obtained and analyzed for current purposes.
Detailed Design -

Virtualization introduces many changes into the environment and ensures that the platform can co-exist and interact with existing infrastructure.

The purpose of the detailed design is to set naming and security standards, define the disk and network structure. It includes the following -

(1) Security and administrative model.
(2) Backup methodology.
(3) VMware service console configuration.
(4) Implement tables and configurations setting.

2) Virtual LAN (VLAN) -

A virtual local area network (VLAN) is a network technology used to logically separate large broadcast domains using layer 2 devices. VLAN standard is IEEE 802.1Q.

Types of VLANs:

(1) Data VLAN - Main type of virtual network. It is designed to carry user-defined data.
(2) Default VLAN - This is the VLAN assigned by default to all ports. For Cisco switches, this is VLAN 1.
(3) Native VLAN - This is the VLAN assigned to untagged packets, which have not yet travelled through a VLAN tagged port.
(4) Management VLAN - A VLAN used for switch management.
(5) Voice VLAN - This is a special type of VLAN used with VoIP devices.

Benefits of VLAN -

(1) Improved security.
(2) Higher performance.
(3) Cost reduction.
(4) Simplified network management.
Virtual SAN (VSAN) -

A virtual storage area network (VSAN) is a logical partition in a SAN that allows traffic to be isolated within specific functions of a SAN.

Benefits of VSAN -

1. Virtual SAN Islands - A SAN Island is a storage area network (SAN) that exists as a discrete, isolated entity within a larger SAN.
2. Transparent to end devices
3. ISL Trunking (InterSwitch Link) - Trunking allows ISLs to carry traffic for multiple VSANs on the same physical link.
4. Fabric availability
5. Fabric scalability
6. Traffic management is easier

Fabric - The hardware that connects workstations and servers to storage devices in a SAN is referred to as a "fabric".