ENTERPRISE CLOUD CONCEPTS

Unit-2

Important Q & A

1) Explain Broadband networks and internet architecture?

Ans) Internet Service Providers (ISPs) (Figure 5.1 & 5.2)

- Connectionless Packet Switching (Datagram Networks)
- Router-Based Interconnectivity (Figure 5.3 & 5.4)

- Technical and Business Considerations (Figure 5.5 & 5.6)
  - Connectivity issues
  - Network bandwidth and latency issues
  - Cloud carrier and cloud provider selection

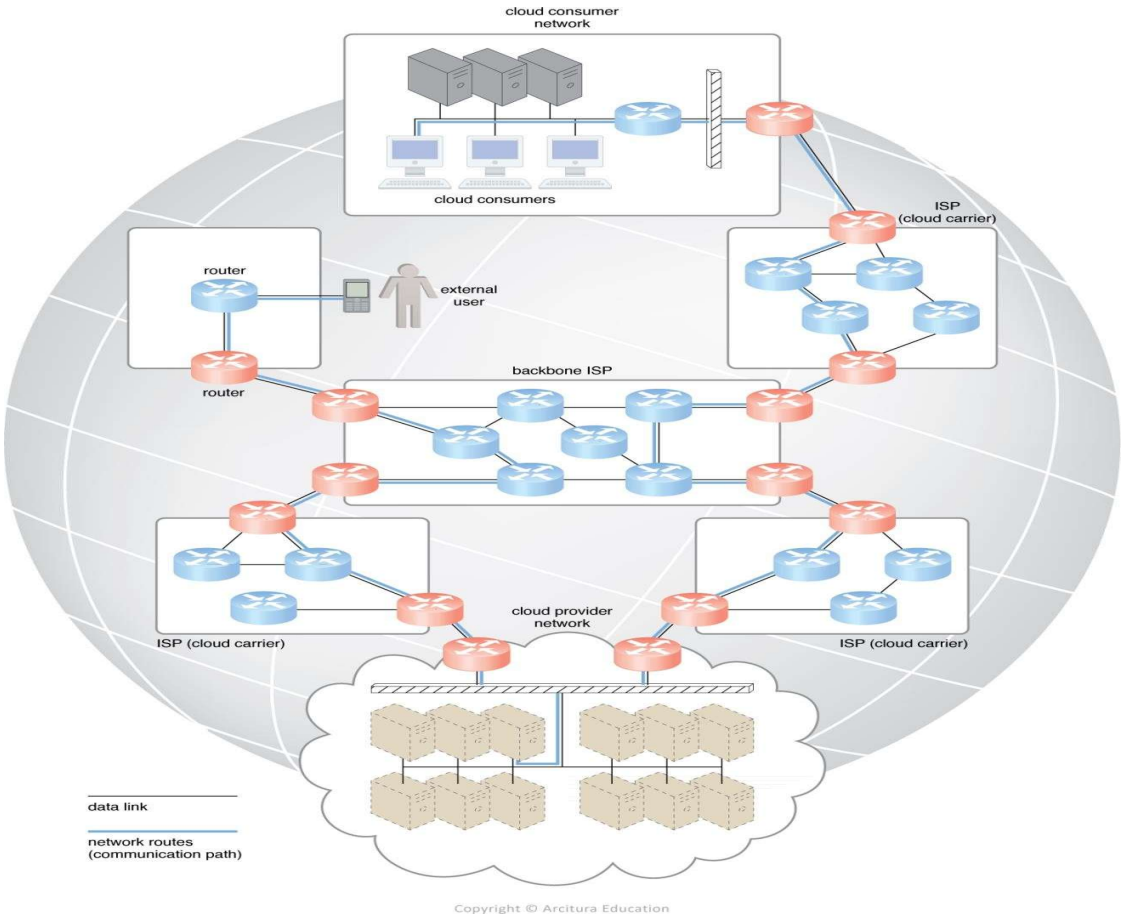

Figure 5.1 - Two messages travel over dynamic network routes in this ISP internetworking configuration

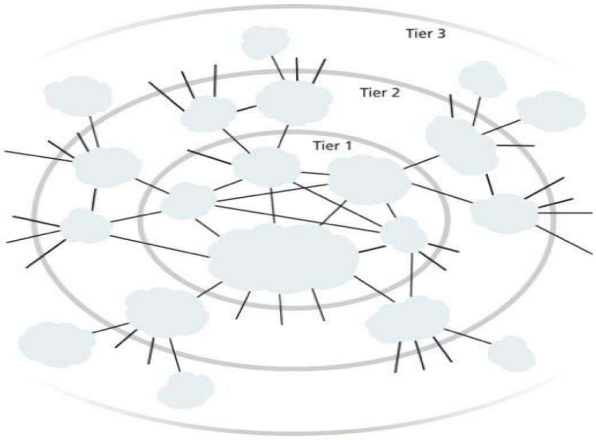

Figure 5.2 - An abstraction of the internetworking structure of the Internet

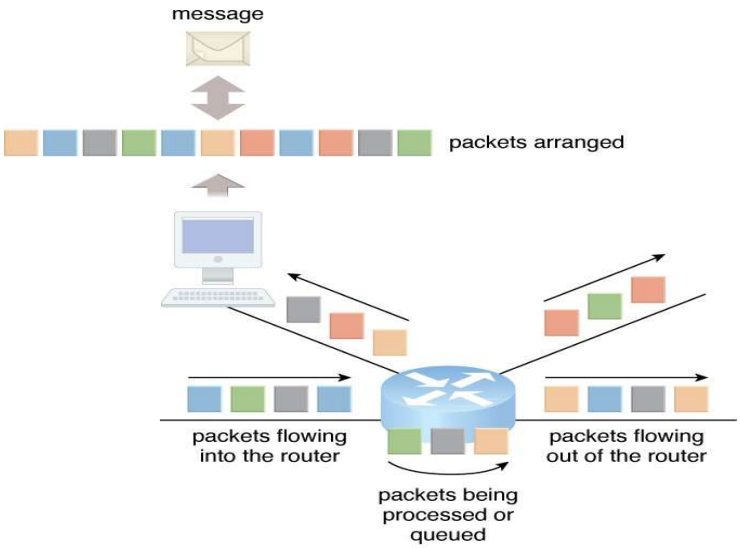

Figure 5.3 - Packets traveling through the Internet are directed by a router that arranges them into a message.

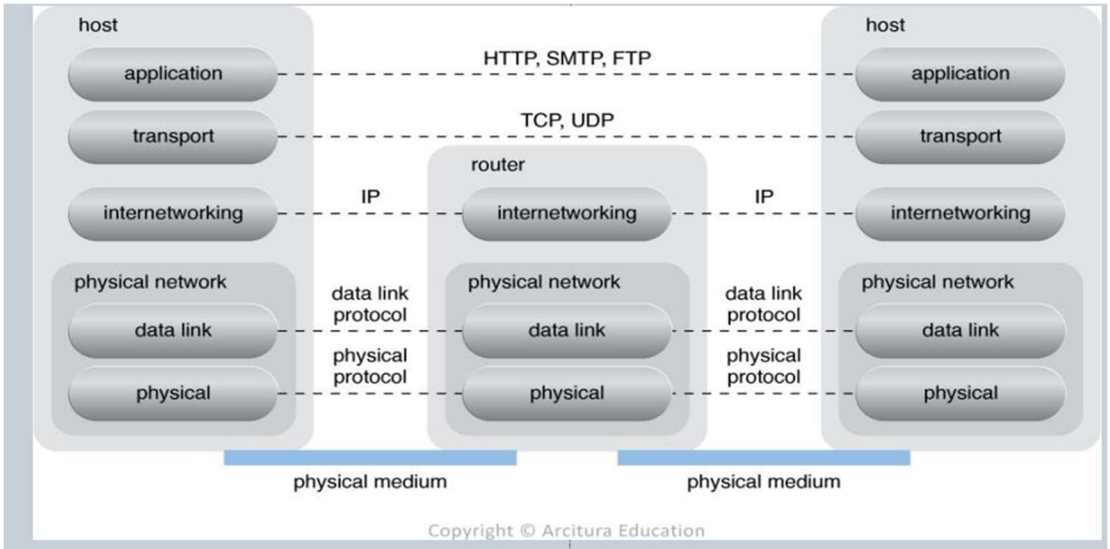

Figure 5.4 - A generic view of the Internet reference model and protocol stack.

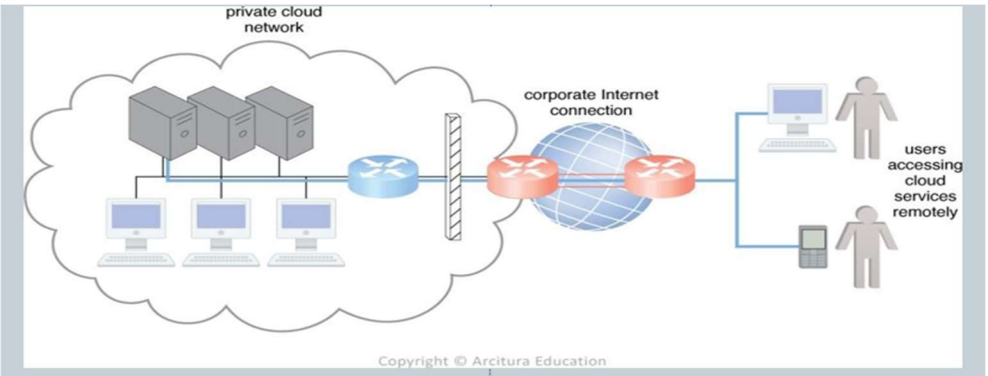

Figure 5.5 - The internetworking architecture of a private cloud. The physical IT resources that constitute the cloud are located and managed within the organization.

Figure 5.6

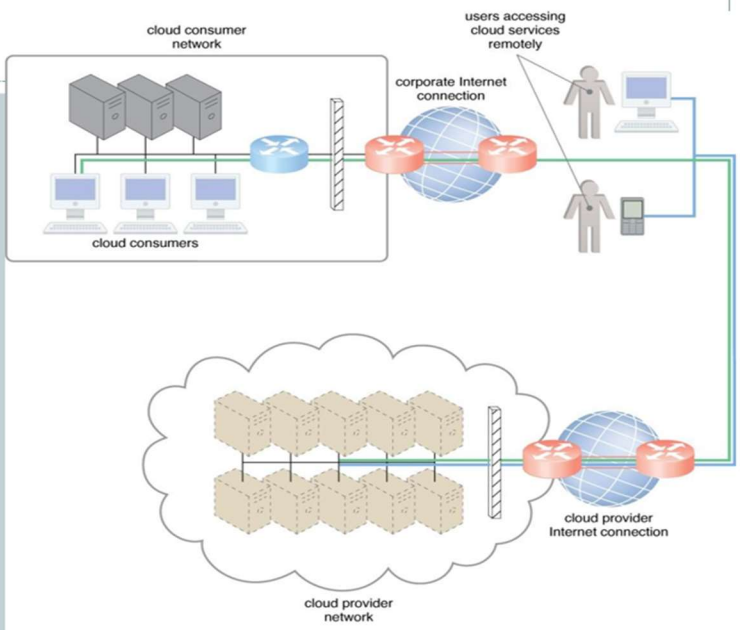

Figure 5.6 - The internetworking architecture of an Internet-based cloud computing deployment model. The Internet is the connecting agent between non-proximate cloud consumers, roaming end-users, and the cloud provider's network.

A comparison of on-premise and cloud-based internetworking

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On-Premise IT Resources	Cloud-Based IT Resources
internal end-user devices access corporate IT services through the **corporate** network	internal end-user devices access corporate IT services through an **Internet** connection
internal users access corporate IT services through the corporate Internet connection while roaming in external networks	internal users access corporate IT services while roaming in external networks through the cloud provider's Internet connection
external users access corporate IT services through the **corporate Internet connection**	external users access corporate IT services through the **cloud provider's Internet connection**

Summary of Broadband Networks and Internet

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- Cloud consumers and cloud providers typically use the **Internet** to communicate, which is based on a decentralized provisioning and management model and is not controlled by any centralized entities.
- The main components of internetworking architecture are connectionless packet switching and router-based interconnectivity, which use network routers and switches.
- Networks bandwidth and latency are characteristics that influences QoS, which is heavily impacted by network congestion.

2)Explain about Data Center Technology?

Ans)

5.2 Data Center Technology (1/2)

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- Grouping IT resources in close proximity with one another allows for power saving, higher efficiency in sharing resources, and improve accessibility for IT personnel. Following issues are concerned:

1. Virtualization (Figure 5.7)
2. Standardization and Modularity (enable economy of scale)
3. Automation (self-configuration, recovery)
4. Remote Operation and Management
5. High Availability (through redundancy)

5.2 Data Center Technology (2/2)

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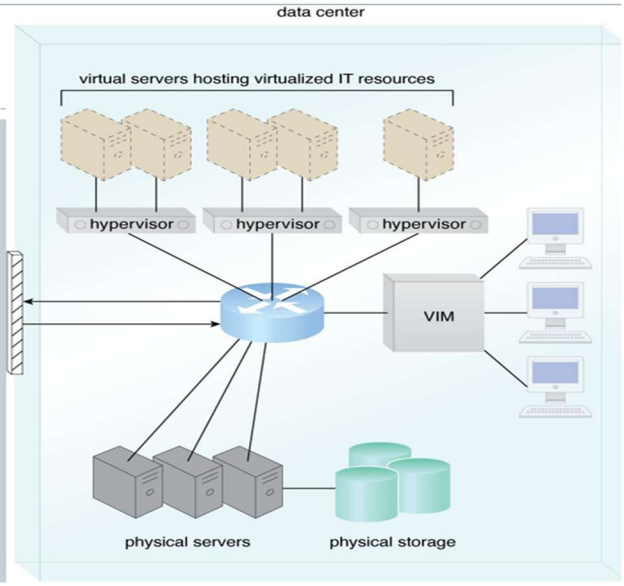
6. Security-Aware Design, Operation, and Management (outsourcing resources)
7. Facilities (power, cabling, cooling, fire protection,…)
8. Computing Hardware (standardized commodity servers)
9. Storage Hardware (array, hot-swapping, storage virtualization, fast data replication, SAN, NAS,…)
10. Network Hardware
    1) Carrier and External Networks Interconnection
    2) Web-Tier Load Balancing and Acceleration
    3) LAN Fabric
    4) ANS Fabric
    5) NAS Gateways

Figure 5.7

- *Figure 5.7 - The common components of a data center working together to provide virtualized IT resources supported by physical IT resources.*



Summary Data Center Technology (1/2)

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- A data center is a specialized IT infrastructure that houses centralized IT resources, such as servers, databases, and software systems.
- Data center IT hardware is typically comprises of standardized commodity servers of increased computing power and storage capacity, while storage system technologies include disk arrays and storage virtualization. Technologies used to increase storage capacity include DAS, SAN, and NAS.

Summary of Data Center Technology (2/2)

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- Computing hardware technologies include rack-mounted server arrays and multi-core CPU architectures, while specialized high-capacity network hardware and technology, such as content-aware routing, LAN and SAN fabrics, and NAS gateways, are used to improve network connectivity.

3) What is Virtualization Technology? Explain its features.

Ans)

5.3 Virtualization Technology (1/2)

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- Most types of IT resources can be virtualized: servers, storage, network, power.
- Hardware Independence
- Server Consolidation
  - Different virtual servers share one physical server
- Resource Replication
  - Virtual disk images can be accessible using simple file operations, such as copy, move, and paste by the host's OS for replication purpose

5.3 Virtualization Technology (2/2)

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- Operating System-Based Virtualization (Figure 5.8)
- Hardware-Based Virtualization (Figure 5.9)
- Virtualization Management
  - Virtualization infrastructure management (VIM) collectively manage virtual IT resources running on a centralized module.
- Other Considerations
  - Performance overhead
  - Special hardware compatibility
  - Portability (Open Virtualization Format OVF)

Figure 5.8

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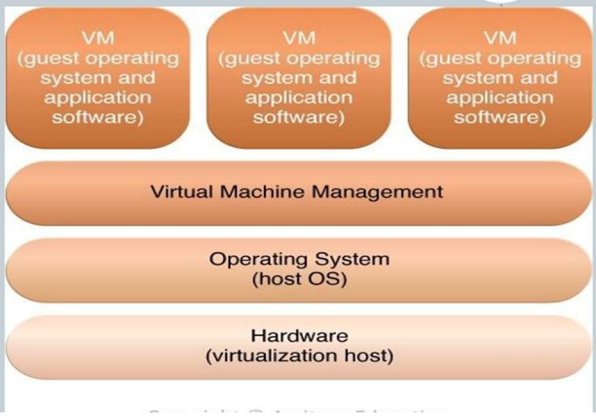

- *Figure 5.8 - The different logical layers of operating system-based virtualization, in which the VM is first installed into a full host operating system and subsequently used to generate virtual machines.*

Figure 5.9

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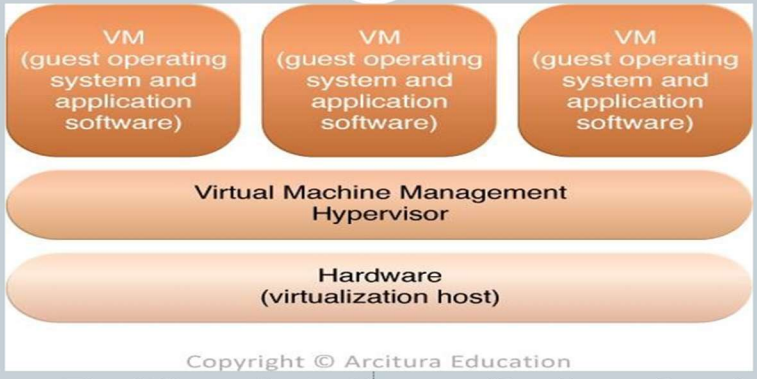

- *Figure 5.9 - The different logical layers of hardware-based virtualization, which does not require another host operating system.*

Summary of Virtualization Technology

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- Server virtualization is the process of abstracting IT hardware into virtual servers using virtualization software.
- Virtualization provides hardware independence, server consolidation, and resource replication, and further supports resource pooling and elastic scalability.
- Virtual servers are realized through either operating system-based or hardware-based virtualization.

4) What is Logical Network Perimeter explain with neat diagram?

Ans) Defined as **the isolation of a network environment from the rest of a communications network**, the ***logical network perimeter*** **establishes a virtual network boundary** that can encompass and isolate a group of related cloud-based IT resources that may be physically distributed

This mechanism can be implemented to:

- isolate IT resources in a cloud from non-authorized users
- isolate IT resources in a cloud from non-users
- isolate IT resources in a cloud from cloud consumers
- control the bandwidth that is available to isolated IT resources

Logical network perimeters are typically established via network devices that **supply and control the connectivity of a data center** and are commonly deployed as virtualized IT environments that include:

- ***Virtual Firewall*** – An IT resource that actively filters network traffic to and from the isolated network while controlling its interactions with the Internet.
- ***Virtual Network*** – Usually acquired through VLANs, this IT resource isolates the network environment within the data center infrastructure.

Figure 7.2 introduces the notation used to denote these two IT resources.

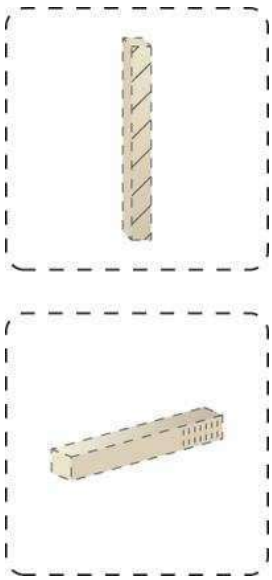

Figure 7.2. The symbols used to represent a virtual firewall (top) and a virtual network (bottom).

Figure 7.3 depicts a scenario in which one logical network perimeter contains a cloud consumer's on-premise environment, while another contains a cloud provider's cloud-based environment. These perimeters are connected through a VPN that protects communications, since the VPN is typically implemented by point-to-point encryption of the data packets sent between the communicating endpoints.

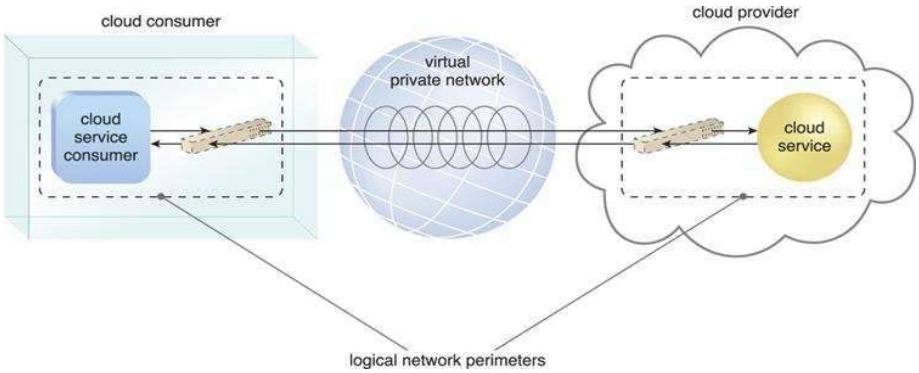

Figure 7.3. Two logical network perimeters surround the cloud consumer and cloud provider environments.

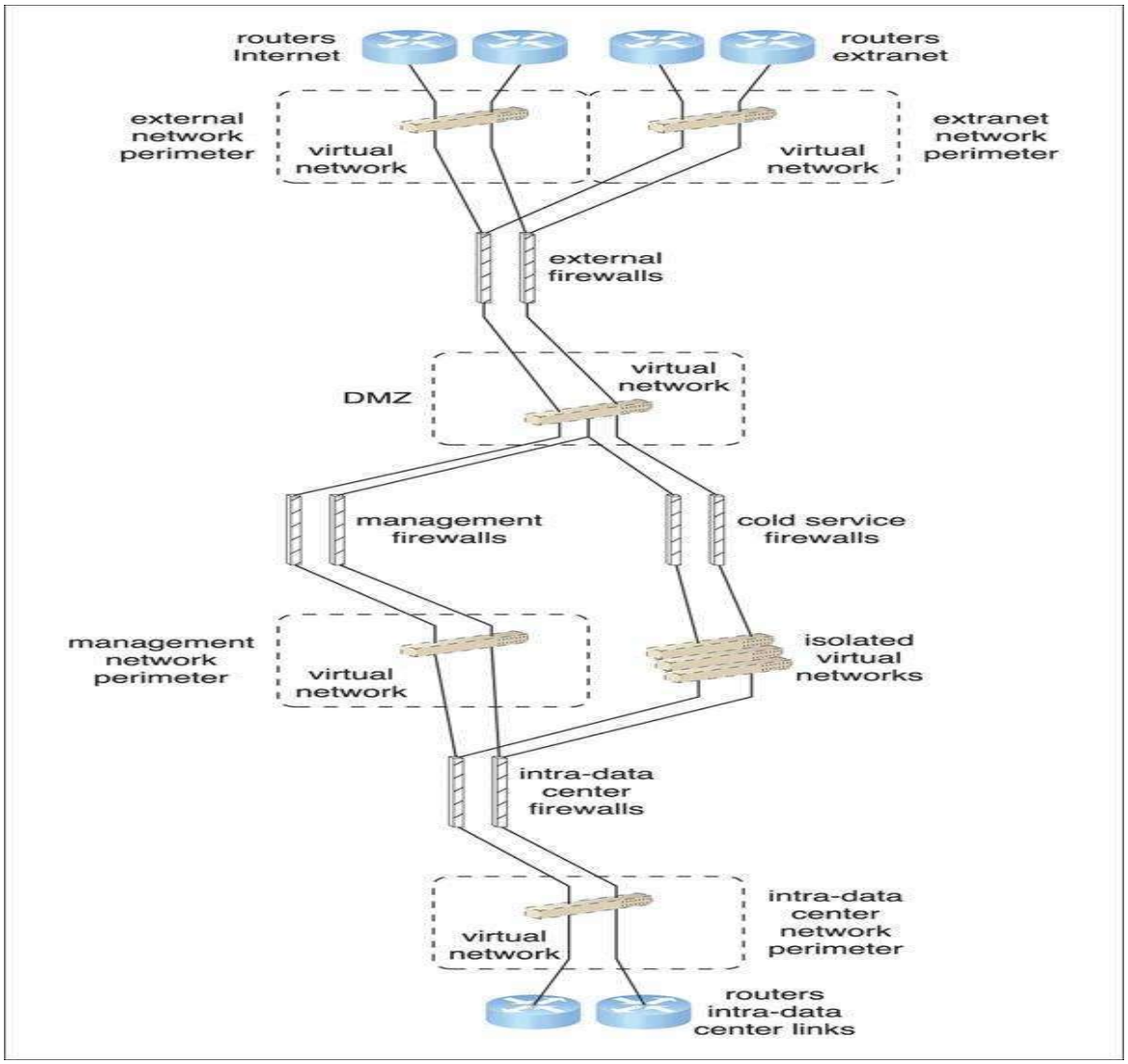

Figure 7.4. A logical network layout is established through a set of logical network perimeters using various firewalls and virtual networks.

5) What is Server Virtualization? Explain its advantages & disadvantages?

Ans) Server Virtualization is most important part of Cloud Computing. Cloud Computing, it is composed of two words, cloud and computing. Cloud means Internet and computing means to solve problems with help of computers. Computing is related to CPU & RAM in digital world. Now Consider situation, You are using Mac OS on your machine but particular application for your project can be operated only on Windows. You can either buy new machine running windows or create virtual environment in which windows can be installed and used. Second option is better because of less cost and easy implementation. This scenario is called **Virtualization**. In it, virtual CPU, RAM, NIC and other resources are provided to OS which it needed to run. This resources is virtually provided and controlled by an application called Hypervisor. The new OS running on virtual hardware resources is collectively called **Virtual Machine (VM)**.

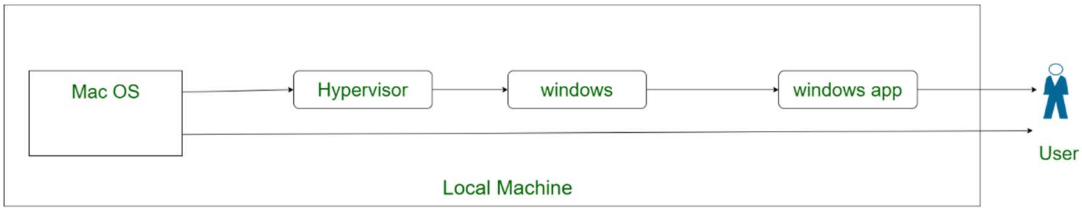

Figure – Virtualization on local machine

Now migrate this concept to data centers where lot of servers (machines with fast CPU, large RAM and enormous storage) are available. Enterprise owning data centre provide resources requested by customers as per their need. Data centers have all resources and on user request, particular amount of CPU, RAM, NIC and storage with preferred OS is provided to users. This concept of virtualization in which services are requested and provided over Internet is called **Server Virtualization.**

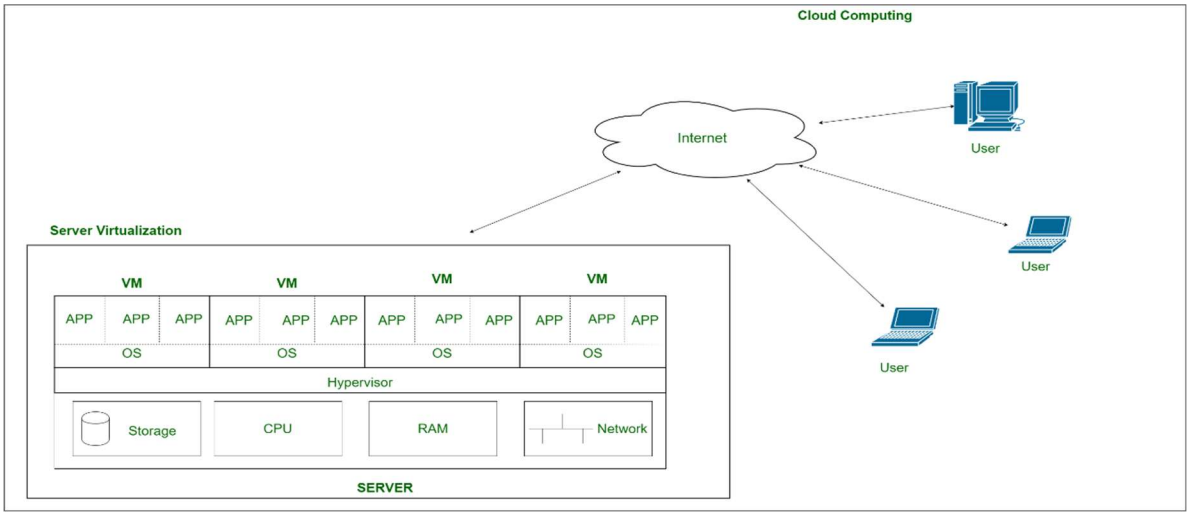

Figure – Server Virtualization

To implement Server Virtualization, hypervisor is installed on server which manages and allocates host hardware requirements to each virtual machine. This hypervisor sits over server hardware and regulates resources of each VM. A user can increase or decrease resources or can delete entire VM as per his/her need. This servers with VM created on them is called server virtualization and concept of controlling this VM by users through internet is called **Cloud Computing.**

Advantages of Server Virtualization:

- Each server in server virtualization can be restarted separately without affecting the operation of other virtual servers.
- Server virtualization lowers the cost of hardware by dividing a single server into several virtual private servers.
- One of the major benefits of server virtualization is disaster recovery. In server virtualization, data may be stored and retrieved from any location and moved rapidly and simply from one server to another.
- It enables users to keep their private information in the data centers.

Disadvantages of Server Virtualization:

- The major drawback of server virtualization is that all websites that are hosted by the server will cease to exist if the server goes offline.
- The effectiveness of virtualized environments cannot be measured.
- It consumes a significant amount of RAM.
- Setting it up and keeping it up are challenging.
- Virtualization is not supported for many essential databases and apps.

6) What is Cloud Storage Device? Explain its benefits and Examples

Ans)

1. **Storage Infrastructure:** This includes the physical data centers and servers managed by cloud service providers. These data centers house the hardware necessary to store large amounts of data securely.
2. **Storage Services:** Cloud providers offer various storage services tailored to different needs, such as:
    - **Object Storage:** Designed for storing unstructured data like documents, images, and videos (e.g., Amazon S3, Google Cloud Storage).
    - **Block Storage:** Suitable for applications that require high performance and low latency (e.g., Amazon EBS, Google Persistent Disk).
    - **File Storage:** Ideal for shared file systems and collaborative work environments (e.g., Amazon EFS, Google Filestore).

Benefits of Cloud Storage

1. **Scalability:** Easily scale storage capacity up or down based on demand, without the need for physical upgrades.
2. **Accessibility:** Access data from anywhere with an internet connection, promoting remote work and collaboration.

3. **Cost Efficiency:** Pay only for the storage you use, reducing the need for large upfront investments in hardware.
4. **Durability and Redundancy:** Cloud providers offer high levels of data durability by replicating data across multiple locations, ensuring data integrity and availability.
5. **Security:** Benefit from advanced security measures, including encryption, access controls, and compliance with industry standards.
6. **Disaster Recovery:** Enhance data protection with built-in backup and disaster recovery solutions, ensuring business continuity.

Examples of Cloud Storage Providers

- **Amazon Web Services (AWS):** Offers a variety of storage services, including Amazon S3, Amazon EBS, and Amazon Glacier.
- **Google Cloud Platform (GCP):** Provides Google Cloud Storage, Persistent Disks, and Filestore.
- **Microsoft Azure:** Features services like Azure Blob Storage, Azure Disk Storage, and Azure Files.

7) What is Cloud Usage Monitor and explain its types?

Ans) The cloud usage monitor mechanism is a lightweight and autonomous software program responsible for collecting and processing IT resource usage data. Depending on the type of usage metrics they are designed to collect and the manner in which usage data needs to be collected, cloud usage monitors can exist in different formats. The upcoming sections describe three common agent-based implementation formats. Each can be designated to forward collected usage data to a log database for post-processing and reporting purposes.

Monitoring Agent

A monitoring agent is an intermediary, event-driven program that exists as a service agent and resides along existing communication paths to transparently monitor and analyze dataflows (Figure 1). This type of cloud usage monitor is commonly used to measure network traffic and message metrics.

Resource Agent

A resource agent is a processing module that collects usage data by having event-driven interactions with specialized resource software (Figure 1). This module is used to monitor usage metrics based on pre-defined, observable events at the resource software level, such as initiating, suspending, resuming, and vertical scaling.

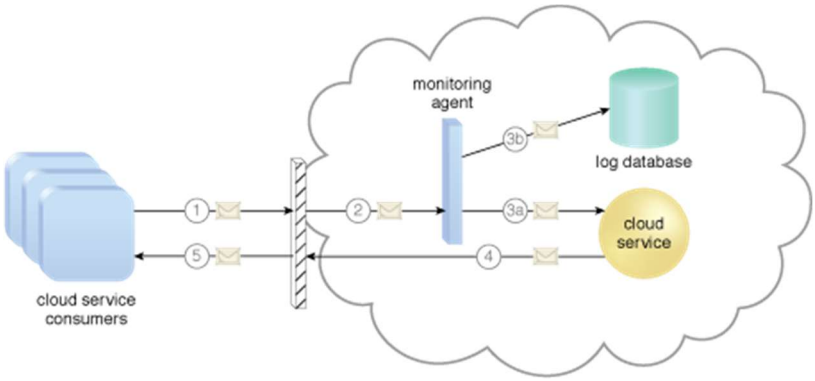

Figure 1 – A cloud service consumer sends a request message to a cloud service (1). The monitoring agent intercepts the message to collect relevant usage data (2) before allowing it to continue to the cloud service (3a). The monitoring agent stores the collected usage data in a log database (3b). The cloud service replies with a response message (4) that is sent back to the cloud service consumer without being intercepted by the monitoring agent (5).

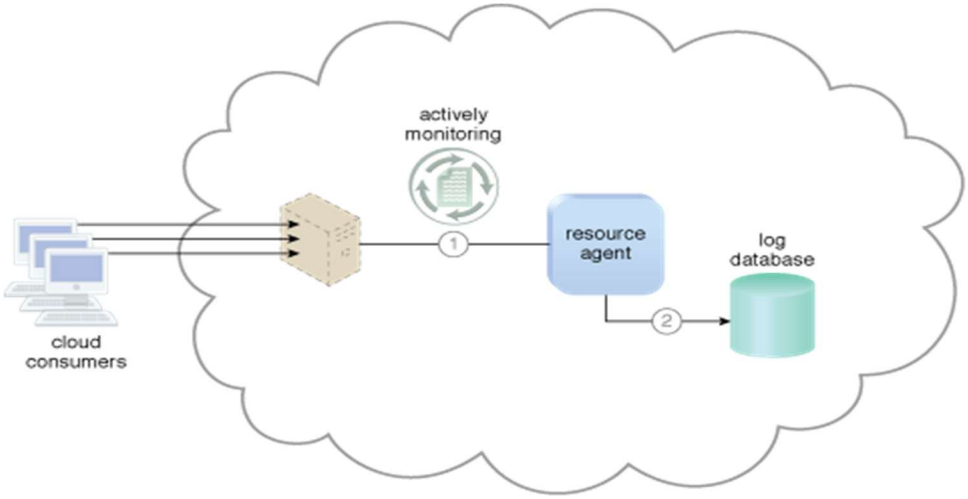

Figure 2 – The resource agent is actively monitoring a virtual server and detects an increase in usage (1). The resource agent receives a notification from the underlying resource management program that the virtual server is being scaled up and stores the collected usage data in a log database, as per its monitoring metrics (2).

Polling Agent

A polling agent is a processing module that collects cloud service usage data by polling IT resources. This type of cloud service monitor is commonly used to periodically monitor IT resource status, such as uptime and downtime (Figure 3).

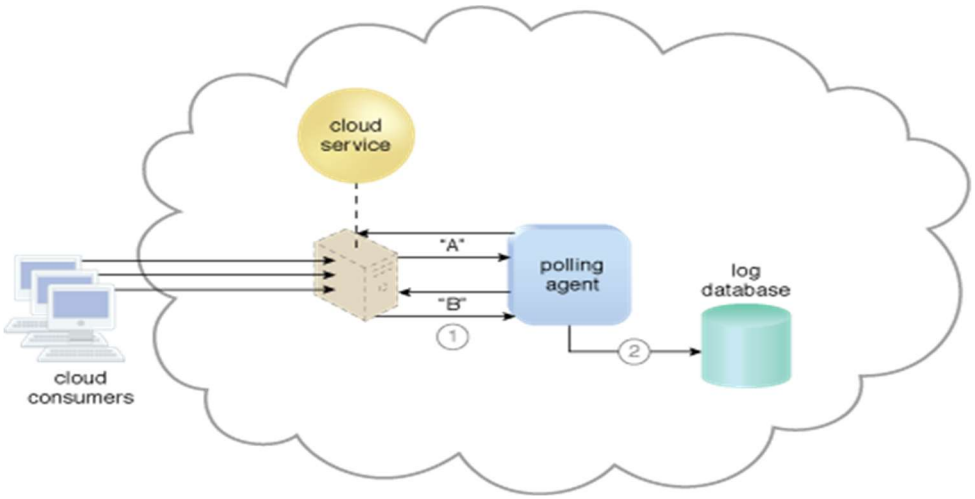

Figure 3 – A polling agent monitors the status of a cloud service hosted by a virtual server by sending period polling request messages and receiving polling response messages that report usage status “A” after a number of polling cycles, until it receives a usage status of “B” (1), upon which the polling agent records the new usage status in the log database (2).

8) What is Resource Replication? What are its Types and Benefits?

Ans) Resource replication involves creating multiple copies of data, applications, and services across different physical or virtual locations. This ensures that if one copy becomes unavailable, another can take over, minimizing downtime and data loss.

Types of Resource Replication

1. **Data Replication:**
    - **Synchronous Replication:** Data is copied simultaneously to multiple locations. It ensures consistency but can introduce latency.
    - **Asynchronous Replication:** Data is copied with a time delay, which minimizes latency but may result in minor inconsistencies.
2. **Service/Application Replication:**
    - **Active-Active Replication:** All instances are active and handle requests simultaneously, providing high availability and load balancing.
    - **Active-Passive Replication:** One instance is active while others are on standby, ready to take over if the active instance fails.

Benefits of Resource Replication

1. **High Availability:** Ensures that services remain accessible even if one or more instances fail.
2. **Disaster Recovery:** Provides a reliable backup solution, enabling quick restoration of services and data in case of catastrophic events.
3. **Load Balancing:** Distributes workload across multiple instances, improving performance and user experience.
4. **Data Durability:** Protects against data loss by maintaining copies in different locations.
5. **Compliance and Security:** Helps meet regulatory requirements and enhance security by storing data in multiple secure locations.

Use Cases in Cloud Computing

1. **Database Replication:** Ensures that databases are available and consistent across different regions.
2. **Content Delivery Networks (CDNs):** Replicates content to multiple edge locations for faster delivery to users worldwide.
3. **Microservices Architecture:** Distributes microservices across different instances to enhance fault tolerance and scalability.