Reviewer: Cloud Computing

Lesson 6

Cloud Computing

The Problem Cloud Computing Solves: The "Old Way" vs. The "New Way"

- **The "Old Way" (On-Premises)**: The company had to buy powerful *physical servers*, *storage disks*, and *networking equipment*. This required a huge *upfront investment*, known as *Capital Expenditure (CapEx)*. They had to *guess their peak traffic needs*, often buying far more capacity than they used day-to-day, leading to *wasted resources*. If they needed a new server, the process of ordering, installing, and configuring it could take *weeks or even months*.

- **The "New Way" (Cloud Computing)**: The cloud changes this model entirely. Instead of buying hardware, you *rent computing power* from a *cloud provider* (like *AWS, Google, or Microsoft*). This shifts the cost from a large upfront investment to a manageable *monthly bill*, known as an *Operational Expenditure (OpEx)*. This model *eliminates guesswork*, *long waiting times*, and *wasted resources*.

What is Cloud Computing?

Cloud Computing is a technology that allows you to *store and access data and applications over the internet* instead of using your computer's *hard drive* or a *local server*.

On-Demand Services

Cloud computing delivers essential computing services—including *servers, storage, databases, networking, and software*—all over the Internet. It's about *accessing resources as you need them*, rather than owning and maintaining them.

Shared & Scalable

This model enables *on-demand access* to a pool of *shared, scalable resources*. Organizations can *rapidly provision and de-provision* computing power, ensuring they always have the right amount of capacity without the *upfront investment in physical infrastructure*.

"You don't generate your own electricity. Why generate your own computing?" – Jeff Bezos, Founder of Amazon.

Cloud Deployment Models

1. **Public Cloud**: Services are offered by *third-party providers* over the *public internet*, open to anyone who wants to use them. Examples include *Amazon Web Services (AWS)* and *Google Cloud Platform*.

2. ***Private Cloud***: Dedicated to a ***single organization***, a private cloud can be hosted ***on-premises*** or by a ***third-party***, offering ***enhanced security and control*** tailored to specific business needs.

3. ***Hybrid Cloud***: A mix of ***public and private clouds***, this model allows ***data and applications to move*** between the two environments, providing greater ***flexibility*** and ***optimized resource allocation***.

Nearly ***90% of companies*** now leverage ***multicloud strategies***. This approach ***enhances resilience***, ***prevents vendor lock-in***, and ***optimizes performance***.

Cloud Service Models Explained

1. ***IaaS (Infrastructure as a Service)***: Provides fundamental computing resources like ***virtual machines, storage, and networking*** over the internet. You manage your ***operating systems, applications, and data***, while the provider handles the ***underlying infrastructure***. Example: ***Amazon EC2***.

2. ***PaaS (Platform as a Service)***: Delivers a ***platform*** allowing developers to ***build, run, and manage applications*** without the complexity of building and maintaining the infrastructure. Example: ***Google App Engine***.

3. ***SaaS (Software as a Service)***: Provides ***ready-to-use software applications*** over the internet on a ***subscription basis***. Users access the software via a ***web browser or mobile app***. Examples: ***Microsoft 365*** and ***Salesforce***.

Why Businesses Choose Cloud Computing

- ***Cost Efficiency***: Reduces operational costs by eliminating expensive ***hardware investments*** and maintenance. Businesses ***pay only for resources consumed***.

- ***Scalability & Flexibility***: Enables ***instant scaling*** of resources to meet fluctuating demand spikes without ***over-provisioning***.

- ***Global Accessibility***: Data and applications are accessible ***anytime, anywhere***, from any device with an internet connection.

- ***Business Continuity***: Offers robust ***automated backup solutions***, ***disaster recovery***, and ***high availability***.

Real-World Cloud Computing

- ***Gmail and Outlook***: Leverage cloud infrastructure to ***store and synchronize*** communications across devices.

- ***Netflix***: Streams high-definition video content worldwide, relying on cloud servers to handle ***massive data volumes*** and ***personalized viewing experiences***.

- ***Zoom***: Enables over ***300 million daily meeting participants*** to connect via cloud infrastructure providing bandwidth and global reach.

Challenges & Considerations

- *Data Security and Privacy*: Concerns about *data breaches* and *compliance* with privacy regulations.

- *Vendor Lock-in Risks*: Migrating data/apps can be *complex and costly* due to proprietary services.

- *Potential Data Loss and Downtime*: Outages or cyberattacks can lead to temporary *data inaccessibility*.

- *Need for Skilled Cloud Engineers*: Designing and maintaining systems requires *specialized expertise*.

Data Stream

What is Data Stream: A *data stream* is an existing, *continuous, ordered* (implicitly by entrance time or explicitly by timestamp) *chain of items*. It is unfeasible to control the order in which units arrive or to locally capture the stream in its *entirety*.

Characteristics of Data Stream

1. Large volumes of *continuous data*, possibly infinite.

2. *Steady changing* and requires a *fast, real-time response*.

3. *Random access is expensive* and requires a *single scan algorithm*.

4. Store only the *summary of the data* seen so far.

Types of Data Stream

- *Transactional data stream*: Credit card purchases; *Telecommunications* (phone calls); *Web* (accesses by clients).

Advantages and Disadvantages of Data Streams

Advantages: Helpful in *upgrading sales*, recognizing the *fallacy*, *minimizing costs*, and reacting swiftly to *risk*.
Disadvantages: *Lack of security* in the cloud, *vendor subordination*, and potential for *disconnection*.