

Unit - 4

Basics of Cloud Computing & New Technologies:

Introduction to cloud computing:

Cloud computing is the delivery of hosting services that are provided to a client over the Internet.

"The cloud" refers to servers that are accessed over the Internet, and the software and databases that run on those servers. Cloud servers are in data centres all over the world. By using cloud computing, users and companies do not have to manage physical servers themselves or run software applications on their own machines.

The cloud enables users to access the same files and applications from almost any device, because the computing and storage takes place on servers in a data centre, instead of locally on the user device. Therefore, a user can log into their Instagram account on a new phone after their old phone breaks and still find their old account in place, with all their photos, videos, and conversation history. It works the same way with cloud email providers like Gmail or Microsoft Office 365, and with cloud storage providers like Dropbox or Google Drive

For businesses, switching to cloud computing removes some IT costs and overhead: for instance, they no longer need to update and maintain their own servers, as the cloud vendor they are using will do that. This especially makes an impact for small businesses that may not have been able to afford their own internal infrastructure but can outsource their infrastructure needs affordably via the cloud. The cloud can also make it easier for companies to operate internationally, because employees and customers can access the same files and applications from any location.

Definition of Cloud Computing:

The term "Cloud Computing" refers to services provided by the cloud that is responsible for delivering of computing services such as servers, storage, databases, networking, software, analytics, intelligence, and more, over the Cloud (Internet).

Advantages of cloud computing:

- 1. Cost:** It reduces the huge capital costs of buying hardware and software.
- 2. Speed:** Resources can be accessed in minutes, typically within a few clicks.
- 3. Scalability:** We can increase or decrease the requirement of resources according to the business requirements.
- 4. Productivity:** While using cloud computing, we put less operational effort. We do not need to apply patching, as well as no need to maintain hardware and software. So, in this way, the IT team can be more productive and focus on achieving business goals.
- 5. Reliability:** Backup and recovery of data are less expensive and extremely fast for business continuity.
- 6. Security:** Many cloud vendors offer a broad set of policies, technologies, and controls that strengthen our data security.

Overview of cloud platforms

A cloud platform offers an environment on which developers create and deploy applications and do not necessarily need to know how many processors or how much memory that applications will be using. In addition, multiple programming models and specialized services (e.g., data access, authentication, and payments) are offered as building blocks to new applications. Google AppEngine, an example of Platform as a Service, offers a scalable environment for developing and hosting Web applications, which should be written in specific programming languages such as Python or Java, and use the services' own proprietary structured object data store.

Google Drive

Google Drive is a cloud-based file storage and synchronization service provided by Google. It allows users to store files in the cloud, access them from any device with internet connectivity, and collaborate with others in real-time. The web service provides a centralized cloud storage hub where changes to content are automatically saved and synchronized across all connected devices. This allows multiple users to collaborate on the same content in real time and always see the latest version of each file.

In addition to basic file storage, Google Drive integrates seamlessly with Google Workspace apps, including Google Docs, Sheets and Slides. The integration allows users to create, edit and collaborate on content without needing to leave the Drive interface.

AWS

Amazon Web Services offers a broad set of global cloud-based products including compute, storage, databases, analytics, networking, mobile, developer tools, management tools, IoT, security, and enterprise applications: on-demand, available in seconds, with pay-as-you-go pricing. From data warehousing to deployment tools, directories to content delivery, over 200 AWS services are available.

In 2006, Amazon Web Services (AWS) began offering IT infrastructure services to businesses as web services—now commonly known as cloud computing. One of the key benefits of cloud computing is the opportunity to replace upfront capital infrastructure expenses with low variable costs that scale with your business. With the cloud, businesses no longer need to plan for and procure servers and other IT infrastructure weeks or months in advance. Instead, they can instantly spin up hundreds or thousands of servers in minutes and deliver results faster. Today, AWS provides a highly reliable, scalable, low-cost infrastructure platform in the cloud that powers hundreds of thousands of businesses in 190 countries around the world.

Microsoft Azure:

Microsoft Azure Cloud Services offers developers a hosted .NET Stack (C#, VB.Net, ASP.NET). In addition, a Java & Ruby SDK for .NET Services is also available. The Azure system consists of a number of elements. The Windows Azure Fabric Controller provides auto-scaling and reliability, and it manages memory resources and load balancing. The .NET Service Bus registers and connects applications together. The .NET Access Control identity providers include enterprise directories and Windows LiveID. Finally, the .NET Workflow allows construction and execution of workflow instances

Introduction to emerging technologies:

Emerging Technology is a term generally used to describe a new technology. It also refers to the continuing development of an existing technology. The term commonly refers to technologies that are currently developing, or that are expected to be available within the next five to ten years, and is usually reserved for technologies that are creating, or are expected to create, significant social or economic effects.

Emerging Technologies are those technical innovations which represent progressive developments within a field for competitive advantage.

BLOCKCHAIN:

A blockchain is a secure, shared digital record book (ledger) that tracks transactions across a network of computers rather than one central bank or server. Data is stored in "blocks," which are linked together in a "chain," making it nearly impossible to change or fake information.

Blockchain is used to create secure, transparent, and tamper-proof digital records for transactions and data, eliminating the need for intermediaries by using a decentralized, distributed ledger system, making it ideal for cryptocurrencies (like Bitcoin), supply chain tracking, secure data management in healthcare, and efficient, trustworthy digital systems in finance, voting, and government.

IoT:

The Internet of Things (IoT) refers to everyday physical objects—like appliances, vehicles, or wearable devices—embedded with sensors, software, and technology that allow them to connect, collect data, and exchange information over the internet without human intervention.

A typical IoT system works through the real-time collection and exchange of data. An IoT system has three components:

- **Smart devices**

This is a device, like a television, security camera, or exercise equipment that has been given computing capabilities. It collects data from its environment, user inputs, or usage patterns and communicates data over the internet to and from its IoT application.

- **IoT application**

An IoT application is a collection of services and software that integrates data received from various IoT devices. It uses machine learning or artificial intelligence (AI) technology to analyze this data and make informed decisions. These decisions are communicated back to the IoT device and the IoT device then responds intelligently to inputs.

- **A graphical user interface**

The IoT device or fleet of devices can be managed through a graphical user interface. Common examples include a mobile application or website that can be used to register and control smart devices.

AR/VR:

Augmented Reality (AR) and Virtual Reality (VR) are immersive technologies that merge digital content with the physical world or create entirely virtual environments. AR overlays digital information onto the real world via smartphones or glasses (e.g., Pokémon Go), while VR requires a headset to completely submerge the user in a computer-generated, 3D experience.

QUANTUM COMPUTING:

Quantum computing is a next-gen type of computing that uses the rules of quantum physics to process information — which makes it insanely powerful for certain problems compared to normal computers.

A **classical computer** (your laptop/phone) uses:

- **bits** → either 0 or 1

A **quantum computer** uses:

- **qubits** → can be 0, 1, or **both at the same time**

This happens because of quantum physics effects.

GREEN CLOUD / SUSTAINABLE TECH:

Green cloud computing (or **sustainable technology**) means designing and using digital systems in a way that reduces environmental impact — mainly by saving energy, cutting carbon emissions, and using eco-friendly resources.

Main goal of Green Cloud:

- Lower CO₂ emissions
- Reduce electricity usage
- Use resources efficiently
- Eco-friendly IT infrastructure