UNIT III

Cloud Services and File System:

Cloud Computing services are changing the way information technology is being used by public institutions and private organizations. Today, there are a **variety of cloud computing services** to fulfil almost any IT requirement. Organizations typically pay only for the cloud service they use, helping them reduce operating costs and run infrastructure more efficiently.

With every organization today entering the cloud world, it is essential to understand the different types of services cloud computing offers. Although there are many types of cloud computing services, all these services have a few basic features and advantages in common and can be categorized into four basic cloud service offerings. Organizations can fly their business, small or big, to the cloud with these four different types of cloud computing services

1. Infrastructure as a Service (IaaS)

The lower end of managed cloud computing services where hardware resources are provided by an external provider and managed for you. IaaS provides users access to computing resources such as networking, processing power and data storage capacity.

IaaS helps users to use computing power or virtual machines without labor-intensive hardware investments or server management. Physically, the hardware resources are pulled from a variety of networks and servers distributed across different data centers, all of which are managed and maintained by the cloud service provider.

For example, say a user wants a Linux system, with IaaS he will get access to it without having to worry about the networking of the machine on which Linux is installed or the physical system.

IaaS is beneficial for customers who want to create cost-effective and highly scalable IT solutions where the expenses and complexities involved in managing hardware resources are outsourced to a service provider. Most of the IaaS packages include servers, networking, storage, and virtualization components while the users are responsible for installing and maintaining databases, OS, applications, and security components.

Examples of IaaS Cloud Computing Services:

Amazon EC2, Windows Azure, Rackspace, Google Compute Engine.

Features and Benefits of IaaS Cloud Computing Service

- A typical infrastructure as a service offering saves both time and money as the underlying hardware set up and support is provided by the service provider.
- Resources are available on demand as and when required so there is no wastage of any unused resources and no delays on adding any resources.
- Utility-based pricing model i.e. pay only for the resources you actually use.

2. Platform as a Service (PaaS)

This cloud computing service is an advanced version of IaaS. Apart from just providing the IT infrastructure, PaaS also provides the computing platform and solution stack as a service. PaaS is a cloud computing service that provides developers with a framework that can be used for building custom applications. Platform as a Service lets software developers build custom applications online without having to worry about data storage, data serving, and management.

A typical Platform as a Service offering consists of –

- Hosting Solutions
- OS
- Software tools for design and development.
- Environment for server-side scripting
- DBMS
- Network Access
- Storage
- Server Software
- Support

Examples of PaaS Cloud Computing Services:

Microsoft Azure, AWS Elastic Beanstalk, Force.com. by Salesforce, Google App Engine, Rackspace Cloud Sites, OpenShift, and Apache Stratos

Features and Benefits of PaaS Cloud Computing Service

- PaaS makes software development easy even for non-experts as anybody can develop an application through the web browser with just a single click functionality.
- There is no need for the users to upgrade or update the infrastructure as the PaaS service provider handles all the update patches, upgrades, and regular software maintenance.
- PaaS provides location independence as developers in different locations can work together on the same application build.
- There is no need to invest in physical infrastructure or in expertise required to manage it, an example of this would be SAP. The ability to rent virtual IT infrastructure brings in great cost benefits for the users.

3. Software as a Service (SaaS)

A special cloud computing service that incorporates both IaaS and PaaS service offerings. SaaS is a cloud computing service that provides application-level services tailored to diverse business needs such as **business analytics**, CRM, or marketing automation. SaaS is a cloud computing service offering that provides web-based software applications to customers on-demand. SaaS providers host a fully-functional application through a browser-based interface and make it accessible to the users through the Internet.

SaaS offerings allows the cloud to be leveraged for software architecture thereby reducing the overhead of support, maintenance, and operations as the applications run on systems belonging to the vendor. SaaS is the most familiar cloud computing service offering as users most often interact directly with SaaS applications like Netflix, Gmail, JIRA, Dropbox, or Salesforce.

SaaS is a subscription-based offering where users subscribe to software on a monthly basis instead if purchasing it so there are no upfront costs involved. It also provides a provision to the users to end the subscription when it is no longer needed.

Examples of SaaS Cloud Computing Services:

SAP Business ByDesign, Zoho CRM, AppDynamics, Microsoft Office 365, Pardot Marketing Automation.

Features and Benefits of SaaS Cloud Computing Service

- There is no initial setup cost as the users can make use of the application as soon as they subscribe. There is no hardware cost as well because the processing power is supplied by the service provider.
- Flexible payments as the users pay for the services on a pay-as-you-go model.
- Any updates to the software are automatic and free of charge.
- SaaS provides cross-device compatibility because SaaS applications can be accessed through any internet enabled devices, such as laptop, smartphone, or desktop.
- Enterprises need not engage an IT expert to download the software on multiple systems in the office nor have to worry about the keeping the software up-to-date on every PC.

Database-as-a-Service (DBaaS)

Database-as-a-Service (DBaaS) is a cloud computing service that allows companies to use a database without setting up physical hardware. Users also do not need to install software or hire staff members to maintain the underlying technologies.

DBaaS simplifies database management with one-click operations, eliminates time-consuming tasks, and grants the agility for faster software development.

Database-as-a-Service Features

In a traditional setup, the database server is a part of the on-premises computing infrastructure. The local staff is responsible for installing, managing, protecting, and scaling the database.

In contrast, DBaaS is a subscription service in which the provider manages the hardware and delivers the database as a private cloud service. The service provider handles the high-level database administrative (DBA) tasks, including:

- Initial installation.
- Configuration management.
- Database maintenance.
- Performance management.
- Backups.
- Patches and upgrades.
- Disaster recovery.
- Cloud monitoring (both for the database and the underlying infrastructure).
- Maintaining high availability.

The DBaaS customer's only responsibilities are using the database and controlling its content. However, if the company desires more control over the database, the DBaaS provider can enable more user involvement.

Another common name for DBaaS is the **managed database service**. This type of cloud service covers both relational and non-relational databases.

DBaaS removes the need to hire and train a team to manage the database. Instead, one staff member controls the database instances via an API and a management dashboard. The dashboard allows one-click operations that simplify complex processes such as provisioning and specification.

Once the console receives instructions from the user, the DBaaS platform provisions the database and returns a query-able endpoint. The user can use this code directly in the application.

Monitoring as a Service (MaaS)?

Monitoring as a Service (MaaS) provides you with the security solutions that are essential for the organizations that are reliant on the IT infrastructure. However, for effective and efficient monitoring, the organization must have up to date technology, experts knowing advanced technical skills, scalable security processes and all this come with a tremendous expense.

Prior to the advent of electronic gadgets that are used for providing security services, the human resource was used to perform all these monitoring activities but it was ineffective.

MaaS provides an effective solution to this problem. It provides 24/7 real-time monitoring, reports any issue across the security infrastructure and secures the crucial data of their customers.

If compared to the traditional security operations centre MaaS exceed in two important things:

1. The total cost of ownership was higher in the traditional security operations centre.
2. Traditional security operations are less effective.

Features of MaaS

1. Protection Against External and Internal Threats
The security monitoring services analyze the alerts from security devices 24/7 in real-time. The security analyst collects data from various security devices to recognize the threats and thereby imply effective measures to respond to these threats.

- **Early Detection**
  The information security team detects and discloses the security threats as soon after they appear. The threats are reported to the customer via emails.
  This reports describes the vulnerabilities in the security of the system and also describes its effect on the systems or application. The report may also include the protective measures that you can take for these vulnerabilities.

- **Dashboard Interface**
  The dashboard interface is implemented as a platform, control and service monitoring. This conceptualizes your system and its resource at one place and eases the information security team to monitor the operation status of the platform being monitor. The information security team try to find the reason of vulnerability by navigating back in time and visualize how the system was performing before the problem occurred and how it is performing after the problem has occurred.
  As the root cause of the vulnerability is understood the preventive measure are suggested to resolve the issue.

- **Log Centralization and Analysis**
  It is a monitoring solution which involves the correlation of log entries and matching of the log entries. Analyzing this correlation and matching of log entries set a benchmark for the operational performance and provide an index of the security threats.
  An alarm is raised if an incident moves above the benchmark parameters. This alarm or warning is analyzed by security experts responsible for the quick response for such threat incidents.

- **Vulnerabilities Detection and Management**
  This service provides periodic automated testing which exposes the threat to information system over the internet.
  The service identifies threats such as unauthorized access to the administrative services, the services that have not been updated for a long.

- **Continuous System Patching/Upgrade and Fortification**
  The level of security is enhanced with the continuous system patching. System patching is nothing but enhancing the computer program to fix the vulnerabilities and bugs in the computer program.
  System patching is very important as it not only raises the security level of your system but also supports the newer version of the application and software installed on your system.

- **Intervention, Forensics, and Help Desk Services**
  We all are familiar with the help desk that provides you with quick assistance to your problems. Similarly, the MaaS vendor has a team of experts with ample of knowledge that intervenes whenever any threat is detected. They provide 24/7 assistance to support and maintain the applications and infrastructure.

  Whenever a threat is detected it requires the forensic analysis to check out how much time cost and effort it will require to fix it.

2. Delivering Business Values
Most of the customer consider build-vs-buy decision is better if compared to calculating return on investment (ROI).
But when calculated it is observed that cost of building a security monitoring infrastructure along with the security monitoring team is more as compared to the outsourcing a MaaS service provider.

3. Real-Time Log Monitoring Enables Compliance
Log monitoring is a process of recording log messages into a file which helps the developers or administrator to understand how the system or application is being used. Real-time log monitoring helps in quick detection of errors, failed process and services.

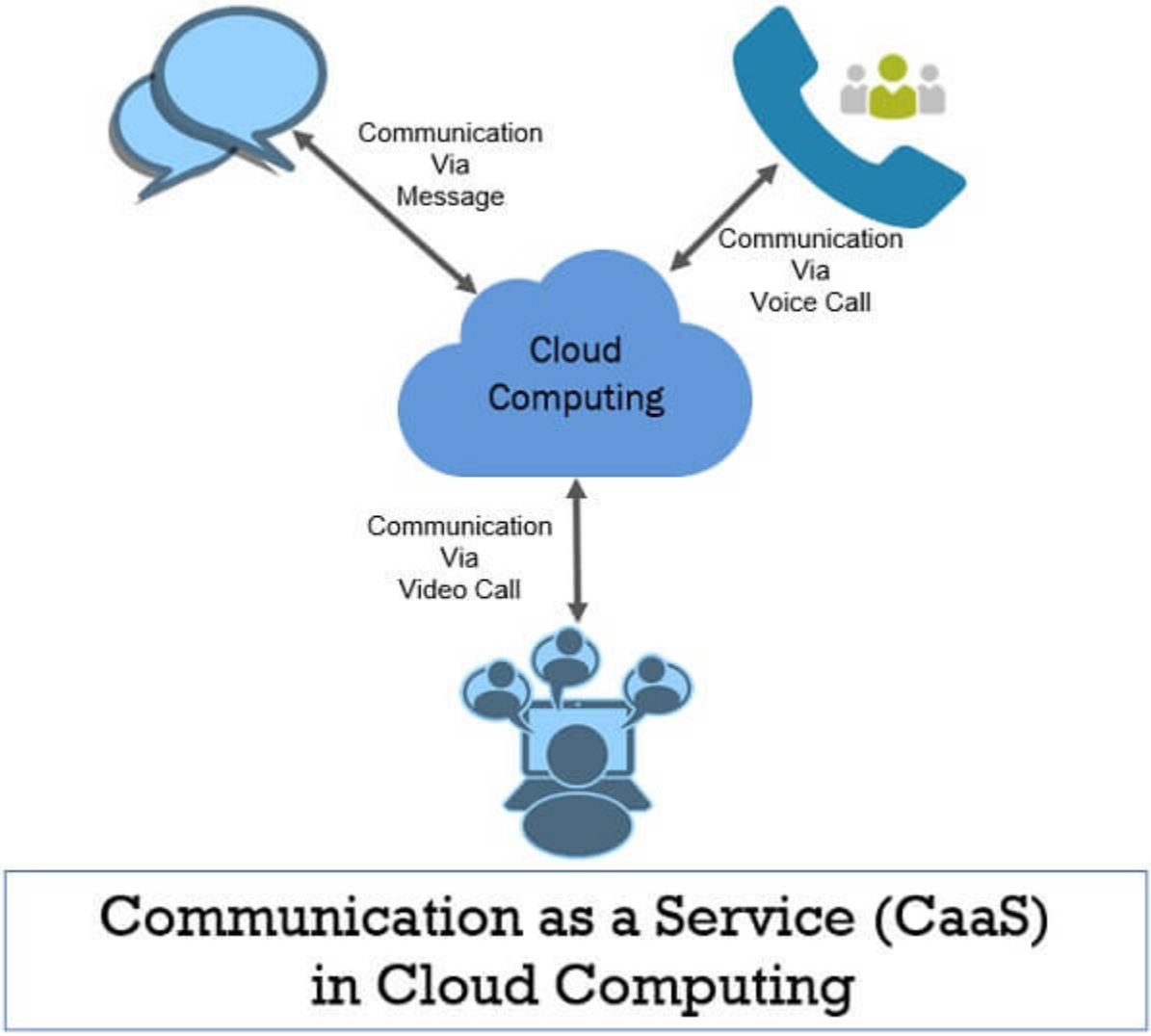
It also provides alerts for network and protocol failures. It warns the developers of infrastructure problems. MaaS provides automation for this time-consuming process.

Advantages of MaaS

1. MaaS provide a ready to use a monitoring tool to its customer at a very minimal price.
2. MaaS leverage the customer to focus on their business instead of worrying about the information security of their enterprise.
3. MaaS provides 24/7 assistance to its customers, who can report the issues and get immediate assistance from the MaaS team.

Communication as a Service (CaaS)?

Communication as a service (CaaS) is a cloud-based solution provided by cloud vendors. CaaS is a specialized variation of **Software as a Service (SaaS)** which is among three basic services delivered by the cloud computing technology. When we talk about communication, recall, in how many ways we can communicate with others. Well, we can communicate via text message, voice call and video call.



CaaS providers manage the **hardware** and **software** that are important for delivering Voice over IP (VoIP) for voice communication service, and other services like Instant Messaging (IM) to provide text communication service and video conferencing to provide video communication service.

CaaS model provides economical services as the service users do not have to bear the expenditure of buying and managing the communication equipment. CaaS is favourable for small IT companies that on the verge of expansion. Let us discuss the features of CaaS.

Features of CaaS

1. Integrated and Unified Communication

The advanced unified communication features include Chat, Multimedia conferencing, Microsoft Outlook integration, Real-time presence, "Soft" phones (software-based telephones), Video calls, Unified messaging and mobility.

Nowadays, CaaS vendor introduces new features to their CaaS services much faster than ever before. It has become economical for providers to introduce a new feature to their CaaS application faster because the end-users are benefitting from the provider's scalable platform infrastructure and ultimately the many end-users using the provider's service shares this cost of enhancement.

2. No Investment Required

As we have learnt above it is the sole responsibility of CaaS vendor to manage hardware and software deployed to provide the communication service to their customers. The customer only has to pay for the service he is getting from the CaaS vendor, not for communication features deployed to provide communication services.

3. Flexibility & Scalability

The customer can outsource the communication services form CaaS vendors. The customers pay for what they have demanded. The customer can extend their service requirement according to their need. This brings flexibility and scalability in communication services and even make the service economical.

4. No Risk of Obsolescence

The CaaS vendors keep on updating their hardware and software that provide communication services to meet the changing demands of the market. So the customer using the services does not have to be worried about the service obsolescence.

5. No Maintenance Cost Incurred

The customer outsourcing the CaaS service does not have to bear the cost of maintaining the equipment deployed for providing communication services.

6. Ensure Business Continuity

If due to any calamity your business's geographical region is affected then how long can you continue your business? That's why nowadays companies distribute their data to the geographically dispersed data centre which maintain the redundancy & help them in recovering soon after any catastrophic event.

The same feature is adopted and implemented by the CaaS providers in order to provide voice continuity or communication continuity even if any catastrophic event strikes.

Service providers-

Google App Engine,

Amazon EC2,

Microsoft Azure,

Sales force,

Clarizen