THADOMAL SHAHANI TSEC ENGINEERING COLLEGE

EXPERIMENT NO. 1

Aim :- Introduction and Overwiew of Cloud Computing.

Theory :-

Definition of Cloud Computing :-

Cloud computing refers to the delivery of applications and services over a distributed network using virtualized resources. It operates through common internet protocols and networking standards, with the key feature being the abstraction of physical system details from users. Two primary cloud types based on deployment and service models are distinguished. Deployment models include public, private, community, and hybrid clouds, while service models comprise software as a service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS).

Characteristics of Cloud Computing :-

1. Scalability : Cloud Computing caters to specific needs of the customer. Its inherent scalability allows you to effortlessly adjust resources like shortage and processing power based on your fluctuating demands. No more overspending on underutilized infrastructure or scrambling for resources during the peak periods.

2. Resource Pooling : The Cloud Computing operates on a shared resource model, where multiple users tap into a vast pool of infrastructure. This translates to significant cost savings for you, eliminating the need for upfront investments in hardware, software and also maintenance. You only pay for what you use, making it a highly-budget friendly solution.

3. Virtualization : Cloud Computing providers use virtualization technology to abstract the underlying hardware resources and provide them as logical resources to users.

4. Security Measures : Cloud service providers store encrypted data of users and provide additional security features such as user authentication and security against breaches and other potential threats.

NIST Cloud Computing Model :

Cloud Computing, as defined by the National Institute of Standards and Technology (NIST), is a paradigm that facilitates ubiquitous and convenient, and on-demand network access to a shared pool of configurable computing resources.

Different models of Cloud Computing service models

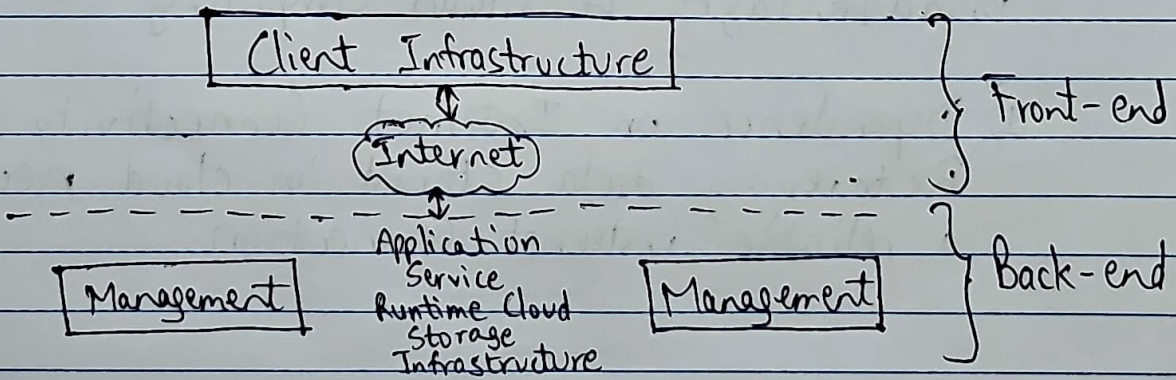
IaaS - IaaS provides virtualized computing resources over the internet.
PaaS - PaaS offers platform for developing and deployment of applications.
SaaS - SaaS delivers software applications online, accessible through a web browser.

Explanation of architecture of cloud computing with suitable diagram:-

Cloud computing is a transformative paradigm allowing organizations to store and access information globally through the internet.

Key - components :-

1) Front End : The client-side interface of the cloud computing system.
2) Back End : The cloud infrastructure managed by the service provider.



Benefits and limitations of Cloud Computing :-

Advantages of Cloud Computing :-

1) Efficient Data Back-up and Restoration :
Cloud storage simplifies process of backing up and restoring data with help of services.
2) Enhanced Collaboration :
Cloud applications foster collaboration by enabling groups to share information seamlessly through shared storage.
3) Global Accessibility :
Cloud computing provides swift access to stored info world wide.
4) Cost-Efficient Maintenance :
Organizations experience cost savings on hardware and software maintenance.
5) Robust Data Security Measures :
Advanced security features within cloud platforms ensure secure storage and handling of sensitive data.

Disadvantages of Cloud Computing :-

1) Dependence on Internet Connectivity :
Retrieving data stored in cloud necessitates a reliable internet connection.

2) Vendor Lock-In Challenges :
Transitioning services between different cloud vendors can be complex due to platform variations.

3) Limited User Control :
Cloud infrastructure is managed by providers, limiting user control over functionality and execution.

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Definition of Cloud Computing:

Cloud computing refers to the delivery of applications and services over a distributed network using virtualized resources. It operates through common Internet protocols and networking standards, with the key feature being the abstraction of physical system details from users. Two primary cloud types based on deployment and service models are distinguished. Deployment models include public, private, community, and hybrid clouds, while service models comprise Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS).

Characteristics of Cloud Computing:

1. Flexibility:

Imagine accessing your files and documents from anywhere, anytime, on any device. Cloud computing makes this a reality, shattering geographical barriers and fostering seamless collaboration across teams and continents. No more bulky storage devices or restricted access – your data is always a click away.

2. Scale on Demand:

Whether you are a budding startup or a seasoned enterprise, cloud computing caters to your unique needs. Its inherent scalability allows you to effortlessly adjust resources like storage and processing power based on your fluctuating demands. No more overspending on underutilized infrastructure or scrambling for resources during peak periods.

3. Resource pooling:

Cloud computing operates on a shared resource model, where multiple users tap into a vast pool of infrastructure. This translates to significant cost savings for you, eliminating the need for upfront investments in hardware, software, and maintenance. You only pay for what you use, making it a highly budget-friendly solution.

4. Extensive Network Reach:

One of the compelling aspects of cloud computing lies in its ability to transcend geographical boundaries. Operating on a global scale, cloud computing offers a wide-reaching network access accessible via the internet. Whether you are retrieving files from distant locations or uploading data, all

that is required is a reliable internet connection and a compatible device, providing unparalleled flexibility.

5. Self-service On-Demand:

Operating on a self-service paradigm, cloud computing empowers users to govern their services, from allocated storage to server uptime. Users become masters of their cloud environment, capable of monitoring and selecting the tools and resources they need instantly through the cloud portal. This autonomy not only facilitates informed decision-making but also instills a sense of responsibility for resource consumption. Cloud service providers don't dictate how users manage their services, instead, billing is purely based on their usage during the billing cycle.

6. Economical Solutions:

Cost-effectiveness is a hallmark of cloud computing. Users exercise control over their usage, managing costs efficiently. Cloud service providers typically don't impose upfront fees and often provide free initial storage. Billing is transparent and tied directly to resource usage. Beyond direct costs, cloud computing minimizes organizational expenses by alleviating concerns about hardware and software setup, data maintenance, and other indirect costs. For startups, cloud computing can prove financially prudent, eliminating the need for substantial investments in physical storage and software products, along with alleviating worries about power, maintenance, and repairs, all handled by the vendors.

7. Robust Security Measures:

Data security in cloud computing is a major concern among users. Cloud service providers store encrypted data of users and provide additional security features such as user authentication and security against breaches and other threats. Authentication refers to identifying and confirming the user as an authorized user. If the user is not authorized, the access is denied. Cloud

vendors provide several layers of abstraction to improve the security and speed of accessing data. A copy of data is often stored in a separate location to prevent data loss in case of a disaster (such as abrupt power loss, or server damage). Besides all these measures, data servers are secured physically as well. These servers are generally housed in an isolated location that is well guarded, preventing people from accessing or disrupting them. Creating a backup of data in the cloud is also easy. All these measures seem to have paid off as there are no reports of a cloud security breach to date.

8. Automation Advantages:

Automation is a key driver in cloud computing, enabling IT teams and developers to create, modify, and maintain cloud resources with minimal human interaction. The automated nature of cloud infrastructure, from configuration to maintenance and monitoring, significantly contributes to the surge in demand and rapid expansion of cloud services.

9. Simplified Maintenance:

Maintenance of cloud infrastructure is a streamlined and automated process, often requiring minimal additional costs. Continuous upgrades in cloud infrastructure and software contribute to the ease and cost-effectiveness of maintenance, enhancing overall efficiency.

10. Measured services:

Cloud services follow a pay-as-you-go subscription model, where users are billed based on the resources they consume. Service providers monitor and analyse the usage of resources like storage, bandwidth, processing power, and more, providing a transparent and economically efficient approach for both users and providers.

11. Resilience and Disaster Recovery:

Resilience in cloud computing refers to its ability to recover from interruptions. Cloud service providers invest in robust disaster management strategies, utilizing backup nodes to manage loads in case of server failures. Advanced backup and recovery methods ensure data remains secure, making cloud services resilient against unforeseen circumstances.

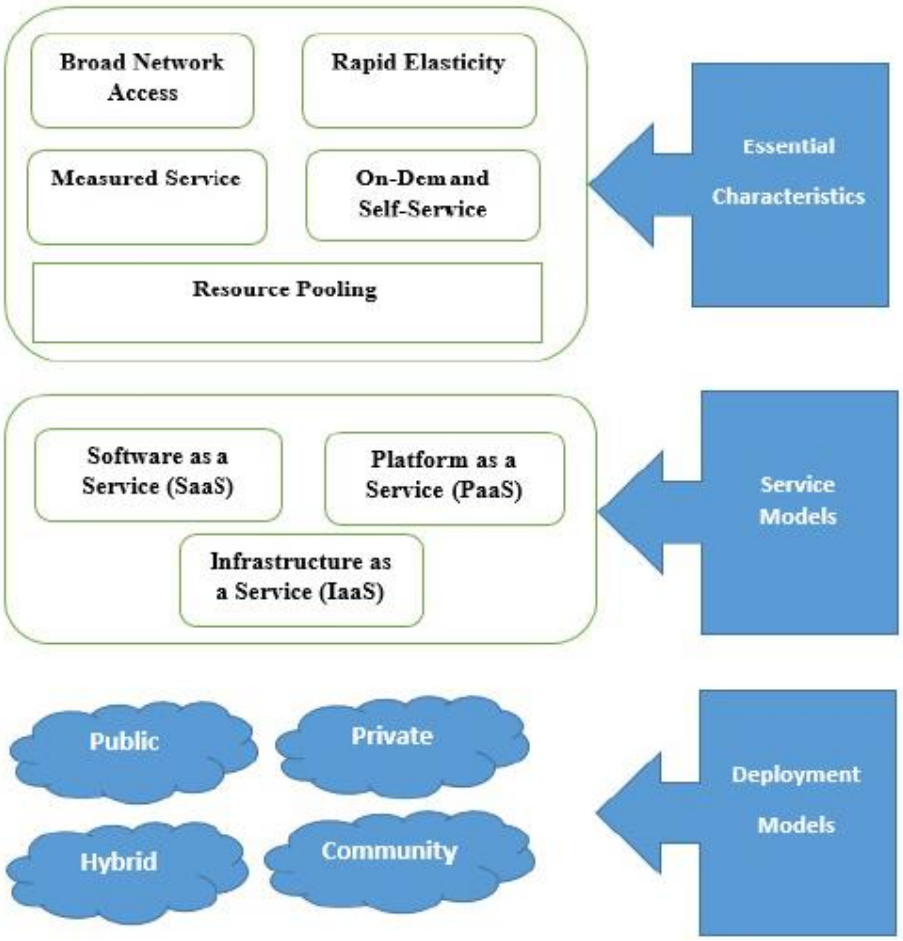
NIST cloud computing model

Cloud computing, as defined by the **National Institute of Standards and Technology (NIST)**, is a paradigm that facilitates ubiquitous, convenient, and on-demand network access to a shared pool of configurable computing resources. These resources encompass networks, servers, storage, applications, and services. The key elements highlighted in NIST's definition include:

1. **Essential Characteristics:**
    - *On-Demand Self-Service:* Users can independently provision and manage resources without requiring human intervention.
    - *Broad Network Access:* Resources are available over the network through standard mechanisms.
    - *Resource Pooling:* Resources are dynamically allocated and shared among multiple users.
    - *Rapid Elasticity:* Resources can be swiftly scaled up or down based on demand.
    - *Measured Service:* Usage is continually monitored, controlled, and transparently billed.
2. **Service Models:**
    - *Software as a Service (SaaS):* Delivery of applications over the network (e.g., email, collaboration tools).
    - *Platform as a Service (PaaS):* Platforms provided for developing, deploying, and managing applications.

- *Infrastructure as a Service (IaaS):* Virtualized computing resources encompassing servers, storage, and networking.

3. **Deployment Models:**
    - *Public Cloud:* Services accessible to the general public through platforms like AWS and Azure.
    - *Private Cloud:* Dedicated to a single organization's exclusive use.
    - *Community Cloud:* Shared by multiple organizations with common interests.
    - *Hybrid Cloud:* A combination of both public and private cloud infrastructures.



Different models of cloud computing(Service and deployment)

Delving into various models of cloud computing, exploring both service and deployment perspectives:

1. **Service Models**:
    - **Infrastructure as a Service (IaaS):**

      IaaS furnishes virtualized computing resources via the internet. Users can lease servers, storage, and networking components, akin to managing a virtual data center where they oversee the operating system, applications, and data.

    - **Platform as a Service (PaaS):**

      PaaS provides a platform for the development, deployment, and management of applications. Developers can concentrate on coding without grappling with infrastructure concerns. It encompasses tools, libraries, and services to facilitate the building and deployment of applications.

    - **Software as a Service (SaaS):**

      SaaS delivers software applications online, accessible through a web browser. Users can access these applications without the need for local installation or maintenance. Examples include email services, collaboration tools, and CRM software.

    - **Serverless Computing:**

      This model abstracts server management completely. Developers write code in functions that execute in response to events (e.g., HTTP requests). Scaling, execution, and billing are handled by the cloud provider.

2. **Deployment Models**:
    - **Public Cloud:**

      Public clouds offer internet-based resources (compute, storage, network) to anyone in need. Operated by cloud service providers like

AWS and Azure, public clouds are known for cost-effectiveness, scalability, and accessibility from anywhere.

- **Private Cloud:**

  Private clouds are constructed, managed, and utilized by a single organization. Typically located on-premises, they provide enhanced control over security and customization. Private clouds are suitable for handling sensitive data or meeting specific compliance requirements.

- **Hybrid Cloud:**

  Hybrid clouds integrate both public and private cloud infrastructures. Organizations leverage both types, facilitating seamless movement of data and applications between them. This setup offers flexibility, scalability, and cost optimization capabilities.

- **Community Cloud:**

  Community clouds are shared among multiple organizations with shared interests, such as research institutions or government agencies. Collaboration on infrastructure and resource-sharing occurs while maintaining privacy and security protocols.

Explanation of architecture of cloud computing with suitable diagram:

Architecture of cloud computing: Cloud computing is a transformative paradigm allowing organizations to store and access information globally through the internet. Below is a breakdown of its key components:

- **Front End:**

  The client-side interface of the cloud computing system.

  Encompasses user interfaces and applications facilitating access to cloud services.

  Components:

Web Browsers: Examples include Chrome, Firefox, and Internet Explorer.

Thin & Fat Clients: Devices like tablets and mobile phones.

- **Back End:**

  The cloud infrastructure managed by the service provider.

  Houses resources essential for delivering cloud services.

  Components:

  Application: Software or platforms accessible to clients.

  Service: Manages SaaS, PaaS, and IaaS offerings.

  Runtime Cloud: Provides execution and runtime environments for virtual machines.

  Storage: Offers scalable storage capacity for data.

  Infrastructure: Includes servers, virtualization software, and network devices.

  Security Mechanisms: Ensures data protection.

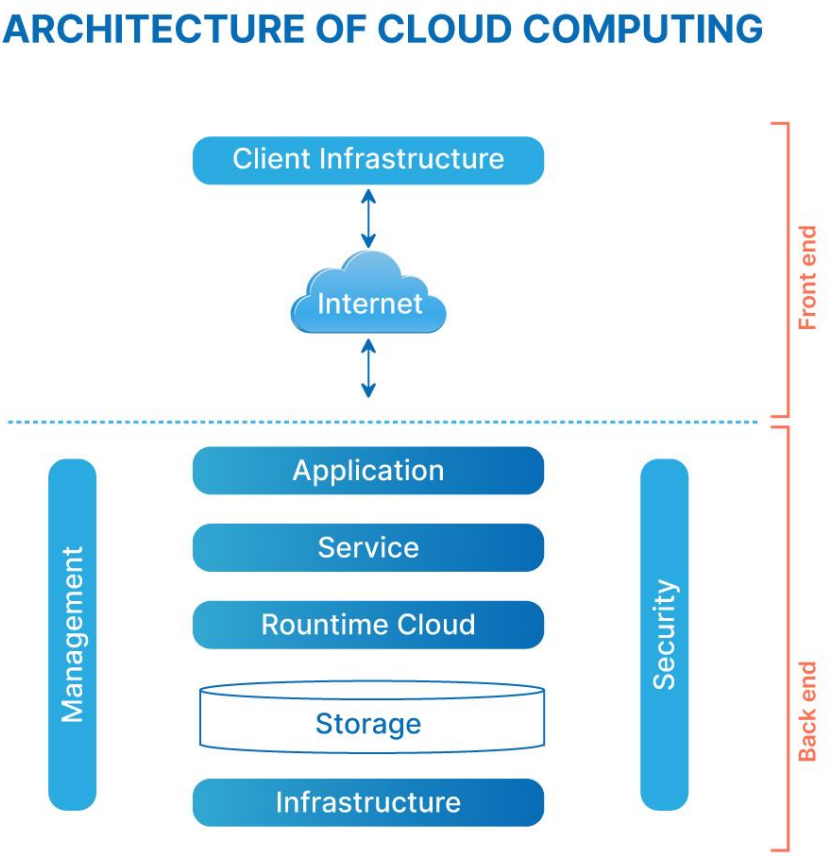
- **Cloud Services:**

  Cloud computing provides three primary service types:

  Software as a Service (SaaS): Applications run directly through web browsers (e.g., Google Apps, Salesforce, Dropbox).

  Platform as a Service (PaaS): Offers a platform for software creation (e.g., Windows Azure, Force.com).

  Infrastructure as a Service (IaaS): Manages applications, data, and runtime environments (e.g., AWS, Google Compute Engine).



Benefits and limitations of cloud computing?

Advantages of Cloud Computing:

1. **Efficient Data Back-up and Restoration:**
   - Cloud storage simplifies the process of backing up and restoring data with the help of cloud services.
2. **Enhanced Collaboration:**
   - Cloud applications foster collaboration by enabling groups to share information seamlessly through shared storage.
3. **Global Accessibility:**
   - Cloud computing provides swift access to stored information worldwide, accessible through an internet connection.
4. **Cost-Efficient Maintenance:**

- Organizations experience cost savings on hardware and software maintenance when leveraging cloud services.

5. **Mobility Benefits:**
    - Cloud facilitates easy data access through various mobile devices, enhancing user mobility.
6. **Pay-per-Use Model:**
    - Cloud services offer APIs for accessing services, and users are billed based on their actual usage.
7. **Vast Storage Capacity:**
    - Cloud platforms offer extensive storage capacity for a variety of data types, including documents, images, audio, and video.
8. **Robust Data Security Measures:**
    - Advanced security features within cloud platforms ensure secure storage and handling of sensitive data.

Disadvantages of Cloud Computing:

1. **Dependence on Internet Connectivity:**
    - Retrieving data stored in the cloud necessitates a reliable internet connection.
2. **Vendor Lock-In Challenges:**
    - Transitioning services between different cloud vendors can be complex due to platform variations.
3. **Limited User Control:**
    - Cloud infrastructure is primarily managed by service providers, limiting user control over functionality and execution.
4. **Security Apprehensions:**
    - Despite adherence to security standards by cloud providers, organizations must entrust third parties with the handling of sensitive data.

It is important to acknowledge that while cloud computing brings scalability, cost-effectiveness, and flexibility, organizations must carefully consider both its advantages and limitations when embracing cloud services.