Module 3

Cloud Services and Management

Introduction to Service

- In Cloud computing, the phrase services' refers to the idea of being able to utilize reusable components across a provider's network.

- This is commonly known as 'as a Service'.

- The suffix 'as a Service' includes the following characteristics:

1. The entry is a little difficult, making them accessible to small industries.

2. Scalability is large.

3. Multitenancy, which allows sharing of resources by many users.

4. Device independence, which allows client to access the system on diverse hardware.

Introduction to Service

Main Features of Cloud Services

1. Developing the applications which have the ability to manage several clients.

2. Accessing, maintaining and managing the commercial software.

3. Coordinating the updating feature of the software which avoids the need of downloading the upgrades

4. Coordinating the activities regarding management of software in the web environment.

Advantages of Cloud Services

1. Helps in saving time regarding deployment and maintenance.

2. Helps in developing scalable and robust applications.

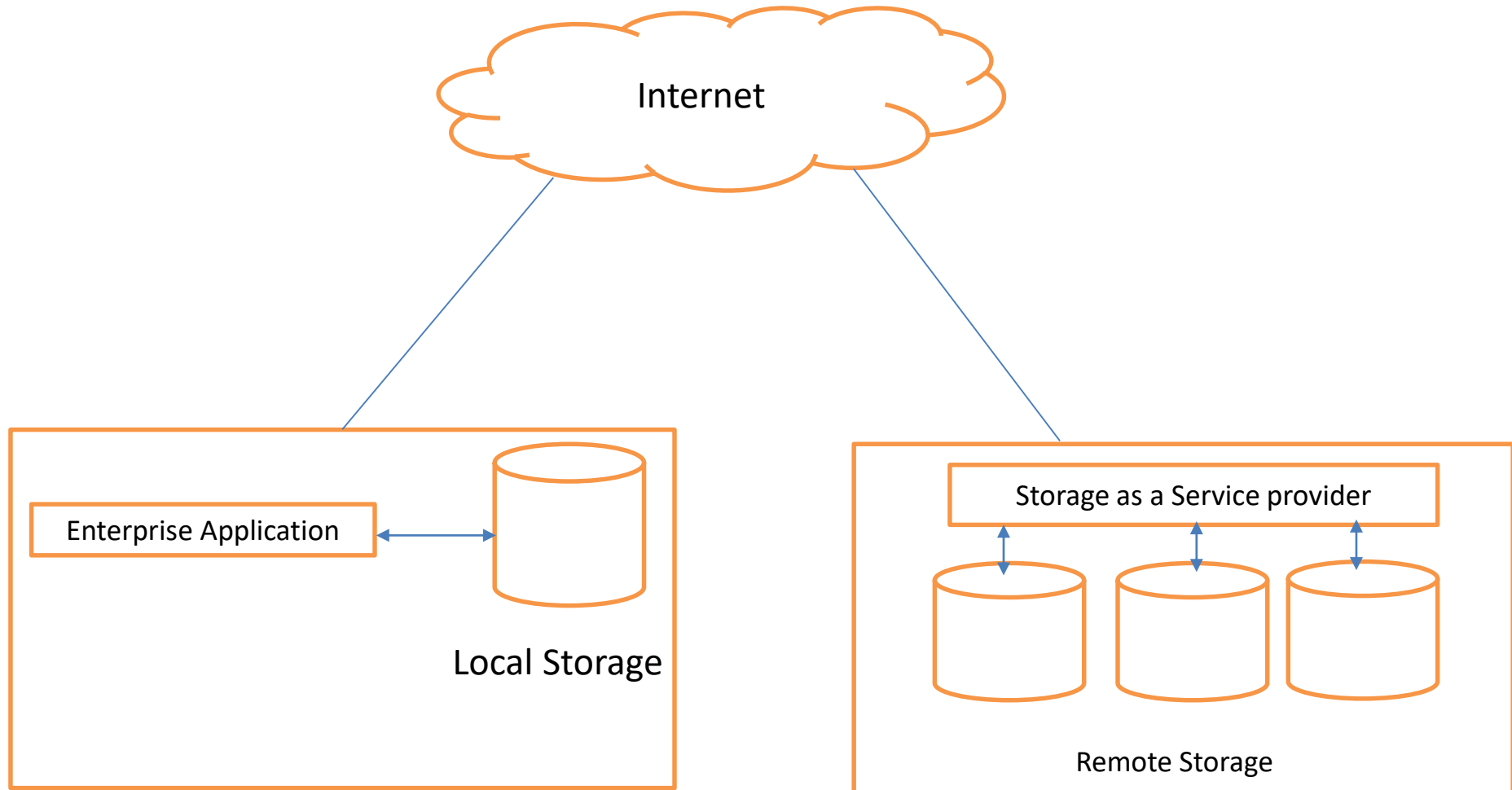3. Helps with the investment issues in the corporate sector, which leads to cost saving

STORAGE AS A SERVICE

- Storage as a Service is simply called STaaS.

- Storage as a Service defines a business model where a large company will rent space on their storage infrastructure to a small company or an individual who lack the budget to compensate for it on their own.

- There exist hundreds of several Cloud storage systems which help in storing e-mail messages, digital pictures, all forms of digital data, etc.

- It is a best alternative option for small and middle level business when they do not have sufficient knowledge to implement and maintain the storage infrastructure, or when technical persons are not available.

- The storage service became popular by providing disaster recovery needs, the complexity of current backup, and replication.

- The main advantage of STaaS in an enterprise in cost savings.

- The storage is rented by the provider using either a cost-per-data-transferred or cost-per-gigabyte-stored model.

STORAGE AS A SERVICE

- The users need not compensate for infrastructure; they just pay for how much data they transferred and saved on the server of the provider.

- With the help of client software the client specifies the backup set and then transfers the data across a Wide Area Network (WAN).

- If there is any loss of data, the client can get the lost data from the provider of the service.

- For example, web e-mail providers such as yahoo, Gmail and Hotmail; sites like Flickr, Picasa, YouTube and Facebook.

STORAGE AS A SERVICE
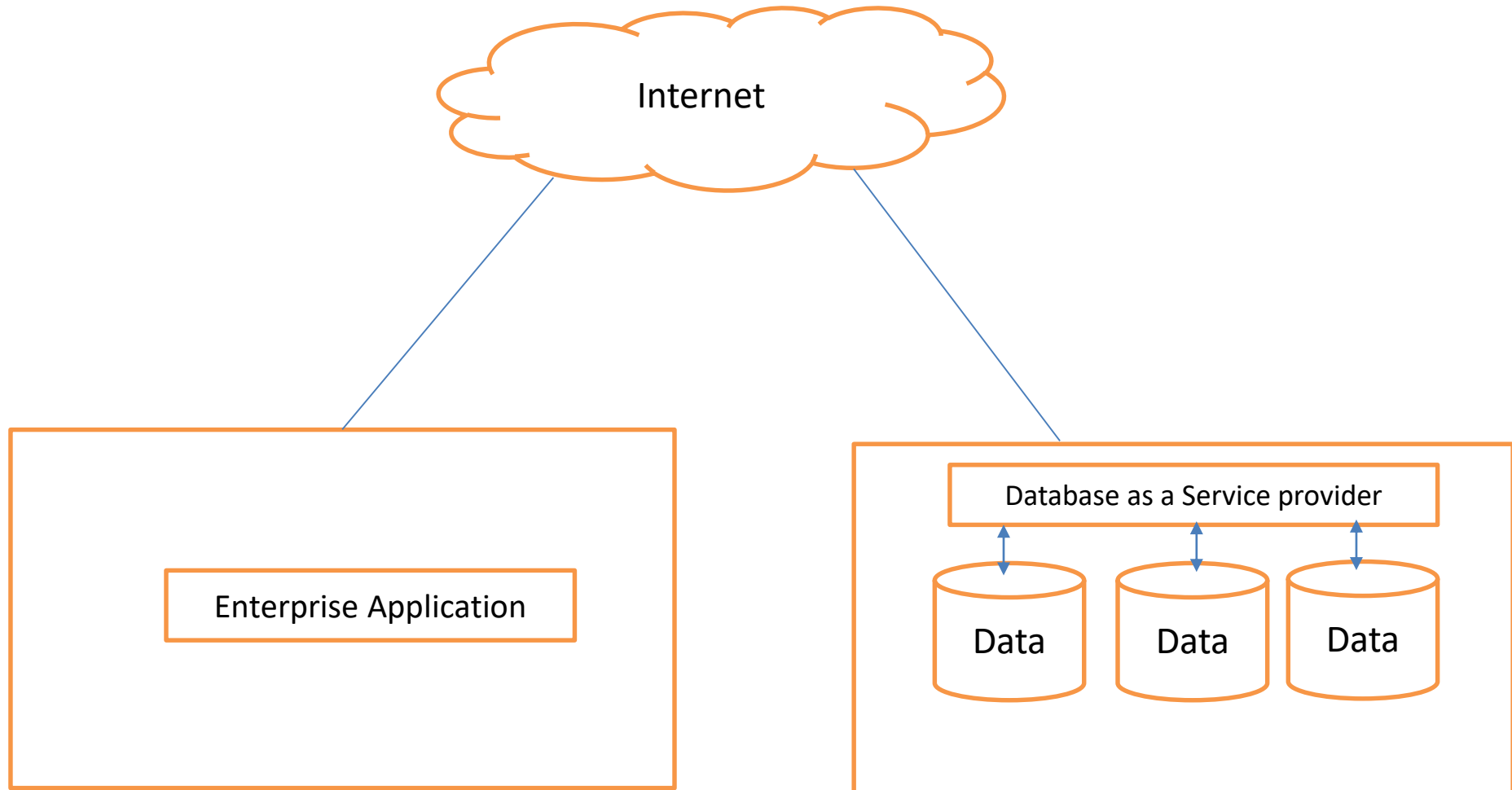
DATABASE AS A SERVICE

- Simply written as DaaS, Database as a Service is emerging and growing popular among Cloud providers.

- The thought behind DaaS is to avoid the cost and complexity of maintaining your own database.

- Databases are mainly used as the basis for many enterprise applications.

- As per the request of the user, the database is made accessible to users from the Cloud database provider's servers through internet.

- This is referred as DaaS.

- Cloud databases will use this Cloud computing technology to achieve multi-tenancy, optimized scaling, high availability, better service through centralized management, and effective allocation of resources.

- A Cloud database may be a traditional database such as SQL Server database or MySQL.

- For example, Amazon SimpleDB, Microsoft SSDS and Trackvia.

Advantages of DaaS

1. **Ease of use**: No need to be bothered about purchasing, installing, and maintaining the hardware for the database.

2. **Power**: To guarantee that the information is accurate the user can get custom data validation which depends on the vendor. The user can create the database, as well as maintain the database with no difficulty.

3. **Integration**: More power and value can be provided to the database by integrating other services of the user. For example, the user can bind it within e-mails, calendars, and people to make the user job more potent.

4. **Management**: Constant pruning and optimization are the advantages of large databases. To perform this task there are dedicated expensive resources. With the help of some of the DaaS offerings, this management can be made available as part of the service for less expense.
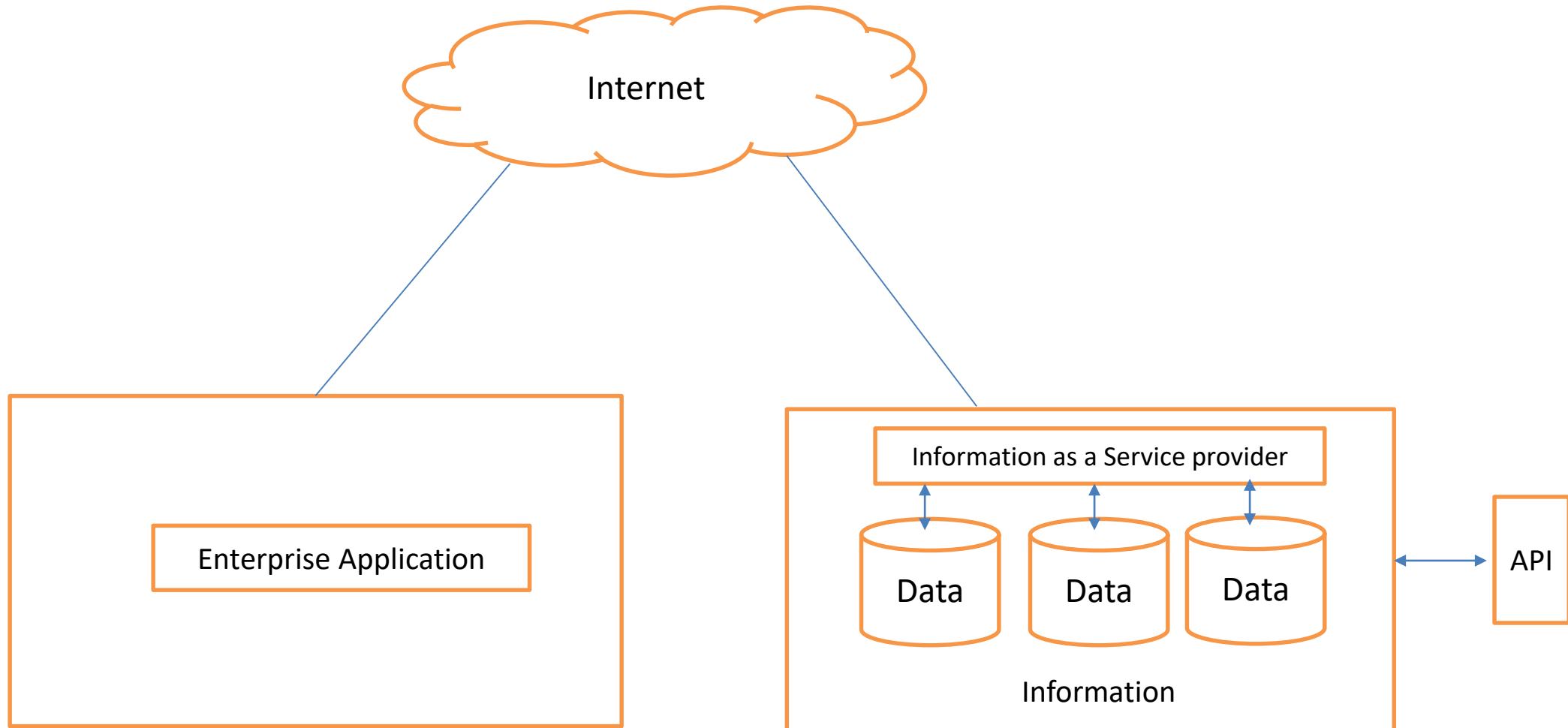
DATABASE AS A SERVICE

INFORMATION AS A SERVICE

- This service is simply called as IaaS.

- In this service information on demand by the users is made available to them from the Cloud through the internet at any time.

- Information as a Service refers to the facility to use any type of information which is hosted remotely.

- The storage and computer are accessed using well-defined Application Programming Interfaces (APIs) in Cloud computing.

- By using the APIs the available information can be easily accessed.

- In general, these providers offer stock price information, payment processing, address validation, data cleansing. or other services which validate the data.

- To perform validation service, the users link to the web service using URL and pass the required parameters, and as a response it passes the result back.

- The advantage of this kind of service is that the users need not to maintain the data by hand.

- The users need not relearn the interfaces as they move from API to API because the interfaces are standardized.

INFORMATION AS A SERVICE
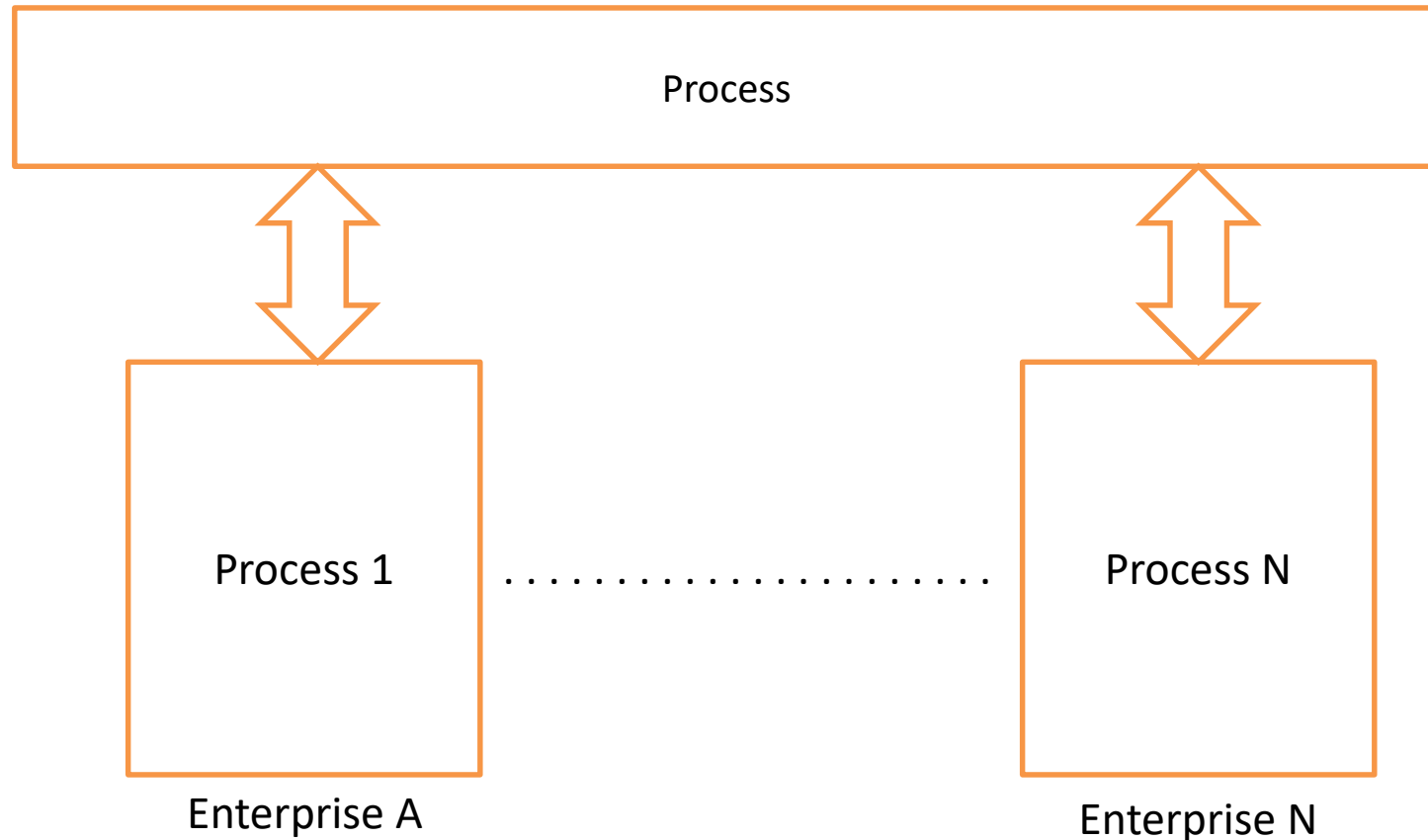
PROCESS AS A SERVICE

- Process as a Service is written as PraaS.

- The rapid growth of PraaS is increasing the popularity of Cloud computing for different sectors of organizations of all sizes.

- This is the area which has a direct focus on business managers within an organization.

- Thus, Praas has a great impact on all businesses which are using IT solutions, and also, it covers major business support processes.

- Process as a Service refers to a remote resource which can unite many resources collectively, hosted either remotely or in the same Cloud computing resource, to form a business process.

- For example, to create a business process which describes how to process an invoice on a remote Cloud system and then have that process invoke any number of Cloud-based services to form a business process.

PROCESS AS A SERVICE

- Process as a Service provides a mechanism to form a business solution by uniting the resources together.
- Though the user information and APIs are hosted within the Cloud provider, the user would leverage this service to bind the resources to form a business solution, such as the payroll system.
- Series of events that should occur in a certain order are considered as processes.
- For example, the process of 'Payroll System' includes:
1. Input information of employees;
2. Calculation of pays of the employee;
3. Output the employee record.
- All the steps above comprise services called by the process.
- The services themselves cannot be processes.
- Processes offer control instructions regarding how to do something by using several resources existing in the Cloud.
- When dealing with PraaS, processes can span a single or many enterprises.
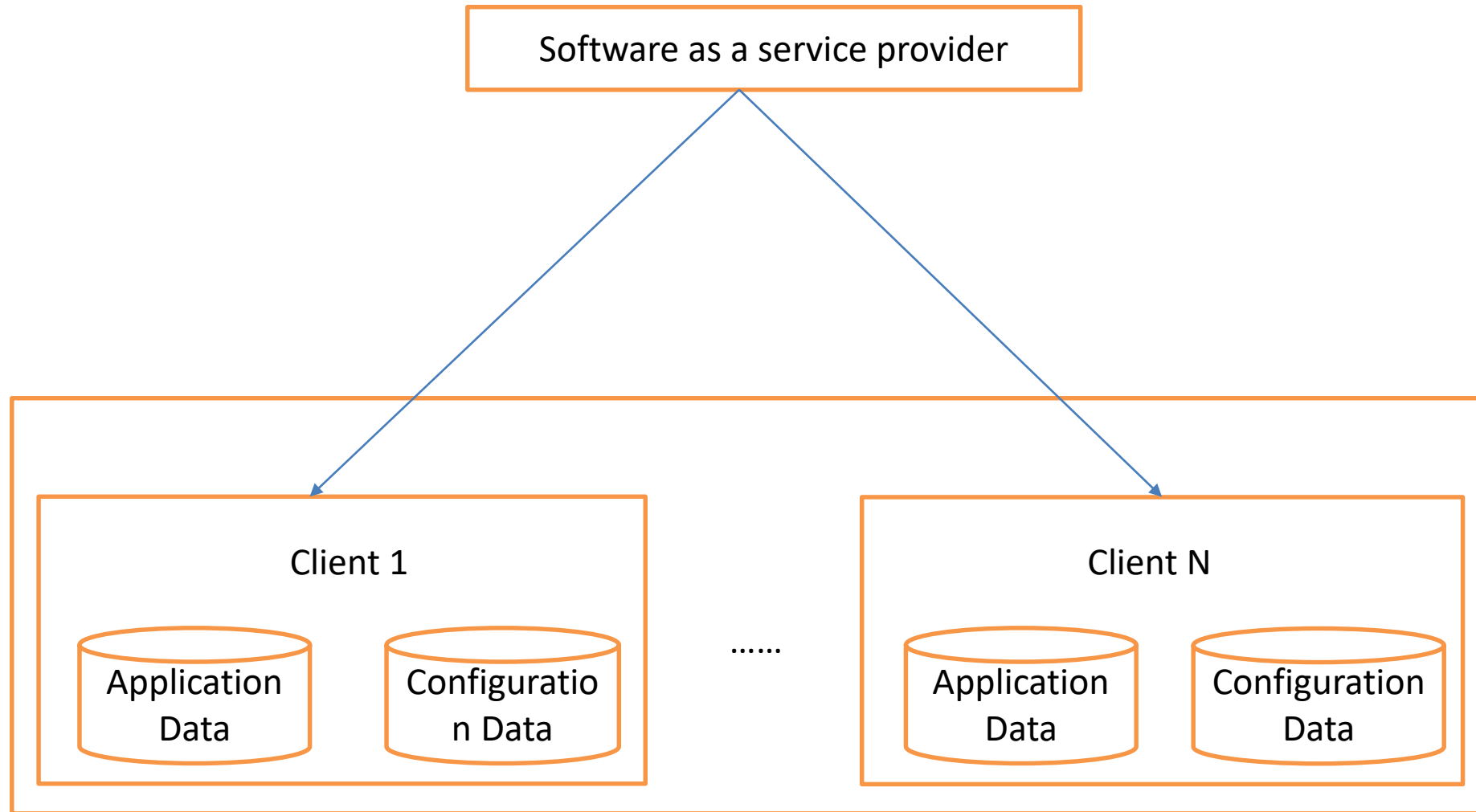
APPLICATION AS A SERVICE(SaaS)

- Application as a Service can also be called as (Software as a Service) which is simply written SaaS.

- In SaaS, customers rent software hosted by the vendor.

- This service is defined as a(software distribution mode) where the applications are hosted by a service provider or a vendor and made accessible to users over the internet.

- Software as a Service is similar to Application Service Provider (ASP) where a provider hosts available applications or software for the users (customers) and delivers those over the web.

- The merits of the model which includes this service are global accessibility, easy administration, compatibility, that is, all customers can use the same software version.

- With SaaS, tasks such as application or software deployment, maintenance, and keeping it working correctly from day to day, testing, managing patches, observing performance, etc., will be managed by the provider.

- In simple words, it can be understood as a provider hosts software or centrally located application, and can be made available for easy access to customers over the network, that is, internet on the basis of payment.

APPLICATION AS A SERVICE(SaaS)

APPLICATION AS A SERVICE(SaaS)

Characteristics of SaaS

- Managing software from a central location.
- There is no need for users to take care of software patches and upgrades, and Accessing commercial software through the web.
- APIs allow for integration between various pieces of software.

Advantages of SaaS

- The service model SaaS facilitates the enterprises by using an application of accurate version at all locations. So that the format of information being recorded and suggested is accurate, compatible, and consistent.
- Enterprises can reduce management and administration burdens by giving up the responsibility of the application to the provider of SaaS.
- Software as a Service also increases the accessibility of application to global localities.
- It also logs all the transactions of the applications for conformity purposes.

APPLICATION AS A SERVICE(SaaS)

Advantages of SaaS

Some of the advantages are

1. **Customization:** Older applications are complex to customize, whereas SaaS applications are easier to customize and give exactly what the organization want.

2. **Security:** The widely used and trusted layer is the Secure Sockets Layer (SSL). This layer permits the users to reach their applications safely without using complex back-end configurations.

3. **Web reliability:** Web is generally reliable.

4. **More bandwidth:** Increased bandwidth and quality of service perfections are assisting data flow. This will permit the enterprises to believe that they can access their applications with good speeds and low latencies.

5. Software as a Service is cheap since it enables organizations to access and use business

6. Software as a Service involves less maintenance of set-up, installation, and monitoring of software.

APPLICATION AS A SERVICE(SaaS)

Disadvantages of SaaS

1. Security is a major concern since the whole data will be in Cloud.

2. Switching between different SaaS vendors is a little bit challenging as it may involve a slow and difficult process of transferring very big data files through the internet.

3. Internet connection is mandatory.

4. Software as a Service model is not apt for the applications which demand response time in milliseconds.

Different Modes of SaaS

1. **Simple multi-tenancy:** Every user will have their own resources which are different from other users.

2. **Fine grain multi-tenancy:** It is more efficient than simple multi-tenancy. In this all resources get shared except customer related data and access capabilities.

APPLICATION AS A SERVICE(SaaS)

Obstacles

- Software as a Service also faces complications to its use and implement.
- The first is that an enterprise which has a particular computational need may not be able to locate the application obtainable through SaaS.
- Therefore, they might realize that they have to purchase the software and install it on their machines.
- There is an element called 'lock-in' with customers, that is, to use an application the customer pays to a provider, but once they complete installation, they are not able to port that application to a new customer.
- It is feasible to shift that application to a new customer, but the old customer may charge a heavy moving fee.
- Software as a Service also faces challenges from cheaper hardware and open source applications.

APPLICATION AS A SERVICE(SaaS)

Applications of SaaS

- Software which performs a task without much interaction with other systems make use of SaaS, and also the customers who have requirement of high-powered applications can benefit from SaaS.

- It became a general and suitable delivery model for several business applications, along with collaboration, Content Management (CM), accounting, Customer Relation Management (CRM), invoicing, Human Resource Management (HRM), Enterprise Resource Planning (ERP), service desk management, and Management Information Systems (MISS).

- Some of the services include:

1. Web applications such as blogs, social networks, web content management, and wiki services.

2. Enterprise services, such as desktop software, workflow management, supply chain, Customer Resource Management (CRM) and financial management.

APPLICATION AS A SERVICE(SaaS)

Driving Forces

1. **Software vendor's interest:** Earlier, many vendors had nothing to say about SaaS, but now many more vendors are evincing interest regarding SaaS. Even Oracle and SAP have reached the best position in SaaS developers. It is expected that more SaaS applications are to be made available in the future.

2. **Enterprises interest:** It is possible to deploy SaaS in two ways, that is, both internally and externally. The external use is especially to appease IT professionals, since it takes work off their shoulders. So they will get the capability to focus more on their related work, thereby hoping that any work would generate a competitive advantage in their marketplace instead of simply maintaining servers and responding whenever servers fail. This represents that IT professionals might be busy by developing their own SaaS applications that are to be used internally. If they can offload their work to the Cloud, it offers them the opportunity to focus mainly on creating their own complementary internal SaaS tools.

APPLICATION AS A SERVICE(SaaS)

Driving Forces

3. **Plenty of SaaS platforms:** Software as a Service platforms are growing each month. Since SaaS is becoming more popular, many more vendors are forced to make their platforms SaaS-friendly for those applications which are based on SaaS. Clients are very much interested to move towards SaaS platforms because they can reduce the monitoring of many servers.

4. **Total cost of ownership:** Among several number of driving forces, the primary driver is the total cost of ownership. The reason for quick diversion to new applications with lower initial cost of ownership makes SaaS an interesting offer for small and middle scale businesses, importantly expanding the market for software applications.
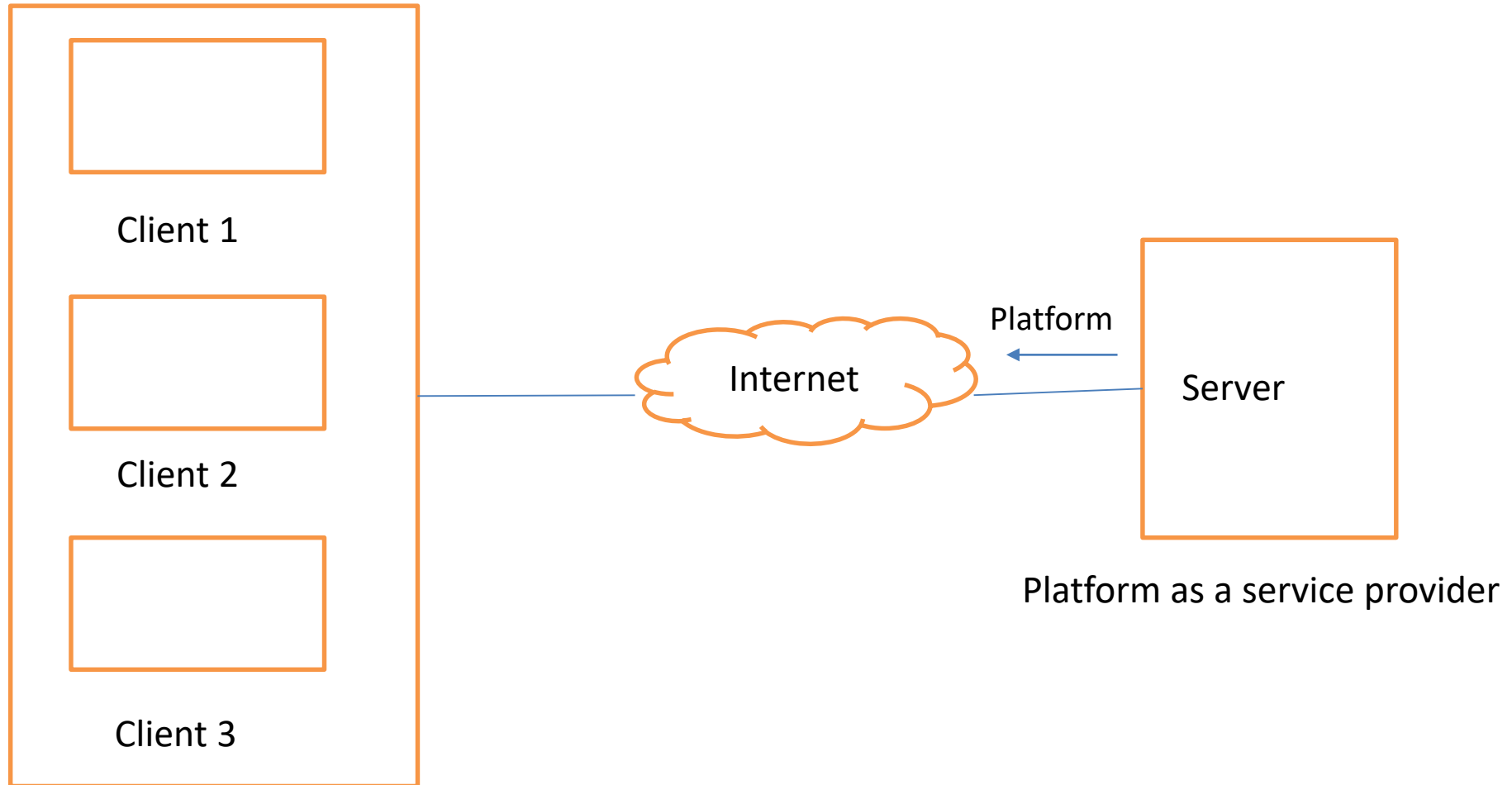
PLATFORM AS A SERVICE

- Platform as a Service, shortly called as PaaS, provides hardware, storage, Operating Systems (OSs), and network capacity on a charge basis over the network internet.

- It includes services for application development and deployment.

- Platform as a Service is a verified model for running applications without the difficulty of maintaining software and hardware infrastructure in a company.

- It allows users to create web applications very quickly, without bothering about the cost and complexity of buying, and also managing the related hardware/software.

- Platform as a Service is used to build multi-tenant applications.

- Multi-tenant applications are the services that can be accessed by multiple users simultaneously.

- Because of PaaS the applications can be deployed to the Cloud using tools and different programing languages supported by a particular provider.

PLATFORM AS A SERVICE

Client 1

Client 2

Client 3

Internet

Platform

Server

Platform as a service provider

LEARN . GROW . EXCEL

Characteristics of PaaS

1. It includes multi-tenant architecture in which multiple users can use the same developed application concurrently.

2. Safety is achieved since customer environments are separated from each other, thereby applications related to one customer cannot be accessed by others.

3. As it is common to all Cloud services, internet connection is a must.

Advantages of PaaS

1. The features of the OS can be upgraded and can also be changed if required, very frequently.

2. Members of the development teams, who are located at very distant places, can work together to develop software related projects.

3. Different types of costs can be minimized.

4. The advantage of PaaS to application developers is that they do not have any need to buy hardware and employ members to maintain or manage it.

5. It is used as a multi-tenant development tool and also deployment architecture.

6. Simplified deployment is there since developers need to focus on development rather than maintaining the infrastructure.

Examples : Google App Engine, LongJump. Force.com, WaveMaker, Microsoft Azure, Cloudbees.

Disadvantages of PaaS

1. Platform as a Service solutions do not permit the flexibility of laas offering.

2. Platform as a Service need not represent the whole product in the process that SaaS offerings do.

3. There are some providers which do not permit moving developed software out of the platform.

4. Data security is a major concern.

5. Integration of PaaS with the rest of the systems and applications could be a little bit tricky.

Companies offering PaaS

1. **Google App Engine:** The main aim of Google Application Engine (GAE) is to run the user's web application very efficiently. In this python and Java runtime environments are maintained on application servers, including simple APIs to access Google services. Applications are able to integrate data services and also other Google App Services like e-mail, image storage, etc., along with APIs providedby the GAE.

2. **Microsoft Azure:** The applications regarding Microsoft's Cloud offerings are categorized into two types, namely worker role instances in which it is possible to receive messages from any other web role instances or any on-premise applications, and web role instances in which web requests are serviced through Internet Information Services (IIS).

3. **Force.com:** The two main popular technologies regarding Force.com are metadata and multi-tenancy. The main aim of Force.com is taking care of all necessary requirements; thereby users will have focus only on application design. It is a very powerful, scalable, and also secure Cloud platform.

SECURITY AS A SERVICE

- Security is provided as a Service (SecaaS) to the applications or to any information remotely through internet) In a simple way, it can also be said that it is provided as a service (SecaaS) from the Cloud without the need of on-premises hardware.

- Security plays a vital role in any area while dealing with confidential information.

- In Cloud computing technology data is being accessed from the Cloud by the customer through the internet, so there is a need to provide security to the data belonging to Cloud users.

- Security should be provided for the data at various stages, like data in processing, data in transit, and data at rest, that is, while storing also.

- The term Cloud security can also be called internet-based security.

- To provide security to the Cloud it is important to know about five things, such as who is logged in, what are they going to access, how are they authorized, where is the device, and when was the asset changed.

Different Security Issues of Cloud Computing

- To provide security to the Cloud it is important to know about five important things who is logged in, what are they going to access, how are they authorized, where is the device, and when was the asset changed.

- The various security issues regarding Cloud computing are:

1. Data segregation and protection
2. Identity Management
3. Availability Management
4. Vulnerability Management
5. Access Control Management

Data segregation and protection

- Data segregation and protection assures the customers that the related data is secure at any cost and in any situation.

- Since the data gets stored in a shared environment every user desires to protect and provide security to their data.

- So data and the confidential information belonging to a single user should be separated and protected from others by providing security, otherwise the private information, bank account numbers, passwords, etc., may be seen by malicious users.

- If the Cloud provider does not take intense care while separating and protecting the data then Cloud computing is a failure.

- With the help of encryption and decryption methods these security issue risks will be solved, The authorization and authentication mechanism helps to provide more security to the data.

Identity Management

- It is the practice of managing identities which includes establishing identity, describing identity, and logging identity activity.

- This security issue is mainly needed to prevent unauthorized access to information resources in a Cloud.

- To ensure this the users have to authenticate themselves to Service Providers (SP) in order to use the services) The user should provide Personally Identifiable Information (PII) that uniquely identifies it to a service provider.

- Identity management deals with securing user ID's and access credentials.

- It should also handle user account management namely provision and deprovision of accounts.

Availability Management

- It is related to managing several available resources existing in the Cloud to the users.

- Availability means that an organization has its full set of computing resources accessible and usable at all times.

- Availability is the practice of vendors meeting their obligations to provide customers with regular and predictable access to the specified Cloud computing resources.

- During a Cloud disruption, customers are unable to access the Cloud service and if so, it may result in performance degradation.

- For example, when a storage service gets disrupted, it may show effect on the performance of a computing service that depends on storage service.

Vulnerability Management

- Vulnerability is a weakness in the security system that could be exploited to cause harm.

- In some cases it is possible for attackers to precisely map where a target's data is physically located within the 'Cloud' and use various tricks to gather intelligence.

- Since Cloud management is becoming much more robust, Cloud providers must take care of these vulnerabilities in a particular customer's Cloud.

- Vulnerability management is a required threat management element to protect hosts, applications, and network devices from attacks across known vulnerabilities.

- Most popular organizations should consider vulnerability management process which involves frequent scanning of systems which are connected to their network, assessing the risks resulted from vulnerabilities to the organization, and a remediation process to solve the risks.
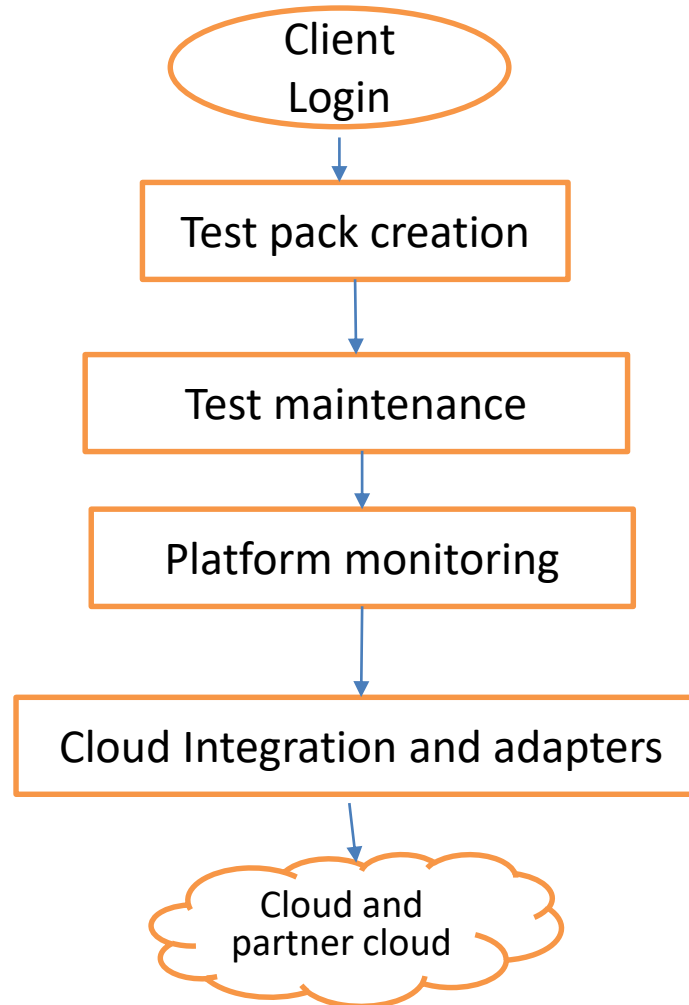
Access control management

- It is a vital function that mainly focuses on accessibility requirements for the users and system administrators (privileged users) who access network, system, and application resources.

- Access Control Management includes several issues such as managing user access rights, encouraging good accessibility practices, controlling access to information, network services, OSs, and applications.

- Access control mechanism's responsibility is to make sure that the authorized user can access, and to prevent unauthorized access to information systems.

- The mechanisms should include the initial registration of users before accessing, using the information systems and services, and final de-registration of users who no longer require access to those.

Testing as a Service

- Testing as a Service is simply written as TaaS which is an outsourcing model where the testing activities are related with some of an organization's business activities that are accomplished by a service provider, but not by employees.

- It is also known as on-demand testing. This Cloud computing technology leads an opportunity in presenting testing as a service for SaaS and Clouds.

- Cloud-based software testing mainly refers to testing on the Cloud-based environment and infrastructure by influencing Cloud technologies and solutions.

- Cloud computing provides the facility to access test environments and test tools from anywhere within the world without having any need to own those assets.

- Testing as a Service has been becoming popular and widely used by several organizations to obtain minimized costs and improved service for related IT test requirements.

Testing as a Service

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Testing as a Service

- Cloud-based software testing has the following goals:

1. Validating SaaS in a Cloud environment, such as software scalability, performance, security, and measurement depending on economic scales and pre-defined Software Level Agreements (SLAs).

2. To provide a guarantee regarding the quality of the applications which are Cloud-based.

3. Testing inter-operation capability and Cloud compatibility between SaaS and the related applications in a Cloud infrastructure.

Different Forms of Testing

1. **Testing SaaS in a Cloud**: It provides guarantee regarding the quality of SaaS in a Cloud depending on both functional and non-functional requirements.

2. **Testing a Cloud**: This form of testing validates the power of a Cloud from an external side, depending upon the concerned Cloud service features and specified capabilities. Cloud, SaaS vendors, and end users are also responsible to carry this form of testing

3. **Testing Cloud internally**: It validates the quality of a Cloud internally, depending upon the Cloud specified capabilities and the internal infrastructure of a Cloud. Cloud vendors can only carry out this form of testing.

4. **Testing over the Clouds**: It checks Cloud-based service applications over various types of Clouds, namely Public, Private, and Hybrid, depending upon system level application service specifications and requirements. This form of testing is carried out by Cloud-based application system providers.

Different Levels of Testing

- Testing the Cloud involves testing various things at different levels which are explained below:

1. **Network interconnectivity infrastructure level**: At this level testing must validate Voice over IP (VoIP) gateways, switches, routers, and application delivery platforms.

2. **Virtualization level**: Here testing must validate video head ends, virtual hosts and VM instantiation and movement.

3. **Server and storage infrastructure level**: Data centre networks, data centre capacity, storage systems, and converged network adapters must be validated by the testing process at level

4. **Security infrastructure** : Testing must validate Virtual Private Network (VPN) gateways, firewalls, and Intrusion Prevention Systems (IPS). this level.

Advantages of Taas

1. Cost reduction regarding the quality of a Cloud.

2. Test cycle time can be minimized.

3. Helps to perform large scale and real time online validation for internet based software in Clouds due to on-demand test services.

4. Less time spent on test environment creation.

INTEGRATION AS A SERVICE

- Integration as a Service can be simply written as Itaas and also 'be known as an Integration Platform as a Service (IPaaS).

- This Cloud service model keeps system integration into the Cloud. It allows the use of Cloud services to connect to an enterprise, enabling it to interface with its internal systems and applications with the required number of remote or external environments.

- It provides a solution which avoids system and data level interdependencies and also offers a web based interface to connect files and applications with any other data, the backend data, applications, and systems. It is implemented in Business to Business (B2B) environments in which an organization needs to connect its related applications and data with an external partner organization.

- ItaaS has its positive impact on small and medium-sized businesses since it is very efficient,available at low cost, and offers reliable B2B integration.

INTEGRATION AS A SERVICE

- It enables organizations of medium size to spend the more valuable resources on the services and products which directly benefit customers.
- Any integration engine in the Cloud has to maintain some fundamental functions, including:

1. Transformation
2. Routing
3. Interface
4. Logging

INTEGRATION AS A SERVICE

- **Transformation:** It means that the information semantics of one system can be translated to information semantics of another system by the user, so that the target system can accept information in a format it understands.

- **Routing:** It means that depending on the pre-defined logic the information is routed to the correct system. It is also called as intelligent routing.

- **Interface:** It means that using whatever interface is exposed the user can connect to the source system or to the target system.

- **Logging:** It means that all integration activities, such as in and out flow of messages, other events can be log by the user.
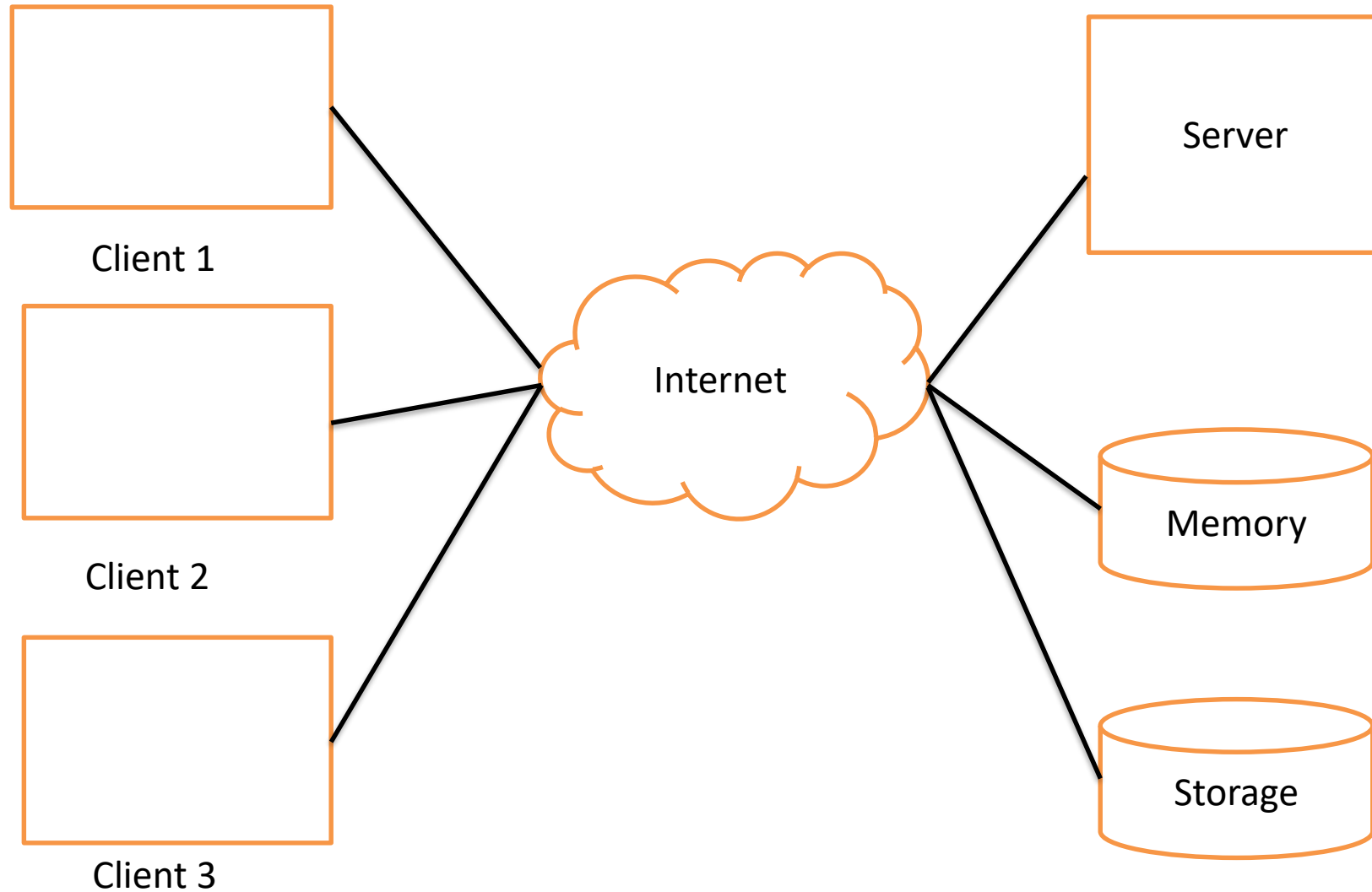
INFRASTRUCTURE AS A SERVICE

- This service can be simply called as IaaS and is also known as Hardware as a Service (HaaS).

- Infrastructure as a Service is a virtual provider of computing resources such as hardware, storage services, networking, OSs, virtualization technology, etc.

- This service provider owns the required equipment and is responsible for configuring, running, and maintaining it.

- Instead of buying and then installing these resources in their own data centre, companies can rent these resources as per requirement.

- Infrastructure as a Service is a process of making available the Cloud computing infrastructure resources, that is, servers, storage, network, and OSs as an on-demand service.

- Rather than purchasing servers, software, data centre space or network equipment, clients instead buy those resources as a fully outsourced service on demand.

INFRASTRUCTURE AS A SERVICE

- Amazon Web Services is the best all-around IaaS provider.

- This service can be considered as the basic foundation for the other two services such as SaaS and PaaS.

- Depending on the computing requirements and configuration, the IaaS provider will react quickly in case of scale- up or down which is known as Auto Scaling.

- Another important feature regarding various IaaS providers is Elastic Load Balancing which auto-distributes the incoming traffic related to an application to various multiple instances (virtual computers).

INFRASTRUCTURE AS A SERVICE

Client 1

Client 2

Client 3

Internet

Server

Memory

Storage

INFRASTRUCTURE AS A SERVICE

<u>Characteristics of IaaS</u>

1. Infrastructure as a Service is platform independent.

2. It charges for only the resources that are accessed and used.

3. Scaling of resources can be done as per requirement.

4. It includes multi-tenant architecture which represents several users who can work on a single piece of hardware.

5. Elasticity is also possible.

INFRASTRUCTURE AS A SERVICE

Advantages of IaaS

1. It offers flexible scalability because users can access the resources at any time as per requirement.

2. Less total cost of ownership since customers will pay only for what they use.

3. Avoids the need for hardware administration and maintenance.

4. It also includes location independence since the users can access the service from anywhere, as long as the internet connection facility exists.

5. Because of the redundancy of the Cloud hosts, if one network or server fails, there is no effect on data centres due to multiple hardware resources. Even in the worst case if an entire data centre failed, there would be secondary and tertiary data centres to assure continued required function.

6. Minimized risk on ROI (Return On Investment).

INFRASTRUCTURE AS A SERVICE

Disadvantages of IaaS

1. Success regarding particular usage of the service is based on the ability of the vendor.

2. Security is a major concern.

3. As data can be stored anywhere in the Cloud, it is necessary to determine the kind of data to be stored since many countries have their own strict regulations regarding the location of data.

INFRASTRUCTURE AS A SERVICE

Types of IaaS

- Infrastructure as a Service is categorized into two kinds:

1. **Computation as a service:** In this VM based servers are charged per hour, depending upon the VM capacity, mainly RAM size and CPU, OS, features of that particular VM, and deployed software.

2. **Data as a service:** In this there is no restriction on storage space to store the data related to the user, regardless of its type, and charged per GByte for data transfer and data size.

INFRASTRUCTURE AS A SERVICE

Types of IaaS Clouds

- There exist three types of IaaS Clouds which are explained as follows:

1. **Public IaaS Cloud:** This is similar to that of the Cloud computing concept where multiple users will share the server resources as provided by the provider.

2. **Private IaaS Cloud:** using virtualization technology, it provides Cloud computing services to a single company. The services are provided privately and exist behind firewalls which are managed by individual business. The resources are especially concerned to the individual business and must not be used by others.

3. **Hybrid IaaS Cloud:** It is a combination of Public and Private Cloud. It is helpful in those cases where some organizations might want to maintain certain servers in Private Cloud and other categories of servers in Public Cloud.

INFRASTRUCTURE AS A SERVICE

Companies offering IaaS

1. **Amazon EC2:** It is a web service which offers dynamic scaling of computing capacity in the Cloud. It enables users to have complete control over computing resources and makes them run on Amazon's excellent computing environment. It allows the users to pay as per the capacity they use. It minimizes the time needed to obtain and boot any new server instances, allowing the users to quickly scale capacity whenever computing requirements change.

2. **Bluelock:** It offers Cloud computing and managed services supported by VMware Cloud data centre services. The data centres related to this are very secure and also SAS-70 type II certified, so the users know that their data, existing in the Cloud is not touchable by anyone.

3. **GoGrid:** It offers customers with a web service interface which is user friendly, contains video demonstrations which are very easy to understand, and also have an inexpensive billing system. It supports multiple OSs, load balancing, Cloud storage, etc.

- The certificate of SAS 70 is awarded to those data centers that adhere to the industry's strictest criteria.

Cloud ecosystem

- It describes the complex system of interdependent components which work together to enable Cloud services.

- Here the word complex means not only the traditional elements of Cloud, like software and infrastructure, but also integrates, consultants, third parties, partners, and anything related to their environment which has a bearing on the other components.

- The Cloud ecosystem primarily includes five major roles:

1.   Service Providers
2.   Software Vendors
3.   Enablers
4.   Businesses
5.   Independent Software Vendors

Cloud ecosystem

Service Providers

- The service providers are nothing but the companies which offer Cloud services to the customers and businesses.

- These companies usually run the giant data centres, which host massively virtualized, redundant software and hardware systems.

- These may provide services directly to the consumers, businesses, or independent software vendors.

- These are experts in the area of data centre management and scalable software management.

Cloud ecosystem

Software Vendors

- Software which is used to run on-premise is very different when compared to software that is used for Cloud services.

- Although these two software provide the same business functionality for the end-users, they are different in architecture.

- In some cases, there exists significant overlap between the software vendors and the service providers.

- Unlike service providers. the software vendors observed that it will be economically feasible to package software and hardware together in the data centres for the optimization of service delivery in the Cloud.

Cloud ecosystem

Enablers

- Enablers are also called implementers.

- These are vendors which offer services to provide end-to-end solutions with software integration from different vendors.

- Most of the enterprises buy the software licenses from vendors, but never try to deploy it due to lack of availability of product expertise.

- Enablers solve this by providing consulting services for those purchased software licenses.

- This Cloud platform gives enablers an opportunity to extend their service offerings without limiting to on premise solutions.

Cloud ecosystem

Businesses

- If businesses observed any value or cost savings in some specific solution, they will surely implement it.

- To withstand in today's market, the businesses need to maintain their IT and application matters up-to-date and take advantage of cost reduction issues wherever possible.

- The software vendors, service providers, enablers, and independent software vendors should work together in developing Cloud applications and services to provide a competitive edge to businesses.

Independent Software Vendors

- These play an important role in the success of Cloud services due to their talent in vertical business applications.

- These usually build vertical applications on an existing platform.

- The Cloud provides a great platform for the independent software vendors to build vertical solutions.

CLOUD MANAGEMENT

- The process of operating and monitoring the applications, data and services which reside in the Cloud is called Cloud Management.

- Cloud Management provides data access, computation, software, and storage services which do not require any information regarding the end-user of the physical location and system configuration which delivers services.

- Cloud Management tools will help to assure that a particular organisation's Cloud computing-based resources are working properly and interacting with users and also other services.

- In other words, it is a combination of software and technologies which are designed to manage Cloud environments.

- Some of the most popular vendors that have management systems especially for managing Cloud environments are Novell, HP, Eucalyptus, Citrix, and OpenNebula.

CLOUD ASSET MANAGEMENT

- This task is to manage all the assets, such as network, hardware and software that make the Cloud infrastructure.

- The main aim of Asset Management is to secure organizational assets.

- In general, physical access is needed to place new servers into the network.

- Regarding Cloud concept, virtual environments are provided without having any need for physical access.

CHARGING MODELS

- While using Cloud, the cost to the end-user is the combination of the charges the user- pays to the Cloud vendor and the communication cost.

- Communication is provided by an Internet and Communication Service Provider (ICSP).

- In general, the customers are charged only for the amount of resources they had used.

- Cloud computing includes the following characteristics:

1. Infinite virtual computing resources are made available on demand, which eliminating the need for the users of Cloud computing to plan ahead for provisioning.

2. The ability to pay for the usage of computing resources on short-term basis when needed and releasing them as per requirement, thereby rewarding conservation by allowing machines and storage to go when they are of no use for a long period of time.

Cost Types

- To determine a price model, all the direct and indirect costs regarding a provided service should be considered.

- The total costs generally include **Operational Expenditures (OpEx)** and **Capital Expenditures (CapEx),** Operational expenditures comprise all costs for running the service, such as maintenance costs for infrastructure, servers, payroll, facilities, and also legal and insurance fees.

- Capital expenditure includes all costs for acquiring assets like software licenses, server and network hardware, as well as power, facilities and cooling infrastructure.

- Cloud-based data management consists of some specific characteristics which should be considered in pricing models, since data is not that much elastic when compared to pure computing jobs.

- The data sets will be uploaded to the Cloud and stored there for a long period of time, which usually need additional space for high availability (backups) and effective access (indexing).

Cost Types

- The following are the types of operational costs:

1. **Storage costs:** The applications regarding database need to store data persistently on the disk. To ensure a reliable and high available service, archiving and backup need to be performed which require extra storage space.

2. **Data transfer costs:** This covers the transfer of application data to the Cloud service provider over the network and also the costs for conveying requests and responses between clients and database service.

3. **Computing costs:** This is the important cost type for processing database services and also the processing time of running a data management system.

Cost Types

- When the term Cloud computing was first coined, the normal view was that Cloud computing would lower the costs.

- From the customer point of view, with interim or short- term needs, it is quite possible that the services could provide a lower cost.

- From the producer point of view, with the need to invest in high capacity and delivering the Cloud service, it is an expensive case.

- Because of this reason, the producer needs to strategically take a decision about the charging model for the services being offered.

- Following are the charging models

1. **Utility model:** This is a pay-per-use model, that is, the consumer is billed according to the quantity of the Cloud services they use.

2. **Subscription model:** The consumer is billed according to time-based Cloud services usage. The subscription cost will allow the user unlimited usage during the period of subscription.

Cost Types

3. **Market-based pricing:** In this model, there is a market price for service, like CPU time per hour. This market price varies according to the time, which depends on supply and demand.

METERING AND BILLING

- Transparent metering and billing increases the trust level of users regarding Cloud services.

- There are many pricing strategies like CPU Capacity, RAM hours, storage space (gigabytes of data), bandwidth (Inbound or Outbound data transfer) and subscription-based pricing.

- There are also some interesting new billing models like IDC Cloud billing research and GoGrid prepaid Cloud hosting plan which are good examples of moving Cloud billing models towards telecom models.

ACCESSING THE CLOUDS

- For accessing the Cloud, there exists some platforms and web browsers which are as follows.

- Platforms

- A platform indicates how a Cloud computing environment is delivered to the end-user.

Web Application Framework

- The main purpose of this web application framework is to support the development of dynamic web sites, web services and web applications.

- The framework mainly reduces the overhead that comes with the general activities which help in web development.

- The frameworks provide libraries which are already written, so that the developer doesn't have any need to rewrite them every time they develop a web site.

ACCESSING THE CLOUDS

Ajax

- Asynchronous Java Script and XML (Ajax) is a group of web development techniques which helps in creating interactive web applications.

- With the help of Ajax, web applications are able to retrieve data from the server asynchronously.

- It improves the web page's interactivity, usability, and speed.

- Ajax refers to the following technologies:

Python Django

- Django is a free and open-source web application framework written in python.

- It enables the user to build high-performance, elegant web applications quickly.

- It was developed to ease the task of creation of complex, database-driven websites.

ACCESSING THE CLOUDS

Web Applications

- If the user prefer to use applications on the Cloud, then there are many platforms to utilize the application.
- After selection, you will know about the different types of Cloud platforms.

Sample Applications

- Different companies provide different services, but to get aware of this concept let's look at Google and their offerings.
- They include a slate of apps which are targeted right towards the organization.
- Google Apps is a suite of applications which includes:
1. Google calendar shared calendaring;
2. Google talk instant messaging and voice over IP.
3. Gmail webmail services.
4. Google Apps Premier Edition

ACCESSING THE CLOUDS

Google Apps Premier Edition

- It includes the following features:

1. Provides about 100 times the storage of average corporate mail box which avoids the need for the frequent deletion of email;

2. Support for critical issues 24x7

3. Simple and affordable annual fee which is a practical thing to offer these applications to every individual in the organization.

ACCESSING THE CLOUDS

Web APIs

- Different Cloud providers use different APIs.

- There exist a number of different APIs and the one the user chooses to use among them is based upon the skills and the organization the user prefers for Cloud services.

- The API is an application programming interface which consists of a set of programming instructions and standards to access a web-based program.

- These allow the programs to speak each other.

- The APIs are not a part of the user interface.

- Software companies release their own APIs, thereby the software developers are able to design products which are powered by its service.

- Amazon has released its own API so that the web site developers can have an easy access to the information maintained at the Amazon web site.

- An API operates in between two pieces of software for the exchange of information).

- The user needs to enter the credit card information if any product is ordered online.

- For example, if the user ordered something at Amazon, then it uses its API to transfer the credit card details to a remote application which checks whether the details are correct or not. An API can be viewed as a SaaS.

ACCESSING THE CLOUDS

Working of APIS

- The term API itself represents that it is an interface that defines the process in which two things can communicate.

- An API is nothing but a piece of software code which has been written as a series of XML messages.

- The other standards which help APIs to work are explained as follows:

- **Universal Description, Discovery and Integration (UDDI):** It is an XML-based directory which allows businesses to find each other, to list themselves and collaborate using web services.

- **Simple Object Access Protocol (SOAP):** It provides a way for a program executing in one kind of Operating System (OS) to communicate with the program executing in the same or other OS with the help of World Wide Web's (WWW), Hypertext Transfer Protocol (HTTP) and its XML as the mechanisms for the exchange of information.

- **Web Services Description Language (WSDL):** It is the standard format to describe a web service in XML format. It describes the way to access a web service and What type of operations it will perform.

ACCESSING THE CLOUDS

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ACCESSING THE CLOUDS

Google Gadgets

- These are desktop search applications which allow users to search their files, chats, web history. email, etc.

- It is also called Google Desktop Search, which is a free, lightweight, downloadable application.

- The Google Gadgets API possesses the following three languages:

1. **XML:** A gadget is placed on the Web as an XML file which can be accessed by using Google. The XML file consists of instructions which indicate how to process and represent the gadget. The XML file can include all the data or it may have reference URLs.

2. **JavaScript:** This scripting language is used to add dynamic behaviour to the gadgets.

3. **HTML:** This markup language is mainly responsible for the static content of the webpages. The main difference between HTML and XML is that HTML helps in formatting the web documents and XML describes the structured data.

ACCESSING THE CLOUDS

- This application which usually works locally on the user's system provides the following capabilities:

1. Search speed is high since Google.com will search billions of web pages within a fraction of seconds.

2. Traditional computer search software updates only once a day, but Google Desktop Search updates frequently for most file types.

3. Google Desktop Search allows users to search both, their system, and Web simultaneously.

ACCESSING THE CLOUDS

GoGrid

- GoGrid's API is a web service which enables developers to control their communication with its Cloud hosting infrastructure.

- It provides two-way communication for controlling its control panel functionality.

- General uses include deleting servers, auto-scaling network servers, listing billing details, listing assigned Private and Public IP addresses.

- The GoGrid API supports the languages Java, Python, PHP, Ruby.

- The user needs to be a GoGrid customer and must have the technical knowledge and programming skills to work with GoGrid API.

ACCESSING THE CLOUDS

<u>Apex</u>

- The Apex Web Services API manages complex data relationships like a set of details regarding an account, all the goods they have ordered, and all their contacts in a single request.

- It is the most popularly used enterprise web service.

- Apex is a development platform which helps in building SaaS applications on top of Salesforce.com Customer Relationship Management (CRM).

- Apex allows programmers to access Salesforce.com's back-end database and also client-server interfaces to create SaaS applications.

ACCESSING THE CLOUDS

Apex

- The Apex platforms consist of the following three tools:

1. **Apex API:** This provides a way to retrieve raw data from Salesforce.com's Servers.

2. **Apex builder:** It is an on-demand component which enables easy drag and drop customization with limited features.

3. **Apex code:** It is a programming language which gets executed on Salesforce.com's servers. It provides flexibility in developing with the help of Apex API while decreasing the number of calls between the server and client.

ACCESSING THE CLOUDS

Web Browsers
- A web browser is an application for recovering, presenting and navigating information resources on the WWW i.e World Wide Web.
- An URL (Uniform Resource Identifier) is used to identify an information resource.
- The following are the different web browsers that are used widely:

Internet Explorer
- Windows Internet Explorer 8 is the latest version which became a popular web browser.
- It will work for Windows XP, Vista, and Windows 7.
- IE 8 provides a new look and enhanced capabilities which make the tasks like searching, browsing multiple sites, and printing easy and fast.
- The drastic change in IE 8 is its rendering modes which are as follows:
1. It reflects Microsoft's implementation of current web standards.
2. Reflects Microsoft's implementation of web standards at the release time of IE 7 in2006.
3. Represents methods dating back to previous web standards.

ACCESSING THE CLOUDS

Firefox

- Firefox 3 exhibits two to three times faster than its predecessor and provides more than 15,000 improvements to increase the performance and speed of the browser.
- Firefox 3 allows users to customize their browser with more than 5,000 add-ons.
- Firefox 3 raises the bar for security.

Safari

- Safari version 3.1 is the world's fastest browser for Windows PCs and Mac which work very fast and are easy to use.
- It runs JavaScript up to six times faster when compared to other browsers. It is the first browser to support CSS Animations and new audio and video tags in HTML 5.
- It supports CSS web fonts, providing the designers unlimited choices regarding fonts to develop amazing new web sites.

ACCESSING THE CLOUDS

Chrome

- Google Chrome was designed for today's web and for advanced applications.

- It makes it very easy for users to search and navigate the web for the information they require.

- Its features include:

1. Whenever users open a new tab in Chrome, it displays snapshots of the most visited sites, bookmarks, and recent searches which makes it easy to navigate the web.

2. A combined search and address bar easily takes users to the web page they need to go to.

3. Each tab works as a different process, so if one tab fails for some reason, other tabs operate properly with no disturbance and users can continue their work without any need to restart Chrome.