Cloud Computing

Introduction

Cloud computing now is everywhere. In many cases, users are using the cloud without knowing they are using it. According to small and medium organizations will move to cloud computing because it will support fast access to their application and reduce the cost of infrastructure.

The Cloud computing is not only a technical solution but also a business model that computing power can be sold and rented. Cloud computing is focused on delivering services.

Organization data are being hosted in the cloud. The ownership of data is decreasing while agility and responsiveness are increasing. Organizations now are trying to avoid focusing on IT infrastructure. They need to focus on their business process to increase profitability.

Therefore, the importance of cloud computing is increasing, becoming a huge market and receiving much attention from the academic and industrial communities.

Cloud Computing provides us a means by which we can access the applications as utilities, over the Internet. It allows us to create, configure, and customize applications online.

What is Cloud?

The term **Cloud** refers to a **Network** or **Internet**. In other words, we can say that Cloud is something, which is present at remote location. Cloud can provide services over network, i.e., on public networks or on private networks, i.e., WAN, LAN or VPN. Applications such as **e-mail, web conferencing, customer relationship management (CRM),** all run in cloud.

What is Cloud Computing?

Cloud Computing refers to **manipulating, configuring,** and **accessing** the applications online. It offers online data storage, infrastructure and application.
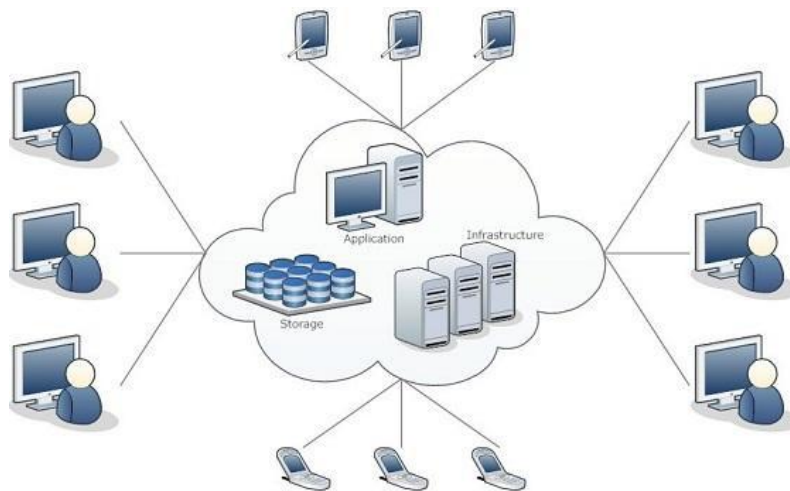
We need not to install a piece of software on our local PC and this is how the cloud computing overcomes **platform dependency issues**. Hence, the Cloud Computing is making our business application **mobile** and **collaborative.**

Def2:

cloud computing is the delivery of computing services—servers, storage, databases, networking, software, analytics and more—over the Internet ("the cloud"). Companies offering these computing services are called cloud providers

and typically charge for cloud computing services based on usage, similar to how you are billed for water or electricity at home. Ex: Yahoo, Gmail, Hotmail etc

Cloud computing with an example -

Whenever you travel through a bus or train, you take a ticket for your destination and hold back to your seat till you reach your destination. Likewise other passengers also takes ticket and travel in the same bus with you and it hardly bothers you where they go. When your stop comes you get off the bus thanking the driver. <u>Cloud computing is just like that bus, carrying data and information for different users and allows to use its service with minimal cost</u>.

Why Cloud Computing?

With increase in computer and Mobile user's, data storage has become a priority in all fields. Large and small scale businesses today thrive on their data & they spent a huge amount of money to maintain this data. It requires a strong IT support and a storage hub. Not all businesses can afford high cost of in-house IT infrastructure and back up support services. For them Cloud Computing is a cheaper solution. Perhaps its efficiency in storing data, computation and less maintenance cost has succeeded to attract even bigger businesses as well.

Cloud computing decreases the hardware and software demand from the user's side. The only thing that user must be able to run is the cloud computing systems interface software, which can be as simple as Web browser, and the Cloud network takes care of the rest. We all have experienced cloud computing at some instant of time, some of the popular cloud services we have used or we are still using are mail services like gmail, hotmail or yahoo etc.

<u>While accessing e-mail service our data is stored on cloud server and not on our computer. The technology and infrastructure behind the cloud is invisible</u>.

It is less important whether cloud services are based on HTTP, XML, Ruby, PHP or other specific technologies as far as it is user friendly and functional. An individual user can connect to cloud system from his/her own devices like desktop, laptop or mobile.

Cloud computing harnesses small business effectively having limited resources, it gives small businesses access to the technologies that previously were out of their reach. Cloud computing helps small businesses to convert their maintenance cost into profit.

Common
Location Independent
Online
Utility that is available
Demand

Cloud computing components is made of several element such as

a) Clients

b) Datacenter

c) Distributed server

Now each element plays a specific role in delivering the cloud function.

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a) CLIENTS

Clients are the device that the end user interact to manage their information on cloud.
   They generally divide into 3 categories

   1.MOBILE 2. THIN 3. THICK

1. MOBILE CLIENTS

  Mobile device include (PDA, SMARTPHONE, or IPHONE)

Now these devices are portable and work on wireless access of network, through   Internet.

2. THIN CLIENTS

Now thin computers are that do not have internal hard drives, but rather the server do all their work and then display the information.

3. THICK CLIENTS

Now these are regular computer that do contain internal hard disk, and use web browser   (Firefox, opera, internet explorer) to connect to the cloud.

NOTE: (Now thin computer are becoming relatively popular solution for the cloud because of its price or effect on environment)

Some benefits of using Thin Clients are

-> Lower Hardware cost
-> Lower IT cost
-> Security
-> Less power consumption
-> Less noise
-> Ease of replacement of hardware

b) Data Centre:

Datacenter is collection of servers application is place and is accessed internet. It could be a large room in basement, or room full of server which you access
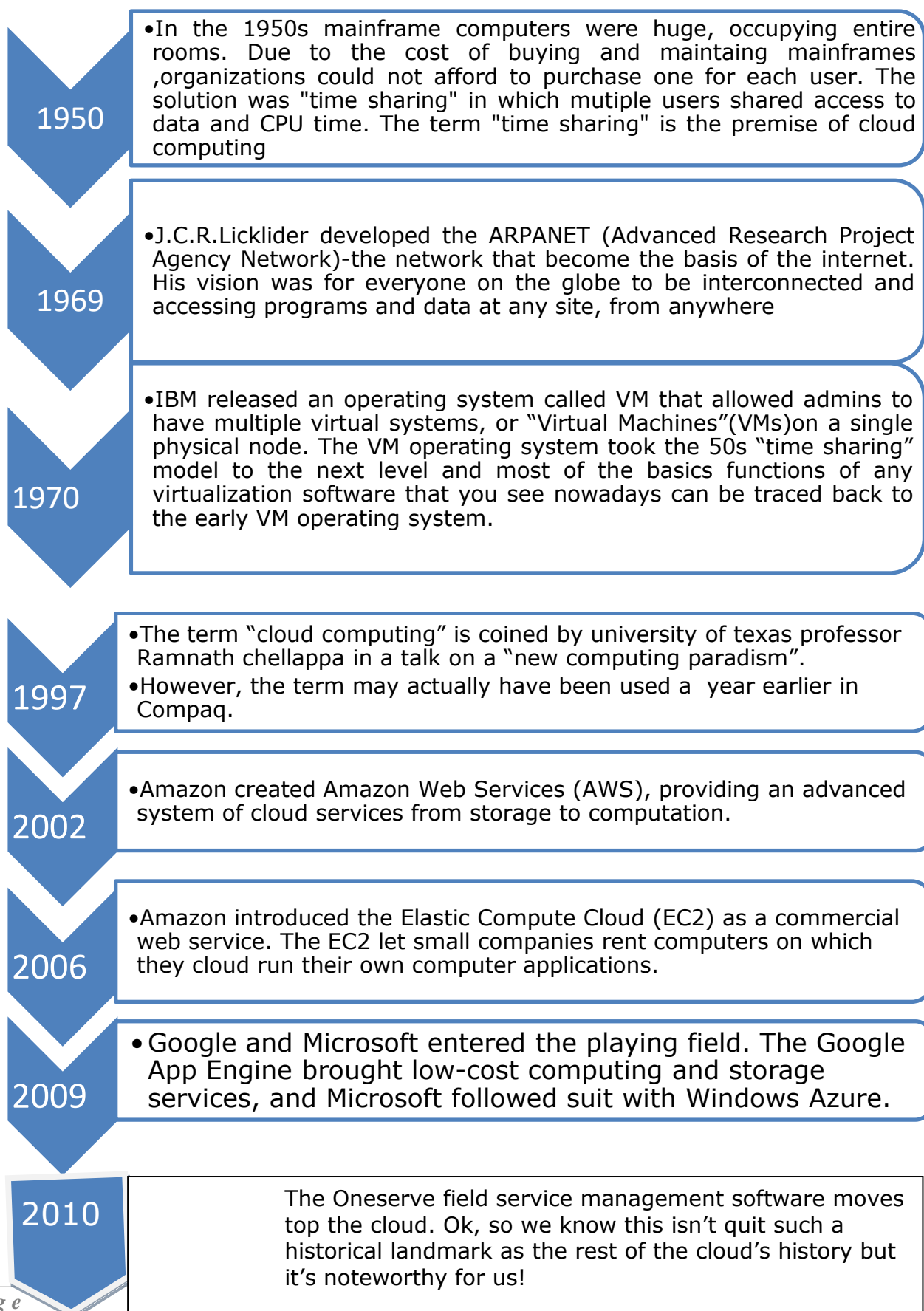
through internet.

c) Distributed server

Now the server don't have to be housed in same location often server are in dispersed geographically location but to you the cloud subscriber, these server acts if they are humming right away next to each other.

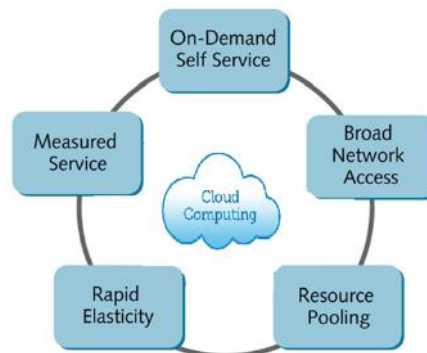This gives the service provider more flexibility in option and security.

FOR EXAMPLE:

Amazon has there cloud solution in servers all the world, if something goes wrong for instance causing a failure on one site, the service will not be stopped it would be accessed through another site also if the cloud needs more hardware they did not need throw more server in the safe room they can add them at another site and simply make it as part of the cloud.

Origins of Cloud Computing

1950
- In the 1950s mainframe computers were huge, occupying entire rooms. Due to the cost of buying and maintaing mainframes ,organizations could not afford to purchase one for each user. The solution was "time sharing" in which mutiple users shared access to data and CPU time. The term "time sharing" is the premise of cloud computing

1969
- J.C.R.Licklider developed the ARPANET (Advanced Research Project Agency Network)-the network that become the basis of the internet. His vision was for everyone on the globe to be interconnected and accessing programs and data at any site, from anywhere

1970
- IBM released an operating system called VM that allowed admins to have multiple virtual systems, or "Virtual Machines"(VMs)on a single physical node. The VM operating system took the 50s "time sharing" model to the next level and most of the basics functions of any virtualization software that you see nowadays can be traced back to the early VM operating system.

1997
- The term "cloud computing" is coined by university of texas professor Ramnath chellappa in a talk on a "new computing paradigm".
- However, the term may actually have been used a year earlier in Compaq.

2002
- Amazon created Amazon Web Services (AWS), providing an advanced system of cloud services from storage to computation.

2006
- Amazon introduced the Elastic Compute Cloud (EC2) as a commercial web service. The EC2 let small companies rent computers on which they cloud run their own computer applications.

2009
- Google and Microsoft entered the playing field. The Google App Engine brought low-cost computing and storage services, and Microsoft followed suit with Windows Azure.

2010

The Oneserve field service management software moves top the cloud. Ok, so we know this isn't quit such a historical landmark as the rest of the cloud's history but it's noteworthy for us!

The five essential characteristics of cloud computing

On-Demand Self-Service:

A consumer can individually get computing capabilities available as per his/her needs, such as server time and network storage ,automatically without requiring human interaction with each service provider.

In simple words, a consumer can individually provide computing capabilities such as server and network storage, as needed automatically without requiring human interaction with each service provider.

Eg: If we want to need Hard disk of 2 Tera byte as user, so we will inform IT department, they will inform manager and manger will contact sales team, and so on after finalizing the price the vendor will dispatch the HDD. So, there is a process to be followed and it will take time depend on how much channels a needs to follow.

In cloud: we don't follow any channel. All we need is to login in to portal (adc.com) can enter credentials. We simply click which increases the space of your sever 1TB.

Cloud computing provides resources on demand. i.e when the consumer wants it. This is made possible by self service and automation. Self service means that the consumer performs all the actions needed to acquire the services herself, instead of going through an IT department.

The consumer's request is then automatically processed by the cloud infrastructure, without human intervention on the provider's side.

Network Access

Cloud computing simply means network access from just about anywhere worldwide. You just need to log in to your account using an internet connection in order to extract the important information from the service provider's website. We can access business management solutions using their smart phones, tablets, laptops, and office computers. They can use these devices wherever they are located with a simple online access point. This mobility is particularly attractive for businesses so that during business hours or on off-times, employees can stay on top of projects, contracts, and customers whether they are on the road or in the office. Broad network access includes private clouds that operate within a company's firewall, public clouds, or a hybrid deployment. This is an important feature of cloud computing as it really helps in generating the best possible results.

Resource Pooling

The cloud enables your employees to enter and use data within the business management software hosted in the cloud at the same time, from any location, and at any time. This is an attractive feature for multiple business offices and field service or sales teams that are usually outside the office.

Elasticity

Companies sometimes require additional resources in a small period of time and this is where cloud computing comes in to play. For example, in case a firm gets a fresh client and needs three extra servers to meet up the customer's business requirements, the service provider could permit the firm to uphold three different servers at a time.

<u>This means that resources are dynamically increased when needed and decreased when there is no need.</u>

Measured service

Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth and active user accounts). Resource usage can be monitored, controlled and reported, providing transparency for the provider and consumer.

Measured service in order to know how much is consumed. Also, it is needed by the cloud provider in order to know how much the consumer has used in order to bill him or her

.Before Cloud Computing?

Life before cloud computing was very expensive and daunting. People were needed to install, configure, and manage every server. As the business grew it became more complicated and a headache to manage different environments and platforms. Not to mention upgrading every time whenever there was a fix.

How many of us remember the big billion day Sale of Flipkart in the year 2014? The sales for that particular day were so huge that the servers crashed as it couldn't handle the sudden surge in the traffic. This traffic was only for that special occasion, so would it be worth for the company to buy the servers only for that day?

If they had a dynamic resource allocation maybe it could handle the load.

So imagine getting a space where the storage is unlimited, where you don't have to worry about installations of servers, access the application from any device and many such features. This is exactly why cloud computing comes into the picture.

Now since we know how it worked before cloud computing, it will be easier for us to understand why slowly not just IT industry but everyone is moving to Cloud Computing. To understand what cloud computing is in simple words, let us take the example of the email. Earlier emails were stored in the server in the same premises and it was very expensive. Later on google, yahoo etc came into the market where they allowed users to use their services for free but all the emails would be stored on their servers and you could access it anytime from anywhere. This is what Cloud computing is all about. The service providers will provide or rent you with their services/servers.

UNIT 2

Cloud scenarios

There are three different major applications of cloud computing. How organizations are using cloud computing is quite different at a granular level, but the uses generally fall into on e of these three solutions.

Whether you should use cloud computing depends on many factors , including

- Cost/benefit ratio
- Speed of delivery
- How much capacity you will use
- Whether your data is regulated
- Your organizations corporate and IT structure

There are three different major implementations of cloud computing.

1. Compute clouds
2. Cloud storage
3. Cloud applications

1. Compute clouds

Compute clouds allow access to highly scalable, inexpensive, on demand computing resources that run the code we are providing.

The examples of compute clouds are

1. Amazon EC2
2. Google cloud
3. Microsoft Azure

Compute clouds are the most flexible in their offerings and can be used for sundry purposes it simply depends on the application the user wants to access.

2. Cloud storage

One of the first cloud offerings was cloud storage and it remains a popular solution. Cloud storage is a big world. There are already more than 100 vendors offering cloud storage. This is an ideal solution if you want to maintain files offsite. Cloud storage allows you to store your data on the vendors equipment.

Some of the examples are

One drive ,Google drive, Drop box

3. Cloud applications

Cloud applications differ from compute clouds in that they utilize software applications that rely on cloud infrastructure. Cloud applications are versions of SaaS(Software as a Service) and include such things as web applications that are delivered to users via a browser or application like Microsoft Online Services.

These applications offload hosting and IT management to the cloud. Cloud Applications deliver applications that depend on the infrastructure of the internet itself.

Some cloud applications include

- Peer to Peer computing(Skype and Ripple)
- Web applications (Like Google doucs ,Microsoft office live)
- SaaS(Google Apps, Windows Azure)

Benefits

Scalability

One of the key benefits of using cloud computing is its scalability. Cloud computing allows your business to easily upscale or downscale your IT requirements as and when required. For example, most cloud service providers will allow you to increase your existing resources to accommodate increased business needs or changes. This will allow you to support your business growth without expensive changes to your existing IT systems.

With scalability, hosting began to be regarded more as a commodity similar to gas or electricity: In the summer, you don't use much of either so your bills are low, and in the winter, you use more of each, and as a result your bills are higher.

Simplicity

Simply again, not having to buy and configure new equipment makes you and your IT staff enabled. The cloud solution makes it possible to get your application started immediately, and low cost compared to what it would cost to

implement an onsite solution. Simplicity means you do not need an army of administrators to build and maintain your cloud.

Well informed Retailers:

Typically, when new technology becomes popular, there are plenty of vendors who pop up to offer their version of that technology. This is not always good, because a lot of those vendors tend to offer less than useful technology. The first comers to the cloud computing party are actually very reputable companies. Companies like Amazon, Google and Microsoft have been good vendors because they have offered consistent and reliable service, plenty of capacity and you get some brand familiarity with these well known names.

Vendors security:

While the cloud offers significant benefits in cost reductions, scalability and efficient use of resources, security concerns have prevented many enterprises from

Taking full advantage of everything cloud. Cloud security vendors services have shown that the cloud often be more or more than equal secure than traditional infrastructure.

One of the most important tasks in moving to the cloud is choosing the right cloud security vendors. A higher cloud services provider will offer strong data centre security, a world –class cloud computing infrastructure, application security experts and a validated methodology for securing and preventing the data stored within a cloud.

A secure vendor provides Infrastructure-as-a-Service (IaaS) solutions which enable enterprise to take benefit of the speed and elasticity of the cloud and improving enterprises security.

These services may include
- Self Service Cloud services –offerings a comprehensive IaaS platform for fast application development and scaling
- Managed Cloud Services-Specially crafted design which supports applications with pre determined network demands.
- Cloud on boarding and Migration Services-

Limitations of Cloud computing

Any discussion involving data must address security and privacy, especially when it comes to managing sensitive data. We mustn't forget Code Space and what happened to it after its AWS EC2 console was hacked and its data eventually deleted, forcing the company to close doors forever. By leveraging a remote cloud based infrastructure, a company basically outsources everything it has.

Over the time, organizations have collected valuable information about the individuals in our societies that contain sensitive information, e.g. medical data. Researchers need to access and analyze such data using big data technologies in cloud computing, while organizations are required to enforce data protection compliance. There has been considerable progress on privacy preservation for sensitive data in both industry and academia, e.g., solutions that develop protocols and tools for encryption of data for confidentiality purposes.

When we say limitations, it does not mean cloud computing should not be used at all, but we must be aware of the situations where cloud computing might not be great idea to relay on.

1. Sensitive information:

'Sensitive Data' is defined as personal information that relates to:

1. Passwords

2. Financial information such as Bank account or credit card or debit card or other payment instrument details

3. Physical, psychological and mental health condition

5. Medical records and history

6. Biometric information

Let us understand by an example. A marketing survey company is using Google docs to store the data like your PAN Card/AADHAR Card etc. The company is not only one who should protect your data. Thought it will be expected from google also to protect your data but google pardons itself of this when agreement with them is signed (Remember clicking   yes to an agreement

even signing for any mail service provider like Gmail). This sensitive information can be used by government for specific analysis.

2. Don't go with Trend:

Your development team has given you a product and that product is completely handling your situation well, even then you are planning to move the applications to cloud just to follow the market trend or fashion then probably time to re analyze the situation and don't take the decision just for the sake of taking it. There are certainly situations where moving to cloud is advantageous but not all.

3. Integration Issues:

There are two applications your business house/development team is using, one of the applications contains the sensitive data and other one contains non-sensitive data so you decided to move, not to move the sensitive data on cloud but moved non- sensitive data on cloud. In this case one application is installed locally and other one is on cloud it would create issues with security and speed.

4. Delay in response:

As the application size grows which means the data used by the application changes and grows everyday (for example sales/production/logs data). The response coming from the application hosted on cloud might increase and delay especially when data is needed spontaneously.

5. Security is largely juvenile and requires focused expertise

6. Using the internet can cause network latency with some cloud applications.

7. Much of the technology is proprietary and thus can cause lock-in.

8. Cost increases exponentially if subscription prices go up in the future.

9. Agreement issues cloud increase the risks of using cloud computing.

10. Data privacy issues cloud rise, if cloud provider hunt to monetize the data in their   System.

Security concerns

Every coin has two sides, same is with ant technology it has its own pros and cons.

Privacy concerns with a Third Party

The statistics on third-party breaches vary widely, and it's clear that organizations have trust issues when it comes to third parties reliably notifying them when an incident or a breach occurs. A report from insurance company Beazley covering the first six months of 2017 indicates that accidental breaches caused by employee error/data breached while controlled by third party suppliers account for 40% of breaches overall.

That doesn't mean that there are not reputable companies who would never think of compromising your data and who are not staying on the cutting edge of network security to keep your data safe. But even if providers are doing their best to secure data, it can still be hacked, and your information is at the mercy of who broke in. So before signing in it is always advisable to know are they doing enough to protect your data or choose the company with a five star reputation.

Hackers:

There is a lot hackers can do if they have compromised your data. It ranges from selling your proprietary information to your competition to secretly encoding your storage until you pay them or they may just delete everything to damage your business and justify the action based on their ethical views. Your data become more prone to them as your data is saved on cloud which is third party.

Denial of services:

In a commonly recognized worst case scenario attackers use multiple internet connected devices each of which is running one or more than one bots to perform distributed denial of service (DDOS) attacks. To get the hackers to stop attacking your network. A Tokyo firm had to pay 2.5 million yen after the network was brought to a halt botnet attacks. Because the attack was so discrete, police was unable to track down the attackers. In the world of cloud computing this is clearly a huge concern.

Security level of third party

Security Benefits:

We are not trying to imply that your data is unsecure on the cloud. Service providers do make an effort to ensure security of data. Otherwise business will dry up. Some of the security benefits of cloud services as follows

By maintaining data on the cloud and ensuring strong access control, and putting a limit for an employee to download/access only what they need to perform a task ,cloud computing can limit the amount of information that cloud potentially be lost. Reduced data loss is also ensured by the fact the data is stored at a centralized place making your systems more inherently secure.

If your data is maintained on a cloud it is easier to monitor security than must worry about the security of numerous servers and clients. Of course the chance that the cloud would be breached puts all the data at risk , but if you are mindful of security and keep up on it, you only must worry about one location rather several.

When you developed your own network we had to buy third party security software to get the level of protection we want. With a cloud solution those tools can be bundled in and available to you and you can develop your system with whatever level of security you desire.

SaaS providers don't bill you for all the security testing they do. It's shared among the cloud users. The result is that because you are in a pool with others you get lower costs for security testing.

Regularity issues:

Laws or regulations typically specify who within an enterprise should be held responsible and accountable for data accuracy and security. If you're collecting and holding data, then you must have a security position designated to ensure compliance

Under the IT Act, 2000, a network service provider or an intermediary is liable for any known misuse of third party information or data; or for not exercising due diligence to prevent the offence. The IT Act covers offences and

contraventions committed outside India as well, irrespective of the offender's nationality, as long as the computer system or network is located in India.

Confidentiality obligations are limited to officers or persons having powers under the Act and do not extend to private persons. Further, the officer is not liable to compensate the person damaged by the disclosure. Moreover, most of the penalties are in the range of Rs.200,000 to Rs.500,000 which are very insignificant amounts when compared to the gains that a person may make from the crime.

Government Polices

Government departments at the centre and states to first evaluate the option of using the GI Cloud for implementation of all new projects funded by the government. Existing applications, services and projects are evaluated to assess whether they should migrate to the GI Cloud.

Policy principles:
- All government clouds to follow the standards and guidelines set by Government of India
- At the time of conceptualization of any new Mission Mode Project (MMP) or other government project the existing services (IaaS, PaaS, SaaS) of GI Cloud to be evaluated first for usage
- All new applications to be cloud ready

GI Cloud Policy – A Mandate

With regard to mandating the use of GI Cloud, it is envisaged that a combination of incentives and sanctions maybe used instead of a pure mandate.

A pure mandate does not align interest of stakeholders or establish accountability. The states may not optimally use cloud, and the national government and even cloud providers have little incentive to make the cloud attractive and if it is mandatory.

A combination of incentives and sanctions like initial funding for development of cloud ready application, services at subsidized rates etc, can be a highly effective means of efficient, innovative and widespread use of the cloud.

UNIT -3

Cloud Computing-Architecture

The Cloud Computing architecture comprises of many cloud components, each of them is loosely coupled. We can broadly divide the cloud architecture into two parts:

- Front End
- Back End

Each of the ends is connected through a network, usually via Internet. The following diagram shows the graphical view of cloud computing architecture:
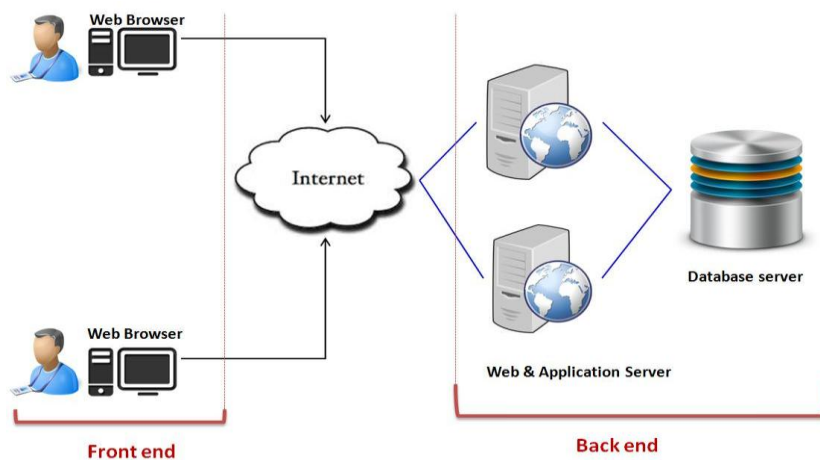

FRONT END

Front End refers to the client part of cloud computing system. It consists of interfaces and applications that are required to access the cloud computing platforms, e.g., Web Browser.

BACK END

Back End refers to the cloud itself. It consists of all the resources required to provide cloud computing services. It comprises of huge data storage, virtual machines, security mechanism, services, deployment models, servers, etc.

Cloud computing distributes the file system that spreads over multiple hard disks and machines. Data is never stored in one place only and in case one unit fails the other will take over automatically. The user disk space is allocated on the distributed file system, while another important component is

algorithm for resource allocation. Cloud computing is a strong distributed environment and it heavily depends upon strong algorithm
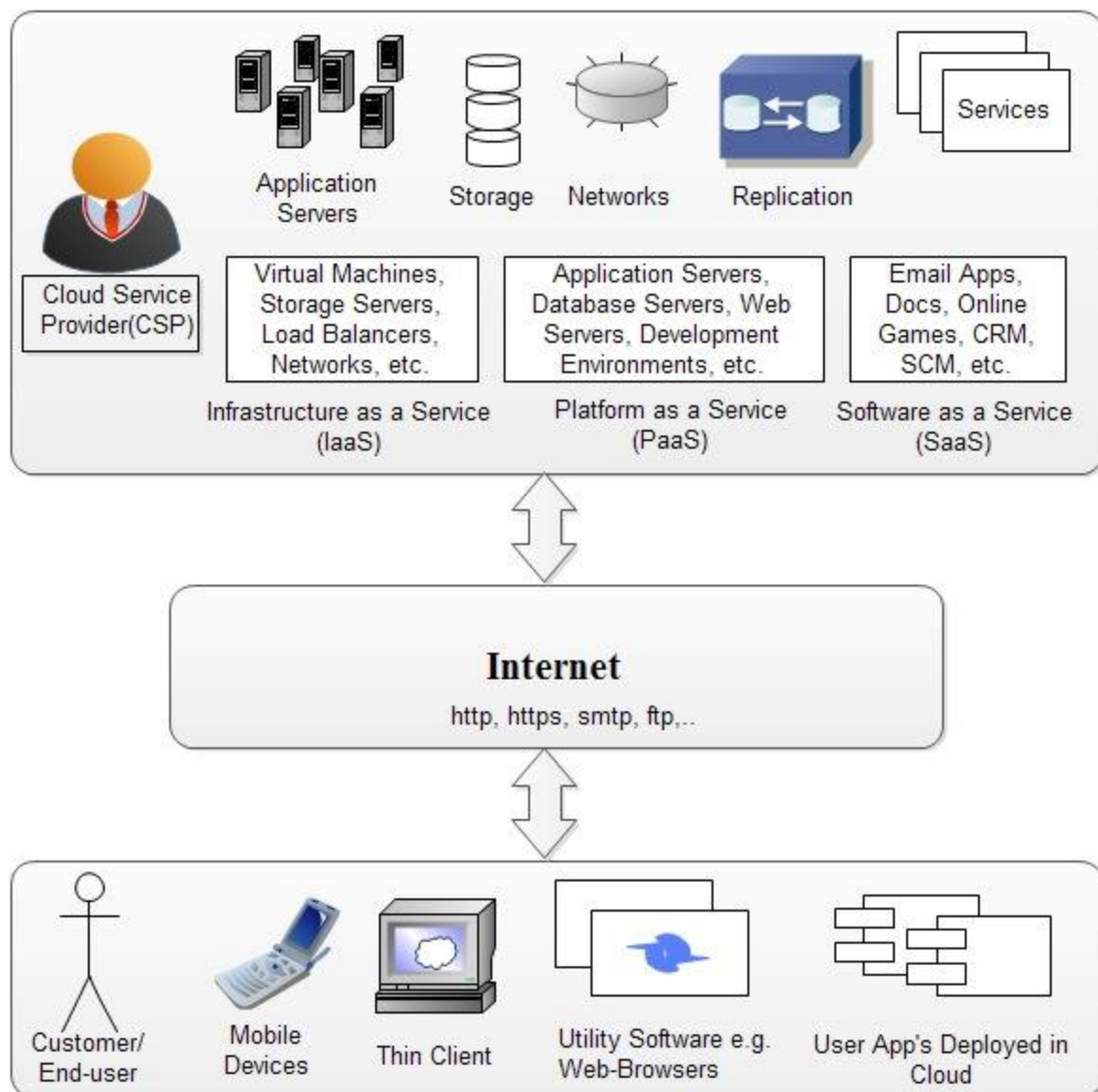
Important Points

- It is the responsibility of the back end to provide built-in security mechanism, traffic control and protocols.
- The server employs certain protocols, known as middleware, helps the connected devices to communicate with each other.

Cloud environment architecture

Cloud Delivery models:

A cloud delivery model represents a specific, pre-packaged combination of IT resources offered by a cloud provider.

Three common cloud delivery models have become widely established and formalized.

- **S**oftware–**a**s-**a**-**S**ervice(**SaaS**)
- **P**latform –**a**s-**a**-**S**ervice(**PaaS**)
- **I**nfrastructure –**a**s-**a**-**S**ervice(**IaaS**)

Cloud Delivery Models
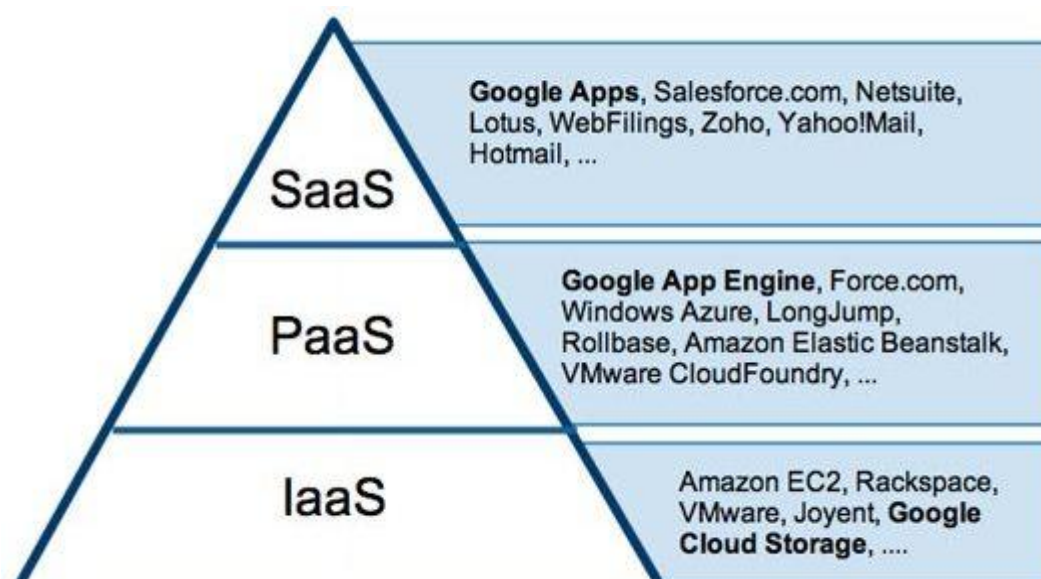
The resource abstraction and control layer usually refers to a virtualization layer the physical resource layer represents physical hardware and facility resources.

SPI frame work

The Software, Platform, Infrastructure (SPI) model is a term that encompasses three types of cloud computing services.

The SPI model looks at these three services in an integrated way, either to differentiate them or offer combined cloud computing that provides two or more combined services. The SPI model is becoming useful as companies increasingly use the web to obtain items for operational purposes.

Software as a Service (SaaS)

In this service, the cloud service provider provides software and the cloud infrastructure to the clients so they can use this software on the cloud infrastructure for their applications. Since the clients can only run the software and use it, the client does not have control over the underlying infrastructure and physical setting of the cloud such as network, operating system, and storage. The cloud service provider is responsible and is the only one who is in charge of controlling underlying physical setting without client intervention. The client can access this software as a thin client through a web browser.

Platform as a Service (PaaS)

This service is similar to SaaS in that the infrastructure is controlled by the cloud service provider but is different in that the users can deploy their software. In this model, the clients can install and deploy their customized applications by using the tool offered by the cloud service provider. Physical settings are controlled and restricted by the cloud service provider and application settings are given to each user to control them.

Infrastructure as a Service (IaaS)

In this service, computing resources such as processing, storage and networks can be provisioned. The client of IaaS can install and use any arbitrary operating system. Also, the clients can install and deploy their applications on this operating system. Cloud services such as Amazon EC2 are adopting this model and charging their clients according to the resources are being utilized.

SPI EVOLUTION

In the 1950s mainframe computers were huge, occupying entire rooms. Due to the cost of buying and maintain mainframes, organizations could not afford to purchase one for each user. The solution was "time sharing" in which multiple users shared access to data and CPU time. The term "time sharing" is the premise of cloud computing.

In 1970s, IBM released an operating system called VM that allowed admin's to have multiple virtual systems or "Virtual Machines" (VMs) on a single physical node. The VM operating system took the 50s "time sharing" model to the next level and most of the basics functions of any virtualization software that you see nowadays can be traced back to the early VM operating system

In 1990s witnessed telecom operators begin offering virtualized private network connections, whose quality of service was as good as those of point –to-point services at a lesser cost. This paved way for telecom companies to offer many users shared access to a single physical infrastructure.

In 2002 Amazon created Amazon Web Services (AWS), providing an advanced system of cloud services from storage to computation.

Some of the most popular cloud applications globally are Amazon Web Services (AWS), Google Compute Engine , Rackspace, Salesfore.com, IBM Cloud managed services among others. Cloud services have made it possible for small and medium businesses (SMBs) to be on par with large companies.

The main benefits of using cloud computing by companies are that they need not buy any infrastructure, thus lowering their maintenance costs.

SPI VS TRADITIONAL IT MODEL

Cloud is the new frontier of business computing and delivery of software and applications and is rapidly overtaking the traditional in-house system as a reliable , scalable and cost effective IT Solution. However, many businesses that have built their own robust data centers and traditional IT infrastructure still rely heavily on this model for security and managerial reasons.

Choosing an IT model for business is a very important decision. Every company needs a safe and secure storage space, where data and applications can be easily accessed and running costs are kept to a minimum. Thinking of migrating data from traditional IT infrastructure to cloud based platforms read on to explore the differences between the two.

The main difference is in the mode of delivery or access to computing resources as well as associated cost.

In traditional computing will typically have to own or consciously share the said remote server. If you own the server you have incurred some capital expenditure (e.g cost of the server ,hiring admins and physical rent etc) and recurrent operational expenditure (e.g power and cooling ,admin wages , software and hardware upgrades) . This cost almost cost regardless of whether the server is fully utilized or not.

The differences between Traditional and cloud computing

	Traditional	**Cloud**
Access to resource	Typically must be owned or shared on remote server	You don't have to own the remote server. You can simply rent out.
Risk of security	You store your files and data with other users at the level of security risk	By use of virtual technology, the risk of security, performance violation is minimized.
Cost	The charges you pay are not dependent on the bandwidth or storage you use.	The charges you pay are dependent on the bandwidth or storage you use. You pay only what you use.
Upgrade	You have to contact your system administrator for an upgrade or increase the size of the disk	The subscription to storage or system upgrade is automatic.
Speed	The access speed is slower than cloud	Cloud computing can access faster as compared to traditional model.

Infrastructure	In this model, we have full infrastructure control and build for a specific purpose	Cloud computing uses shared infrastructure.
Autonomous	In traditional all the jobs like creation, modification on servers will be performed with the help of human intervention.	The cloud is highly autonomous powered by highly intelligent a system that allows end users to create, modify and terminate cloud servers with relative ease without any human intervention.
Secure	With traditional IT infrastructure, we are responsible for the protection of your data.	Cloud service provider that is completely transparent in its hosting of cloud platforms and ensures optimum security measures are in place is crucial when transitioning to the cloud.

Software as a Service (SaaS)
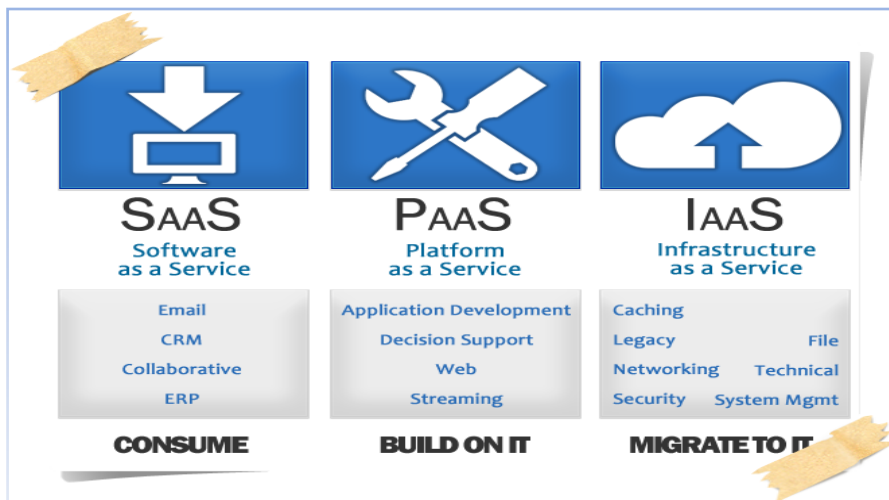
Software as a Service (SaaS) is a way of delivering applications over the internet –as a service. Instead of installing and maintaining software, we simply access it via the internet, freeing you from complex software and hardware management.

SaaS is available for users through internet and browsers. SaaS refers to Prebuilt functionally independent.

Traditionally, software application needed to be purchased upfront &then installed it onto your computer. SaaS users on the other hand, instead of purchasing the software subscribes to it, usually on monthly basis via internet.

Anyone who needs an access to a particular piece of software can be subscribe as a user, whether it is one or two people or every thousands of employees in a corporation. SaaS is compatible with all internet enabled devices.

Software as a service (SaaS) allows users to connect to and use cloud-based apps over the Internet. Common examples are email, calendaring and office tools (such as Microsoft Office 365).

Today SaaS is offered by companies such as Google, Salesforce, Microsoft, Zoho, etc.

SaaS provides a complete software solution which you purchase on a **pay-as-you-go** basis from a cloud service provider.

Ex:

An email system, human resource management, Payroll Processing, Database processing, and other application processes delivered to and used by customer as service.

SaaS Characteristics

Here are the characteristics of SaaS service model:
- SaaS makes the software available over the Internet.
- The Software is maintained by the vendor rather than where they are running.
- The license to the software may be subscription based or usage based. And it is billed on recurring basis.

- SaaS applications are cost effective since they do not require any maintenance at end user side.

- They are available on demand.

- They can be scaled up or down on demand.

- They are automatically upgraded and updated.

- SaaS offers share data model. Therefore, multiple users can share single instance of infrastructure. It is not required to hard code the functionality for individual users.

- All users are running same version of the software.

SaaS Benefits:

1. Zero Infrastructure/Low Cost:

When delivering business applications via SaaS, the complexity of the underlying IT infrastructure is all handled by your SaaS vendor. Users do not need to worry about the maintenance of hardware, or which operating system version supports which database - your SaaS vendor will take care of all of this for you, so you don't have to

2. Work Anywhere/Easy Access

Providing there is an internet connection, SaaS solutions can be accessed from anywhere in the world. Users are able to access their data and work more efficiently from anywhere, making life easier for home-workers or for those people that work across multiple sites.

3. Backups and Data Recovery all done for you

If you are familiar with traditional software, you will know that unless a costly automated solution has been implemented, the process of backing up your data on a weekly basis can be laborious at the best of times. SaaS solutions eradicate this painstaking task, instigating automatic backups without user intervention and thus ensuring the integrity of your data.

4. Quick to Deploy

With SaaS solutions, all you need is a web browser and internet access, and you're ready to go. Whereas traditional software can take weeks or even months to deploy, SaaS solutions don't require any software to be installed and so you are able to access your new software immediately.

5. Affordable

Unlike traditional software, SaaS is usually sold on a subscription basis that includes upgrades, maintenance and a degree of customer support. SaaS subscription models usually operate on a monthly subscription basis and hence there are no large up-front costs.

SaaS Service Providers:

1. Salesforce.com

Salesforce.com is a cloud computing and social enterprise Software-as-a Service (SaaS)provider based in San Franciso. It was founded in March 1999.

Sales force is the innovative company behind the world's #1 CRM platform. It is cloud-based, so it doesn't require a team of IT experts to set up or manage — you just log in and start using it.

CRM stands for "customer relationship management" and it's software that stores customer contact information like names, addresses, and phone

numbers, as well as keeps track of customer activity like website visits, phone calls, email, and more.

Sales Cloud is a fully customizable product that brings all the customers information together is an integrated platform that incorporates marketing, lead generation ,sales, customer service and business analytics and provides access to thousands of applications through the AppExchange.

Salesforce.com offers five versions of sales cloud on a per-user
- Per month basis, from lowest to highest
- Group, Professional, Enterprise, Unlimited and performance
- The company offers three levels of support contracts
- Standard Success Plan
- Premier Success Plan
- Premier +Success Plan

Slaesforce.com customer relationship Model:

Slaesforce.com is a leader in cloud computing in CRM applications. Its CRM offering consists of the sales cloud and service cloud and can be broken down into five core applications

1. Sales   2. Marketing   3.Service   4. Analytics   5.Cutomized Applications

1. Sales:

Easily the most popular cloud computing sales application, Slaesforce.com says that CRM Sales is used by more than 1.2 million customers around the world. All because it is comprehensive and easy to customize. It is value plan that it allows companies to manage people and processes more effectively, so representatives of the company can spend more time in selling the product or on field and less time on administrative tasks.

2. Marketing:

With Slaesforce.com CRM marketing, marketers can put the latest web technologies to work building pipeline while cooperating flawlessly with their sales organization.

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3. Service:

The service cloud is the new platform for customer service. Companies can tap into the power of customer conversations no matter where they take

place. Because it is on the web, the service cloud allows companies to instantly connect to collaborate in real time, share sales information and follow joint processes.

4. Analytics:

Force.com offers real time reporting ,calculations, and dashboards so a business is better able to optimize performance ,decision making and resource allocation.

5. Customized Applications:

Custom applications can be quickly created by leveraging one data model, one sharing model and one user interface.

Google Platform

With Google Cloud Platform (GCP), you can build, test, and deploy applications on Google's highly-scalable and reliable infrastructure for your web, mobile, and backend solutions.

Google App Engine(GAE) is one of the most popular platform in this arena, providing robust and scalable services inherent with its namesake . With GAE developer can build a SaaS with the language of their choice while reaping the benefits of cloud computing in hosting their application.

A good example of SaaS is Google Docus. Google Docus is a productivity suite that is free for anyone to use. All you need is to login and instantly access word processor, spreadsheet application or power point presentation creator.

Google's online services are managed directly from the web browser and require zero installation. You can access your google docus from any computer or mobile device with a web browser.

Google App Engine is free up to a use of certain amount resources. Users exceeding the per-day or per minute usage rates for CPU resources, storage.

GAE supports Java, Python, PHP and Go as well as the associated development frame works for these languages

Operational and Economic Befits of Google Platform and Salesforce.com

1. Cost savings:

If you are worried about the price tag that would come with making the switch over to cloud computing, you aren't alone; 20 percent of organizations are concerned about the initial cost of implementing a cloud-based server.

Once you're on the cloud, easy access to your company's data will save time and money in project start-ups. And, for those who are worried that they'll end up paying for features that they neither need nor want, most cloud computing services are pay-as-you-go. The pay-as-you-go system also applies to the data storage space needed to service your stakeholders and clients, which means that you'll get exactly as much space as you need, and not be charged for any space that you don't.

2. Security:

One major hang up that many organizations have when it comes to adopting a cloud computing solution is the issue of security. After all, when files, programs, and other data aren't kept securely on site, how can you know that they are being protected? If you can remote access your data, then what's stopping some cyber criminal from doing the same thing? Well, quite a bit, actually.

For one thing, a cloud host's full-time job is to carefully monitor security, which is significantly more efficient than a conventional in-house system, where an organization must divide its efforts between a myriad of IT concerns, with security being only one of them.

3. Flexibility: Your business has only a finite amount of focus to divide between all of its responsibilities. The cloud offers businesses more flexibility overall versus hosting on a local server. And, if you need extra bandwidth, a cloud-based service can meet that demand instantly, rather than undergoing a complex (and expensive) update to your IT infrastructure. This improved freedom and flexibility can make a significant difference to the overall efficiency of your organization.

4. Mobility: Cloud computing allows mobile access to corporate data via smart phones and devices, which, considering over 2.6 billion smart phones are being used globally today, is a great way to ensure that no one is ever left out of the loop.

5. Loss prevention: If your organization isn't investing in a cloud-computing solution, then all of your valuable data is inseparably tied to the office computers it resides in. This may not seem like a problem, but the reality is that if your local hardware experiences a problem, you might end up permanently losing your data.

6. Automatic software updates: For those who have a lot to get done, there isn't anything more irritating than having to wait for system update to be installed. Cloud-based applications automatically refresh and update themselves, instead of forcing an IT department to perform a manual organization-wide update. This saves valuable IT staff time and money spent on outside IT consultation.

7. Quality control: There are few things as detrimental to the success of a business as poor-quality, inconsistent reporting. In a cloud-based system, all documents are stored in one place and in a single format. With everyone accessing the same information, you can maintain consistency in data, avoid human error, and have a clear record of any revisions or updates.

8. Disaster recovery: Cloud-based services provide quick data recovery for all kinds of emergency scenarios' from natural disasters to power outages.

Platform as a Service (PaaS)

This service is similar to SaaS in that the infrastructure is controlled by the cloud service provider but is different in that the users can deploy their software. In this model, the clients can install and deploy their customized applications by using the tool offered by the cloud service provider. Physical settings are controlled and restricted by the cloud service provider and application settings are given to each user to control them.

Platform-as-a-service (PaaS) refers to cloud computing services that supply an on-demand environment for developing, testing, delivering and managing software applications. PaaS is designed to make it easier for developers to quickly create web or mobile apps, without worrying about setting up or managing the underlying infrastructure of servers, storage, network and databases needed for development.

It provides a platform and environment to allow developers to build applications and services. This service is hosted in the cloud and accessed by the users via internet.

To understand in a simple terms, let compare this with painting a picture, where you are provided with paint colors, different paint brushes and paper by your school teacher and you just have to draw a beautiful picture using those tools.

In Pass the platform is given to the consumers and they deploy their own software, coding and application in the cloud. It approaches to software and development tools. For example: Application server (Java, .Net framework) and Database server (My sql, oracle) which client will use to make their own applications to meet its specific needs. It creates web applications very easily and quickly on computing platform and it reduces the complexity, cost and maintenance of software.

PaaS providers offer a predefined combination of OS and application servers, such as LAMP platform (Linux, Apache, MySql and PHP), restricted J2EE, Ruby etc. Google"s App Engine, Force.com, etc are some of the popular PaaS examples.

The following diagram shows how PaaS offers an API and development tools to the developers and how it helps the end user to access business applications.
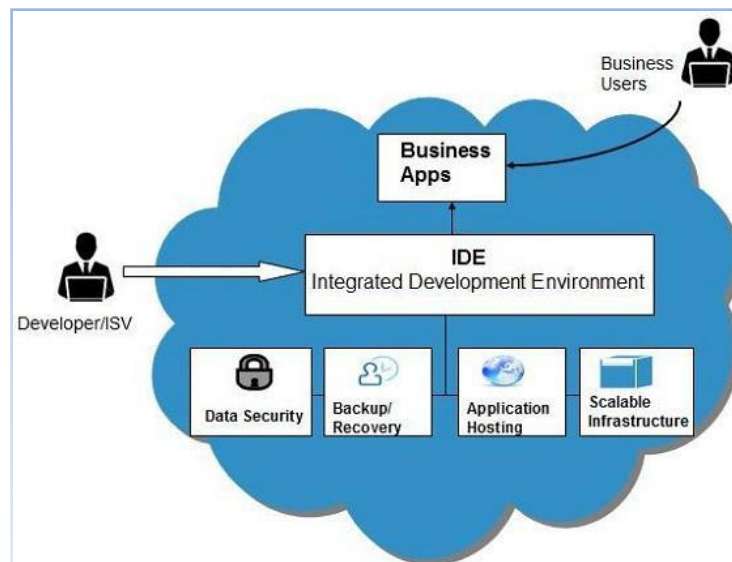

Characteristics of PaaS:

Here are the characteristics of PaaS service model:

- PaaS offers **browser based development environment**. It allows the developer to create database and edit the application code either via Application Programming Interface or point-and-click tools.
- PaaS provides **built-in security, scalability,** and **web service interfaces**.
- PaaS provides built-in tools for defining **workflow and approval processes** and defining business rules.
- It is easy to integrate with other applications on the same platform.
- PaaS also provides web services interfaces that allow us to connect the applications outside the platform.

PaaS Types

Based on the functions, the PaaS can be classified into four types as shown in the following diagram:
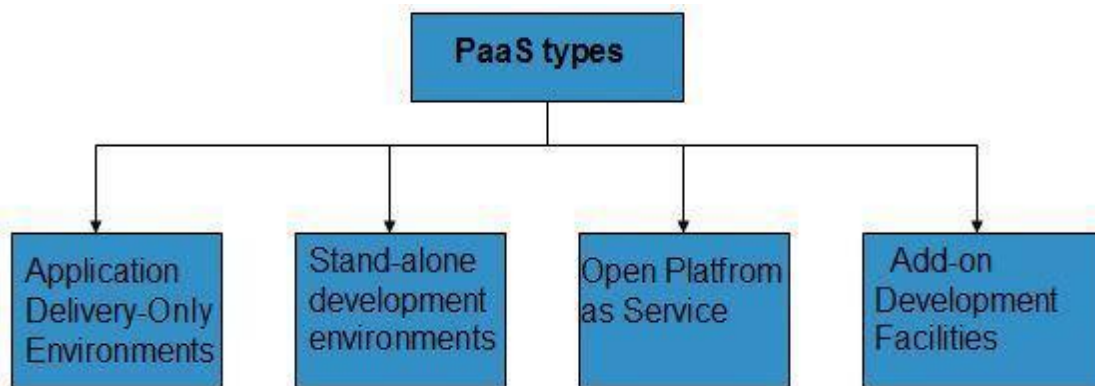
Stand-Alone Development Environments

The **Stand-alone PaaS** works as an independent entity for a specific function. It does not include licensing, technical dependencies on specific SaaS applications.

Application Delivery-Only Environments

The **Application Delivery PaaS** includes **on-demand scaling** and **application security**.

Open Platform As A Service

Open PaaS offers an **open source software** that helps a PaaS provider to run applications.

Add-On Development Facilities

The **Add-on PaaS** allows to customize the existing SaaS platform.

Benefits of PaaS

- It reduces the development and maintenance cost when we develop, deploy and test any application on same integrated environment .

- There is no need of downloading or installing for users to experience the software online. We all use website like Face book, Gmail, and yahoo etc.

- It provides scalability, reliability and security which is in built.

- Proper and deep understanding of user activities.

- Pay for use.
- It has shared architecture means concurrent users can access the application.

PaaS Service Providers

1. RightScale .com

RightScale is a company that sells software as a service for cloud computing management for multiple providers. The company is based in Santa Barbara, California.

Customers can control the RightScale cloud management platform to automatically deploy and manage their web applications –scaling up when traffic demands and scaling back as appropriate allowing them to focus on their business objectives.
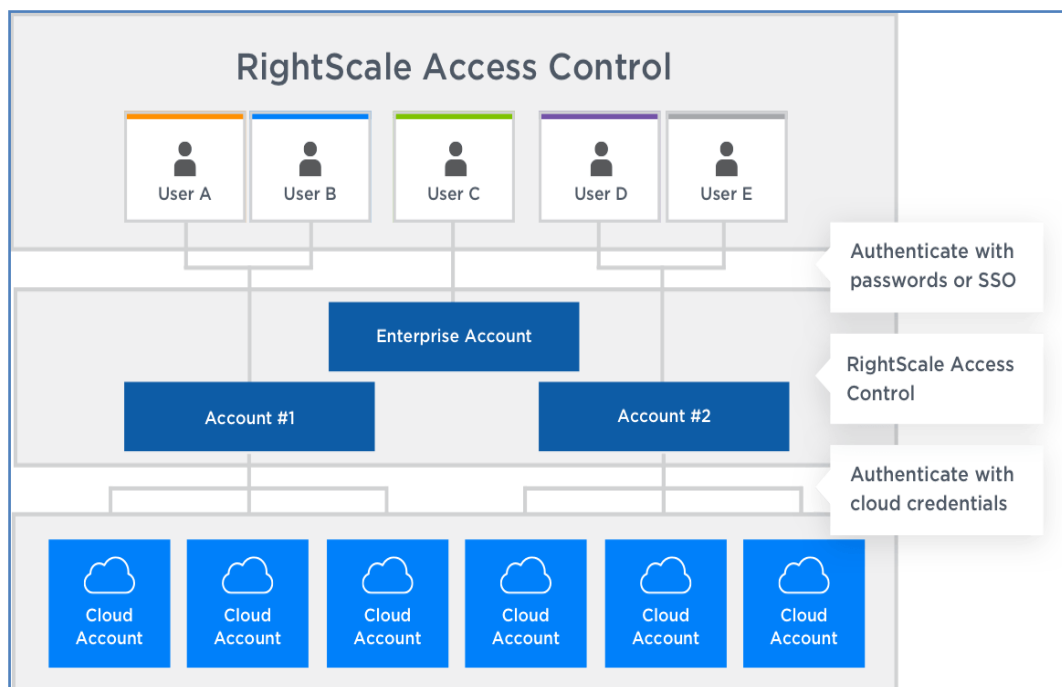
2. Rackspace.com:

It began in 1998 as the idea of Three Trinity University classmates has now become a global company with business customers in over 120 countries.

The **Rackspace Cloud** is a set of cloud computing products and services billed on a utility computing basis from the US-based

company Rackspace. Offerings include web application hosting or platform as a service ("*Cloud Sites*"), Cloud Storage ("*Cloud Files*"), virtual private server ("*Cloud Servers*"), load balancers, databases, backup, and monitoring.

It offers cloud block storage and cloud backup. It is used to deliver higher performance than object based clouds by using a combination of hard drives and solid state drives. It provides following services.

1. **Dedicated Servers**: will help design the right for high performance
   workloads.

2. **VMware**: Dedicated VMware environments, managed by VMware
   Specialists.

3. **Multi-cloud connectivity**: combine the performance of dedicated hosting with the scalability of the cloud of your choice.

4. **Databases:** Our DMA can help take the pain out of database management

5. **Storage**: Dedicated for your specific storage requirements.

6. **Networking**: Networking specialists help build a secure network infrastructure.

Infrastructure as a Service (IaaS):

Introduction:

Infrastructure and Hardware –as-a-Service (IaaS/HaaS) solutions are the most popular and developed market segment of cloud computing. They deliver customizable infrastructure on demand. The available options with the IaaS offering umbrella range from single servers to entire infrastructure , including network devices, load balancers ,database and web servers.

Infrastructure as a Service (IaaS):

IaaS provides the delivery of computing resources in form of hardware, network, storage, operating system and storage devices as on demand service. IaaS is combination of both public and private infrastructure or can be obtained as individual. For IT resources IaaS will provide a new consumption model as compare to SaaS and PaaS the IaaS is growing rapidly.

In this service, computing resources such as processing, storage and networks can be provisioned. The client of IaaS can install and use any arbitrary operating system. Also, the clients can install and deploy their applications on this operating system. Cloud services such as Amazon EC2 are adopting this model and charging their clients according to the resources are being utilized.

IaaS provides access to fundamental resources such as physical machines, virtual machines, virtual storage, etc., Apart from these resources, the IaaS also offers:

- Virtual machine disk storage

- Virtual local area network (VLANs)

- Load balancers

- IP addresses

- Software bundles

All of the above resources are made available to end user via **server virtualization**. Moreover, these resources are accessed by the customers as if they own them. Some common examples are Amazon, GoGrid, 3 Tera, etc.

IaaS (Infrastructure as a service) is a complete package for computing. For small scale businesses who are looking for cutting cost on IT infrastructure, IaaS is one of the solutions. Annually a lot of money is spent in maintenance and buying new components like hard-drives, network connections, and external storage device etc. which a business owner could have saved for other expenses by using IaaS.

Infrastructure as a service (IaaS) is an instant computing infrastructure, provisioned and managed over the Internet. Quickly scale up and down with demand and pay only for what you use.

IaaS helps you avoid the expense and complexity of buying and managing your own physical servers and other datacenter infrastructure. Each resource is offered as a separate service component and you only need to rent a particular one for as long as you need it. The cloud computing service provider manages the infrastructure, while you purchase, install, configure and manage your own software—operating systems, middleware and applications.
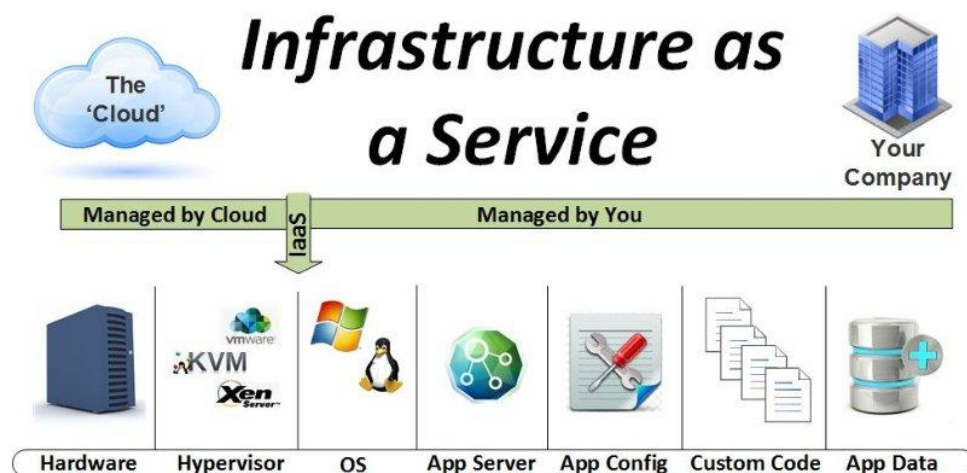
Characteristics of IaaS

- Here are the characteristics of IaaS service model:
- Virtual machines with pre-installed software.
- Virtual machines with pre-installed Operating Systems such as Windows, Linux, and Solaris.
- On-demand availability of resources.
- Allows to store copies of particular data in different locations.
- The computing resources can be easily scaled up and down.

Benefits

- IaaS distribute the resources as a service.
- Dynamic scaling is allowed in IaaS.
- In IaaS cost varies.
- In IaaS, multiple users or customers can access on a same hardware.
- It has full scalability.
- Full Control of the computing resources through Administrative Access to VMs.
- Flexible and Efficient renting of Computer Hardware.
- Portability, Interoperability with Legacy Applications.

IaaS Service Providers:

The IaaS provider owns and maintains the equipment while the organization rents out the specific services it needs, usually on a "Pay as you go" basis.

Below is the list of IaaS Service Providers:

- Amazon (EC2)AWS
- Windows Azure
- GoGrid
- IBM Smart cloud Enterprise
- Rackspace Open Cloud
- Google Compute Engine

1.Amazon Elastic Compute Cloud (Amazon EC2)

Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides secure, resizable compute capacity in the cloud. It is designed to make web-scale cloud computing easier for developers.

Amazon EC2's simple web service interface allows you to obtain and configure capacity with minimal friction. It provides you with complete control of your computing resources and lets you run on Amazon's proven computing environment. Amazon EC2 reduces the time required to obtain and boot new server instances to minutes, allowing you to quickly scale capacity, both up and down, as your computing

requirements change. Amazon EC2 changes the economics of computing by allowing you to pay only for capacity that you actually use. Amazon EC2 provides developers the tools to build failure resilient applications and isolate them from common failure scenarios.

Amazon EC2Benefits

1. **Elastic Web-Scale Computing**:

Amazon EC2 enables you to increase or decrease capacity within minutes, not hours or days. You can commission one, hundreds, or even thousands of server instances simultaneously. You can also use Amazon EC2 Auto Scaling to maintain availability of your EC2 fleet and automatically scale your fleet up and down depending on its needs in order to maximize performance and minimize cost.

2. **FLEXIBLE CLOUD HOSTING SERVICES**

You have the choice of multiple instance types, operating systems, and software packages. Amazon EC2 allows you to select a configuration of memory, CPU, instance storage, and the boot partition size that is optimal for your choice of operating system and application.

3. **INTEGRATED**

Amazon EC2 is integrated with most AWS services such as Amazon Simple Storage Service (Amazon S3), Amazon Relational Database Service (Amazon RDS), and Amazon Virtual Private Cloud (Amazon VPC) to provide a complete, secure solution for computing, query processing, and cloud storage across a wide range of applications.

4. **RELIABLE**

Amazon EC2 offers a highly reliable environment where replacement instances can be rapidly and predictably commissioned. The service runs within Amazon's proven network infrastructure and data centers. The Amazon EC2 Service Level Agreement commitment is 99.99% availability for each Amazon EC2 Region.

5. SECURE

Cloud security at AWS is the highest priority. As an AWS customer, you will benefit from a data center and network architecture built to meet the requirements of the most security-sensitive organizations. Amazon EC2 works in conjunction with Amazon VPC to provide security and robust networking functionality for your compute resources.

6. INEXPENSIVE

Amazon EC2 passes on to you the financial benefits of Amazon's scale. You pay a very low rate for the compute capacity you actually consume

7. EASY TO START

There are several ways to get started with Amazon EC2. You can use the AWS Management Console, the AWS Command Line Tools (CLI), or AWS SDKs. AWS is free to get started.

2. GoGrid

GoGrid is a service provider of Windows and Linux cloud-based server hosting and offers32-bit and 64-bit editions of Windows Server 2008 within its cloud computing infrastructure. Parent company server path is a Microsoft Cloud Certified partner and launched Windows Server 2008

GoGrid becomes one of the first Infrastructure as a Service (IaaS) providers to offer Windows Server 2008 in the cloud.

GoGrid enables system administrators to quickly and easily create, deploy, load balance and manage Windows and Linux cloud servers within minutes.

GoGrid API's

GoGrid API is a web service that allows developers to control their interaction with GoGrid's cloud hosting infrastructure. The GoGrid API providers two-way communication for controlling GoGrid control panel functionality. Typical uses for the API include

- Auto-scaling network servers
- Listing assigned public and private IP addresses
- Deleting servers

- Listing billing details

The GoGrid API requires you to be a GoGrid customer and to have technical knowledge and programming skills.

The GoGrid API supports these languages

- Java
- PHP
- Python
- Ruby

Gogrid is a California company that has been providing IaaS since 2008. They are a company with longevity and a healthy turnover.

"GoGrid has made it easy for companies to stand up big data solutions quickly. Data pipe customers will achieve significant value from the speed at which we can now create new big data projects in the cloud. This acquisition advances Data pipes strategy to help our enterprise clients architect, deploy and manage multi-cloud hybrid IT solutions".

CLOUD DEPLOYMENT MODELS:
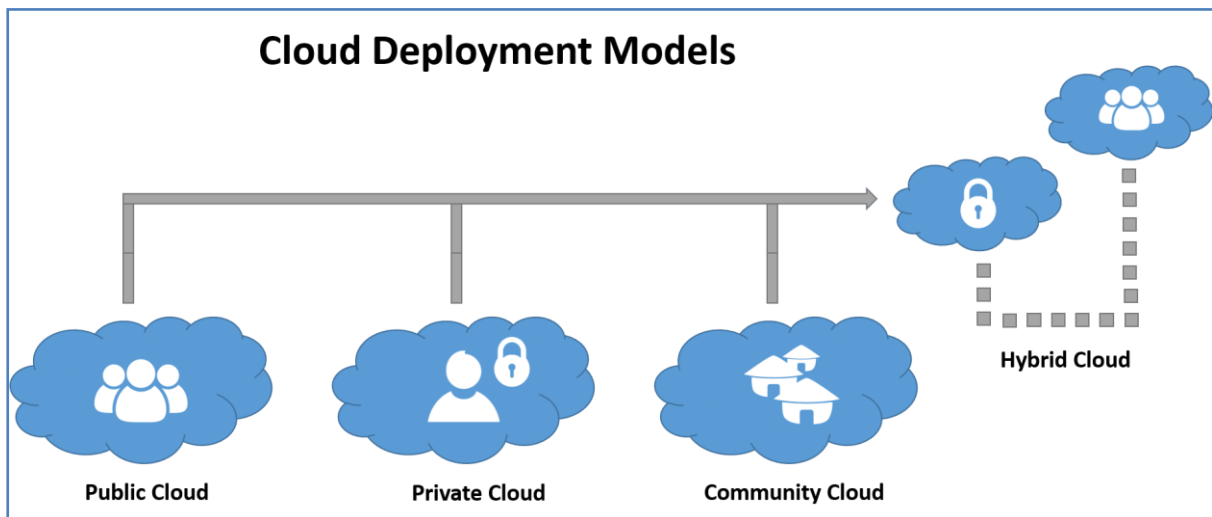
A cloud deployment model represents a specific type of cloud environment, primarily distinguished by ownership, size and access.

There are four deployment models mentioned below:

1. Private Cloud Model
2. Public Cloud Model
3. Community Cloud Model
4. Hybrid Cloud Model

1. Private Cloud Model:

In this model, the cloud provider provides cloud infrastructure to a single organization that has many consumers. This infrastructure is to be used exclusively for their use and need. The owner, manager, and operator of this could be the organization itself, a third party, or the organization and third party together. This private cloud could be on premises or off premises. The only big advantage that private cloud has over public cloud is that of data security and privacy.

Advantage of Private Cloud Computing
1. Offers greater Security and Privacy
2. Offers more control over system configuration as per the company's need
3. Greater reliability when it comes to performance
4. Enhances the quality of service offered by the clients
5. Saves money

Disadvantage of Private Cloud
1. Expensive when compared to public cloud
2. Requires IT Expertise

2. Public Cloud Model

This model differs from the previous model in that it is open for the public; it is not private and not exclusively for community. In this model, a public cloud can be provisioned for public to use it to satisfy their needs. The owner, manager, and operator of this cloud could be a government, private organization, a business or academic organization, and sometimes

many of them can be in one cloud and get the service from the same provider.

In public clouds, resources are offered as a service, usually over an internet connection, for a pay-per-usage fee. Users can scale their use on demand and do not need to purchase hardware to use the service.

Advantage of Public Cloud Computing

1. It offers greater scalability

2. Its cost effectiveness helps you save money.

3. It offers reliability which means no single point of failure will interrupt your service.

4. Services like SaaS, (Paas), (Iaas) are easily available on Public Cloud platform as it can be accessed from anywhere through any Internet enabled devices.

5. It is location independent – the services are available wherever the client is located.

Disadvantage of Public Cloud Computing

1. No control over privacy or security

2. Cannot be used for use of sensitive applications

3. Lacks complete flexibility as the platform depends on the platform provider

4. No stringent protocols regarding data management

Examples of public cloud include: Amazon AWS, Google Apps, Salesforce.com , Microsoft BPOS, Microsoft Office 365

3. **Community Cloud Model**

In this model, the cloud provider provides cloud infrastructure to many organizations that forms community that shares mission, security requirements, compliance consideration, or policy. This infrastructure is to be used exclusively for their uses and needs. The owner, manager, and operator of this cloud could be one of organizations, a third party, or the organization and third party together. This Community cloud could be on premises or off premises.

The advantages of community cloud

1. Cost of setting up a communal cloud versus individual private cloud can be cheaper due to the division of costs among all participants.

2. Management of the community cloud can be outsourced to a cloud provider. The advantage here is that the provider would be an impartial third party that is bound by contract and that has no preference to any of the clients involved other than what is contractually mandated.

3. Tools residing in the community cloud can be usedϖ to leverage the information stored to serve consumers and the supply chain, such as return tracking and just-in-time production and distribution.

Drawbacks of community cloud:

1. Costs higher than public cloud.

2. Fixed amount of bandwidth and data storage isϖ shared among all community members.

4. **Hybrid Cloud Model** :

This model comprises two or more deployment models (private, community, or public). The cloud infrastructure can be combination of those models. Data center within an organization, private cloud, and public cloud can be combined in order to get services and data from both in order to create a well managed and unified computing environment. A cloud can be considered hybrid if the data moves from a data center to a private cloud or public cloud or vice versa.

Advantage of Hybrid Cloud Computing

1. It is scalable

2. It is cost efficient

3. Offers better security

4. Offers greater flexibility

Disadvantage of Hybrid Cloud Computing

1. Infrastructure Dependency

2. Possibility of security breach through public cloud

Advantages of Cloud Computing:

1.Reduced IT costs

Moving to cloud computing may reduce the cost of managing and maintaining your IT systems. <u>Rather than purchasing expensive systems and equipment for your business, you can reduce your costs by using the resources of your cloud computing service provider.</u> You may be able to reduce your operating costs because:

- the cost of system upgrades, new hardware and software may be included in your contract
- you no longer need to pay wages for expert staff
- your energy consumption costs may be reduced
- there are fewer time delays.

2. Scalability

Your business can scale up or scale down your operation and storage needs quickly to suit your situation, allowing flexibility as your needs change. <u>Rather than purchasing and installing expensive upgrades yourself, your cloud computer service provider can handle this for you</u>. Using the cloud frees up your time so you can get on with running your business.

3. Business continuity

Protecting your data and systems is an important part of business continuity planning. <u>Whether you experience a natural disaster, power failure or other crisis, having your data stored in the cloud ensures it is backed up and protected in a secure and safe location</u>. Being able to access your data again quickly allows you to conduct business as usual, minimizing any downtime and loss of productivity.

4. Collaboration efficiency

Collaboration in a cloud environment gives your business the ability to communicate and share more easily outside of the traditional methods. <u>If you are working on a project across different locations, you could use cloud computing to give employees, contractors and third parties access to the same files. You could also choose a cloud computing model that makes it easy for you to share your records with your advisers</u> (e.g. a quick and secure way to share accounting records with your accountant or financial adviser).

5. Flexibility of work practices

Cloud computing allows employees to be more flexible in their work practices. For example, <u>you have the ability to access data from home, on holiday, or via the commute to and from work </u>(providing you have an internet connection). If you need access to your data while you are off-site, you can connect to your virtual office, quickly and easily.

6. Access to automatic updates

Access to automatic updates for your IT requirements may be included in your service fee<u>. Depending on your cloud computing service provider, your system will regularly be updated with the latest technology</u>. This could include up-to-date versions of software, as well as upgrades to servers and computer processing power.

Disadvantages of Cloud Computing

1. Downtime

As cloud service providers take care of a number of clients each day, they can become overwhelmed and may even come up against technical outages. This can lead to your business processes being temporarily suspended. Additionally, if your internet connection is offline, you will not be able to access any of your applications, server or data from the cloud.

2.Security

Although cloud service providers implement the best security standards and industry certifications, storing data and important files on external service

providers always opens up risks. Using cloud-powered technologies means you need to provide your service provider with access to important business data. Meanwhile, being a public service opens up cloud service providers to security challenges on a routine basis.

3. Vendor Lock-In

Although cloud service providers promise that the cloud will be flexible to use and integrate, switching cloud services is something that hasn't yet completely evolved. For instance, applications developed on Microsoft Development Framework (.Net) might not work properly on the Linux platform.

4. Limited Control

Since the cloud infrastructure is entirely owned, managed and monitored by the service provider, it transfers minimal control over to the customer. The customer can only control and manage the applications, data and services operated on top of that, not the backend infrastructure itself. Key administrative tasks such as server shell access, updating and firmware management may not be passed to the customer or end user.

UNIT-V - Virtualization

Introduction

Cloud computing is one of the most useful technology that is been widely used all over the world. It generally provides on demand IT services and products. Virtualization plays a major role in cloud computing as it provides a virtual storage and computing services to the cloud clients which is only possible through virtualization. Cloud computing is a new business computing paradigm that is based on the concepts of virtualization, multi-tenancy, and shared infrastructure.

Virtualization

Virtualization is basically making a virtual image or "version" of something such as server, operating system, storage devices or network resources so that they can be used on multiple machines at the same time.

The main aim of virtualization is to manage the workload by transforming traditional computing to make it more scalable, efficient and economical. Virtualization can be applied to a wide range such as operating system virtualization, hardware-level virtualization and server virtualization.

Virtualization technology is hardware reducing cost saving and energy saving technology that is rapidly transforming the fundamental way of computing.

Even though cloud computing can exists without virtualization it may be inefficient and difficult. As cloud computing tags with "pay-as-use" and "infinite" availability these are mainly virtualization theme.

Cloud computing has clients, data centers, distributed servers as the components.

- Clients: Users like computers, laptops, tablets computers mobile phones or PDA's.
- Data Centers: These are a collection of servers where the application is hosted. Virtualization is done where multiple instances of virtual servers are created.
- Distributed Server: Servers which reside non locally which are geographically far.

THE NEED OF VIRTUALIZATION

Imagine a situation where you don't need to maintain a plethora of servers in a gargantuan server room. You don't have to buy lakhs of PC's for the work force of your organization. <u>No need to buy individual storage space for your apps. All of this is possible and real with a technology named as Virtualization.</u>

With the growing and scaling technology, the complexity to manage IT infrastructure has also increased to a challenging level. This is one of the major factor due to which efficiency is plummeted. To solve this technical bottleneck a technology comes into play, which is 'Virtualization'. <u>With virtualization, there is no need of following the old approach of "One app, One Server".</u>

Virtualization, a state-of-art technology is a great boon for an IT industry which allows performing more with less. The main as well as usual goal of virtualization is to centralize the major and administrative tasks with parallel improvisation in scalability and work load.

Most of the businesses often use a combination of a number of application servers, catalog server, web servers, image servers, file servers, video and audio servers, and the most important the database servers. Although modern web usage developments may suggest that all of the above mentioned hardware infrastructure is being used well almost all the time, this is falsehood and more accurately, an illogical belief. If 75% of the hardware appears to be used at any time it is considered to be underutilized. The servers typically take only about (1-10) milliseconds to service each request.

Generally ,the amount of time the server machine is kept up and running relative to the actual time spent by it servicing the requests, is much higher .This clearly shows that a significant amount of energy is wasted per server in the process of keeping the servers up and ever-ready to service requests upon their arrival. So the efforts to maximize the server utilization is limited by the number of incoming server requests. For ensuring that a good fraction of time is spent by the server in servicing requests, virtualization must be ensured

Virtualization technique ensures the availability of hardware and gives

every application running on top of it. The details of the virtual, simulated environment are kept transparent from the application. The advantage here is the reduced cost of maintenance and reduced energy wastage which is not very surprising. So virtualization reduces the number of physical servers as a result of which one needs to maintain few servers ,this becomes much cheaper and easier. The amount of energy wasted is a function of the number of physical servers that is reduced in a virtualized environment. In case of desktop virtualization updates may now be made available much sooner as a single firmware update does not update one client machine, but several instances of the same

1. **Save resources and money**

Every industry has profit-making as their major goal. Virtualization gives you the same while cutting down the need to maintain lot of servers, desktop and data storage machines. All the money invested on the maintenance of these multiple resources is directly cut down to the maintenance cost equivalent to 1-2 resources.

2. **Simplified management of data centre**

Long gone are the days to manage multiple hard drives and data cables. Now with virtualization just manage 2-3 mega resources and manage zillions of data in fast and easy.

3. **Increased IT productivity and efficiency**

Now with no hassle and wariness of IT management for big firms, all the technical and software advancement can be done with increased efficiency.

4. **Easy disaster recovery:**

If in case there's an event of system crash then with virtualization it is easy to detect the loophole as the network or data system is simplified now just to 2-3 layers in-spite of web of hard wires and connection.

5. **Enhanced Security**

Dropping down to less complex system makes a way to enhance the security level which is easy to implement and more favorable.

So Virtualization is a big boon to the tech industry to march ahead without any hassle of hardware or software complexity

Types of virtualization

In cloud computing the virtualization can be done in two ways either by storage virtualization or by software virtualization.

a. Storage virtualization: The storage available is virtualized to get large virtual storage access and it is further used for allocating memory to the cloud clients.

b. Software virtualization: software built by the company can be used by a large number of systems at the same time with the help of virtualization. A virtual layer is created on which the software is installed and used

Different Types of Hardware Virtualizations

1. **Full Virtualization** – In it, the complete simulation of the actual hardware takes place to allow software to run an unmodified guest OS.
2. **Para Virtualization** – In this type of virtualization, software unmodied runs in modified OS as a separate system.
3. **Partial Virtualization** – In this type of hardware virtualization, the software may need modification to run.

Desktop virtualization

It provides the work convenience and security. As one can access remotely, you are able to work from any location and on any PC. It provides a lot of flexibility for employees to work from home or on the go. It also protects confidential data from being lost or stolen by keeping it safe on central servers.

Software Virtualization

It provides the ability to the main computer to run and create one or more virtual environments. It is used to enable a complete computer system in order to allow a guest OS to run. For instance letting Linux to run as a guest that is natively running a Microsoft Windows OS (or vice versa, running Windows as a guest on Linux).

Types:

- Operating system
- Application virtualization
- Service virtualization

Data Virtualization

Without any technical details, you can easily manipulate data and know how it is formatted or where it is physically located. It decreases the data errors and workload.

Storage Virtualization

In this type of virtualization, multiple network storage resources are present as a single storage device for easier and more efficient management of these resources. It provides various advantages as follows:

- Improved storage management in a heterogeneous IT environment
- Easy updates, better availability
- Reduced downtime
- Better storage utilization
- Automated management

In general, there are two types of storage virtualization:

- **Block-** It works before the file system exists. It replaces controllers and takes over at the disk level.
- **File-** The server that uses the storage must have software installed on it in order to enable file-level usage.
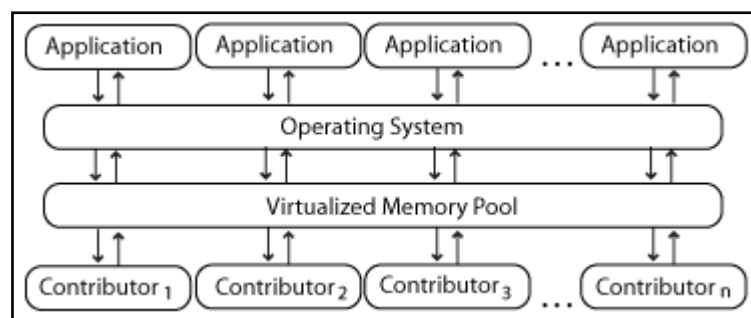
Memory Virtualization

It introduces a way to decouple memory from the server to provide a shared, distributed or networked function. It enhances performance by providing greater memory capacity without any addition to the main memory. That's why a portion of the disk drive serves as an extension of the main memory.

Implementations –

- **Application-level integration –** Applications running on connected computers directly connect to the memory pool through an API or the file system.
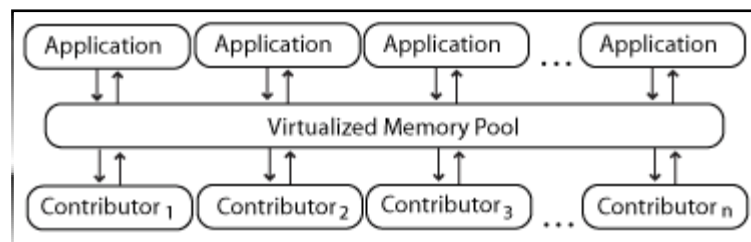

- **Operating System Level Integration –** The operating system first connects to the memory pool, and makes that pooled memory available to applications.

Microsoft Hyper V :

Microsoft introduced Hyper-V as a virtualization platform in 2008, and it continued to release new Hyper-V versions with new Windows server versions. So far, there are a total of four versions, including Windows Server 2012 R2, Windows Server 2012, Windows Server 2008 R2 and Windows Server 2008.

Hyper-V is a hybrid hypervisor, which is installed from OS (via Windows wizard of adding roles). However, during installation it redesigns the OS architecture and becomes just like a next layer on the physical hardware (refer to pic.1).
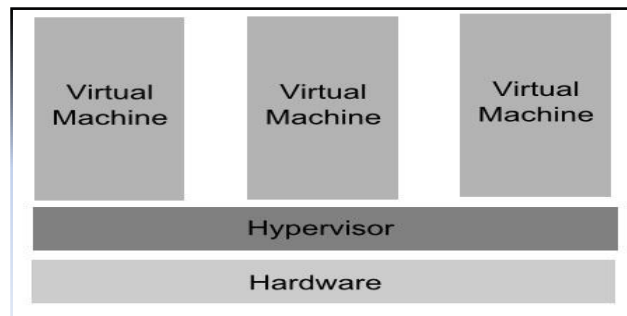
Pic. 1 Hyper-V architecture

How to install Hyper-V

It's simple and the same as any typical program installation. First of all, check and see which Windows version you have. If it's Windows Server OS and newer than 2008, you should activate the Hyper-V role through the Server Manager, and then perform the installation by following the wizard. For Windows 8/8.1, check Windows 8 versions comparison, to make sure your current OS license allows you to deploy Hyper-V.

Note: If you are running a Windows version older than 2008, you will need to upgrade to a newer version before you can proceed.

Once the installation is complete, the computer will reboot. After it has rebooted, you will notice additional services have been installed, including Hyper-V Manager.

Next, let's go to the **Control Panel**, then to **Administration** and then to **Hyper-V Manager** to find out what you can do with this installation.

How does it work?

All Hyper-V management operations are available from Hyper-V Manager (pic.2).