UNIT I

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 public and private networks, i.e., WAN, LAN or VPN.

Applications such as e-mail, web conferencing, customer relationship management (CRM) execute on cloud.

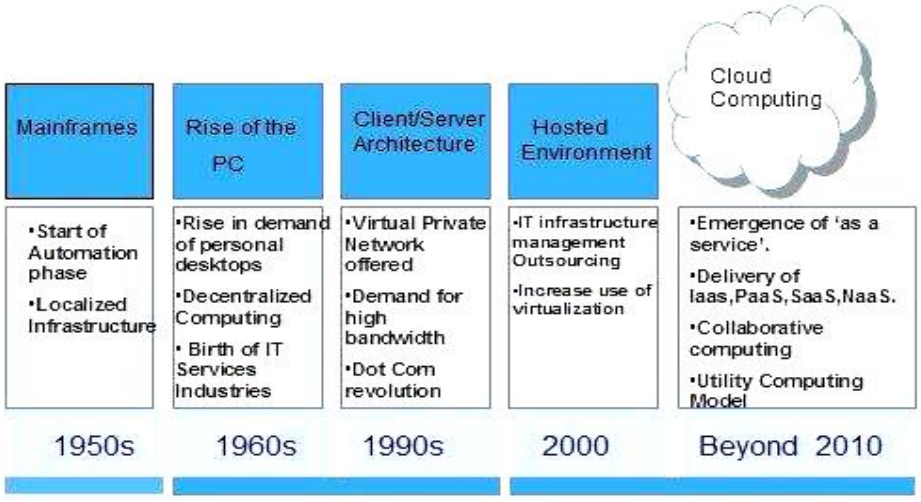
What is Cloud Computing?

Cloud Computing refers to **manipulating, configuring,** and **accessing** the hardware and software resources remotely. It offers online data storage, infrastructure, and application.

Cloud computing offers **platform independency,** as the software is not required to be installed locally on the PC. Hence, the Cloud Computing is making our business applications **mobile** and **collaborative.**

History of Cloud Computing

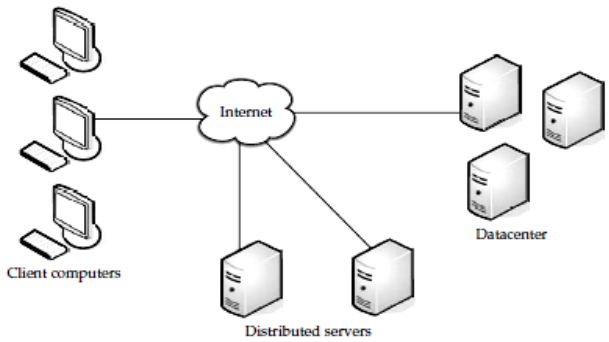
The concept of **Cloud Computing** came into existence in the year 1950 with implementation of mainframe computers, accessible via **thin/static clients.** Since then, cloud computing has been evolved from static clients to dynamic ones and from software to services. The following diagram explains the evolution of cloud computing:



Q. Explain different Components of Cloud Computing?

Components of Cloud Computing

In a simple, topological sense, a cloud computing solution is made up of several elements: clients, the datacenter, and distributed servers.These components make up the three parts of a cloud computing solution. Each element has a purpose and plays a specific role in delivering a functional cloud based application, so let's take a closer look.



1. Clients:

Clients are, in a cloud computing architecture, the exact same things that they are in a plain, old, everyday local area network (LAN). They are, typically, the computers that just sit on your desk. But they might also be laptops, tablet computers, mobile phones, or PDAs—all big drivers for cloud computing because of their mobility. Anyway, clients are the devices that the end users interact with to manage their information on the cloud.

Clients generally fall into three categories:

- **Mobile:**
  Mobile devices include PDAs or smartphones, like a Blackberry, Windows Mobile Smartphone, or an iPhone.
- **Thin:**
  Clients are computers that do not have internal hard drives, but rather let the server do all the work, but then display the information.
- **Thick:**
  This type of client is a regular computer, using a web browser like Firefox or Internet Explorer to connect to the cloud.

Thin clients are becoming an increasingly popular solution, because of their price and effect on the environment. Some benefits to using thin clients include

- **Lower hardware costs:**
  Thin clients are cheaper than thick clients because they do not contain as much hardware. They also last longer before they need to be upgraded or become obsolete.

- **Lower IT costs:**
  Thin clients are managed at the server and there are fewer pointsof failure.
- **Security:**
  Since the processing takes place on the server and there is no hard drive, there's less chance of malware invading the device. Also, since thin clients don't work without a server, there's less chance of them being physically stolen.

- **Data security:**
  Since data is stored on the server, there's less chance for data to be lost if the client computer crashes or is stolen.
- **Less power consumption:**
  Thin clients consume less power than thick clients. This means you'll pay less to power them, and you'll also pay less to air-condition the office.
- **Ease of repair or replacement:**
  If a thin client dies, it's easy to replace. The box is simply swapped out and the user's desktop returns exactly as it was before the failure.
- **Less noise:**
  Without a spinning hard drive, less heat is generated and quieter fans can be used on the thin client.

2. Data centre:

The *data center* is the collection of servers where the application to which you subscribe is housed. It could be a large room in the basement of your building or a room full of servers on the other side of the world that you access via the Internet.

A growing trend in the IT world is virtualizing servers. That is, software can be installed allowing multiple instances of virtual servers to be used.

In this way, you can have half a dozen virtual servers running on one physical server.

3. Distributed Servers:

But the servers don't all have to be housed in the same location. Often, servers are in geographically disparate locations. But to you, the cloud subscriber, these servers act as if they're humming away right next to each other. This gives the service provider more flexibility in options and security.

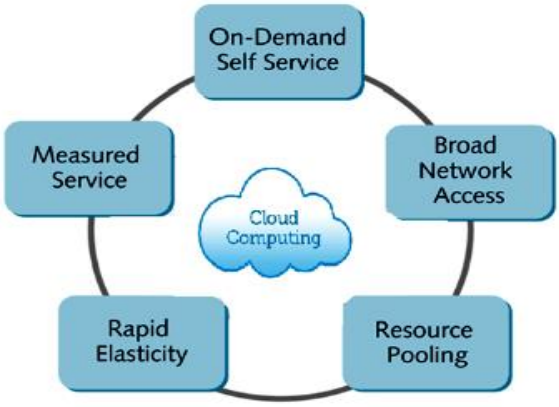
For instance, Amazon has their cloud solution in servers all over the world. If something were to happen at one site, causing a failure, the service would still be accessed through another site.

Also, if the cloud needs more hardware, they need not throw more servers in the safe room—they can add them at another site and simply make it part of the cloud.

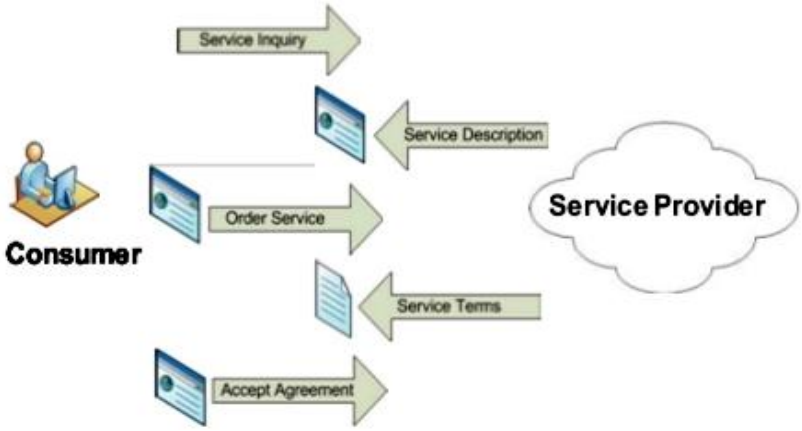
Q. Explain the characteristics of Cloud Computing?

Characteristics of Cloud Computing

The five essential characteristics of cloud computing are



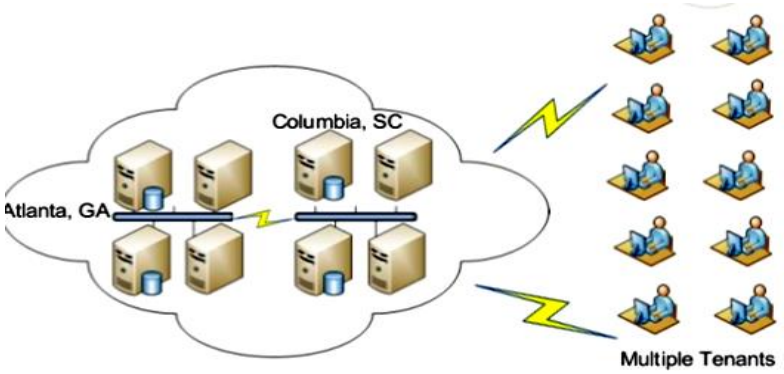
1. **On-demand self-service:** A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.



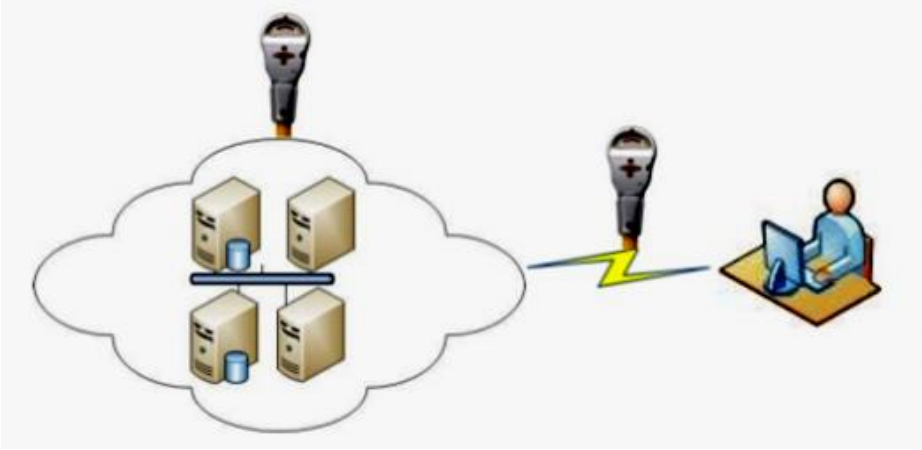
2. **Broad network access:** Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., **mobile** phones, tablets, laptops and workstations).

3. **Resource pooling:** The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify

location at a higher level of abstraction (e.g., country, state or datacenter). Examples of resources include storage, processing, memory and network bandwidth.



4. **Rapid elasticity:** Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.
5. **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.



UNIT II

When You Can Use Cloud Computing?

Cloud computing depends on a number of factors, including

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

Q. Explian about Cloud Scenarios? (Or) Explain different major implementations of Cloud Computing?

Scenarios:

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

1. Compute Clouds

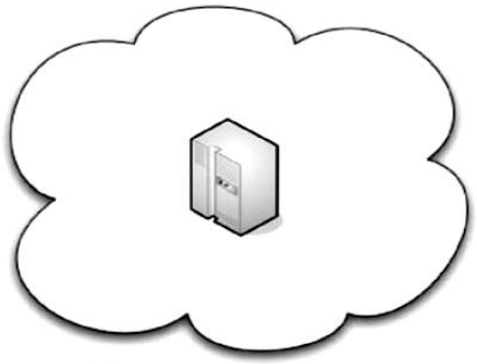
Compute clouds allow access to highly scalable, inexpensive, on-demand computing resources that run the code that they're given.

Examples:

1. Amazon's EC2
2. Google App Engine
3. Berkeley Open Infrastructure for Network Computing (BOINC)

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.

- Sign up for a cloud computing account, and get started right away.
- These applications are good for any size organization, but large organizations might be at a disadvantage because these applications don't offer the standard management, monitoring, and governance capabilities.
- Amazon offers enterprise-class support and there are emerging sets of cloud offerings like Terremark's Enterprise Cloud, which are meant for enterprise use.

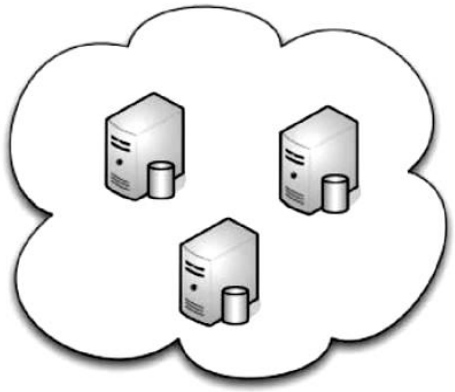


Compute clouds allow you to access applications maintained on a provider's equipment.

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 in excess of 100 vendors offering cloud storage.
- This is an ideal solution if you want to maintain files off-site.
- Security and cost are the top issues in this field and vary greatly, depending on the vendor you choose.
- Currently, Amazon's S3 is the top dog.



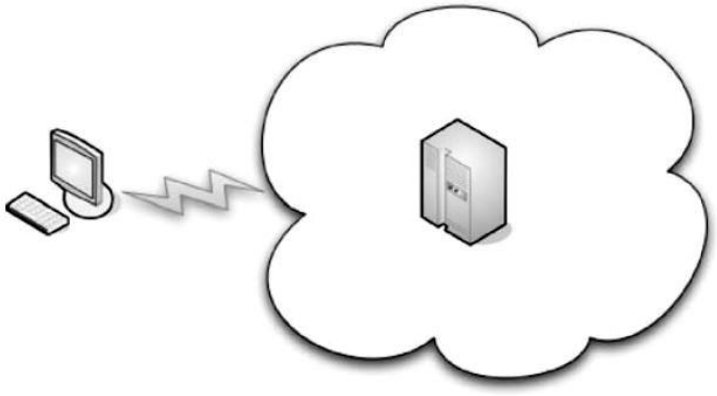
Cloud storage allows you to store your data on a vendor's equipment.

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 Software as a Service (SaaS) 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 often eliminate the need to install and run the application on the customer's own computer, thus alleviating the burden of software maintenance, ongoing operation, and support.

Some cloud applications include

- Peer-to-peer computing (like BitTorrent and Skype)
- Web applications (like MySpace or YouTube)
- SaaS (like Google Apps)
- Software plus services (like Microsoft Online Services)



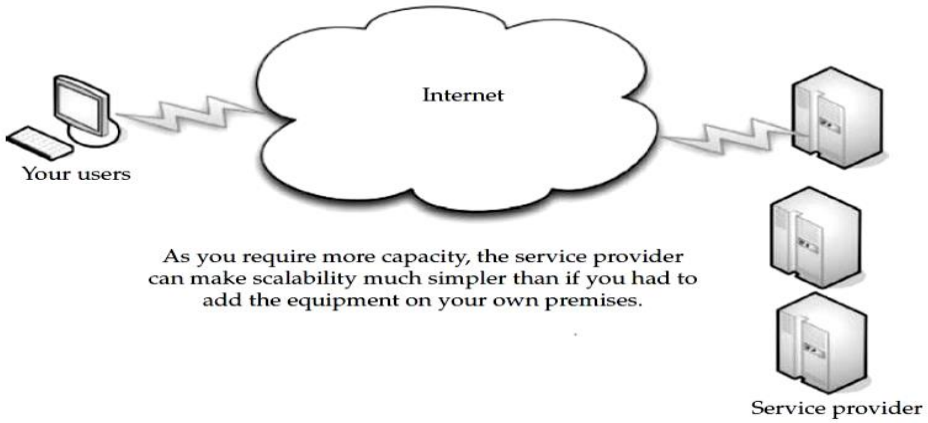
Cloud applications deliver applications that depend on the infrastructure of the Internet itself.

Q. Explain about the Benefits of Cloud Computing?

Benefits

Scalability:

If you are surprised by a sudden demand, cloud computing can help you manage. Rather than having to buy, install and configure new equipment, you can buy additional CPU cycles or storage from a third party. Since your costs are based on consumption, you likely wouldn't have to pay out as much as if you had to buy the equipment. Once you have fulfilled your need for additional equipment, you just stop using the cloud provider's services, and you don't have to deal with unneeded equipment. You simply add or subtract based on your organization's need.



Simplicity:

Again, not having to buy and configure new equipment allows you and your IT staff to get right to your business. The cloud solution makes it possible to get your application started immediately, and it costs a fraction of what it would cost to implement an on-site solution.

Vendors:

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

Security:

There are plenty of security risks when using a cloud vendor, but reputable companies strive to keep you safe and secure.

Vendors have strict privacy policies and employ strict security measures, like proven cryptographic methods to authenticate users. Further, you can always encrypt your data before storing it on a provider's cloud. In some cases, between your encryption and the vendor's security measures, your data may be more secure than if it were stored in-house.

Q.What are the limitations of Cloud Computing?

Limitations

1. Sensitive Information

About the concern of storing sensitive information on the cloud, but it can't be simple. Once data leaves your hands and lands in the part of a service provider, you've lost a layer of control.

Let's say a financial planner is using Google Spreadsheets to maintain a list of employee social security numbers. Now the financial planning company isn't the only one who should protect the data from hackers and internal data failure.

In a technical sense, it also becomes Google's problem. However, Google may release itself of responsibility in its agreement with you. So, it's no less complicated a task to sort out how sensitive information is genuinely secured.

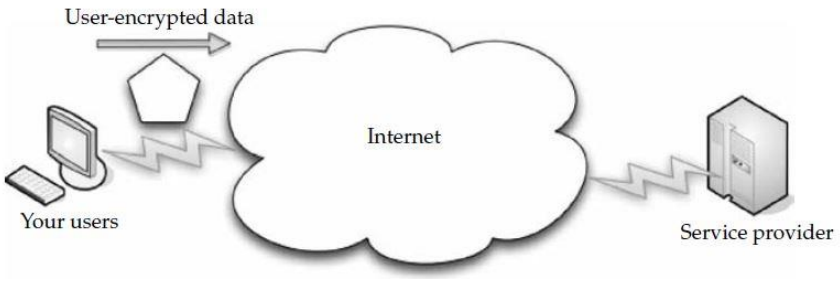
Also, the door is wide open for government investigators to file that information. It has become much easier for the government to get information from third parties than from a privately owned server.

For example, Google's policy states that the company will share data with the government if it has a "good faith belief" that access are necessary to fulfil lawful requests.

Protect Your Data

That doesn't mean you can't maintain your data on a cloud, you just need to be safe. The best way is to encrypt your data before you send it to a third party.

Programs like PGP (www.pgp.com) or open-source TrueCrypt (www.truecrypt.org) can encrypt the file, so that only those with a password can access it.



Encrypting your data before it is sent to the service provider ensures that your data is still secure.

2. Application Development:

In some cases the applications themselves are not ready to be used on the cloud. The application might require a lot of bandwidth to communicate with users.

since cloud computing is paid based on how much you use. The application might also take a lot of effort to integrate with your other applications.

If you try to relocate it to a cloud, you may find that the savings are erased by the additional effort required.

If the application has to talk with a database that you have onsite, it may be better to also have the application hosted locally until you can move the entire infrastructure to the cloud.

Some applications may not be able to communicate securely across the Internet, then your data is at risk.

So you have to write your own applications.

Developing your own Application:

Often, the applications you want are already out there. However, it may be the case that you need a very specific application. And in that case, you'll have to commission its development yourself.

Rolling Up Your Sleeves

Developing your own applications can certainly be a problem if you don't know how to program, or if you don't have programmers on staff. In such a case, you'll have to hire a software company (or developer) or be left to use whatever applications the provider offers.

It is not just applications that you might need some programming ability to deploy. If you have a database on the cloud, you'll need some sort of customized interface and some knowledge of Structured Query Language (SQL) to access and manage that data.

This is sort of a minor concern, because chances are good that you have programmers on staff who can hit out what you need in no time. Failing that, you can always rent a firm or a programmer to do it for you. Who you'll need to hire and how much you'll need to invest will depend on the scope of your application.

Benefits

The fact of the matter is that putting your database needs on a cloud can be very beneficial, in terms of scalability. At some point, your servers are going to have issues if there are too many users trying to access them, and the inherent scalability of cloud-based resources can alleviate that risk. It is often said that this generation of web services got its start from LAMP. LAMP is a stack of simple, powerful web technologies that power a lot of popular, smaller web sites.

LAMP stands for the following popular items:

L → **Linux:** An open-source operating system
A → **Apache:** An open-source web server
M → **MySQL:** An open-source Structured Query Language (SQL) relational database for web servers
P → **Perl:** A programming language

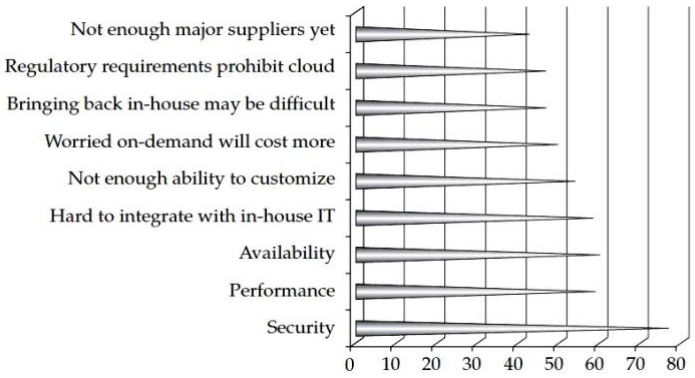
LAMP is widely used because it is very simple. Because of its ease of use, you can get an application up and running very quickly. It's not perfect because the first problem is one of scalability. Scalability issues come from the number of threads and socket connections in the Apache web server. If the server is not properly tuned and a load increases, it can cause problems.

A larger scalability problem comes from MySQL. Relational databases have a hard time growing beyond a certain capacity due to the way they represent information. When you reach that limit, database management becomes more difficult.

Q. Explian security concerns in Cloud Computing?

Security Concerns:

- Security is a two-sided coin in the world of cloud computing.
- Let us examine security in the cloud and talk about what's good, and where you need to take extra care.
- IDC conducted a survey of 244 IT executives about cloud services.
- As Figure shows, security led the pack of cloud concerns with 74.5 percent.
- In order to be successful, vendors will have to take data like this into consideration as they offer up their clouds.



1. Privacy Concerns with a Third Party

- The first and most obvious concern is for privacy considerations. That is, if another party is housing all your data, how do you know that it's safe and secure? You really don't.
- As a starting point, assume that anything you put on the cloud can be accessed by anyone.
- There are also concerns because law enforcement has been better able to get at data maintained on a cloud.
- That doesn't mean that there aren't reputable companies who would never think of compromising your data and who aren't staying on the cutting edge of network security to keep your data safe.
- In a glass-half-full world, that's what all the companies are doing.
- But in reality, even if providers are doing their best to secure data, it can still be hacked.

2. Security level of third party:

- The vendors will be doing above and beyond to ensure that your data is secure.
- Ultimately, while we like to think that they're doing their best, their best simply might not be good enough.
- There are a lot of ways that their cloud and your data can be compromised.

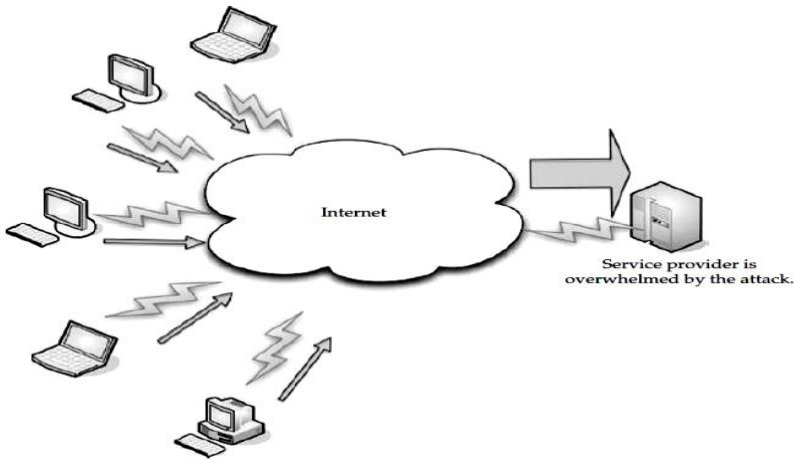
a). Hackers

- Most of the hackers just sitting around, drinking Mountain Dew and trying to break into a secure network just because they can and they want something.
- They can do a lot and compromised your data.
- It ranges from selling your proprietary information to your competition to secretly encrypting your storage until you pay them off. Or they may just erase everything to damage your business and justify the action based on their ideological beliefs.

- Either way, hackers are a real concern for your data managed on a cloud. Because your data is held on someone else's equipment.
- you may be at the mercy of whatever security measures they support.

b). Bot Attackers

- In a commonly recognized worst-case scenario, attackers use botnets to perform distributed denial of service (DDOS) attacks. In order to get the hackers to stop attacking your network, you face blackmail.
- One major Tokyo firm had to pay 3 million yen after the network was brought to a screeching halt by a botnet attack. The police also unable to track down the attackers.



3. <u>Security Benefits</u>

This is not to suggest that your data is unsecure on the cloud. Providers do undertaking to ensure security. Otherwise, word of mouth and repeat business will contract up. But the very nature of the cloud lends it to needing some very strong security practices.

- Centralized data
- Reduce data loss
- Monitoring
- Instant swapover
- Logging
- Secure builds
- Improve software security
- Security testing.

- **<u>Centralized Data</u>**

We've talked about the presence of data loss by being in one place. However, there are some good security qualities that come with centralizing your data. Just in practice, you make your system more inherently secure.

- **<u>Reduced Data Loss</u>**
  - More than 12,000 laptops are lost in American airports every year. It's bad enough to lose your data, but it's especially bad for companies.
  - Also, how many laptops employ really strong security measures, like whole-disk data encryption? If the laptop can be effectively compromised, the information will be in the hands of the thief.
  - By maintaining data on the cloud, employing strong access control, and limiting employee downloading to only what they need to perform a task.

- **Monitoring**
  - If your data is maintained on a cloud, it is easier to monitor security than have to 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 have to worry about one location, rather than several.

- **Instant Swapover**
  - If your data is compromised, while you are conducting your investigation to find the culprits, you can instantly move your data to another machine.
  - You also don't need to spend the time explaining to your C-level management that the system will be down due to an incident. When you perform the swapover, it's seamless to your users. You don't have to spend hours trying to replicate the data or fix the breach. Abstracting the hardware allows you to do it instantly.
- **Logging**
  - In the cloud, logging is improved. Logging is usually thought of late in the game, and issues develop with storage space.
  - On a cloud, you don't need to guess how much storage you'll need and you will likely maintain logs from the get-go.

- **Secure Builds**
  - When you developed your own network, you had to buy third-party security software to get the level of protection you want.
- **Improved Software Security**
  - Vendors are likely to develop more efficient security software. Since you're charged for your CPU cycles, you're going to notice and complain if the price is too high.
  - Additionally, the vendor will be likely to look at the entire security setup and tune wherever possible for a more efficient system.
  - They know that the security vendor who delivers the more efficient product will win the game.

- **Security Testing**
  - SaaS providers don't bill you for all of the security testing they do. It's shared among the cloud users.
  - This is also the case with PaaS where your developers create their own code, but the cloud code–scanning tools check the code for security weaknesses.

Q. What are Regulatory Issues? Explain?

Regulatory Issues:

- It's rare when we actually want the government in our business. In the case of cloud computing, however, regulation might be exactly what we need.
- Without some rules in place, it's too easy for service providers to be unsecure or even straight enough to make off with your data.

1. No Existing Regulation

- Currently there is no existing regulation, but there should be. In September 2008, the United States government took control of Washington Mutual.

- It was viewed as the greatest bank failure in American history to date. It reminds us that no matter how huge a company is, it can still come tumbling down.
- Look at a company like **Google**, for instance. It's a big one and recently valued at $107 billion. That size and value would seem to make them bulletproof.
- But **WaMu** was worth $307 billion when it failed.

2. Government to the Rescue

- Is it the government's place to regulate cloud computing?
- As we mentioned, thanks to the Great Depression, we had regulation that protected WaMu's customers' money when the bank failed.
- There are two schools of thought on the issue.
- First, if government can figure out a way to safeguard data either from loss or theft any company facing such a loss would applaud the regulation.
- On the other hand, there are those who think the government should stay out of it and let competition and market forces guide cloud computing.

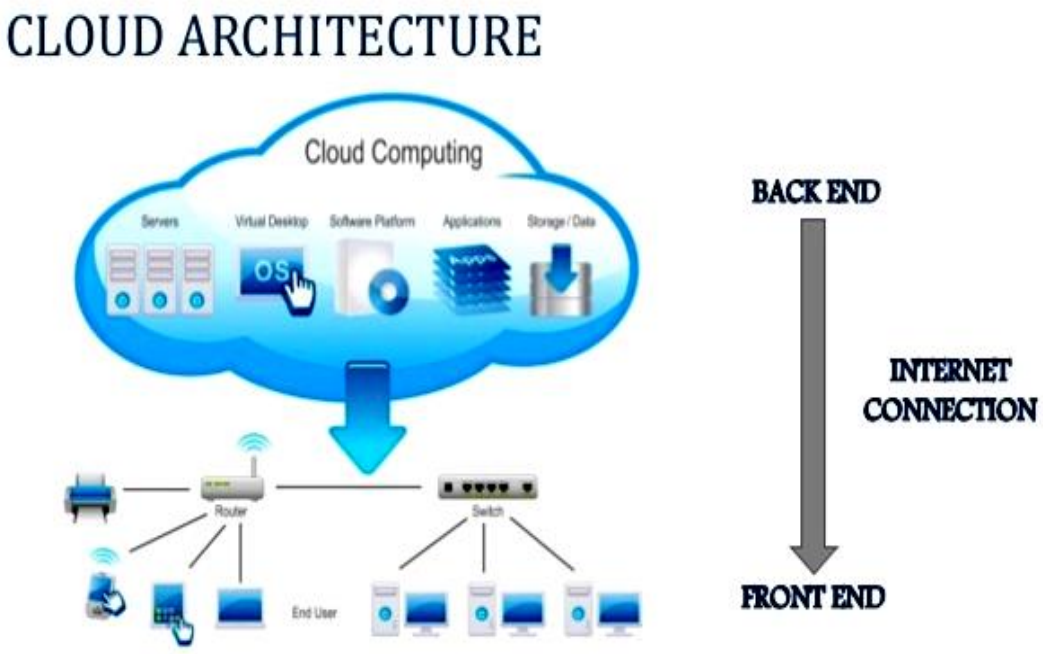
UNIT – III

Q. Explain about Cloud Computing Architecture?

Cloud Computing architecture comprises of many cloud components, which are 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 Internet. The following diagram shows the graphical view of cloud computing architecture:



Front End:

The **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, Example - Web Browser.

Back End:

The **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.

Q. Explain about SPI Evolution?

SPI Evolution:

- Cloud computing is that which does not compute on local computers but on centralized computers that are handled by another organization.
- Cloud computing has its roots as far back in 1950's when mainframe computers came into existence. At that time, several users accessed the central computer via dummy terminals.

- In 1970's, IBM came out with an OS named VM. This allowed for simultaneous operation of more than one OS. Guest Operating System could be run on every VM with their own memory and other infrastructure, making it possible to share these resources.
- In 1990's 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.
- Other catalysts were grid computing, which allowed major issues to be addressed via parallel computing and utility computing facilitated computing resources to be offered as a metered services.
- There are three prominent types of cloud computing for businesses are Saas, Paas and Iaas.
- Some of the most popular cloud applications globally are Amazon Web Services(AWS), Google Compute Engine, Rackspace, Salesforce.com and IBM Cloud Managed Services.
- Cloud services have made it possible for small and medium businesses to be on par with large companies.
- Mobile cloud computing is being harnessed by bringing into existence a new infrastructure, which is made possible by getting together mobile devices and cloud computing.
- The emergence of 4G, worldwide Interoperability for Microwave Access.
- New technologies for mobile such as CSS3, HTML5 and web 4.0 etc. Will only power the adoption of mobile cloud computing.
- The main benefits of using Cloud Computing by companies are that they need not buy any infrastructure, thus lowering their maintenance costs.

Q. Explain briefly about Cloud Delivery Models? Or Explain about SPI Frame Work? Or Explain about Cloud Computing Service Models?

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:

- Infrastructure-as-a-Service (IaaS)
- Platform-as-a-Service (PaaS)
- Software-as-a-Service (SaaS)

SPI Frame Work

SPI is an short form for the most common cloud computing service models.

- **S**oftware as a Service,
- **P**latform as a Service and
- **I**nfrastructure as a Service.

Software as a Service (SaaS) is a software distribution model in which applications are hosted by a vendor or service provider and made available to customers over a network, typically the Internet

Platform as a Service (PaaS) is a paradigm for delivering operating systems and associated services over the Internet without downloads or installation.

Infrastructure as a Service (IaaS) involves outsourcing the equipment used to support operations, including storage, hardware, servers and networking components.

Software as a Service:

Software as a Service (SaaS) is a software distribution model in which applications are hosted by a vendor or service provider and made available to customers over a network, typically the Internet.

There are several SaaS applications listed below:

- Billing and invoicing system
- Customer Relationship Management (CRM) applications
- Help desk applications
- Human Resource (HR) solutions

Some of the SaaS applications are not customizable such as **Microsoft Office Suite.** But SaaS provides us **Application Programming Interface (API),** which allows the developer to develop a customized application.

Q. What are the Characteristics of SaaS?

Characteristics:

A good way to understand the SaaS model is by thinking of a bank, which protects the privacy of each customer while providing service that is reliable and secure on a massive scale. A bank's customers use the same financial systems and technology without worrying about anyone accessing their personal information without authorisation.

A "bank" meets the key characteristics of the SaaS model:

1. Multitenant Architecture:

- A multitenant architecture, in which all the users share a single, common infrastructure and code that is centrally maintained.
- Vendors can innovate more quickly and save the valuable development time previously spent.

2. Easy Customisation

- The ability for each user to easily customise applications to fit their business processes without affecting the common infrastructure.
- SaaS providers can make upgrades more often, with less customer risk and much lower adoption cost.

3. Better Access

- Improved access to data from any networked device while making it easier to manage privileges, monitor data use, and ensure everyone sees the same information at the same time.

4. SaaS Harnesses the Consumer Web

- Anyone familiar with Amazon.com or My Yahoo! will be familiar with the Web interface.
- You can customise with point-and-click ease, making the weeks or months it takes to update traditional business software seem hopelessly old fashioned.

Q. Explain the benefits of SaaS?

Benefits

1. **Operational Benefits**
2. **Economic Benefits**

1. Operational Benefits:

There are benefits to the way you operate. You can change business processes (for the better) by moving some applications and storage to the cloud. The following are some of the operational benefits:

Reduced cost : Since technology is paid incrementally, your organization saves money in the long run.

Increased storage : You can store more data on the cloud than on a private network. Plus, if you need more it's easy enough to get that extra storage.

Automation : Your IT staff no longer needs to worry that an application is up to date, that's the provider's job. And they know they have to keep it up to date or they'll start losing customers.

Flexibility : You have more flexibility with a cloud solution. Applications can be tested and deployed with ease, and if it turns out that a given application isn't getting the job done, you can switch to another.

Better mobility: Users can access the cloud from anywhere with an Internet connection. This is ideal for road warriors or telecommuters or someone who needs to access the system after hours.

Better use of IT staff : IT staff no longer has to worry about server updates and other computing issues. They can focus on duties that matter, rather than being maintenance staff.

2. Economic Benefits:

When you consider the economic benefits of cloud computing, cost is a huge factor. But it isn't just in equipment savings, it is realized throughout the organization. These are some benefits to consider:

People:

- We hate to suggest that anyone lose their job, but the honest-to-goodness truth (we're sorry) is that by moving to the cloud.
- By having fewer staff members, you can look at your team and decide if such and such a person is necessary. Is he or she bringing something to the organization? Are their core competencies something you still need? If not, this gives you an opportunity to find the best people to remain on staff.

Hardware:

- With the exception of very large enterprises or governments, major cloud suppliers can purchase hardware, networking equipment & bandwidth are much cheaper than a "regular" business.
- If you need more storage, it's just a matter of upping your subscription costs with your provider, instead of buying new equipment.

Pay as you go:

- Think of cloud computing like leasing a car. Instead of buying the car.
- You pay a smaller amount each month. It's the same with cloud computing, you just pay for what you use.
- But, also like leasing a car, at the end of the lease you don't own the car. That might be a good thing—the car may be a piece of junk, and in the case of a purchased server, it's sure to be obsolete.

Time to market:

- One of the greatest benefits of the cloud is the ability to get apps and running in a fraction of the time you would need in a conventional scenario.
- Getting an application online faster saves your money.
- With a cloud, you can spin up a new instance in seconds.

Q. Explain about Seas Service Providers?

SaaS Service Providers:

1. Google App Engine:

- Google App Engine (GAE) is one of the more popular platforms providing robust and scalable.
- With GAE, developers can build a SaaS with the language of their choice while reaping the benefits of cloud computing in hosting their application, infinite and automatic horizontal scalability, metered usage and on-demand deployment of services.
- A good example of SaaS is Google Docs. It is a productivity suite that is free for anyone to use.
- All you have to do is log-in and you instantly have access to a word processor, spreadsheet application, and presentation creator.
- Google's online services are managed directly from the web browser and require zero installation.
- You can access your Google Docs from any computer or mobile device with a web browser.

2. Salesforce.com:

- Salesforce.com is a cloud computing and social enterprise software-as-a-service (SaaS). It is developed in March 1999 at San Francisco.
- Salesforce.com is a Customer Relationship Manager(CRM).
- CRM broken down into
  - Commerce cloud
  - Sales cloud
  - Business logic
  - Programmable interface
  - Automatic mobile device management
  - Data cloud
  - Marketing cloud
  - Community cloud
  - Analytics cloud
  - Application cloud

Sales cloud is fully customized product that bringing all the customer information together in a integrated platform that incorporates marketing, sales, customer service, lead generation, business analytics and provider access to thousands of applications through application exchange.

Versions of Salesforce.com:

1. Per month basis from lowest to highest
2. Group, Professional, enterprise, unlimited
3. Company offers in three levels
   i. Standard success plan
   ii. Premier success plan
   iii. Premier + success plan

- **Force.com:**
  It is on-demand cloud computing platform builds by salesforce.com.
- **Desk.com:**
  - It specifically targets small business with its features and functions
  - Desk.com fit in a variety of products such as salesforce CRM, salesforce and other applications.
  - It supports upto 50 languages.
- **Visual force.com:**
  - It was HTML AJAX and FIEX for business applications.
  - The features are pages, module and controllers.
- **Customer Relation Manager:**

- It consists of sales cloud and service cloud and broken into 5 core applications. They are sales, marketing, service, analytics and customized applications.

1) **Sales**: It has 1.2 million customers because of easy to customize.
2) **Marketing**: It allow customers to manage multi channel operations and deliver upto date messaging to sales.
3) **Service**: Connecting with partners is made easy as connecting with people on linked in. The companies instantly share leads, opportunities, account contracts and tasks with their partners.
4) **Analytics**: It offer real time reporting, calculations and dashboard. So that a business is better able to optimize the performance, decision making and resource allocation.
5) **Customized application**: It can quickly create by leveraging one data model and one user interface.

Google Platform:

Q. Explain the Evaluating SaaS?

Evaluating SaaS:

Before employing a SaaS solution, there are factors to consider. You should evaluate not only the SaaS provider and its service, but also what your organization wants from SaaS. Be sure the following factors are present as you evaluate your SaaS provider:

Time to value

As we mentioned earlier, one of the great benefits of using cloud services is the ability to shorten the time it takes to get a new system or application up and running. Unlike traditional software that might require complex installation, configuration, administration, and maintenance, SaaS only requires a browser. This allows you to get up and running much more quickly than by using traditional software.

Trial period

Most SaaS providers offer a 30-day trial of their service. This usually doesn't happen with traditional software—and certainly you wouldn't move everyone en masse to the trial. However, you can try out the SaaS vendor's offering and if it feels like a good fit, you can start making the move.

Low entry costs

Another appeal of SaaS is the low cost to get started using it. Rather than laying out an enormous amount of money, you can get started relatively inexpensively. Using an SaaS solution is much less expensive than rolling out a complex software deployment across your organization.

Service

In SaaS, the vendor serves the customer. That is, the vendor becomes your IT department—at least for the applications they're hosting. This means that your own, in-house IT department doesn't have to buy hardware, install and configure software, or maintain it. That's all on your SaaS vendor. And if the vendor isn't responsive to your needs, pack up your toys and move to a different service. It is in the vendor's best interests to keep you and other customers happy.

Wiser investment

SaaS offers a less risky option than traditional software installed locally. Rather than spend a lot of money up front, your organization will pay for the software as it is used. Also, there is no long-term financial commitment. The monetary risk is greatly lessened in an SaaS environment.

Security

vendor's best interests to keep you as secure as possible. Most SaaS vendors understand that application data must be backed up often and that security is a top. concern. Your local IT department has a lot going on and might not be able to spend as much time as they would like on safety and security. Since the cloud vendor wants to keep customers safe and secure, they will have staff dedicated to ensuring that your data is safe.

Your voice

When's the last time you made a suggestion for a change in Microsoft Word and Redmond listened? We're not just picking on Microsoft here. The fact of the matter is that customers of traditionally installed software have very little ability to influence the development of new product features. But your SaaS vendor wants to keep you happy so that you will not jump ship for another provider. As such, they will listen to your wants and respond. Because you will have a closer relationship, you have a greater ability to influence the product and its features.

Reduced capital expense

Using an SaaS provider eliminates the need for buying hardware and software. This not only makes your CFO happy, but it makes it faster to get approval for a project when the need to buy hardware is taken out of the equation.

Meet short-term needs

Quite often organizations experience busy times, or they launch a new product, a new office opens, or something else occurs that requires more computational power. Rather than buy new hardware to deal with your capacity needs, an SaaS provider can instantly expand and offer you more resources. And when you're done, you scale back what you are using. The best part is that once you're done paying for those additional resources, you go back to paying for what you need.

Q. What is PaaS? Explain the Benefits & Drawbacks of PaaS?

Platform as a service (PaaS)

Platform as a Service (PaaS) is a paradigm for delivering operating systems and associated services over the Internet without downloads or installation.

Benefits of PaaS

- **Quick testing and deployment:**

  Development teams can try different configurations, multiple machines and different locations, to run stress tests and assess performance, compatibility, and response that are impossible in a local environment. With quick testing of applications, deployment also becomes faster.

- **Dynamic allocation:**
  - In today's competitive market, IT teams need to have the flexibility to quickly test and put a new feature of an application or a new service on the market.
  - With PaaS quicker development and deployment of infrastructure is possible which turn can empower visionaries and give internal entrepreneurship a boost.

Drawbacks of PaaS

- **Data security:**
  Many companies still have low confidence in the level of data security offered by PaaS. Many businesses are still doubtful about having their applications hosted by a third party, while some enterprises and government clients need to be assured of compliance with all applicable regulations concerning security, privacy, and data retention before they decide in favor of PaaS services.

- **Limited flexibility:**
  PaaS customers cannot necessarily create and delete multiple virtual machines easily. In addition, when compared with SaaS offerings PaaS falls short as it doesn't represent a complete product.

- **Customer captivity:**
  With a limited number of PaaS vendors in the market today, each of which wants to build a binding relationship through its comprehensive offerings, a vendor lock-in period is often the norm, which can limit the client's choices.

Q. Explain about PaaS Service Providers?

PaaS Service Providers:

1. RightScale.com:

- In 2013 april 25th rightscale introduced the cloud model.
- Rightscale entered into strategic product and partnership, bordering its cloud management platform to support cloud from new vendors like flexiscale, gogrid.
- Business can take advantages of the endless scalability of cloud computing by using rightscale to deploy their applications.
- Customers can control the rightscale cloud management platform to automatically deploy and manage their web applications. Scaling up when traffic demand and scaling back as appropriate.
- It allow the customers to focus on their business objectives
- Rightscale automated system management pre packed and reusable components, leading service expertise and best practices have been proven as best of with the customers.

2. Rackspace:

- It begins in 1998 as the idea of three Trinity University classmates has now become a global company with business customers in over 120 countries. With employees more than 6,000 on four continents.
- After a decade it can be a public company, now it became a private company in November 2016.
- It offer cloud blocks and cloud backup by using combination of hard drives and solid state drives.
- It provide the following services.

Dedicated Servers:

Networking and storage configuration, monitoring and support to bursting the cloud of your choice. Three benefits of Dedicated Servers are

Benefits:

- A Single-tenant infrastructure provides higher levels of security and control.
- It Support your most demanding applications with up to 72 Intel®processor cores, 12TB of local SSD capacity and 3TB of RAM per server.
- It Combine bare metal with the private or public cloud of your choice, including AWS, Microsoft Azure®, VMware®, or OpenStack®.

3. VMWare:

Rackspace portfolio of VMWare solution gives you access to customized dedicated hardware plus your choice of management and control levels.

4. Multicloud Connectivity:

Rackspace connect global provides highly available, private network connectivity between rackspace and your data cneter and cloud provider of your choice.

5. Databases:

Rackspace DBA provide deep expertise you need to manage MySql, Oracle,MySql server and optimizing their performance to help with architecture design guidance, administration, monitoring and trouble shooting.

6. Storage:

The amount of data you have to store and manage is growing daily so a storage partner like rackspace provide a variety of data storage solutions by partnering with industry leaders like Dell and net app.

7. Custom networking:

It is a task to build a secure network and also maintaining performance and efficiency across multiple environments the rackspace customize your network configuration to meet your business needs like

- Enhance performance
- Protect your business critical data
- Handle compliance and controlling requirements.

UNIT – IV

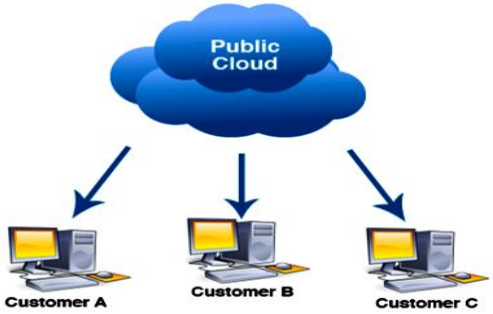
Cloud Deployment Model (Types of Clouds)

There are three types of clouds. They are

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

1. Public Cloud:

The cloud infrastructure is provisions for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization. It exists on the premises of the cloud provider.



2. Private Cloud:

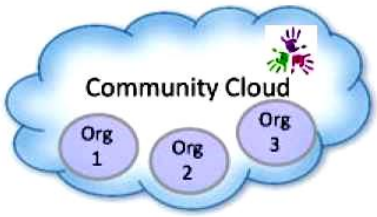
A private cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers such as business units.

It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises

3. Community Cloud:

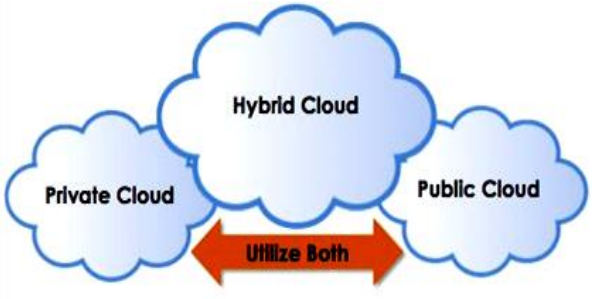
The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns. Such as mission, security requirements, policy and compliance considerations.

It may be owned, managed and operated by one or more organizations in be community, a third party or some combination of them. It may exist on or off premises.



4. Hybrid Cloud:

The cloud infrastructure is a composition of two or more distinct cloud deployment models (private, community, or public) that remain unique entities, but are bound together by standardized technology that enables data and application portability.



Advantages of Cloud Computing

1. **Lower computer costs**

   - You don't need a high-powered and high-priced computer to run cloud computing's web-based applications. Since applications run in the cloud, not on the desktop PC, your desktop PC doesn't need the processing power or hard disk space.
   - When you're using web-based applications, your PC can be less expensive, with a smaller hard disk, less memory, more efficient processor, and the like. In fact, your PC in this scenario doesn't even need a CD or DVD drive, as no software programs have to be loaded and no document files need to be saved.

2. **Improved performance**

   - The large programs use most computer's memory, so computers in a cloud computing system boot and run faster because they have fewer programs and processes loaded into memory.

3. **Reduced software costs**

   - Instead of purchasing expensive software applications, you can get most of what you need for free. That's right—most cloud computing applications today, such as the Google Docs suite totally free.

4. **Instant software updates**

   - You're no longer faced with choosing between obsolete software and high upgrade costs.
   - When the application is web-based, updates happen automatically.
   - When you access a web-based application, you get the latest version without needing to pay for an upgrade.

5. Improved document format compatibility

- You don't have to worry about the documents you create on your machine being compatible with other users' applications or operating systems.
- Word 2007 documents can't be opened on a computer running Word 2003.
- There are no format incompatibilities when everyone is sharing docs and apps in the cloud.

6. Unlimited storage capacity

- Cloud computing offers virtually limitless storage. Your computer's current 200 GB hard drive is small compared to the hundreds of PB(peta bytes) in the cloud.

7. Increased data reliability

- If the hard disk crashs can destroy all your valuable data, a computer crashing in the cloud shouldn't affect the storage of your data. If your PC crashes all your data is still out there in the cloud, still accessible. In a world where few individual desktop PC users back up their data on a regular basis. Cloud computing is the ultimate in data-safe computing.

8. **Universal document access**

- You don't take your documents with you. Instead, they stay in the cloud, and you can access them whenever you have a computer and an Internet connection. All your documents are instantly available from wherever you are.

9. Latest version availability

- When you edit a document at home, that edited version is what you see when you access the document at work. The cloud always hosts the latest version of your documents as long as you're connected.

10. Easier group collaboration

- Sharing documents leads directly to collaborating on documents. To many users, this is one of the most important advantages of cloud computing multiple users can collaborate easily on documents and projects. Because the documents are hosted in the cloud, not on individual computers, all you need is a computer with an Internet connection, and you're collaborating.

11. Device independence

- You're no longer tethered to a single computer or network. Change computers, and your existing applications and documents follow you through the cloud. Move to a portable device, and your apps and docs are still available.

Disadvantages of Cloud Computing:

There are a number of reasons why you might not want to adopt cloud computing for your particular needs. Let's examine a few of the risks related to cloud computing:

- **Requires a constant Internet connection.**
  - The Cloud computing is impossible if you can't connect to the Internet. Since you use the Internet to connect to both your applications and documents, if you don't have an Internet connection you can't access anything.
- **Can be slow.**
  - Even with a fast connection, web-based applications can sometimes be slower than accessing a similar software program on your desktop PC.
  - If the cloud servers happen to be backed up at that moment, or if the Internet is having a slow day, you won't get the instantaneous access you might expect from desktop apps.
- **Features might be limited.**
  - Today many web-based applications simply aren't as full-featured as their desktop-based brethren. For example, you can do a lot more with Microsoft PowerPoint than with Google Presentation's web-based offering.
- **Stored data might not be secure.**
  - All the data is stored on the cloud. How it is secured.
  - The Cloud computing companies say that data is secure, but it's too early in the game to be completely secured of only time will tell it.
- **Stored data can be lost.**
  - Data stored in the cloud is unusually safe and replicated across multiple machines.
  - But on the off chance that your data goes missing, you have no physical or local backup. Put simply, relying on the cloud puts you at risk if the cloud lets you down.

Public Cloud:

Advantages

In public clouds the resources are shared between multiple clients and all the services are controlled by services provider.

1. **Simple and easy:** Public clouds are available as a service in the internet, they are easy to deploy.
2. **Cost:** Initial investment is very low or nil.
3. **Less time:** The IT resources and services are available immediately saving time for the company.

4. **No maintenance:** The hardware and networks are maintained by the cloud services provider. Internal IT staffs have no responsibility in maintaining the infrastructure.
5. **No contracts:** No long term commitment with service provider because public clouds are usually pay-as-you-go models.

Disadvantages

1. **Lacks proper controls:** The client has no control of data or infrastructure. There are issues of data privacy and integrity. The service level policies and compliances are completely enforced by the service provider
2. **Performance:** The performance of the network depends on the speed of the internet connectivity
3. **Weak on Security:** Since the hardware resource is shared between multiple users, IT security issues are more profound and data is vulnerable to thefts
4. **Customization:** Customization of resources or services is not possible.

Private Cloud:

Advantages

Private cloud infrastructure is a dedicated infrastructure provided to one single organization or client.

1. **Controls:** Better controls for data, users and information assets.
2. **Cost:** Initial investment for hardware is very high in case of an on-premise infrastructure.
3. **Security:** The cloud belongs to a single client. Hence, the infrastructure and systems can be configured to provide high levels of security.
4. **Superior Performance:** Normally private clouds are deployed inside the firewall of the organization's intranet which ensures efficiency and good network performance.
5. **Easy Customization:** The hardware and other resources can be customized easily by the company.
6. **Compliance:** Compliance is achieved easily in private clouds.

Disadvantages

1. **Cost:** Costs are substantial in the case of building an on-premise private cloud. The running cost would include personnel cost and periodic hardware upgrade costs. In the case of outsourced private cloud, operating cost will include per resource usage and subject to change at the discretion of the service provider
2. **Under-utilization:** In some instances the resources subscribed can be under-utilized. Hence, optimizing the utilization of all resources is a challenge
3. **Capacity ceiling:** Due to physical hardware limitations with the service provider, there could be a capacity ceiling to handle only certain amount of servers or storage

4. **Vendor lock-in:** This can be a major impediment in private cloud adoption especially when the hardware and infrastructure is outsourced. This is a service delivery technique where the client company is forced to continue with the same service provider, thus preventing the client to migrate to another vendor.

Community Cloud

Advantages

1. Cost effective:

Community cloud offers some advantages like sharing resources and capabilities among several organizations.

2. Security :

Community cloud is comparatively more secure than public cloud as managed by few of the people.

Disadvantages

1. Issue:

Since all the data is housed in one location, one must be careful in storing the data in community cloud. It might be accessed by others.

2. Compliance:

It is also challenging to allocate the responsibilities of government, security and cost.

Hybrid Cloud:

Advantages

1. On premises infrastructure speed, accessing time and lower latency when compared with public cloud.
2. Average workload supported while maintaining the ability for fail over into the cloud for heavy duty work load.
3. Lower on premises infrastructure capital expenses by ability to response resources.

Disadvantages

1. Data moving in and out of public zone and private zone can be targeted by third party.
2. Possible time delay due to communications when data transfer is critical for the organization.

Infrastructure as a service

Infrastructure as a service (IaaS) is a form of cloud computing that provides virtualized computing resources over the internet. It is quickly scale up and down with demand and pay only for what you use

Iaas Service Providers:

Some of the IaaS Service Providers

1. Amazon EC2:

- It Provide secure and resizable compute capacity in cloud.
- It allow to obtain and configure capacity with minimal friction
- It provide complete control of computing resources and run on amazon proven computing environment.
- It reduces the time required to obtain and boot new server instance to minutes.
- It changes the economics of computing by allowing you to pay only for capacity that you actually used.
- It provide developing the tools to built a failure application and isolate them from common failure scenarios.

Benefits:

1. **Elastic Webscale computing:**
   It enable you to increase or decrease the capacity within minutes i.e., you can commissioning one hundred or thousand of servers simultaneously.

2. **Completely Controlled:**
   You have a complete control of your instances including root access and ability to interact with them.

3. **Flexible Cloud hosting Services:**
   It allow you to select the configuration of memory, cpu, storage and boot partition size that is optional for your choice.

4. **Reliable:**
   It offers highly reliable environment where replacement instances can be rapidly and predictably commissioned.

2. GoGrid:

- It is service provider of windows and linux cloud based server hosting offering 32 bit and 64 bit edition.
- GoGrid is one of the first infrastructure provider to offer windows server 2008.
- GoGrid customers can display windows server 2008 in just few minutes.
- GoGrid enable system administration quikly and easily created, load balancing and manage windows and linux cloud servers within minutes.
- GoGrid offers control in the cloud with its web based GUI that allows point and click deployment of complex network infrastructures.
- GoGrid enable system administrators, developers and IT professionals to create, deploy and control the load balanced cloud servers and complex virtual servers.
- Initially windows server 2008 offerings on GoGrid including 32 bit and 64 bit pre configured templates.
- Windows server 2008 standard includes terminal service gateways, remote desktop clients for terminal services, application servers etc.
- GoGrid offer hosted cloud computing infrastructure that enable system administration, developers to create, deploy and control load balanced cloud servers.
- GoGrid also delivers portal controlled servers for windows 2003, windows 2008 and multiple linux operating system.
- Cloud computing for enterprises as arrived with GoGrid and Rightscale partnership.

GoGrid API's:

- Auto scaling network servers
- Listing assigned public and private IP addresses
- Deleting the servers
- Listing billing details
- GoGrid support the following languages
  - JAVA
  - PHP

- Phython
- Ruby

Advantages (Or) Benefits of IaaS:

1. **Cost Savings:**
   An obvious benefit of moving to IaaS is low infrastructure cost. No longer organisations have the responsibility of ensuring uptimes, maintaining hardware and network equipment. IaaS deal with sudden business spikes. It is a pay as you go model provide significant cost saving. The Iaas model demands no upfront charges, bandwidth utilization fee.

2. **Scalability and flexibility:**
   One of the greatest benefit is the ability to scale up and down quickly in response to organization requirements. It provides the latest and most powerful storage, servers and networking technologies. Especially it is helpful in billing and dismantling test and development environment which increases the speed and ability.

3. **Innovate rapidly:**
   As soon as you have decided to launch a new product or initiative, the necessary computing infrastructure can be ready in minutes or hours, rather than the days or weeks—and sometimes months—it could take to set up internally.

4. **Respond quicker to shifting business conditions:**
   IaaS enables you to quickly scale up resources to accommodate spikes in demand for your application—during the holidays, for example—then scale resources back down again when activity decreases to save money.

5. **Focus on your core business:**
   IaaS frees up your team to focus on your organisation's core business rather than on IT infrastructure.

6. **Better security:**
   With the appropriate service agreement, a cloud service provider can provide security for your applications and data that may be better than what you can attain in-house.

7. **Backup's:**
   Because you don't need to first set up the infrastructure before you can develop and deliver apps, you can get them to users faster with IaaS.

UNIT – V

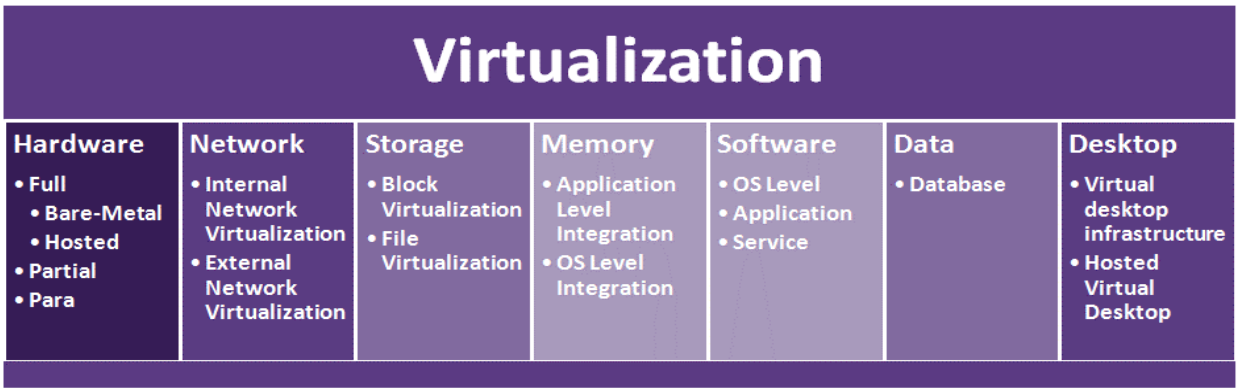
Virtualization:

Q. Define Virtualization and Explain about different types of Virtualization?

Virtualization is the "creation of a virtual (rather than actual) version of something, such as a server, a desktop, a storage device, an operating system or network resources".

Types of Virtualization:

1. Hardware Virtualization.
2. Network Virtualization.
3. Storage Virtualization.
4. Memory Virtualization.
5. Software Virtualization.
6. Memory Virtualization.
7. Data Virtualization.
8. Desktop Virtualization.



1. Hardware Virtualization

- It is the most common type of virtualization and it provides advantages like optimum hardware utilization and application uptime.
- The basic idea is to combine many small physical servers into one large physical server, so that the processor can be used more effectively.
- The operating system that is running on a physical server gets converted into a well-defined OS that runs on the virtual machine.

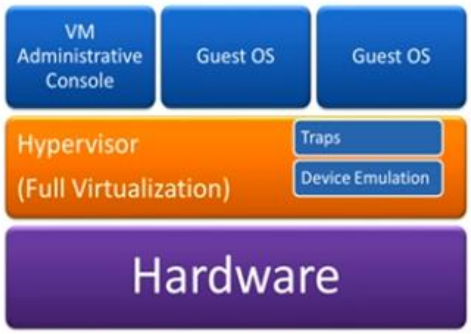
Subtypes:

i. **Full Virtualization.**
ii. **Para Virtualization.**

iii. Partial Virtualization.

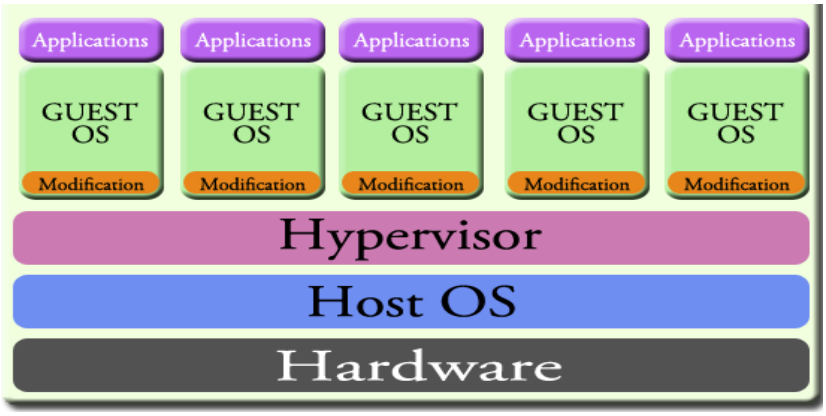
i. Full Virtualization

- Full Virtualization is a virtualization in which the guest operating system is unaware that it is in a virtualized environment.
- Hardware is virtualized by the host operating system.
- the guest can issue commands to what it thinks is actual hardware, but really are just simulated hardware devices created by the host.



ii. Para Virtualization

- Para Virtualization is a virtualization in which the guest operating system (the one being virtualized) is aware that it is a guest and accordingly has drivers.
- Instead of issuing hardware commands, simply issue commands directly to the host operating system.
- This also includes memory and thread management as well, which usually require unavailable privileged instructions in the processor.



iii. Partial virtualization

- Partial virtualization, including address space virtualization, the virtual machine simulates multiple instances of an underlying hardware environment, particularly address spaces.

- This means that entire operating systems cannot run in the virtual machine which would be the sign of full virtualization but many applications can run.
- A key form of partial virtualization is address space virtualization, in which each virtual machine consists of an independent address space.
- This capability requires address relocation hardware, and has been present in most practical examples of partial virtualization.

2. Network Virtualization

- Network virtualization refers to the management and monitoring of an entire computer network as a single administrative entity from a single software-based administrator's console.
- It is designed to allow network optimization of data transfer rates, flexibility, scalability, reliability and security.
- It is especially useful for networks experiencing a rapid, large and unpredictable increase in usage.

Subtypes:

i. **Internal Virtualization.**
ii. **External Virtualization.**

- **Internal network:** Enables a single system to function like a network.
- **External network:** It combines many networks or part of network into a virtual unit.

3. Storage Virtualization:

- In this virtualization multiple physical storage devices are grouped together, which appear as a single storage device.

Advantages:

- It improve storage management in heterogeneous IT environment.
- It is easy to update and better available
- It reduce down time
- Better storage utilization
- It provide automated management

Subtypes:

i. **Block Virtualization.**
ii. **File Virtualization.**

i. **Block Virtualization**: Multiple storage devices are consolidated into one.
ii. **File Virtualization:** Storage system grants access to files that are stored over multiple hosts.

4. Memory Virtualization:

- Physical memory across different servers is aggregated into a single virtualized memory pool.
- It provides the benefit of an enlarged contiguous working memory.

- Some OS such as Microsoft Windows OS allows a portion of your storage disk to serve as an extension of your RAM.

Subtypes:

i. **Application Level Control.**
ii. **Operating System Level Control.**

i. **Application-level control**: Applications access the memory pool directly.
ii. **Operating system level control**: Access to the memory pool is provided through an operating system.

5. <u>Software Virtualization:</u>

- 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 inorder to allow guest operating system to run.

Subtypes:

i. **Operating System Virtualization.**
ii. **Application Virtualization.**
iii. **Service Virtualization.**

i. **Operating System Virtualization**: hosting multiple OS on the native OS
ii. **Application Virtualization**: hosting individual applications in a virtual environment separate from the native OS
iii. **Service Virtualization**: hosting specific processes and services related to a particular application

6. <u>Data Virtualization:</u>

- Without any technical details you can easily manipulate data, how it is formatted or where it is located.
- It decreases data input and formatting errors.
- The data is presented as an abstract layer completely independent of data structure and database systems.

7. Desktop Virtualization:

- It provide the work convenience and security.
- You are able towork from any location or any pc. It provides a lot of flexibility for the employers to work from home or on the go.
- It also protect confidential data from lost or stolen by keeping it safe on a central server.
- The desktop computer is comprised of four system layers:
  i. Physical Machine(Processor, Memory & Storage).
  ii. Operating System(Windows or Linux).
  iii. Application(email client, Word Processor & Spread Sheet).
  iv. Presentation(User interface and interaction with keyboard or mouse).

Q. Explain the needs of Virtualization?

Need of virtualization:

1. Cost
2. Administration
3. Fast development
4. Reduce the infrastructure cost

1. Cost:

- Depending on your solution you can have cost free data centers.
- You do have shell ort the money for physical servers itself but there are options for free software's and operating systems.
- Microsoft virtual server and virtual machine ware server are free to download and install.
- If you use licensed operating system, of course that will be costed.
- For instances window server on a physical server then you have to pay for the licence. That said if you were to use a free version of Linux for the physical server.
- Therefore virtualization can be cost effective.

2. Administration:

- If all your servers in one place reduce your administrative burden.
- According to VM Ware you can reduce your administrative burden from 1:10 to 1:30
- New servers can be quickly deployed.
- New virtual servers can be deployed more in expensively that physical servers.
- The virtual servers can be moved from one server to another

3. Fast deployment:

- Because every virtual server is just a file on the disk, it is easy to copy a system to create a new one.
- To copy an existing server you just copy the entire directory of the current virtual server.

- This can be used if the physical server is failed or you wanted to test out a new application to ensure that it will be work and play will with the other tools on your network.
- If you want different work environments for different users then virtualization allow to do it.

4. Reduce infrastructure cost:

- We already discussed about how you can cut the cost by using free servers and clients like Linux, as well as free distribution of windows or virtual machine.
- These are also reduce the cost across your organization.
- If you reduce the number of physical servers then you save money on hardware, cooling and electricity.
- You also reduce number of network ports, video ports, mouse ports etc.

Q. What are Limitations (Or) Disadvantages of Virtualization?

Limitations (or) Disadvantages of Virtualization

The limitations of virtualization are mostly those that would come with any technology transition. With careful planning and expert implementation, all of these drawbacks can be overcome.

1. **Upfront Cost**
2. **Software licensing considerations**
3. **Possible learning Curve.**

1. Upfront costs:

- Many businesses have sufficient capacity to accommodate the virtualization without requiring a lot of cash.
- This obstacle can also be more readily navigated by working with a Managed IT Services provider, who can offset this cost with monthly leasing or purchase plans.

2. Software licensing considerations:

- This is becoming less of a problem as more software vendors adapt to the increased adoption of virtualization.
- It is important to check with your vendors to clearly understand how they view software use in a virtualized environment.

3. Possible learning curve:

- Implementing and managing a virtualized environment will require IT staff with expertise in virtualization.
- On the user side a typical virtual environment will operate similarly to the non-virtual environment.
- There are some applications that do not adapt well to the virtualized environment. The IT staff will need to be aware of and address prior to converting.

Microsoft Implementation

Q. Explain about Microsoft Hyper V?

Microsoft Hyper V:

Microsoft introduced Hyper V as virtualization platform in 2008. There are four versions

1. Windows Server 2008
2. Windows Server 2008 R2
3. Windows Server 2012
4. Windows Server 2012 R2

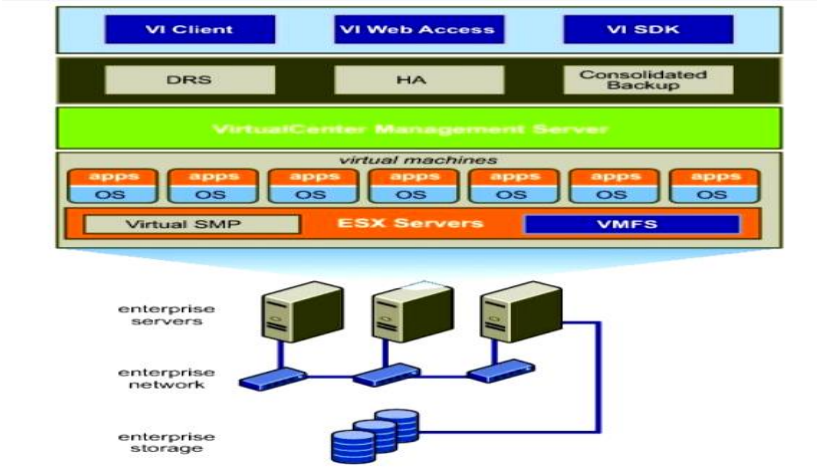
- Hyper Vis an hybrid version which s installed from operating system, during installation it redesign the operating system architecture.
- It handle interrupts to the processor and redirect them into the respective partitions.
- It can also accelerate the address translation between various virtual address space by using IOMMU (Input Output Memory Management Unit)
- Request to virtual devices are redirected via VM Bus to the device in the parent portion.
- The VM bus is interpretation communication channel.
- The parent portion host VSP(Virtual Service Provider) which communicate over VM bus to handle the device access request from child partition.
- The child partition host VSC(Virtual Service Consumer) redirect the device requests to the VSP via VM bus.

Q. What is VM Ware? Explain about VM Ware Infrastructure?

VM Ware:

- It allow multiple copies of same operating system to run in the same machine. For years VM Ware has been the lead in virtualization software.
- VM Ware is virtualization and Cloud computing software provider founded in 1998.

VM Ware Infrastructure:



VMware Infrastructure includes the following components shown in the figure

VMware ESX Server :

A robust, production-proven virtualization layer run on physical servers that abstracts processor, memory, storage, and networking resources into multiple virtual machines.

VirtualCenter Management Server (VirtualCenter Server) :

The central point for configuring, provisioning, and managing virtualized IT environments.

Virtual Infrastructure Client (VI Client) :

An interface that allows users to connect remotely to the VirtualCenter Server or individual ESX Servers from any Windows PC.

Virtual Infrastructure Web Access (VI Web Access):

A Web interface that allows virtual machine management and access to remote consoles.

VMware Virtual Machine File System (VMFS):

A high-performance cluster file system for ESX Server virtual machines.

VMware Virtual Symmetric Multi-Processing (SMP) :

Feature that enables a single virtual machine to use multiple physical processors simultaneously.

VMware VMotion :

Feature that enables the live migration of running virtual machines from one physical server to another with zero down time, continuous service availability, and complete transaction integrity.

VMware HA:

Feature that provides easy-to-use, cost-effective high availability for applications running in virtual machines. In the event of server failure, affected virtual machines are automatically restarted on other production servers that have spare capacity.

VMware Distributed Resource Scheduler (DRS) :

Feature that allocates and balances computing capacity dynamically across collections of hardware resources for virtual machines.

VMware Consolidated Backup (Consolidated Backup) :

Feature that provides an easy-to-use, centralized facility for agent-free backup of virtual machines. It simplifies backup administration and reduces the load on ESX Servers.

VMware Infrastructure SDK :

Feature that provides a standard interface for VMware and third-party solutions to access the VMware Infrastructure

Features:

VM Ware server enable the users to quickly provision of new server capacity by portioning a physical server ito multiple virtual machines.

1. Support for two way virtual SMP.
2. Support any standard hardware.
3. Quick and easy Wizard driven installation.
4. Quick and easy virtual machine Creation using the VM Vizard.

Q. What is VirtualBox and its features?

Virtualbox:

- It is powerful virtualization product for enterprise as well as home use. It is rich and high performance product for enterprise customers.
- It is freely available as an open source software under general public license version 2
- Virtualbox runs on Windows, Linux, Solaris and support large number of guest operating systems.
- It is developed by innotek and released in 2007 as open source software.
- The oracle corporation now develops this software and titled as Oracle VM Virtualbox.
- Virtualization software, it has two question.
    1. Why we can call this software a cross platform software?

    Ans. Like any other software it can be installed on our existing intel of AMD based computers. Whether they are running on Windows, Linux, Solaris operating system.

    2. What does this software do?

    Ans. It helps us to run multiple OS in our existing computer at the same time.

Features of Virtualbox:

1. Free.
2. Portable.
3. Guest editions.
4. Great hardware support.