Lecture 1 Outline.

OVERVIEW:

Because the overall goal of this is for you to be an informed user of information technology, we devote this to a vital and cutting-edge topic: cloud computing. A working knowledge of cloud computing will enhance your appreciation of what technology can and cannot do for a business. In addition, it will enable you to make an immediate contribution by analyzing how your organization manages its information technology assets.

You will be using these computing resources yourself in your career, and you will also have input into decisions about how your department and organization can best utilize them. Additionally, cloud computing can be extremely valuable to you if you decide to start your own business.

This defines the cloud as distributed computing services and presents many examples of how the cloud can be used for business purposes. However, the cloud also provides you with personal applications, and this can help you plan for your own use of the cloud.

First, you need to understand that there is no single "cloud." Companies offering Internet-based services call them "cloud services." Basically, anything you do over the Internet that you used to do on a local computer is a form of cloud computing. For example, when you store files on Dropbox, type a document with Google Docs, use Amazon's iCloud to store purchases or sync documents, or use the OnLive app on your iPad, you are using cloud-based services intended for personal use.

Infrastructure-as-a-service is an important application of the cloud for personal purposes. Dropbox is one of the most prominent companies in this area. In the past, users had to carry around a USB drive, CD, external hard drive, or, way back in the day, floppy discs to store their personal information. A free Dropbox account offers 2 GB of online storage. Not only does this offer you a place to store your files (eliminating the need for personal infrastructure on removable storage), but it provides synchronization across computers and access from mobile devices!

Virtualization is gaining ground. If you have an iPad you should look up the app called "OnLive" and give it a test run. It allows you to log into a virtual computer that is running Windows 7. Here, your iPad is simply providing the input/output and the server is "serving up" a virtual operating system. It is very likely that one day your home computer will be virtual as well.

Software-as-a-Service has been a popular option for quite some time. Google Docs has offered Internet-based word processing, spreadsheet, presentation, forms, and drawing tools for quite

some time. Recently, Microsoft released its Office 365 product. Basically, each of these services allows you to use a computer program without having to install it on your computer or mobile device. You simply access the entire program (and your saved files) over the Internet.

Google recently released Google Drive, a service that offers the same services as Dropbox with the addition of Google Docs. This offering includes "software-as-a-service" due to the added benefit of Google Docs. It is very likely that one day Google will try again with their Chrome Notebook that would merge virtualization, infrastructure, and software into one cloud-based service. When this happens, all you will need as a consumer is an Internet-connected device and you will be able to access, edit, share, and store all of your information in the cloud.

Cloud-based services are here to stay. The rise of ubiquitous Internet access has brought a new world of possibilities. So as you move into your career and further into your personal life, you need to pay close attention to privacy statements and to Internet security. Since your files will no longer be stored on your local machine, they are only as safe as the company you have trusted them with makes them. Be sure you choose wisely!

## 1 Introduction

An organization's *IT infrastructure* consists of IT components—hardware, software, networks, and databases—and IT services—developing information systems, managing security and risk, and managing data. Organization's IT infrastructure is the foundation for all of the information systems that the organization uses.

Modern IT infrastructure has evolved through several stages since the early 1950s, when firms first began to apply information technology to business applications. These stages are as follows:

• *Stand-alone mainframes.* Organizations initially used mainframe computers in their engineering and accounting departments. The mainframe was typically housed in a secure area, and only MIS personnel had access to it.

• *Mainframe and dumb terminals.* Forcing users to go to wherever the mainframe was located was time consuming and inefficient. As a result, firms began placing so-called dumb terminals—essentially electronic typewriters with little processing power—in user departments. This arrangement enabled users to input computer programs into the mainframe from their departments, a process called *remote job entry*.

• *Stand-alone personal computers.* In the late 1970s, the first personal computers appeared. The IBM PC's debut in 1981 legitimized the entire personal computer market. Users began bringing personal computers to the workplace to improve their productivity—for example, by using spreadsheet and word processing applications. These computers were not initially supported by the firm's MIS department. However, as the number of personal computers increased dramatically, organizations decided to support personal computers, and they established policies as to which personal computers and software they would support.

• *Local area networks (client/server computing).* When personal computers are networked, individual productivity is substantially increased. For this reason, organizations began to connect

personal computers into local area networks (LANs) and then connect these LANs to the mainframe, a type of processing known as *client/server computing*.

• *Enterprise computing.* In the early 1990s, organizations began to use networking standards to integrate different kinds of networks throughout the firm, thereby creating enterprise computing. As the Internet became widespread after 1995, organizations began using the TCP/IP networking protocol to integrate different types of networks. All types of hardware were networked, from mainframes to personal computers to smart phones. Software applications and data could now flow seamlessly throughout the enterprise and between and among organizations.

• *Cloud computing and mobile computing.* Today, organizations and individuals can use the power of cloud computing. As you will see, cloud computing provides access to a shared pool of computing resources, including computers, storage, applications, and services, over a network, typically the Internet.

Keep in mind that the computing resources in each stage can be cumulative. For instance, most large firms still use mainframe computers (in addition to all the other types of computing resources) as large servers to manage operations that involve millions of transactions per day.

Before You Go On….

1. ***Describe the evolution of the IT infrastructure in organizations.***

## 2 What Is Cloud Computing?

Information technology departments have always been tasked to deliver useful IT applications to business users. Today however, for a variety of reasons, IT departments are facing increased challenges in delivering useful applications. This section begins with a look at problems that traditional IT departments face in delivering useful applications. In that way, when you learn about cloud computing, you will see how cloud computing can help organizations manage the problems that occur in traditional IT departments. You will also see why so many organizations are utilizing cloud computing. The section continues with a definition of cloud computing and closes with an examination of the essential characteristics of cloud computing.

### Problems Facing Traditional IT Departments

Today, the world is experiencing a digital and mobile transformation, with more information available more quickly from more sources than ever before. As a result, business people need IT-enabled services to help them handle this transformation and envision new opportunities.

Before you take a look at cloud computing, let's look at traditional IT departments in organizations and the problems they face. Today, most companies own IT infrastructure (their software, hardware, networks, and data management) and keep them "on premise" in their data centers, the traditional model of the IT function in organizations.

Traditional IT departments spend huge amounts on IT infrastructure and expert staffs to build and maintain complex IT systems. These expenses include software licenses, hardware, and staff training and salaries. Typically, these expenses result in an infrastructure that often is not used to

its full capacity. The majority of these expenses are typically applied to maintaining existing IT infrastructure, with the remainder being spent on developing new systems. In addition, companies are being buried in vast amounts of data. Traditional IT departments are having difficulty capturing, storing, managing, and analyzing all this data. As a result of these problems, traditional IT infrastructures can actually inhibit an organization's ability to respond quickly and appropriately to rapidly changing dynamic environments.

Large organizations can afford comprehensive enterprise software and top IT talent. These companies can buy or build software and install these systems in their data centers. They can enable their applications for use on different devices – desktops, laptops, tablets, and smartphones – and make them accessible to employees wherever they are. These companies can also make their applications available to people outside the organization, such as consultants, contractors, suppliers, customers, and other business partners. Although large companies have these capabilities, their IT departments are often overtaxed, and are not able to accomplish all these functions. Further, smaller organizations usually do not have the resources to accomplish these functions.

As you will see in the next section, cloud computing can help organizations manage the problems that traditional IT departments face. The next section defines cloud computing and discusses cloud computing's essential characteristics.

**Definition of Cloud Computing**

Cloud computing is a type of computing that delivers convenient, on-demand, pay-as-you-go access for multiple customers to a shared pool of configurable computing resources (e.g., servers, networks, storage, applications, and services) that can be rapidly and easily accessed over the Internet. Cloud computing lets customers acquire resources at any time and get rid of them the instant they are no longer needed.

**The essential *characteristics* of cloud computing are as follows:**

**Cloud computing provides on-demand self-service**. A customer can access needed computing resources automatically.

**Cloud computing encompasses the characteristics of grid computing**. *Grid computing* applies the unused processing resources of many geographically dispersed computers in a network to form a virtual supercomputer.

- Grid computing enables organizations to utilize their computing resources more efficiently.
- Grid computing provides fault tolerance and redundancy, meaning that there is no single point of failure, so the failure of one computer will not stop an application from executing.
- Grid computing makes it easy to "scale up" (add computers) to meet the processing demands of complex applications. "**Rapid Elasticity"**
- Grid computing makes it easy to "scale down" (remove computers) if extensive processing is not needed.

**Cloud computing encompasses the characteristics of utility computing**. In *utility computing*, a service provider makes computing resources and infrastructure management available to a customer as needed. The provider then charges the customer for specific usage rather than a flat rate. Utility computing enables companies to efficiently meet fluctuating demands for computing power by lowering the cost of owning hardware infrastructure.

**Measured Service:** Cloud computing systems are adaptive systems. They automatically balance loads and optimize the use of resources. A user is permitted to monitor and control resource usage, thereby providing transparency in bills.

**Cloud computing utilizes broad network access**. The cloud provider's computing resources are available over a network, accessed with a Web browser, and able to be used with any computing device.

**Cloud computing pools computing resources**. The cloud computing provider's computing resources are available to serve multiple customers, with resources dynamically assigned and reassigned according to customer demand.

**SLA Driven**
Usually businesses have agreements on the amount of services. Scalability and availability issues cause clients to break these agreements. But cloud computing services are SLA driven such that when the system experiences peaks of load, it will automatically adjust itself so as to comply with the service-level agreements. The services will create additional instances of the applications on more servers so that the load can be easily managed.

**Flexible**
Another feature of the cloud computing services is that they are flexible. They can be used to serve a large variety of workload types - varying from small loads of a small consumer application to very heavy loads of a commercial application.

**Cloud computing often occurs on virtualized servers**. Cloud computing providers have placed hundreds or thousands of networked servers inside massive data centers called *server farms* (see Figure PI3.1). Recall that a *server* is a computer that supports networks, enabling users to share files, software, and other network devices. Server farms require massive amounts of electrical power, air conditioning, backup generators, and security. They also need to be located fairly closely to fiber-optic communications links.

According to Gartner Inc. (www.gartner.com), a research firm, typical utilization rates on servers range from 5 to 10 percent. That is, most of the time, organizations are using only a small percentage of their total computing capacity. CIOs tolerate this inefficiency in order to make certain that they can supply enough computing resources to users in case of a spike in demand. To help with this underutilization problem, companies and cloud computing providers are utilizing virtualization.

*Server virtualization* uses software-based partitions to create multiple virtual servers—called *virtual machines*—on a single physical server. Therefore, each server no longer has to be dedicated to a particular task. This arrangement enables multiple applications to run on a single physical server, with each application running within its own software environment.

As a result, virtualization enables companies to increase server utilization. In addition, companies see cost savings in two areas. First, they do not have to buy additional servers to meet peak demand and second they reduce their utility costs through reduced energy needs. The following example illustrates the benefits of virtualization for MaximumASP.

**Example**

MaximumASP is a Web-hosting company based in Louisville, Kentucky. Its 35 employees host more than 48,000 domains for customers located in more than 60 countries. MaximumASP prides itself on its innovative offerings and its outstanding customer service.

Unfortunately, the company's rapid expansion resulted in a proliferation of servers that required increasing amounts of resources to manage. This situation adversely affected the company's bottom line. Furthermore, adding servers pulled staff away from researching new services, which diminished the company's agility and innovation.

Web hosting has become extremely competitive and even commoditized in many parts of the world. The CIO for MaximumASP notes that there is tremendous market pressure to develop new products. To do so, MaximumASP had to add new servers, which increased the company's costs.

MaximumASP added hundreds of new servers every year, each of which took roughly four hours to deploy. The company spent so much time deploying new servers that it could not respond as quickly to its customers' needs or its competitors' moves as it had in the past. MaximumASP also wanted to reduce the rising cost of physical servers as well as the related real estate and power costs.

The company was spending thousands of dollars every year on new hardware, software licenses, and electrical power. Finally, the firm was concerned that if it continued to deploy more servers, it would outgrow its Louisville data center and have to build another one. Having to fund new servers each year was especially frustrating because most of the company's existing servers operated at a very low capacity, often 5 percent or less.

MaximumASP decided to implement Microsoft's server virtualization technology, and the results have been outstanding. The company was able to operate between five and ten virtual machines on each physical server, which generated a savings of $350,000 in hardware costs alone.

In addition, the technology enabled MaximumASP to utilize its data center floor space much more efficiently, thereby sparing the firm the cost of building a new data center. Furthermore,

average server utilization increased dramatically from 5 percent to 65 percent.

And the bottom line? Virtualization allowed MaximumASP to expand its product offerings, enhance its business agility, and improve its customer service, while actually lowering its operating costs.

*Sources:* "MaximumASP," *Microsoft Virtualization Case Study*, 2011; J. Hoover, "Microsoft Ramps Up Virtualization Management, Management Services," *InformationWeek*, April 28, 2009; www.maximumasp.com, accessed March 19, 2012.

With cloud computing, setting up and maintaining an IT infrastructure need no longer be a challenge for an organization. Businesses do not have to scramble to meet the evolving needs of developing applications. With cloud computing, up-front capital expenses and operational costs are reduced, and infrastructure is better utilized and shared from one project to the next.

The difficult tasks of procuring, configuring, and maintaining hardware and software environments are eased to a large degree by using cloud computing. Cloud computing allows enterprises to get their applications up and running faster, with easier manageability and less maintenance, and enables IT to more rapidly adjust IT resources (such as servers, storage, and networking) to meet fluctuating and unpredictable business demand.

Businesses are employing cloud computing for important and innovative work. The next example shows how Amazon has successfully "moved music into the cloud."

**Example**

Amazon, whose online music store competes with Apple's (www.apple.com/icloud), has "moved music into its cloud" to solve two problems. The first problem is that music libraries have typically been scattered. For example, when you bought a new song at home, you could not listen to it at work, at least not without copying it manually.

You could buy a song on your phone, but it would not be on your computer until you performed a sync. Moreover, if your music library was large, then you could fit only a portion of the music onto your phone. The second problem is that Amazon wants more people to buy music from its proprietary store, as opposed to from iTunes.

In March 2011, Amazon released a package of software and services that solved both of these problems. The fundamental idea behind the new package is that your music collection will reside in the cloud. That way, you can conveniently listen to it from any computer—at home, at work, at a friend's—by logging into a special Web page called the Amazon Cloud Player (www.amazon.com/clouddrive).

You can also listen to any of the songs in your music collection on an Android phone without having to copy or sync the music. All your songs are always available everywhere, and they do

not take up any storage on your phone itself.

In addition to being accessible from anywhere, the Cloud Player has some other notable perks. It contains a list of your songs, which you can sort and search. You can also drag songs into playlists and play back a song, an album, or a playlist. Plus, you can download songs to your computer. Amazon also provides a free Uploader app that lets you send your existing music files to your online library so that your existing music is also available from anywhere.

The Cloud Player is almost free. To get you started, Amazon offers everyone 5 gigabytes of free space online—enough room for about 1,200 MP3 songs. You can buy additional storage for the price of $1 per gigabyte per year. Although this price might seem insignificant, the service can become expensive if you have a huge music collection—enough to make "pay $15 per month for unlimited music" sites like Rhapsody look appealing.

To attract customers, Amazon is offering incentives. For example, if you buy an album from Amazon's music store, your Cloud Drive storage is increased to 20 gigabytes for the year at no charge. In addition, any songs you buy from Amazon do not count against your storage limit.

Amazon faces tough competition with its Cloud Drive. Many other companies offer similar systems. Apple (www.apple.com/icloud) and Google (http://music.google.com) offer similar services. Also, Rdio (www.rdio.com), Audio Galaxy (www.audiogalaxy.com), Spotify (www.spotify.com), and GrooveShark (www.grooveshark.com) all offer some elements of the Amazon concept for less money.

Sources: Compiled from E. Bott, "How Amazon Has Outsmarted the Music Industry (and Apple)," *ZDNet*, March 30, 2011; D. Pogue, "The Cloud That Rains Music," *New York Times*, March 30, 2011; www.amazon.com/clouddrive, www.apple.com/icloud, http://music.google.com, accessed April 15, 2012.

In the next section, you learn about the various ways in which customers (individuals and organizations) can utilize cloud computing. These types of cloud computing include public clouds, private clouds, hybrid clouds, and vertical clouds.

Before You Go On…..

1. Define cloud computing

2. Describe the essential characteristics of cloud computing.

**Reasons for the emergence of Cloud Technology**

Even though, there are numerous reasons for the emergence of Cloud Technology in the technical
side, the major reasons for cloud emergence are,

**1. Rapid growth of computer and communication technologies:** Technological growth in computing and computing devices, and in the data communication lead to the tremendous growth of cloud technology.
**2. Changes in management philosophy:** Decades ago, most of the organizations used to keep their data manual or stored their data in on premise infrastructure. But to meet the global competency, most of the organizations want to utilize their time to improve the business, and ready to outsource their IT requirement.
**3. Availability of excess computing capacities** with giant corporations such as Amazon and Google.

**Advantages of Cloud Computing**
Cloud computing provide more benefits to micro businesses, Small Medium Businesses (SMBs) and Small Medium Enterprises (SMEs). They are given below:

**Flexibility:** Cloud-based services can rapidly meet the business demand of any organization by providing various services.

**No Up-Front Cost:** Cloud computing services are typically pay-as-you-go, so there's no need for upfront cost of infrastructure. Since cloud computing is much faster to deploy, businesses (SMEs) have marginal project start-up costs and expectable ongoing operating expenses.

**Increased collaboration:** Cloud computing upsurges collaboration by allowing all employees to synchronize up and work on documents and shared applications simultaneously from their own place. It even allows them to follow colleagues and records to receive critical updates in real time.

**Automatic software updates:** Cloud service providers do the server maintenance including software upgrades, security updates, freeing up their customers' time and resources for different other tasks.

**Document control:** If a company doesn't use the cloud, workers have to send files from side to side over email. This means only one person can work on a file at a time and the same document will be duplicated in millions of formats and names.

**Security:** Businesses storing everything in the cloud, can access the data even anything happened to the machine.

**Work from anywhere:** Cloud computing allows employees to work from anywhere. This elasticity positively affects knowledge workers' work-life balance and productivity.

**Environmentally friendly:** Businesses adopting cloud computing uses only the server space they needed, so it decreases their carbon footprint and saves the environment.

**Disaster recovery:** When companies start trusting on cloud-based services, they need not have to device complex disaster recovery plans, because cloud service providers take care of most issues in a very fast manner.

**Competitiveness:** The cloud technologies grant SMEs access to enterprise-class technology by providing various ERP solutions. It also allows small and medium businesses to act faster than established, big competitors.

**Limitations of Cloud Technology**

Even cloud technology has several advantages, the organization adopting cloud has to keep aware
of following limitations.

1. Failure of communication will cut off a cloud service.

2. Sending data on a publicly accessible communication system have the danger of eavesdroppers tapping the communication line and stealing or corrupting data or stealing it from disk storage.

3. Deterioration of the quality of service of a cloud provider or a provider ceasing operations due to bankruptcy.

4. Complex legal problems may arise if providers' servers are in a foreign country and an organization's program and data are corrupted or stolen. An organization must clarify what laws apply while signing the Service Level Agreement with a cloud services provider.

5. A recent problem is the clandestine surveillance of data traffic on the Internet by the intelligence agencies of UK and USA. As cloud providers' infrastructure is spread throughout the world, so it may not be wise to use those services, particularly if the data to be processed or the program is sensitive.

**Impact of adopting Cloud Technology in Business Organization**

There are some major consequences of adopting cloud in Business. They are Ease of use and convenience, Cost reduction, Reliability, Security and privacy, and Sharing and collaboration.
The literature support of these impacts is summarized below.

**1.Ease of use and convenience:** Small business employees often work outside the actual office location and hence having easy access to their data (using their mobile devices) is a big plus. This need for employees to have access from remote locations as well as the increasing number of online transactions necessitates a cloud computing solution.

Accounting and finance work has been outsourced to the cloud, leaving more time for small business executives squander on strategic work and initiatives. Accountants are using cloud technologies for their SMEs clients for a convenient monthly fee. The Cloud approach helps eliminate administrative overhead and permits access from any geographical location, any device, and from any organization. Less powerful devices (smartphones, netbooks) are able to make the most of the company's backend IT systems via a simple web-based interface like AWS Management console.

**2. Cost reduction:** Due to the subscription model, there is a huge cost savings for small firms. The access cost for small firms utilizing business analytics and intelligence, which needs lots of computing power consumption, has been lowered. A 70% cost reduction has been observed since adopting AWS (Amazon Web Services) as the cloud vendor. AWS has also reduced their prices a couple of times, in the past three years, in spite of the absence of competitive forces.

European SMEs, who are more risk averse, compared to USA SMEs, appreciate this reduction of fixed IT assets cost as well reduction of maintenance costs of IT assets, resulting in lowering the entry barrier. Due to the per user revenue model, small businesses could afford enterprise applications like CRM (Customer Relationship Management) or SCM (Supply Chain Management) tool. Computing power is nowadays considered as an article of trade, due to the entry of various players, providing it at an inexpensive cost. Small businesses and startups can now afford applications such as ERP (Enterprise Resource Planning), CRM (Customer Relationship Management), SFA (Sales Force Automation) and SCM (Supply Chain Management) due to economical subscription fees.

Immediate access to hardware and software resources is available with no upfront capital investments resulting in faster time to market, with IT become an operational expense (instead of capital expense). Adoption of IaaS reduces capital expenses and IT costs. Elasticity in ramping up (scalable infrastructure) and disposing of cloud capacity when not needed, is extremely budget friendly.

For risky business models, if the demand rises piercingly in ad-hoc manner, scalability of resources provided by Cloud service providers (operational excellence) becomes a huge competitive advantage.

**3. Reliability:** Since the cloud is available round the clock, it is more reliable. Employees can even call up the cloud center (if needed) instead of depending on the in-house IT staff. Data redundancy is built-in by cloud storage solutions so that the files are always obtainable, even in times of network downtime, power failures, etc. This built-in redundancy helped Netflix to stay buoyant online, regardless of AWS failure in 2011.

Even in 2010, Gmail had an uptime of 99.984%, which is 32 times more reliable than a typical widely used email system. On the contrary, for SMEs, the reliability of cloud services is definitely important, but not as crucial as for large companies. Sultan adds that portability of end-user data to another cloud provider (in case of failure of the primary provider) is extremely important. Lack of interoperability is an
issue prevailing across the cloud computing landscape. Also, reliability gets impacted
because of the downtime of various commercial cloud solutions like Salesforce.com, Amazon, Gmail and Google Docs, resulting in setting up of failsafe cloud systems. Needed reliability level has to be observed in spite of low prices of cloud services. It is further stated that
quick phone support is needed under SLAs by commercial enterprises providing automatic disaster recovery and back up provides confidence. Efforts are underway by the FTC (Federal Trade Commission) and the Cloud Security Alliance to improve the reliability of these cloud providers.

**4. Security and Privacy:** Organizations talking about cloud security are actually more concerned about having their own control (something like a private cloud) than any other serious issue. Cloud security is good, as risks get minimized due to authentication and encryption and. Security is heightened by, for example, monitoring activities, tracking transactions, providing selective access to users, and utilizing strong password. In it is reported that 75% of the CIOs reporting are concerned about cloud security and argues that Google does not encrypt data on their servers. On the other hand, in also stated that 66% of USB drives are lost; hence the cloud is more secure. Installation of security patches can be avoided in this manner days and months are saved. There may be some elasticity depending on the cloud solution chosen, for example, Google Apps allows certain users to stipulate the location of data storage to meet the Federal guidelines. Improved security is possible due to economies of scale as well as affordability of excellent security experts [19]. Even if data security is the main issue for SMBs, they still utilize public clouds, because a public cloud provides standard services at reasonable cost.

**5. Sharing and collaboration:** With the proliferation of social media and smart phones (mobile devices), startups and small companies have improved collaboration within their companies. Cloud file storage allows various SMBs stakeholders to share information and data (via emails, shared web-links, IM-instant messengers), store and retrieve information with each other. Google Apps, box and Jive are very good examples of sharing content and collaboration among stakeholders. Large data are being shared and collaboration with other CSE (Computational Science and Engineering) research groups is enabled

Collaboration becomes easier with IMs (instant messaging) and video conferencing, enabled via the cloud. Document sharing and editing of the same document by several people at the same time (via Google Docs) and collaboration (via Skype, Google chat) is compelling for users to adopt cloud computing

BENEFITS OF CLOUD COMPUTING

There are numerous benefits in cloud computing. Major ten benefits are explained below.

*1, Cost Savings:* Cloud computing provide facility to use services such as infrastructure, platform etc based upon requirements, it helps to reduce the initial cost, avoid the setting of high capacity servers and others that are capable of more than needy one. It charges amount depending upon usage of infrastructure, platform and other services, this helps consumers to reduce the expense by specifying the exact requirements.

*2, Time Saving:* Cloud computing reduce the set up time of organizations by providing all facility simultaneously. No need of waiting to set up the infrastructure, platform and others and avoid the initial headache. This helps organizations to save time, helps to run trial basis initially and gradually move to a permanent condition.

*3, Scalability and Flexibility:* As discussed in second benefit, companies can start with a small set up and grow to a large condition fairly rapidly, and then scale back if necessary. Also, the flexibility of cloud computing allows companies to use extra resources at peak times, enabling

them to satisfy consumer demands. Moreover cloud computing is ready to meet any peak time requirement by setting up with high capacity servers, storages etc.

*4, Backup and Recovery:* Since all the data is stored in the cloud, backing it up and restoring the same is relatively much easier than storing the same on a physical device. Also it has many techniques to recover it from any type of disaster.

*5, Resource Maximization:* Cloud computing has reduce burden of IT resources to many companies and agencies by maximizing the resources from cloud computing pool. Most providers providing facility to meet any type of requirements at any time. This is one of the exciting feature of cloud computing.

*6, Mobile Access:* The cloud computing enables to access high- powered computing and storage resources for anyone with a network access device. Employees can access and work on their application by sitting home, no need of going to office or organization. Moreover nowadays number of mobile users is very high compare to the users of PCs and other devices. Consumers can access their files and other applications anytime from anywhere by using their mobiles. This has increased the rate of adopting cloud computing technology.

*7, Multisharing:* Cloud computing offers sharing of architecture and other applications for multiple users. With the cloud working in a distributed and shared mode, multiple users and applications can work more efficiently with cost reductions by sharing common infrastructure.

*8, Customization:* Cloud computing is a platform where we can modify to our needs with being redevelopment. It offers a platform for creating and amending applications to address a diversity of tasks and challenges.

*9, Collaboration:* Major projects or applications are delivering by the effort of multiple groups of employees working together. Cloud computing provide a convenient way to work group of people together on a common project or applications in an effective manner.

*10, Deliver new services:* Cloud services are provided by multi-national companies like Amazon, Google, IBM, Microsoft, Salesforce.com, etc. These companies can easily deliver any new application/product at the release time itself.