1. INTRODUCTION

The Internet technologies, manageable and distributed computing, global positioning systems, etc., identify the idea about “anytime" and "anywhere". Due to Internet technology, remote work is possible, remote organizations may be engaged in near cooperation and public can form groups on the Internet (Wiberg, 2005).

Unlike light bulb or the telephone invention, the Internet has no particular inventor. Instead, it has developed over time. More than 50 years ago, the Internet developed its basic start in the United States as a government weapon in the Cold War. Previously, scientists and researchers were using it to communicate and share data with one another. Today, everyone we use the Internet for almost everything, and for many people it would be terrible to imagine life without it. The Soviet Union launched the world’s first man made satellite into orbit in October 1957. The satellite was known as Sputnik. It stumbled uselessly around in outer space. It was sending different blips and bleeps from its radio transmitters because it circled the whole Earth. After the launching of Sputnik, many Americans initiated to think more seriously about science and technology (History.com, 2010).

But Scientists and military specialists were specifically worried about what might happen in the incident of a Soviet attack on the nation’s telephone system. Just one missile, they be afraid of, could finish the whole network of lines and wires that made effective long distance communication happen. In the year 1962, a scientist from M.I.T. and ARPA named J.C.R. Licklider suggested a solution to this problem. It is a galactic network of computers that could talk to one another. Such a network would enable government authorities to communicate even if the Soviets damaged the telephone system. In the year 1965, another M.I.T. scientist suggested and designed a way of sending information from one computer to another. This way was known as packet switching. Before sending the information to its destination place, Packet switching breaks the whole information into blocks known as packets. Each packet can take its own route from place to place. Without packet switching network, the government’s computer network was known as the ARPA.net. It would have been just as susceptible to enemy attacks as the phone system. In 1969, ARPA.net conveyed its first message a node-to-node communication from one computer to another. The
message LOGIN was short and simple, but it crashed the inexperienced ARPA network anyway. The Stanford computer only received the first two letters of the note. In the end of the year 1969, only four computers systems were connected to the ARPAnet, but the network developed steadily during the year 1970s. In the year 1971, it added the University of Hawaii’s ALOHAnet, and after two years, it added networks at London’s University College and the Royal Radar Establishment in Norway. As packet-switched computer networks increased, however, it became more difficult for them to integrate into a single worldwide Internet (History.com, 2010).

In the end of the year 1970s, Vinton Cerf, a computer scientist had started to solve this problem by designing a way for all of the computers on all of the world’s small networks to connect with one another for good communication. His kind of invention was known as Transmission Control Protocol or TCP. After then he added an additional protocol which is known as Internet Protocol or TCP/IP. During the year 1980s, researchers and scientists tried it to exchange information and files between two computers. Hence in the year of 1991, the Internet was changed drastically again. During the same year, Tim Berners-Lee who is a computer programmer in Switzerland developed the World Wide Web or WWW concept. Due to this Internet that was not limited to only send files from one place to another but became a WEB of information and because of it anyone on the Internet could retrieve the information from any place in the world.

After that the Internet was became more advanced in many ways. During the year of 1992, a group of students and researchers working at the University of Illinois designed a stylish browser known as Mosaic. It permitted users to see words and pictures on the same page for the first time and to navigate using scrollbars and clickable links. Due to this invention, Congress decided to use the Web for commercial purposes. So, all kinds of organizations took their efforts and interest to set up their own websites.

Hence Internet became a gigantic library comprised of files, pictures, videos & content and it is helping billions of people around the world because it is certainly occupying all aspects of life. It is helping the corporate and individuals in numerous ways as it is promising to communicate with each other, to do international trade, and to get entertainment (History.com, 2010).
Meanwhile multiple users were capable of accessing a central computer through dumb terminals, whose solely function was to produce access to the mainframe. Because of the prices to buy and maintain mainframe computers, it absolutely was not sensible for a corporation to buy and maintain one for each worker. Nor did the everyday user would like the big (at the time) storage capability and process power that a mainframe provided. Providing shared access to one resource was the answer that created economic sense for this refined piece of technology.

Hence the concept of computing services as utility using Internet came to solve many problems. This concept was known as Cloud computing.

Cloud computing may be a way to communicate and set of connections with a verity of recourses that the web provides. Cloud during this tense is used metaphorically to point how immense the internet is and to image the large quantity that will hold. Prof Ramnath K. Chellappa is the one who came up with this term of Cloud Computing. It is restricted by economic principle. Everyone believe that cloud computing is that the latest phenomena within the field of IT as some people say that it is also the ultimate variety of globalization. World Wide Web (WWW) is the modern illustrious cloud around documents. Within the web, where the massage goes, the cloud can keep it within to deliver it to the receiver (Allen).

Desktops, mobile devices and clouds are basic platforms. The one that is progressively leaned on by the general public is that the cloud. Cloud computing also can be elaborated because the activities that somebody needs to try and do should be ought to remote server. The only way to reach it is by internet software. Several clouds computing that are best-known and employed by most of the general public has advanced technique. Some big cloud computing services are Amazon, Google, Microsoft, and also salesforce.com services.

The principles of cloud computing includes:

i. Virtualization and automation,

ii. Interchangeable resources such as servers, storage and network,

iii. Management of these resources as a single fabric,

iv. Elastic capacity to respond to business demands,

v. Applications that can truly scale out,
vi. Focused on the service delivered to the business.

- **Nature of cloud computing**
  Cloud computing builds on established trends for driving the price out of the delivery of services whereas increasing the speed and integrity with those services are deployed. It minimizes the time from creating application design to actual preparation. Cloud computing incorporates visualization, on-demand deployment, internet process of delivery of computing utilities and open source software.

  Virtualization more enhances flexibility as a result of it abstracts the hardware to the purpose wherever software system stacks will be deployed and redeployed without being tied to a selected physical server. Virtualization allows a dynamic datacenter wherever servers give a pool of resources that are controlled as required, and the relationship of applications to compute or storage, and network resources changing very dynamically to satisfy each workload and business demands.

  The on-demand self-service, pay-by-use atmosphere of cloud computing is additionally an extension of established trends. The on-demand nature of cloud computing serving supports the performance and capability aspects of service-level objectives. The on-demand service facility of cloud computing lets organizations to make elastic environments to extend and contract supported the employment and mark performance parameters. The pay according to use facility of cloud computing might take the shape of apparatus lease that promises a least level of service from a cloud supplier.

  Cloud computing extends this trend through automation. Rather than negotiating with an IT organization for resources on which to deploy an application, a compute cloud could be a self-service proposition wherever a MasterCard can buy compute cycles, and an online interface or API is employed to make virtual machines and establish network relationships between them. Rather than requiring a long-term contract for services with an IT organization or a service supplier, clouds work on pay-by-use model wherever an application might exist to run employment for a number of minutes or hours, or it's going to exist to supply services to customers on a long-term basis.
It nearly goes without expression that cloud computing extends the present trend of creating services available over the network. Virtually each enterprise has recognized the worth of Web-based interfaces to their applications, whether or not they are internal applications that are created out there to the staff, partners, suppliers, consultants. The value of primarily based service delivery is that applications will be created out there any place, and at any time. Whereas enterprises are cognizant of the flexibility to secure communications the value Secure Socket Layer (SSL) encoding beside sturdy authentication, bootstrapping trust in a very cloud computing atmosphere needs carefully considering the variations between enterprise computing and cloud computing. Once properly architected, web service delivery will offer the flexibleness and security needed by enterprises of all sizes.

- **Grid Computing Vs Cloud Computing**

  Grid computing needs the utilization of package that may divide and farm out items of a program together massive system images to too many thousand computers. One concern regarding grid is that if one piece of the package on a node fails, different pieces of the package on different node could fail. This can be relieved if that part incorporates a fail over part on another node, however drawback will arise if elements admit different items of package to accomplish one or additional grid computing tasks. The system and associated hardware to control and maintain them will contribute to massive capital and operative expenses.

  Cloud computing and grid computing are scalable. Measurability is accomplished by using load balancing of application instances running on an individual basis on a spread of operative systems and connected through net services. Electronic equipment and network information measure is allotted and dis-allocated on demand. The system storage capability will goes up and down counting on the amount of users, instances, and also the quantity of information transferred at a given time.

  Both computing varieties involve multi-tenancy, which means that a lot of customers will perform totally different tasks, accessing one or multiple application instances. Sharing resources among an oversized pool of users assists in reducing infrastructure prices and peak load capability. Cloud and grid computing give service-level
agreements (SLAs) for secure period of time service; the buyer can get service credit for receiving information late.

The Amazon S3 provides an online services interface for the storage and retrieval of information within the cloud. Setting a most limits the quantity of objects we will store in S3. We can store an object as one byte and as large as 5 GB or maybe many terabytes. S3 uses the concept of buckets as containers for every storage location of objects. The information uses the same data storage infrastructure that Amazon uses for its e-commerce websites.

While the storage computing within the grid is like minded for data-intensive storage, it is not economically suited to storing objects as small as one byte. In a very information grid, the amounts of distributed information should be giant for maximum advantages.

Cloud computing is wherever information, or information process power are access through clouds of on-line resources. It permits users to access their information from any device. Though the benefits of cloud computing are various, there are some disadvantages, even if the information are safely saved within the cloud, several reasons will cause damages to those information. Cloud design means the cloud is organized to be functioning. Peer-to-peer (P2P) is taken into account as a cloud; however this cloud has not centralized that store all the information.

There is a lot of misunderstanding on the web about what the differences are between cloud computing and using the Internet. Many beginner users argue that they are the same thing, or very similar, but in fact they are not. Cloud computing and using the Internet are very unlike (Vinton Cerf, 2009). They are like:

a. **The Internet is not succeeded:** The Internet is a huge network of networks; it is the base for online communication. The cloud is an achieved resource and it can allow you to implement various applications and other tools over the Internet. Most cloud vendors and providers offer nonstop support for their cloud services. And so, the Internet is simply an implement and not a service.
b. **The Internet can provide only connectivity:** The Internet links you to the web and allows TCP/IP protocol to transfer your data between servers online, but it cannot provide cloud services like virtual servers and many more. Maximum cloud services are based on infrastructure as a service where the entire infrastructure you need like data storage, power, and scalability is up to your cloud vendor, and user both have not to worry about anything and allowed him free to focus on other business activities.

c. **The cloud computing will give server resources immediately:** Once we work with a cloud supplier, we are able to run all of application and computing desires on our managed systems. If we have a tendency to work with a web supplier then we must have to be compelled to get servers additionally to rent another company or to rent servers. Once a cloud vendor’s managed systems are non-inheritable then we are able to use virtual processors to assist us once we want extra resources to induce our computing power desires in monthly payment.

d. **The cloud give us the flexibleness to alter our resources:** The cloud will facilitate us to beat periods of peak usage and might provide us remote support and applications that require a lot of resources than what are actually offered. The Internet will only keep us on-line and does not give any flexibility for provision virtual resources. Cloud services are a contemporary evolution of web services that enable you to beat troublesome computing challenges.

e. **The cloud offers you remote access to your programs and applications:** The Internet permits you to attach with a number of resources, however will not allow you to run a developer platform from simply any application. If you wish to use programs, or software package with strict processor, RAM and storage needs remotely then the cloud offers you the most effective resolution.

Cloud computing is a phrase which describes a variety of computing concepts but the most universally accepted definition of cloud computing is the one given by NIST. The definition given by NIST is simple to understand. It states that whenever the ownership and operations of traditional IT are distributed over to service providers then it is cloud computing. The definition is lucid enough to be understood but there
are many capabilities and complexities of Cloud and its structure respectively. Cloud is a technology which is in a still maturing stage and over coming years it is sure that it will drastically revolutionize the entire global economy whether it is in terms of industrial development or technological development. The concept of power plants which revolutionized the entire economy can be illustrated to show the potential which cloud has in terms of industrializing computing power over the globe in near future.

In recent times, lots of research has been done to study the various aspects associated with cloud. These are both independent research and sponsored research which have basically tried to define cloud following the definition given by NIST. Most of the sponsored research focuses on interoperability issues between platforms and cloud. However, majority of independent research have tried to throw light on the need of a universal platform. Research in the arena of issues relating to security, pricing system and legislation are very less in number. Since cloud is still in its infancy stage, it requires much more research and study with respect to all aspects which are associated with it.

This is a time which can be described as a “perfect storm” and thus it can be stated that it is the right time to venture in cloud computing to fully utilize its potential. But the constraint faced in this major move is due to lack of vision and a holistic approach on the part of business houses, government as well as non-profit organization. As stated above that most of the sponsored research come from the business houses, it is imperative that the research so conducted are basically with the aim of boosting their vested interest in software licensing and hardware sales. So there is lack of research studies which highlight the benefits of cloud computing from the view of interests of the common person. Thus, a broader vision is required on the part of the business houses to fully harness the trans-border potential of cloud computing. Even the government and the non-profit organizations need to take up the agenda of cloud computing from a broader perspective which will benefit the entire economy in coming years. The focus should be to introduce and implement such cloud computing technology which is hundred percent friendly and lucrative to the user in terms of security and price. Thus, the cloud should not be meant for a particular division of world but it should rather have the motto of integrating the entire globe into one
offering the best computing services. And the providers of the cheapest and most robust cloud services will be the winners and such cloud providers would probably be the new virtual governments in future.

As mentioned above that both sponsored and independent research have been taken in this field, there are also articles written, guidelines prescribed, tutorials and studies conducted in order to throw light on the entire package of cloud, i.e. its services, framework, technological and financial requirements and constraints and the pros and cons which it is likely to bring in the economical arena of business and technology. It is not possible to do an exact compartmental classification of the literary work done on cloud computing but still a broad classification can be done on the basis of four broad categories such as Technology, Application, Business aspects and general issues.

Technology is one such factor which is ever changing. It is one of the most dynamic forces which exist in the IT sector. Technology exists in the traditional IT architecture and so does it in the arena of cloud. The prevalence of hardware and software is common to both the traditional IT and the cloud but the difference is in the advantages both of them offer. There are various factors which have to be assessed in order to understand the technological advantages of cloud over the traditional IT architecture. Cost, security, availability of service and a flexible architecture are a few advantages which the implementation of the cloud technology can bring about to the user. But the migration of the user from the traditional IT architecture to the cloud architecture is a major challenge for cloud service providers.

The move is not easy to bring about and that too when the market offers different types of IaaS services. It becomes extremely difficult on the part of the user to decide upon which environment to opt for in order to reap the highest possible benefits from the architecture. This difficulty arises merely because of the scarcity of standardization in the architectural frame of reference adopted by companies in offering the service of cloud computing. Apart from need for standardized architecture for the provision of cloud services, it is also important to have an architecture which is most secure and has the least probability to grant unauthorized access to unauthenticated users. The Cloud Security Alliance (CSA) is one such
organization which has the motto of promoting best security practices with regard to cloud.

The data centres of cloud are spread across a virtual world and data is described as an asset in cloud by the CSA. It is extremely important to safeguard data integrity. Data requires security according to the criticality of sensitivity it possesses. Sensitive data stored in virtual storage servers are vulnerable to threat of unauthorized access. Such sensitive data can create havoc if they get unauthorized access to unauthenticated users. So security is an extremely important aspect which goes hand in hand with technology. Without proper security the technology can turn into a bane rather than serving as a boon to masses. The complexity of the numerous layers of cloud acts as a major hurdle in having complete data integrity. However, acquisition of certain forensic evidence from IaaS could help in attaining transparency and accountability of data integrity. Thus, maintaining data integrity along with transparency, accountability and auditability is the need for an appealing cloud architecture which is efficient and secure too.

The task doesn’t end by having the above mentioned features incorporated in the architecture of the cloud but there should be prolonged focus on attracting the customers and retaining them. Thus, a balance of net user benefits and user satisfaction has to be kept in mind by the service providers when considering to effect long run migration by the customers. Migration to cloud also means expansion of the present Information services and bridging the gap between the traditional IT and the cloud.

Applications play a major role in cloud computing. It is through the creation of robust and dynamic applications that cloud can reach out to the entire mass of world. Applications should be meant not only for the delivery of services to the customers but also they should be able to be applied to the real world. The applications should have the capability to integrate the world as one service zone by paying significant attention to different lifestyles and cultures in order to provide seamless options of computing. Mobile technology has emerged as one of the most widely used application which has helped cloud to reach out to masses without compromising on the different lifestyles and cultures.
Healthcare is one of the best examples of sectors which have witnessed revolution in terms of their reach with the use of cloud computing and mobile technology. But proper attention is needed while designing the applications and end user devices. The capacities and limitations of the application with regards to the requirement of the user have to be kept in mind while designing the structure and dimensions of the application. Some areas have open-heartedly embraced cloud computing and its applications but some are still reluctant to migrate. This could be because of the unappealing use of the cloud applications to those areas. As per a survey conducted in US in the year 2011, areas such as warehouse management and inventory management have shifted to cloud applications from On-Premises technology at a percentage of around 67% whereas areas such as product testing and market research have shown a very small percentage of shift to cloud applications from On-Premises technology, i.e. 13% and 6% respectively.

How appealing and attractive is the cloud service and its application depends upon the extent to which it can collaborate with the prevalent and prominent business operations of the economy. Cloud computing is no different from other IT technologies which have highly influenced the present business scenario and the way it functions. The cloud has the potential to completely merge Business Operations and Information Technology.

With a dynamic technology like Cloud, it is possible that the cross border barriers between business organizations get substantially reduced. With cloud, the regulations and norms which apply on the business operations do not get reduced but the operations become more seamless and easy to perform as they get distributed to a specialized service provider. Cloud is also capable of bridging the gap of access to market faced by small firms. As cloud is very promising in terms of its virtual access anytime-anywhere and that too at reduced IT cost, it will be very helpful to bring the smallest firms to the upfront. Using the cloud, even the smallest firms can reach out to larger markets.

Today, 70 to 80% of a company IT budget goes in financing the separate data centres and new applications meant to support the business processes. Cloud is potent enough to upset the entire traditional model of fixed cost in the arena of IT services. The conventional fixed cost model of IT expenses is very cumbersome to the business
organizations. Fixed costing approach of traditional IT operations can become huge burden if the traditional technology obsoletes faster than it was expected. Fixed costing approach used in allocation of IT expenses budget plays a very trivial role in reducing the cost. Thus, the newer technology known by the name of cloud computing can work wonders with its element of variability in pricing. It can bring in a more efficient and economical system of costing which is popular by the name Variable Cost Model as it works on the principle of pay-as-you-go basis. Adoption of cloud computing removes physical constraints which enhances mobile working leading to opening up of new business ventures which are free from such dependence. This in turn also helps in better generation of employment opportunities. For example, adoption of cloud computing opens up new job avenues like ‘Enterprise Cloud Architect’ a person who works with both IT and applications, unlike traditional IT engineers and software engineers. Cloud computing can boost further industrialisation in the economy. It has the potential to industrialise computing power. It can standardise and enhance the availability of computing power. It is also potent to make the provision of computing power available on a very large scale. Thus, it can bring about economies of scale in the availability and use of cloud computing services which in turn brings about optimal cost efficiencies.

In general, cloud has affected the entire IT sector. It has emerged as one of the greatest revolutions which could ever happen in the arena of IT. It has brought about a situation where the monopoly and compartmentalisation of the traditional IT has been replaced by democracy, choice of the user and conformity to quality. The service providers who can satisfy their users in terms of scalability and portability of services will be the winners. Thus, it has brought an IT environment to the world which is much more customer-oriented and economical.

As, distributed computing allow to a system to circulates system parameters, applications, and enormous frameworks among a few machines, it might be an innovation with significant implications not only for the IT area as an issue. It raises authorizations to shape the on-interest provisioning of package, equipment, and data as administration, accomplishing economies of scale in IT arrangements planning and operation.
Distributed computing does not have a normal definition, however a better than average working depiction of its to say that mists, or bunches of dispersed machines, offer on-interest assets and administrations over a system, ordinarily the web, with the size dependableness of a data focus.

The same distributed computing was awed by the cloud picture that is generally used to speak to the web in stream diagrams and outlines. Distributed computing may be an application, a base on that these applications will run, a gathering of administrations that supply the profits of gigantic measures of processing assets. Distributed computing is developing as an issue figuring stage for imparting assets. Virtualization may be a centre asset imparting. Virtualization may be a term that alludes to the reflection of pc assets. They are similar to Virtual machine (VM), a bundle usage of a machine that executes projects kind of a true machine.

Distributed computing is making it feasible to discrete the technique for building a framework for the matter of giving client administrations. Clients can capture not one or the other neither the exact area of their data nor the inverse sources of the information set up together. Distributed computing clients will stay away from expense (Capex) on fittings, programming, and administrations once they pay a supplier only for what they utilization.

Building design develops about elements. Inside the 1960's and 1970's, the essential wave of processing comprised of huge, lavish, effortful, solid, servers that would be thought about the fourth father of the centralized server. Inside assets were pooled and genuine utilization was result of virtualization to affirm that the best conceivable was result of these unpleasantly pricey assets.

In 1980's and 1990's, with the increment of PC's contracting cost of systems administration and registering base, and a yearning for extra lightsomeness, customer/server gave the adaptability to discrete the machine level expelled from the server level. This was carried out to backing disseminated buyers running agreeable client interfaces and conjointly to scale back costs by offloading the client taking care of, use and solid servers. These bigger servers stayed to manage vast execution and logical workloads.
In 2000's, as data focuses started to round out, and power, house and cooling got to be extra and costlier, thoughts like exchange merchandise framework figuring and virtualization started to wind up settled. Distributed computing takes these thoughts any by allowing organization toward oneself, metered utilization and extra machine-driven element asset and work administration rehearses.

A speedy research, the historical environment of distributed computing will shy all the more light on the question that; is the distributed computing an advancement of IT or would it say it is a transformation?

1.1 History of Cloud Computing

The word or expression ‘Cloud’ has been in use in various branches of science over very long period of time that precedes the history of the computer if the abacus is not taken into account. In Latin, the term for cloud or mist is ‘Nebula', and it has been in use in astronomy to describe the milky way or any diffuse astronomical objects, including galaxies. In meteorology, a study of the atmosphere uses the literal meaning of the word ‘cloud’. In mathematics, the term of ‘point cloud’ is defined as customary of data fact in a three-dimensional coordinate system which is used to represent the surface of an object. The point cloud is shown in figure 1.1 (Point Cloud). In chemistry and nuclear physics, ‘electron cloud’ is used to describe the region of the path of electrons around the nucleus in an atom.

![Figure 1.1 Point Cloud Torus](image-url)
It was quite natural to assign the word ‘cloud’ as allegory for Internet, which has its network spread around the world without any definite pattern. The standardized shape of the cloud is also used as a symbol to correspond to a set of connections on telephony schematic. It represents the Internet in computer network diagrams. The standardized shape and electronic architecture inside the cloud is shown figure 1.2. (Walker, 2010)

Just as the coining of the name appears misty, cloud computing base is cloudy. Concepts of cloud computing are like sharing same hardware between multiple users at different locations since the time of mainframe computers in the 1950’s. Mainframe computers in the 50’s were colossal structures that used up a whole room and their prices were matched their size. The size, price, space and maintenance required for a mainframe computer prevented organizations from thinking or even dreaming of an individual computer for each user. It is shown in figure 1.3 (Steddum, 2013). It was the normal practice in those days to access the ‘server’ (mainframe computer) in the server room through dumb terminals or thin clients located in different parts of the organization. This practice called for sharing of CPU time for better performance and ensuring zero inactive time of CPU to ensure greater returns on the heavy investment. The sharing of CPU time was known as ‘time sharing’.

Figure 1.2 A Standardized Shape of the Cloud
Recent cloud computing ideas like public utility, elastic provision, giving online services and illusion of the unlimited offers is to the 50’s and 60’s and were expressed within the book, “The Challenge of Computer Utility”, written by Douglas Parkhill and published in the year 1966.

Later within the 1970’s, IBM came up within Operating System (OS) called Virtual Machines (VM) with the power to permit multiple virtual systems on their mainframe systems. The virtualization is shown in figure 1.4 (Steddum, 2013). This suggests that additionally sharing an equivalent hardware by multiple users, multiple operating systems may well be run on an equivalent hardware with all equivalent resources like memory, CPU, storage, input devices and networking located virtually allotted and one by one to every OS on the Virtual Machine (VM). Every OS on the VM would behave like everyone had its own separate hardware and network.
In the 1990’s telecommunication, companies utilized virtualization to provide Virtual Private Networks (VPN) in addition to the traditional single dedicated point to point data connections. This reduced the requirement of additional infrastructure to the telecommunication companies and allowed them to share the same infrastructure with their growing number of clients. This process allowed the companies to balance more networks and control over bandwidth by being able to monitor and shift traffic as required, and it also made the services cheaper.

It was during this period that the cloud symbol was introduced in the telephony schematics to represent the demarcation point of responsibility between service provider and the user.

1.1.1 Internet VPN
During the 90’s, the Internet available to the public and personal computers were becoming popular due to their reduction in size and price. The World Wide Web (WWW) that came into being in the early 90’s also made the Internet easier to use for the average person who was not familiar with all the protocols for file transfers, sharing and searching.
It was not long before the whole world was connected by the World Wide Web. The new community created by the Internet led to the beginning of commerce through the Internet.

Selling web space and web hosting was and still is a flourishing business. Sharing utilities over the Internet and paying for services used are two important characteristics of cloud computing. They are such kinds of services that have developed into the present day’s cloud computing which has been potential for unlimited storage, automatic utility and high scalability.

The same concept is shown in the figure 1.5 (McQuerry, 2012) which is an Internet but Virtual Private Network. The dot-com (.com) bubble needs to be mentioned in the history of cloud computing because it is the burst of the dot-com bubble in the year 2000 that led to the beginning of the cloud computing. Salesforce.com, Amazon.com, Ebay.com, Yahoo.com and Google.com are some of the success cloud stories that grew out of the dot-com bubble burst (McQuerry, 2012).
1.1.2 Amazon.com

Amazon was founded in the year 1994 by Jeff Benzoyl’s. Amazon’s early business plan was remarkable because it did not expect to make a profit for the next five years. The very slow growth of the company as compared to the other dot-com companies of that time caused stock holders to complain about the company’s profitability and questioned its ability surviving for the long term. When the dot-com bubble burst in the first quarter of the year 2000, many e-companies were destroyed, but Amazon then survived and at last turned its first profit in the fourth quarter of the year 2001.

Although, Amazon started out as books and CD store, it now sells almost everything a person can think of. The crunch brought about by the bubble burst made Amazon to plan about its newly acquired hardware resources. So the company decided to increase its income by launching the Amazon web services in the year 2002. Today, it has become one of the major cloud computing companies in the world (Ann, 2008).

The Amazon S3 provides an online services interface for the storage and retrieval of information within the cloud. Setting a most limits the quantity of objects we will store in S3. We can store an object as one byte and as large as 5 GB or maybe many terabytes. S3 uses the concept of buckets as containers for every storage location of objects. The information uses the same data storage infrastructure that Amazon uses for its e-commerce websites.

While the storage computing within the grid is like minded for data-intensive storage, it is not economically suited to storing objects as small as one byte. In a very information grid, the amounts of distributed information should be giant for max advantages.

Amazon includes a long history of employing a decentralized IT infrastructure. This arrangement has made possible for Amazon for development of groups to access compute and storage resources on demand, and it has increased overall productivity and lightness. By 2005, Amazon had spent over a decade and lots of dollars building and managing the large-scale, reliable, and economical IT infrastructure which is high-powered one in all the world’s largest on-line retail platforms. Amazon launched Amazon internet Services (AWS) so that different organizations may gain advantage from Amazon’s expertise and investment in running a large-scale distributed, transnational IT infrastructure. AWS services are in operation since the year 2006.
Nowadays it serves many thousands of consumers worldwide. Nowadays, Amazon.com runs a worldwide internet platform and it is serving variant customers and managing billions of dollars’ prices of commerce once a year.

Using AWS, we can be able to demand work out power, storage, and different services in minutes and have the flexibility to decide on the development platform or programming model that creates the foremost sense for the issues they’re making an attempt to resolve. Customer has to pay only for the utilized services with no extra expenses or long-run commitments. This makes AWS a cheap approach to deliver applications.

Due to many advantages of cloud computing, many businesses are shifting to the cloud computing. The year of 2011 made the cloud available for the mobile with all predictions and expectations for the year. Then at the end of 2013, it was the expected norm. Choices of mobile services are made based on the cloud applications available, and devices are purchased on its capacity to keep the user connected with the rest of the world on all levels, visually, audibly and with the ability to transfer data of various types like documents, spread sheets or even software.

AWS is quickly distinguished from different vendors in the traditional IT computing landscape as a result of it is:

- **Flexible**: AWS allows organizations to use the programming models, operation system, database, and also architecture with that they have already acquainted. Additionally, this flexibility helps organizations combine and match architectures so as to serve their various business desires.
- **Cost-effective**: With AWS, organizations pay just for what they use, without extra charges.
- **Scalable and elastic**: Organizations will quickly add and deduct AWS resources to their applications in order to meet client demand and manage prices.
- **Secure**: In order to produce total security and privacy, AWS builds services in accordance with security best practices, provides the suitable security measures in those services, and documents the way to use those options.
Experienced: When using AWS, organizations will leverage Amazon’s over fifteen years of expertise delivering large-scale, global infrastructure during a reliable, secure fashion.

1.1.3 Implications of Cloud Computing, A User’s Perspective
Before the cloud, services were available but people had to purchase software and had to possess bulky hardware to use it. However, both were expensive and not very portable. Furthermore, data and information could be transferred over the Internet, and the purchase could be done online through the heavy devices which could not be accessed anywhere and everywhere.

Although work could be done on laptops and shared through the Internet, common platforms where people could work together on the same file from different devices from any region of the world were really impossible.

Today, due to partnership between cloud computing and mobile technology, the input can be done on a real-time basis from any corner of the world. People are capable of carrying out all the activities any time from any place and for that they do not rely on a computer or on a thick client. People do not have to purchase software like MS Office, Photoshop, software for video editing and many more.

Furthermore, they do not have to be bothered about storage space because most of these services are made available for free or at a nominal charge by the mobile service providers through the cloud. Everything from booking tickets to submitting reports or paying bills can be done on the move from a device as small as the mobile phone. This has translated to impulsive buying and easy communication across the globe. Marketing through mobile service providers (like SMSs and other advertisements over the phone) and sponsoring mobile applications has generated unprecedented revenues for the businesses.

With the advent of cloud applications, it is not necessary for mobile manufacturers to install bulky applications on their mobile devices to provide unique services. Users can access and use the special services of the provider who is installed and computed in the cloud. It not only increases the performance of the mobile devices but also speeds up the purchasing process from the mobile.
The Graph 1.1 and two tables 1.1 and 1.2 below were published on smarinsights.com on June 10th, 2013 in the article “Mobile Marketing Statistics 2013” which is written by Daniel Bosom worth.

The Graph 1.1a and 1.1b below shows the device share of website traffic in the years 2012 and 2013. We can see that the number of tablets and smart phone's intake into the share of the traditional devices has doubled in a year.

**Graph 1.1a Q1 2012**

**Graph 1.1 b Q1 2013**

**Graph 1.1: Device Share of Website Traffic**
We can see in the table 1.1 below, the percentage of website visits through various devices in the year 2012 and the first quarter of 2013.

<table>
<thead>
<tr>
<th>Devices</th>
<th>Website Visit By Device</th>
<th>Q1 2012</th>
<th>Q2 2012</th>
<th>Q3 2012</th>
<th>Q4 2012</th>
<th>Q1 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>Traditional</td>
<td>88.62%</td>
<td>85.27%</td>
<td>82.61%</td>
<td>80.74%</td>
<td>78.99%</td>
</tr>
<tr>
<td></td>
<td>Tablet</td>
<td>5.95%</td>
<td>7.09%</td>
<td>8.48%</td>
<td>8.93%</td>
<td>10.58%</td>
</tr>
<tr>
<td></td>
<td>Smartphone</td>
<td>5.42%</td>
<td>7.64%</td>
<td>8.91%</td>
<td>10.34%</td>
<td>10.44%</td>
</tr>
<tr>
<td>Tablet</td>
<td>iPad</td>
<td>91.68%</td>
<td>90.82%</td>
<td>90.17%</td>
<td>89.49%</td>
<td>89.28%</td>
</tr>
<tr>
<td></td>
<td>KindleFire</td>
<td>3.58%</td>
<td>4.06%</td>
<td>4.08%</td>
<td>3.41%</td>
<td>2.51%</td>
</tr>
<tr>
<td></td>
<td>Android</td>
<td>4.75%</td>
<td>5.12%</td>
<td>5.75%</td>
<td>7.10%</td>
<td>8.20%</td>
</tr>
<tr>
<td>Smartphone</td>
<td>iPhone</td>
<td>58.20%</td>
<td>36.93%</td>
<td>38.51%</td>
<td>38.81%</td>
<td>35.52%</td>
</tr>
<tr>
<td></td>
<td>Android</td>
<td>40.16%</td>
<td>36.93%</td>
<td>38.51%</td>
<td>38.81%</td>
<td>35.52%</td>
</tr>
<tr>
<td></td>
<td>Windows</td>
<td>0.90%</td>
<td>0.92%</td>
<td>0.92%</td>
<td>0.94%</td>
<td>1.04%</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>0.74%</td>
<td>0.66%</td>
<td>0.80%</td>
<td>0.50%</td>
<td>0.25%</td>
</tr>
<tr>
<td>Devices ↓</td>
<td>Conversion Rates By Device</td>
<td>Q1 2012</td>
<td>Q2 2012</td>
<td>Q3 2012</td>
<td>Q4 2012</td>
<td>Q1 2013</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------------------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>Overall</td>
<td>Traditional</td>
<td>2.25%</td>
<td>2.34%</td>
<td>2.72%</td>
<td>3.13%</td>
<td>2.51%</td>
</tr>
<tr>
<td></td>
<td>Tablet</td>
<td>1.87%</td>
<td>1.82%</td>
<td>2.35%</td>
<td>2.86%</td>
<td>2.60%</td>
</tr>
<tr>
<td></td>
<td>Smartphone</td>
<td>0.49%</td>
<td>0.53%</td>
<td>0.77%</td>
<td>0.83%</td>
<td>0.79%</td>
</tr>
<tr>
<td>Table</td>
<td>iPad</td>
<td>1.94%</td>
<td>1.90%</td>
<td>2.41%</td>
<td>2.96%</td>
<td>2.68%</td>
</tr>
<tr>
<td></td>
<td>KindleFire</td>
<td>1.03%</td>
<td>0.92%</td>
<td>1.43%</td>
<td>1.70%</td>
<td>1.50%</td>
</tr>
<tr>
<td></td>
<td>Android</td>
<td>1.14%</td>
<td>1.15%</td>
<td>2.15%</td>
<td>2.22%</td>
<td>2.04%</td>
</tr>
<tr>
<td>Smartphone</td>
<td>iPhone</td>
<td>0.51%</td>
<td>0.55%</td>
<td>0.77%</td>
<td>0.84%</td>
<td>0.76%</td>
</tr>
<tr>
<td></td>
<td>Android</td>
<td>0.49%</td>
<td>0.50%</td>
<td>0.78%</td>
<td>0.82%</td>
<td>0.83%</td>
</tr>
<tr>
<td></td>
<td>Windows</td>
<td>0.51%</td>
<td>0.47%</td>
<td>0.75%</td>
<td>0.74%</td>
<td>0.82%</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>0.04%</td>
<td>0.02%</td>
<td>0.23%</td>
<td>0.40%</td>
<td>0.48%</td>
</tr>
</tbody>
</table>

Table 1.2 shows the percentage of online purchases and conversion done through various devices in the year of 2012 and the first quarter of 2013.

In addition to application, users or subscribers to SaaS, there are also the service providers and software developers who use the cloud services. For such classes of users, the cloud services are unit signed and paid in step with usage as more infrastructure and computer code licensing fees are involved. They also can afford to work on multiple platforms without having to be bothered about the scaling and networking and pay only for resources consumed. This is very convenient for small and medium businesses because they can afford to take up projects of a wider scope.
with minimal investment in infrastructure, software, and expenses which are incurred only while the project is on.

1.1.4 Implications of Cloud Computing, A Developer’s Perspective

Gone is the past when a software developer had to create only for a contained environment. With the wide-spread incorporation of cloud technology in every aspect of everyday life right from access to hospital records to the online shopping from various devices including the mobile phone; the software developer has to keep many aspects in mind when developing a program. The application has to be compatible with various devices and various operating systems. The user interface must appear suitable for all the different devices with different sizes of display. There must be completely different protocols through which different devices can access the applications.

Furthermore, the vital issue is the security implications caused by the range of devices and increase in users accessing an equal application at an equal time. The deployment of applications in the cloud is one of the challenges for the developer because applications made in the pre cloud eras were sold to individuals or organizations and were deployed at their premises.

The applications in the cloud era are created, installed and maintained by the service provider and has to cater to the different requirements and usage of the different types of consumers at the same moment. The capabilities of the applications have to be increased a hundred fold to meet the basic requirements. Interoperability between applications also has to be kept in mind for the successful implementation of the application.

Interoperability between applications was taboo in the pre cloud era where software developers created a monopoly for their software by making it unique and incompatible with the rival applications available in the software market. This technique, however, will not help the software developer to survive in the cloud era where portability and compatibility are the keys for successful operations on the cloud.

With diverse sorts of mists and distinctive sorts of administrations, the customer has the decision of selecting a multi-area heterogeneous cloud based applications for
incorporation, between supplier and between stage interoperability. Due to this reason, software developers have to think in terms of staying connected to other applications instead of focusing on isolation to provide uniqueness which in turn gave the upper hand in the monopoly oriented traditional software market. The cloud has democratized the software industry.

1.1.5 Myth’s about cloud computing
As seen with significant changes of IT throughout the most recent four decades, new innovations are creating quickly. Be that as it may when new innovation is at last comprehended, the preferences rapidly start to exceed the apparent disadvantages. It is conceivable with distributed computing additionally. Taking after are a few myths about distributed computing.

i. Public cloud is just veritable/genuine cloud:

Open mists draw more consideration and eminent appearances in client based applications, for example, Gmail, Amazon, purplish blue and so forth yet the truth of the matter is the extent of private cloud. Additionally, a 2012 Gartner Data Center Conference survey, just about none out of ten study respondents said they were arranging, administering, and utilizing a private cloud inside their own particular association. With this, a climbing number of organizations are sending cross breed mists that incorporate information and business transform crosswise over both open and private mists.

The principle purpose behind this myth may be, toward the start of the advancement of distributed computing the majority of the clients are of open cloud. Later, the appropriation of this processing engineering by the business and corporate made the private cloud more noticeable.

ii. Cloud is brought together size and fits everything:

Cloud has three administration models, four arrangement models. Because of this; client and supplier can possess and work them. Likewise, the client claims the arrangement yet the supplier works it. This demonstrates that cloud is dynamic existing with different alternatives and administrations to furnish with.

iii. Virtualization and distributed computing are the same:
Alone virtualization can't make cloud, however it is one of the driving innovation. While virtualization is basically centered on server and workload union with the decreased expense of framework, it incorporates significantly more than that. Cloud clients are adjusting stage as an issue more quickly than foundation as an issue. Since those organizations find that organizations are picking up more readiness and adaptability and investment funds from the profits that stage as an issue gives.

iv. **Cloud can be run just on ware compound:**

Some well-known online buyer destinations have picked up some attention for utilizing reasonable, administration and equipment. Their methodology is stand out of a lot of people. Cloud is running on all servers of all distinctive shapes and sizes. The discriminating issue is picking the right sort of foundation.

v. **Cloud means pay for every utilization:**

Paying for the utilization of an open cloud on for every moment or hourly premise is likely sparing, however the expense are differing and can increment up quickly. Pay-for every utilization is well for applications that have a short lifespan or have vast variances in limit needs. Membership based estimating that are long lasting and have generally steady limit necessities. So before picking open or private, one must consider about what application is financially savvy.

i. **Public cloud is not secure:**

Security is a real concern among associations considering a move to open cloud. The truth of the matter is that organizations frequently enhance application and information security by leveraging venture grade open cloud. Numerous corporate server farms have restricted security assets and ability, difficulties, gathering administering necessities, antiquated programming and equipment, and don't perform standard security reviews and charges. Huge numbers of them have after:

- Hardworking group of cloud security specialists,
- Processes that guarantee full consistence with controlling, and industry criteria,
- Frequently masterminded outsider security reviews,
Automatic upgrades for their diligent work and programming.

Cloud security is a word of wisdom to audit cloud supplier's security engineering and practices to see any potential security dangers.

ii. The greatest profit of distributed computing is lower costs:

Diminishing operational and capital expenses are great motivations to receive distributed computing. For some associations, the essential venture in the development to cloud includes union that infers huge value speculations. Anyway today, embracing cloud- is once in a while pretty much sparing cash. Organizations is to understanding about future development to a predefined administration set, own administration provisioning, arrangement speed, business innovation, and readiness to change business needs. A lot of people more believe that cloud is to increase adaptability and to decrease the danger of disappointment of arrangements. The greatest profit of cloud may vary starting with one association then onto the next and is generally straightforwardly fixed to whatever issue is driving cloud reception in any case.

iii. Cloud figuring eases process off and decreases profit:

For interest in profit, distributed computing administrations streamline basic procedures as well as enhance benefit.

iv. Cloud administration suppliers have nothing to stress over:

On the off chance that an associations cloud administration supplier experiences a force blackout, while uncommon, its manager and representatives will have no real way to get to the information put away in the cloud unless it keep reinforcements on servers or capacity drivers. The administration supplier's server could likewise glitch, rendering the associations information distant. Situations like these can bring about gainfulness misfortune.

An alternate danger is that associations may face is having their cloud administration supplier's server seized by powers for specific infringement. Mega upload, a document facilitating administration supplier, for example was as of late shown for copyright infringement and different charges, which rendered its servers unavailable.
In the event of a force blackout, administration level assertions can guarantee cloud administration adopters that their picked sellers will give reliable and managed administrations.

1.2 Need of Study
This modern-day phenomenon has the potential to change our everyday life as we know it at the moment to a different dimension. It was not so long ago when this world functioned perfectly well without the Internet, email and mobile technology and at present, nothing seems to work without any of these. Now everything we know of is dependent on these all kinds of technologies. Cloud computing is such a magic and attraction of internet. Without understanding it completely, vendors and enterprises are doing profit by providing computer services as a utility and business organizers and public is blindly using it as an application and ready to compromise with the security and privacy of their data.

So, understanding cloud computing has become a necessity that cannot be avoided. So to provide this purpose, it is needed to study cloud computing thoroughly and to have a good look at its definition before any further study of the matter could take place. Understanding the history of cloud computing and the origins of its name, all are needed to get a help to put in perspectives on its Implementations, Applications, Security and Economy.

1.3 Type of Study
Cloud computing is highly preferred topic for research as this being a novel field, it opens many of the avenues for research from different perspectives and objectives. Besides the exploding growth, this new technology has attracted the attention of not only the entrepreneurs but also the researchers desirous of contributing to increase the knowledge based on various dimensions for users, industries and academic researchers.

Figuring out, the cloud can be quite confusing when there are so many different opinions about it among the stalwarts of IT (Prank) (Simonite, 2011). If one looks at the most popular and concise definition of cloud computing, the definition according to NIST (Peter, 2011), one can safely conclude that when the ownership and
operations of each layer of Traditional IT are distributed between service providers and organizations, the cloud is formed.

Simple as it may sound, the complexities and capabilities of the cloud have started a chain of events that will bring about a change so drastic in our lifestyles, that it can be compared to the impact of the automobile or of the devices of mass communication and telephone. Cloud computing in the virtual world can be compared to the power grids, motorways and gas lines in the physical world.

There is a need for developers and enterprises to examine and understand the various issues of cloud computing and how these issues affect their choices regarding cloud computing technologies. The three modes of cloud computing delivery as the public, private and hybrid models must be examined on the factors determining the choices.

Thus, it is essential to present a bird’s view of cloud computing technology, various services available, architectures and platforms. The issues of secrecy, safety and reliability in cloud computing are factors of such a great concern that these issues are the main reasons for the shortfall from the predicted projections of quantum of migration to cloud environments.

Hence, the main aim of this work is to understand cloud computing in a comprehensive manner in relation to the IT industry and the society at large.

1.4 Statement of the Problem

Most of the work and studies in the field of cloud computing are done by business houses that have their vested interest in software licensing and hardware sales. Hence conflicting opinions regarding cloud computing exist, which can confuse the average person. However, the potential of the cloud is far beyond the mere profit in software licenses and hardware. The effects and reach of cloud computing are trans-border, and therefore, the clouds are often compared to the infrastructure within the universe on that businesses, and thereby; the economy is critically dependent on. Like the industrial revolution and the IT revolution, the providers of the cheapest and most robust clouds will be the winners of the new revolution.

To fully utilize the potential, the initial hiccups of migration, scalability, security and billing techniques need to be addressed by nonprofits organizations or governments or
even business houses with broader visions, keeping the interests of the common person in mind.

1.5 Objectives of Research

This thesis presents an overview on all major aspects of cloud computing and discusses the technical issues that show the clear benefits of implementing such exciting technology for all the stakeholders. At the same time, the outstanding concerns of the organizations regarding security and privacy as well the performance parameters are presented.

As this is a vast topic, it is decided to break it up into segments and cover it in the following sequence:

a. To understand cloud computing based on its definition by NIST.

b. To explore and compare 3 service facsimiles of cloud computing with Traditional IT.

c. To understand and compare deployment models of cloud computing.

d. To understand the infrastructure, different available frameworks, role of metadata and requirements for implementing cloud computing.

e. To understand the factors required for successful enablement and management of cloud computing.

f. To understand consumer requirements from a cloud perspective for a better insight to its potentials and concerns.

g. To understand the requirements for a successful migration to cloud computing and its implementation.

h. To present a comprehensive picture of the above studies and attempt to portray the extent, consequences, potentials and concerns of cloud computing.

1.6 Methodology

Cloud computing is a multi-faceted phenomena. Focusing and working on one or few of the facets without awareness of the whole picture will cause more damage than progress and benefit to the society at large. A holistic view is necessary to utilize the potential of cloud computing fully.

So, the methodology adopted is devised based on the objectives of the research undertaken. Accordingly, ‘Qualitative Research Methodology’ is considered as a
suitable method for the objectives stated. The thesis evaluates various models and implementation, architectures, and platform for discussing their implication to the service providers and the clients.

Understanding of cloud computing also falls under descriptive research. Hence the ‘Analytical Methodology’ is used on existing secondary data in order to compile a holistic picture of cloud computing. Extensive literature review from newspaper articles, blogs, text books, videos, etc., is done. Redundant and baseless data is discarded. Conflicting data is looked into thoroughly, analyzed and conclusion is drawn. Relevant data is sorted out in accordance with a data flow which is based on the NIST definition. Data was collected from various universities, publishing houses and libraries. It was then scrutinized, categorically organized and summarized the findings in Lay man’s terms.

1.7 Work Plan

As the aim is to understand cloud computing in a holistic manner; it has been decided to discern cloud computing according to definition described by NIST. The more visible parts of cloud computing are its platforms and applications. In order to understand how the different platforms and applications work, their advantages, disadvantages and to be able to choose the appropriate platform or application that will best suit one’s need, a clear understanding of the whole system is required. The work plans to achieve this end is very simple. It is as given below:

i. Data Collection (secondary data)
ii. Sorting and categorizing the collected data
iii. Presenting the information in Lay man’s terms
iv. To connect the sorted and categorized information to portray a bird’s eye view of cloud computing

1.8 Significance and Scope of work

The research outcome is believed to answer all the concerns of the implementing cloud computing in organizations, the expansion of the services at future dates without compromising on security and privacy and the factors that inhibit the new organizations to migrate to the cloud computing platforms.
To do this, the thesis dwells on the definitions of cloud computing from different perspectives from the angles of technology and service providers. The detail study of different services of cloud computing is undertaken in the context of the following research questions:

i. What is the impact of adoption of the cloud computing on the process of an organization? What is Return on Investment, if it is implemented?

ii. What are the factors of availability and reliability of cloud computing for the organization, when it is implemented?

iii. What is the cost effectiveness for an organization while implementation of cloud computing?

iv. What are the concerns of security when of Resource Shared Pooling Multiple Service Providers met successfully in adoption of cloud computing?

The scope of this research is to provide through knowledge about cloud computing so that the reader will decide the perfect and proper service or model of cloud computing before its actual implementation.

**1.9 Outline of the Thesis**

In this thesis, in the first chapter of *Introduction*, the purpose of the work is explained. Also, this chapter explains about the motivation behind this research work, objectives of the research work and the work planned to achieve these objectives.

Chapter two is *Literature Review*. This chapter is an attempt to attain a deeper and simpler insight to cloud computing. So, the articles are chosen to throw light on distinctive spheres of cloud computing with guide lines of researchers, tutorials and studies. The classification is not exactly possible because the distinct aspects related to cloud computing are intertwined and quite difficult to unnamable. So, the review is explained with the technology, applications, business aspects and general issues about cloud computing.

Chapter three is about *Defining Cloud According to NIST*. The NIST the definition of cloud computing is explained in this chapter.
Chapter four is *What Does It Takes To Provide IaaS?* This chapter looks at the different elements that constitute IaaS, the infrastructure, services to be delivered, possible optimization techniques, billing structure, security and legal issues.

Chapter five is *What Does It Takes To Provide PaaS?* To get a clear picture of Platform-as-a-Service, this chapter provides a look at the services to be delivered, methods and process of delivery, complexities and challenges posed by the hypervisors and operating systems, billing structure as well as security and legal issues.

Chapter six is *What does it takes to provide SaaS?* In this chapter SaaS is taken apart and reassembled to give a clear understanding of its properties, functions, pricing issues, security and legal implications.

Chapter seven is *The Relationship of IaaS, PaaS and SaaS with Cloud Models.* In this chapter, the relationships of cloud services with cloud models are closely examined.

Chapter eight is *Virtualization in Cloud Computing.* This chapter explains about historical development in cloud computing, an overview of distributed computing, virtualization, cloud technologies, issues in cloud computing, cloud security architecture, cloud platform architecture, programming for cloud and cloud computing economics.

Chapter nine is *Migration to the Cloud.* This chapter explains about all factors which are required for selecting a cloud system and the issues which arises within the method of migration.

Chapter ten is *Applications in Cloud Computing.* This chapter gives various applications of cloud computing like social networking, e-mail services, backup services, banking and financial services, health care and application of cloud in government sectors.

Chapter eleven is *Coding and Implementation.* It explains about the basic workaround of how to use Trace in the Windows Azure.

Chapter twelve is *Security.* As the ownership and operations of each layer of the cloud are distributed between service providers and clients, security and responsibility for data in the cloud, is the biggest challenge. This chapter discusses about the factors that can affect security and the support system available to ensure security.
Chapter thirteen is Conclusion which concludes about the research work.