13. CONCLUSION

13.1 Summary

Cloud computing is the new buzzword in the world of Information Technology. Even a cursory look at the superfast pace in which IT has swept commercial, industrial and social arena, a new development such as Cloud computing will no doubt attract great attention by all the players in IT world. Service providers, portals, developers and the organizations of every kind do not wish to miss the next big opportunity in the IT sector by not utilizing the opportunity provided by cloud computing.

Hence, there was a need for developers and enterprises (both the service providers and client organizations) 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 the public, private and hybrid models must be examined on the factors determining the choices.

Thus, it was essential to present a bird’s view of the technology of cloud computing, various services available, architectures and platforms. The issues of privacy, security and integrity 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.

This thesis has presented the overview on all the major aspects of cloud computing and discussed the technical issues that showed the clear benefits of implementing this exciting technology for all the stakeholders. At the same time the major concerns of the organizations regarding security and privacy as well the performance parameters are presented.

The literature reference selected for this thesis offered an excellent base in this endeavor of presenting the various facets of implementing cloud computing in all the details. The research papers were chosen for highlighting the technical issues in detail that help the developers and entrepreneur providing the services. Finally, some applications like e-Learning and Medical records management are examined for studying the practical implementation of real life applications on cloud computing and demonstrate the advantages and the ways to overcome security concerns.
The methodology employed in this research was based on the technical discussion of the architecture of cloud computing, different types of services and their implementation with the focus on the issues of security. The same was explored through examples of relevant applications.

There are numerous definitions of cloud computing. So, this thesis has explained the definition set by National Institute of Standards and Technology (NIST) is a most exact, compact and broadly acknowledged meaning of distributed computing.

This thesis gave brief look at different elements that constitute Infrastructure-as-a-Service like the infrastructure, the services to be delivered, and possible optimization techniques, billing structure, security and legal issues.

To get a clear picture of Platform-as-a-Service, this thesis provides a look at the services to be delivered, methods and process of delivery, complexities and challenges posed by the hyper visors and operating systems, billing structure as well as security and legal issues. Also it has discussed about Software-as-a-Service in detail. It has explained relationship between service models with all deployment models.

Virtualization in cloud computing and the factors which are needed to be considered when choosing a cloud system, the problems which arise in the process of migration and the popular methods of tackling some of these issues, security issues are looked into in this thesis.

After this work got clear picture of cloud computing that:

Cloud computing involves shared resources, it is quite clear that this is the business computation solution for today and the future. The process of storage of data in frequently used databases makes the operations easier and allows a clear direct access without tensions down servers or the loss of data because hardware malfunctioning.

Cloud computing has now become a business standard with data storage in virtual space and easily available to the client without any tension about the process of its mechanism.
Cloud computing in one platform or the other will be needed in business functions because it provides benefits that have not yet been matched by any other process. Some of them are:

- **Cost Savings**: Cloud computing low downs the financial burden of business organizations because it does not have to invest in hardware, or infrastructure.
- **Focus on the infrastructure**: It makes it easier for a business organization to concentrate on the core issues of the business and enables the organizations tension free about technical backup issues and physical storage problems.
- **Performance**: The automatic updating of data services and applications is a special feature of cloud computing along with the fact that the topographical location and distance are not an issue. The ability of the cloud is so specific that the delivery is very rapid, and the communication provided is reliable.
- **Performance in security**: It can ensure no loss of data and unauthorized access by any other user. It can provide a security up to a given limit depending on the needs and requirements of the business.
- **Computing changes**: With the introduction of the cloud computing system, the additional and advanced features have brought about such a vast change in computing that it is still taking time for the businesses in all countries to grasp the ability.

### 13.1.1 The Future of Cloud Computing

- **Internet presence**

The presence of the Internet is a practical reality today as it comes to the high level and gives its deep penetration ability in the communications because of the cloud. It does not matter that why or how it is possible but it really matters that the cloud as with its immense speed and broad-bandwidth made it possible for connectivity and communication at every corner of the earth.

- **No software updates**

One of the most important features of the cloud computing is that it is no longer required for businesses to manually update their software because cloud computing is doing it very smartly and so the user has to concentrate on the core requirements of his business by leaving such issues to the cloud provider.
• **Optional hardware**

It is no longer necessary for a person to store data in hardware of large capacity and worry about the breakdown. It can now be stored in the cloud and there is no anxiety about the loss of the data or the capacity of the storage of the data.

• **Fluid entertainment**

The entertainment industry do not have limit to do their work because due to cloud computing there is huge access of all entertainment channels through the globe that can be connected to in any geographical location. This is one of the reasons about why the working policy of the entertainment industry has also changed and they don’t have to struggle for the exposure of their movies, plays drama, etc. illegally but sells the rights for the exposure beforehand.

• **Simplified medical treatment**

Medical treatment has undergone critical and major changes since cloud computing has shown the medical area of the field of operation that exists with it’s facilities.

• **Education**

Before the cloud, student had to visit physically to an educational center to learn, but now every institutional has its own presence available on the Internet and providing access for students and educationists. It cannot be said about prices because this facility has not helped in lowering the costs of education even though most institutions are on a public cloud.

• **Removal of ready cash**

It is no longer essential to carry cash as all transactions can be done over the Internet in secure environments, which earlier was impossible. However, it must be remembered that the far-reaching effects of cloud computing also bring with the ability of many technical experts to breach security so the provider will have to be alert and capable of recognizing the issues.

• **Paperless functioning**
Paper work is going out of the business. This is one of the important benefits of cloud computing which just a while earlier was unthinkable to many. It is helping as green technology

- **No need for physical presence**

Now a day, it is not essential to stand in the queue personally to buy the movie tickets, concert tickets, grocery, and goods. Using cloud computing system, one can stay at home and do everything that is necessary without ever being seen or heard.

- **Location**

Location finding was difficult job for defense and police force. Cloud computing made it easy to find or locate the targeted person, friends and family.

- **Asset for digital media**

- Cloud computing has proven to be an asset for digital media. It has brought about new opportunities for those who have understood the value of cloud computing as the monopoly of many media organizations and other publishing organizations have come to an end. The reach with cloud computing is so immense that it now gives writers, thinkers, and artists a wider platform at no cost or minimum cost. The purpose of this advance technology is to reduce costs and to get greater value.

- **Weather**

As one goes through the news channels, it becomes evident about the quality and the detailed weather reporting that one gets ever since the cloud computing system has emerged. The details are also accurate because of which it is easy to predict the weather in detail up to the last second of emergence of the natural natures of weather elements

13.1.2 Extent of Cloud Computing

- **Proactive application monitoring**

It may sound a little futuristic but right now there is only proactive technology available. However, it is not too far into the future that the predictive technology
of the cloud will also be relied upon a disaster and to get many attempts at different issues. The extent of the flexibility of the cloud computing will therefore increase boundlessly.

- **Technology to ensure uptime**

Business companies need an uptime guarantee. Businesses are getting more facility of acquiring at least seven to ten data centers in different time zones to use the cloud computing uptime fully as much as 99.99%. This kind of uptime will keep competition away.

- **Disaster recovery and remote access**

The most important feature of cloud computing is to help businesses to recover rapidly from disasters with the minimum downtime. This not only saves costs but ensures that there is no loss financially to business or profits or lives thus making the business more competitive and perhaps a leader in it’s industry too.

- **Migration**

This is one of the most important processes of cloud computing that every business understands the benefits of using it. The only issue is the regulatory interpretations of the migration to a cloud and the open expressions of what is possible and what is impossible yet, has not been clearly defined. This has given rise to many questions that the businesses are asking the service providers and the service providers, in turn are asking the regulatory agencies.

- **Ability to validate identities**

Identity-based security is expected than other forms of security measures. Most countries are already trying out or using successfully the biometric finger print process. The future of cloud computing includes the capability to validate and endorse identities of persons taking the security level higher. The validation of these identities would be done through validation trusts.

- **Centralized data**

Many experts feel that the way in the future is centralized data. This is based on empirical confirmation that a large database is important and help to businesses
and in the medical field. The ability to access large data bases will reduce the time of completing a mission or an operation. The rate of success would be higher than what it is today. Even the stock market will be able to take better decisions if it has the benefit of accessing a large database in a centralized data format.

- **Quantum of capability**

Over the coming years, all applications will be the Internet based. This means that all mobile devices will cloud dependent for clarity, speed, frequency and agility. All portable devices will store data that is there in the cloud, and this will help designers to design low cost devices with greater versatile capabilities.

- **Variety of cloud computing**

With the private, public, community and hybrid cloud available there is a perfect solution for every business, especially for those using the PaaS platform or for those using the hybrid cloud. The combined ability in a hybrid cloud develops independent new features, which add to it’s benefits.

- **Mobile optimization**

The applications in cloud computing require lesser resources than traditional forms of computing. Since the resource requirement is less the accessibility is greater.

- **Commodity hardware**

Regarding hardware, there is a prediction that by the year 2020, low cost hardware will be made available, and it will become easier to configure advanced data centers capable of complex algorithms. It is also predicted that the servers and storage systems will look like sleds.

- **Low power processors**

In large data centers cheaper power processors will help to lower the cost of operations. It will enhance the ability to reduce electricity bills considerably. In the year 2014, the power ARM chips will make it possible. These ARM chips will be used with Risc chips and enterprise software package to give up better economic and environment-friendly solutions.
• **Optimization of investments**

The scaling benefit that is provided by the cloud is immense. Companies can use this to run the maximum IT capacity of the company seamlessly thus giving it greater agility and higher profit margins. Investments win scaling will also give an organization greater operational flexibility and agility.

• **Assumption of security**

Data encryption is not such important as data security in today’s competitive scenario of this business world. Higher security and reliability are expected from cloud researchers so that unlike today where it is still a discussion of debate as whether or not the cloud should be used, then it will become a period where providers will not be trying to convince businesses to use the cloud but will be convincing them as which application will be best suited for the complex problems and business transactions that a business will have entered into. Security levels are fairly good in the cloud but every business has specific requirements, and every requirement has to be arranged for in the cloud services but in another six years or so the cracks, the security system will also have been walled up to offer greater confidentiality.

• **Reliability**

The reliability will automatically be perceived when the advanced security measures can be incorporated into the cloud system. Some security measures that are being looked at are regular biometric scans and minimum encryption levels will be raised from the current SSL and also the fact that the minimum encryption will have to complement the fact that it should be more than the minimum requirement to access a database for data theft, data deletion, data adulteration, etc.

• **Interconnects**

There will be faster interconnections. By the year 2020, there is possibility that cloud computing will become a permanent solution for business. Data centers will be fully programmed and will be able to support scalable software architecture.
There is also a distinct possibility that a human communicating with a device will become a day to day affair.

**13.1.3 Potential of Cloud Computing**

When it comes to seNISTivity, security also goes hand in hand. However, potential is also one factor, which is coherent with seNISTivity. So, both security and potential are important aspects associated with sensitivity. Security is basically related to the criticality and value of something, but potential has to do with the outcome and service which can come as a result of its existence and use. An important point is that highly sensitive objects, whether in the virtual world or in the physical, world has been more potential to transform something or to create or destroy something. Therefore, potential in the cloud computing environment can be defined as the capability to create, destroy or change something, which can be either beneficial or harmful to an individual, organization or the entire community at large. However, when we discuss the aspects of potential of cloud in this chapter, an attempt will be made to have more of a positive outlook. Thus, more of pros of cloud in the coming scenario would be focused upon, but at the same time it becomes obligatory to discuss the negative potentials, if any.

It is now a situation which can be perfectly called as an ‘inflection point’, ‘tipping point’ or a ‘perfect storm’, and it is time now when organizations are opting and optimizing change. There are organizations, which resist change too but the benefits of optimizing this change at this point of time will certainly help the organizations to reap success years after year. Cloud Computing is one such development, which has appeared as the combination of technologies. It has emerged as a rapid evolution which has revolutionized the entire globe with its virtual computing power and still has lots more to offer in coming years.

Like the web, Cloud Computing has been more of an ongoing technological development in recent years. And this process has been potential to continue developing. It has to go a long run because it is still in an early stage. Cloud computing is still maturing, and as it goes along it will unleash many newer potentials and prospects in the way. The definition of cloud computing also implies one of its immediate potential, and that is integration of the entire world into one. And this feature of cloud computing has the potential to lead to many more different prospects.
in different arenas. It can offer developments in the economy to customized private uses. Thus, it has to can bring the world to an individual and an individual to the entire world.

The potentials of Cloud Computing are not only numerous, but they are also diverse. It can prove extremely useful in coming years in not only in the organizations, but it could be a massive change as how an individual uses the services of cloud computing in his individual life. It is also important to note the potential of cloud at both individual and organizational level, which will mark its presence at a bigger level at the world economy. When it comes to economy, the potential could range from effective business models to technological achievements at large.

Below an attempt is made to discuss what cloud can do in forthcoming years. The potentials discussed below give an outline of which arenas it can serve. The following is the potential of cloud computing:

- **The merging of business operations and information technology**

  The cloud has the potential to completely merge in the business operations with Information Technology. Though the process has taken its pick, today we can see business models, which rely on IT services for its daily business activities but a lot more come along with advanced IT technologies like a cloud. Cloud has the potential to completely wipe out the brick and mortar system of business operations, and a time can be witnessed in the future when all the business operations take place at tips of finger using computing power and technology. Today, 70 to 80 percent of a company IT budget goes into financing the separate data centers, and new applications meant to support the business processes. So, with a dynamic technology like Cloud, it is possible that the barriers between the business processes and IT services may get substantially reduced. Thus, it can make the Business and the IT service as one whole, which not only has its advantages in terms of an easy to operate and easy to reach business model but also in terms of cost.

- **New IT architecture**

  Cloud also has the potential to bring about a revolutionary change in the way IT architecture exists today. Dr. Rubin’s research shows that today IT financial models are based mostly on a fixed cost. The IT fixed cost can range anywhere between 70 to
75 %, and this is a huge burden to any company. Therefore, Dr. Rubin suggests the use of ‘IT commons’ and his concept of IT Commons states that it could provide companies with a 60 percent or more variability in their IT operating budget resulting in saving of money, which could then be used to develop to new and contemporary systems. Thus, Cloud with its ‘Pay on Usage’ basis also has the potential to drastically reduce the fixed cost element in the IT expenses of companies. The IT Commons is being created by companies like Amazon, HP, IBM, Microsoft and other IT vendors that are creating huge data centers and offering their computing power and software applications on a pay-as-you-go basis. Cloud Computing is one such prominent service offered by IT vendors like this.

- **Slashing down of IT expenses**

Cloud computing has the potential to cut down user’s IT expenditure. It is based on the model of IT commons suggested by Dr. Rubin. Cloud computing potential to reduce costs will be basically due to adoption of variability in expenses. Thus, it is the pay on usage basis features of cloud computing, which plays a dominant role in introducing reduction and variability in IT expenses.

- **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 computing technology, the smallest firms can reach out to larger markets. Thus with the use of cloud, it will no longer require a small firm to spend huge amounts on communication and access.

- **Help the government to improve its service to public**

Cloud can help the government to make their services more attractive and appealing to the public. Government can improve the level of service to be offered to the public because using cloud they can be in a better position to contact the public, listen to their requirements and take their feedback regarding the quality of service. Thus, they can improve the services of public utilities also thereby leading to a better social position.

- **Cloud computing can mitigate harmful environmental impacts**
The present system of electronic processing has posed some harmful environmental impacts due to extraordinary increase in data flow and information processing over the Internet. It has led to massive usage and consumption of energy and water. It is also responsible for harmful greenhouse-gas emissions. Many thanks to cloud computing, which can mitigate these problems by a better and optimum use of hardware. It can also mitigate these problems by building data centers, which use less-energy servers and green servers. It is predicted according to a study that large companies in US country can annually save $12.3 billion in energy consumption, and it is only by adopting cloud computing.

Cloud computing makes more efficient use of servers who leads to less consumption of energy. It can be seen in the above figure that the same numbers of customers are served by:

- Six Premises based servers.
- Four Clouds based servers.

So, cloud is a much greener way to server utilization, which leads to lesser energy consumption.

- **Cloud computing can boost further industrialization in the economy**

Cloud computing can industrialize computing power. It can standardize 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. Based on all these, it can give a boost to the industrialization of computing power. This situation can be better explained by giving the example of power plants, which industrialized the provision of electric power. However, the difference in electric power and computing power is the usage of standardized interfaces, which acts as equivalents to electric plugs.

- **New business opportunities as a result of enhanced mobile working**

As per a survey conducted in 2011 by a Commission, adoption of cloud computing services could bring about an increase of 33% in new business opportunities. This factor can be associated with the benefit of cloud computing, which is enhanced
mobile working of 46% as per the 2011 survey. Since physical barriers are almost none in cloud computing services, mobile working induces new business opportunities, which were earlier dependent on physical factors. Adoption of cloud computing removes physical constraints, and thus it can pave the way for new business ventures, which are free from such dependence.

- **Generation of new employment opportunities**

As a result of opening of new business opportunities, cloud computing also provides the prospects of generation of new employment opportunities. It can again be associated with the 46% enhancement of mobile working due to adoption of cloud computing technology, which has the possibilities of opening new avenues of employment.

- **Decline of the traditional fixed cost IT model**

Adoption of clouding computing services in business organizations has brought about a transformation in the cost model. The traditional fixed cost model is now looked upon as burdensome and cumbersome. Smart executives would rather like to go for adoption of a variable cost model and such type of model goes well with the variability of usage features of cloud computing services. The demerits of the traditional fixed cost IT model have already become a heated discussion among business and IT executives. Implementation of a traditional fixed cost model might result in owning a technology that can become obsolete much faster than expected. So, the order of the day is to have such a technology implemented that is dynamic, flexible and up to date. Cloud computing technology changes very rapidly. Some of the components of cloud computing technology change so fast that their names and technical operation details change significantly every 6 to 12 months. Thus, it is the most vibrant and dynamic technology which is potent enough to upset the entire traditional model of fixed cost in the arena of IT services and bring in a more efficient system of costing, which is popular by the name variable cost model.

- **Cloud based model of variable costing**

The above diagram illustrates a cloud based model, which works on the system of inclusion of variability in costing approach rather than following a conventional fixed system of pricing. For example, Windows Azure is a cloud computing technology
from Microsoft, which works on the pricing system based on the usage of hardware or computer hours. Windows Azure has been largely contributed by Amazon.

- **Potential to bring about shift in traditional corporate IT activities**

Cloud computing has made it possible to change the way of performing the activities in which the traditional corporate IT activities are being performed. For over years, the staffing department is responsible for managing the corporate IT activities. However, with the advent of the cloud services, the picture seems to be changing. The basic performance of operating, maintaining data centers, data networks, monitoring and enhancing of application systems is generally observed by and belong to IT staff. However, cloud computing is bringing about a transition where all these activities will be largely performed by the service provider. Thus, it has the potential to shift the operation of these typical IT activities from the regular staff of the organization to specialized service providers.

- **Potential to bring about a change in the earning power of the IT staff**

With its potential to bring specialized service providers to the upfront, cloud computing can affect the earning power of the IT professionals. When most of the IT operations go into the hands of the specialized service providers, it is obvious that it will adversely affect the earning power of the IT professionals. On one hand, it creates new employment opportunities, but on the other hand, it can also bring down their earning power as a major portion will go into the hands of the service providers as their fees.

- **Potential to change the way individuals manage information related to their individual lives**

Cloud computing can also change the way individuals use and manage information. For example, it can bring about a complete change in which people share their photographs, videos, etc. today through emails, social networks, etc.

The above potentials discussed are positive in nature and can bring about a complete revolution in the economy. Below are three more potentials, which can create havoc and are as a result of adoption of cloud computing technology.

- **Monopoly of service providers**
With the adoption of cloud computing services on a large scale, specialized service providers come on the upfront. In near future, they can become the dictators of the technological market. Thus, they can gain a monopoly in the economy and can start regulating the entire economy on terms, which are suitable and beneficial to them.

- **Downsizing in the organization**

Downsizing is another havoc, which can affect the lives of employees. Downsizing is a practice in an organization to heavily reduce the number of employees it has. So, when most of the IT operations fall into the hands of the service providers, the employees can lose their jobs.

- **Potential to lead to a chaos if security is breached**

If the security of the cloud is breached, and the sensitive data falls into wrong hands it can lead to chaotic effects. The data thus leaked can cause different types of damage and in different magnitudes. Also, it cannot only affect individuals but can also affect the entire community at large.

### 13.2 Conclusion

Understanding the cloud from both provider’s and client’s perspective is absolutely necessary for both Client and provider to thrive. Cloud computing is still in its infancy and has a long way to go before it becomes the norm. After studying cloud computing in detail we can conclude that

- The availability of cloud computing services and applications are fully get accessed if and only if the device is having good internet connectivity.
- Many Business organizations are very interested in adopting services based on cloud computing because it is utility computing with lot of benefits like cost saving, its nature of flexibility and its high speed.
- It is smooth way of building good business environment for small and medium-size companies because cloud computing is giving them less costly infrastructure to reduce cost in administration and many more possibilities like large scale industries and organizations.
• Compared to three service models like SaaS, PaaS, and IaaS, it is the whole responsibility of the users for data, managing applications, middleware, OSs, and runtime. Cloud Providers will manage about virtualization, hard drives, storage, servers, and networking. About virtualization, many IaaS providers are offering new services like databases and messaging queues on the virtualization layer.

• Low CAPEX and pay per use are the attraction factor behind the growth of cloud computing.

• Cloud computing exists because it makes the technology attainable for the small and medium operator who was previously ready for use only to big businesses.

• Virtualization plays an important role in making cloud computing economical. Although there is much free open-source software are available for hypervisors, the outrageously expensive management consoles very clearly taking the effects of the free wares.

• Smooth Inter Cloud Operability and Inter Cloud Scalability are two factors that are capable of reducing migration pangs and OPEX.

• Cheaper, robust and flexible cloud will emerge winners in the cloud era, and the financial scope of cloud services makes the software market look like peanuts.

• Security issues in the cloud generally arise due to lack of clarity and focus on both the provider’s and client’s sides. This can be attributed to the infancy of the scenario.

• Free open-source software for framework and infrastructure will release cloud computing from the reins that are holding it back at the moment.

• Though cloud computing is a growing revolution in the internet technology, there are still doubts about cloud services. The security of data and privacy concern are making doubt about cloud computing.

• Cloud computing guarantees to revolutionize the longer term of IT service delivery by enabling a quicker and a lot of versatility to achieve the technology desires of the organization.
13.3 Recommendations

- **Security:**

  The majorities are concerned about the privacy and the confidentiality about their businesses. The study shows that businesses must have operating areas where they prefer oral dealing.

- **Regulatory compliance:**

  The regulators themselves are a bit hazy about the specific regulations under which the cloud system should be placed. It does not exactly fit into the criteria of set regulations dealing with either IT or communication. So, trials must be run to find out that which arena the cloud system fits. The period of uncertainty is the period of full-scale utilization that the businesses should use the cloud system for. It bypasses many national-security systems and regulations, whether on commerce or criminality or partnering without drawing any penalty as no penalty has as yet been set it is still being looked into by all the countries.

- **Privacy**

  Privacy appears to be a concern in all the areas of cloud computing and so, serious improvements and modifications are required. Once the privacy factor is dealt with fully, there will be less hesitation to use the cloud system because as a technology, it is very advanced technology which remains an undisputed fact still.

- **Network bandwidth**

  The broad network bandwidth again raises concerns of hacking, tapping extraction of data as well as incursions of privacy and confidentiality.

- **Reliability**

  Reliability should not be a concern, because although there is not much confidentiality except in a private cloud, the system in its raw elements is a reliable system perhaps far more than the traditional methods of computing. The speed in itself shows that the entry of a user will go almost undetected because of the high speed, and the chances of breakdown are less sense if one component
breaks down the customer can connect to any of the other data bases in the other countries or locations for uninterrupted continuity.

- **Complexity**

The mode of operation may be a little complex because it is a new system and as an operating system, it simplifies the functions and automates some functions which do not require a physical presence. The complexities are more in the physical usage of the system. To use the system, business has to migrate to the system. For small enterprise customers, it is very financially and functionally beneficial but for large business organizations, it is important that while transferring data the entire migration process needs to be treated like a separate project and not just an upload of data for that is where customer organizations will be making a big mistake.

The other operating complexity that develops is when a hybrid cloud is set up. Like any other hybrid, it has the distinct features of the cloud but in addition, there are new features formed which can alter the data. While writing applications one must ensure that it does not change the profile of the customer organizations’ data.

- **Pricing**

The pricing of the cloud system is and not so simple to calculate. The IaaS pricing is easy as it is for the price of the application as well as the price of writing the applications suited to customer needs. But the problem comes when one has to calculate the pricing of the PaaS, which is three-dimensional calculations, and it is hard to be accurate. So in such a situation, it is important that the prices given to customer organization should be looked at carefully. It should be a package deal price so that it is a onetime expenditure that will not recurred again, though there are additional charges for the regular pay-as-you-use charges of the service provider.

Regarding about three platforms, one must understand the exact method used for pricing and not just the mathematical formula. It is to ensure that everything has been incorporated into the pricing and there are no other additional charges for moving to the cloud system.
• Expense

Except for the pricing aspect of the expense, the other expenses are less due to the scalability of the operation and the connection. What one must be careful is that during the migration, it is not just the cost of the project to migrate, but the expenses go up with the added expenses towards more than one application being used, more than one service provider being used and more than one location being connected to the cloud. These costs are not in built into the cost of moving to the cloud.

13.4 Limitation of work

This thesis is limited to a fundamental study of cloud computing and its evaluation. Practical considerations such as different cloud applications designed in the market are intentionally not discussed. Their comparative study can be treated as separate work. Security issues are discussed in this thesis but their solutions are also needed to be given.

13.5 Scope and Extension of work

The scope of this work is that the research outcome in this thesis 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.

For the extension of this work we can say that:

• This thesis has focused on the primary study of cloud computing, the details about the concept cloud computing, its migration, virtualization, and security issues. So, this research work can be extend to find out coming advancement and recent issues, difficulties in cloud computing and their solutions.

• There are still lot of difficulties and confusion about adoption of cloud computing, and the terminology and advantages about cloud computing. Not only this, cloud computing is making it very much difficult to identify that which features are truly new and related to it. Also, it is difficult to distinguish that which features are rebranded previous technologies which are coming from cluster, distributed, GRIDs and other technologies.
Therefore, this current work can be extend to solve these above mentioned upcoming issues in cloud computing.