ISSN : 2347 - 8446 (Online)
ISSN : 2347 - 9817 (Print)

# Cloud Computing: Plugging into The Cloud

**Navneesh Singh Malhotra**
Student, B. Tech, Dept. of Electronics And Communication, Jamia Millia Islamia, New Delhi, India

**Abstract**
*Cloud computing comes into picture when we think about what IT requires- a way to increase abilities without any investment in new infrastructure, training new personnel, or licensing new software. In order to achieve this, Cloud Computing has been adopted .Cloud computing is the latest effort in delivering computing resources as a service. It represents a shift away from computing as a product that is purchased, to computing as a service that is delivered to consumers over the internet from large-scale data centres –or "clouds". Marketers have further popularized the phrase "in the cloud" to refer to software, platforms and infrastructure that are sold as a service, i.e. remotely through the Internet. This research paper will throw light on the history, advantages, disadvantages, architecture, models and its future.*

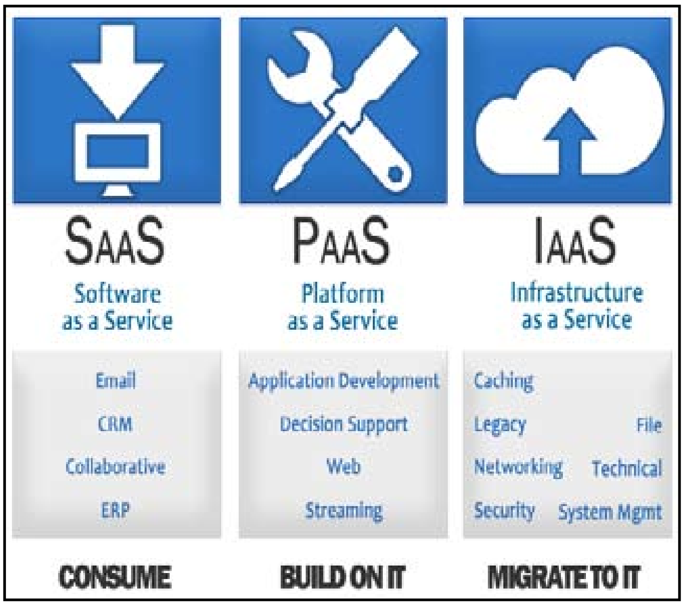
*"There was a time when every household, town, farm or village had its own water well. Today, shared public utilities give us access to clean water by simply turning on the tap; cloud computing works in a similar fashion. Just like water from the tap in your kitchen, cloud computing services can be turned on or off quickly as needed. Like at the water company, there is a team of dedicated professionals making sure the service provided is safe, secure and available on a 24/7 basis. When the tap isn't on, not only are you saving water, but you aren't paying for resources you don't currently need." - Vivek Kundra, Federal CIO, United States Government*

**Keywords**
*Cloud, services, telecommunication, market growth , software .*

## I. Introduction
Before cloud came into usage, it was very difficult for organizations to work and function properly. The main issues were the infrastructure, employee training, software licensing, and moreover to obtain and maintain these at minimal costs and workload .These were added liabilities as the actual work began only after these were fulfilled. But, in a cloud computing system, there's a significant workload shift. Local computers no longer have to do all the heavy lifting when it comes to running applications. The various computers that form the cloud handle these. Hardware and software demands on the user's side decrease. The only thing the user's computer needs to be able to run is the cloud computing systems **interface software**, which can be as simple as a Web browser, and the cloud's network takes care of the rest. Cloud Computing is the result of evolution and adoption of existing technologies and paradigms. The goal of cloud computing is to allow users to take benefit from all of these technologies, without the need for deep knowledge about or expertise with each one of them. The cloud aims to cut costs, and help the users focus on their core business instead of being impeded by IT obstacles.

## II. History
John McCarthy opined in the 1960s that "computation may someday be organized as a public utility". Other scholars have shown that cloud computing's roots go all the way back to the 1950s when scientist Herb Grosch (the author of Grosch's law) postulated that the entire world would operate on dumb terminals powered by about 15 large data centers. In the 1990s, telecommunications companies, who previously offered primarily dedicated point-to-point data circuits, began offering virtual private network (VPN) services with comparable quality of service, but at a lower cost. By switching traffic as they saw fit to balance server use, they could use overall network bandwidth more effectively. In early 2008, OpenNebula became the first open-source software for deploying private and hybrid clouds, and for the federation of clouds. On March 1, 2011, IBM announced the IBM SmartCloud framework to support Smarter Planet. Among the various components of the Smarter Computing foundation, cloud computing is a critical piece [4] and [6].

## III.Clouds On The Basis Of Services
These services can be divided into three branches: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS) [1] :-




[2]

### A. Infrastructure-as-a-Service (IaaS)
In defining Infrastructure as a Service (IaaS), we need to drill into specific characteristics that a cloud platform provider must provide to be considered Infrastructure as a Service. This has been no easy task as nearly every cloud platform provider has recently promoted features and services designed to address the IaaS and cloud computing market. The service provider owns the equipment and is responsible for housing, running and maintaining it. The client typically pays on a per-use basis.

### B. Platform-as-a-Service (PaaS)
Platform as a service-- or PaaS-- is a proven model for running applications without the hassle of maintaining the hardware and software infrastructure at your company. Enterprises of all sizes have adopted PaaS solutions like Salesforce.com for the simplicity, scalability and reliability. PaaS applications that always have the latest features without constant upgrade pain.

### C. Software-as-a-service (SaaS)
Software as a Service (SaaS) is a model in which applications are given by a service provider and made available to consumers over a network, generally the Internet.

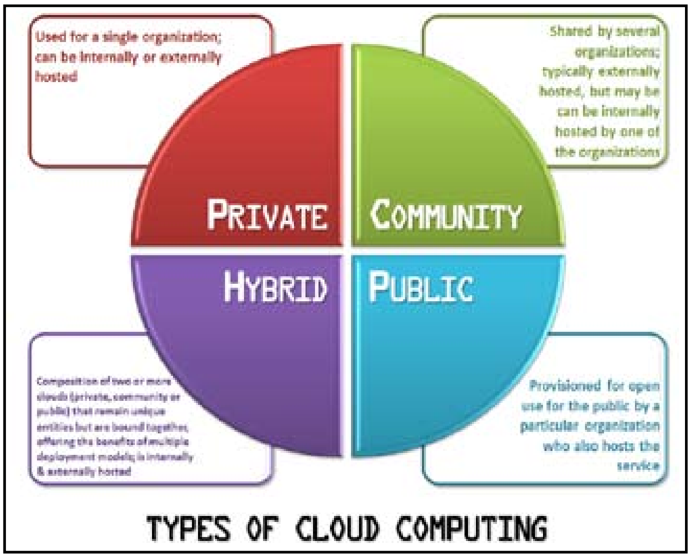
## IV. Clouds On The Basis Of Deployment

### A. Private Cloud
Private cloud is cloud infrastructure operated solely for a single organization, whether managed internally or by a third-party and hosted internally or externally. Undertaking a private cloud project requires a significant level and degree of engagement to virtualize the business environment, and requires the organization to reevaluate decisions about existing resources. When done right, it can improve business, but every step in the project raises security issues that must be addressed to prevent serious vulnerabilities.

### B. Public Cloud
A cloud is called a “public cloud” when the services are rendered over a network that is open for public use. Technically there may be little or no difference between public and private cloud architecture, however, security consideration may be substantially different for services (applications, storage, and other resources) that are made available by a service provider for a public audience and when communication is effected over a non-trusted network. Generally, public cloud service providers like Amazon AWS, Microsoft and Google own and operate the infrastructure and offer access only via Internet (direct connectivity is not offered).

### C. Hybrid Cloud
Hybrid cloud is a composition of two or more clouds (private, community or public) that remain unique entities but are bound together, offering the benefits of multiple deployment models. Hybrid cloud can also mean the ability to connect collocation, managed and/or dedicated services with cloud resources. Gartner, Inc. defines a hybrid cloud service as a cloud computing service that is composed of some combination of private, public and community cloud services, from different service providers. A hybrid cloud service crosses isolation and provider boundaries so that it can’t be simply put in one category of private, public, or community cloud service. It allows one to extend either the capacity or the capability of a cloud service, by aggregation, integration or customization with another cloud service. Varied use cases for hybrid cloud composition exist. For example, an organization may store sensitive client data in house on a private cloud application, but interconnect that application to a billing application provided on a public cloud as a software service. This example of hybrid cloud extends the capabilities of the enterprise to deliver a specific business service through the addition of externally available public cloud services.

### D. Community Cloud
Community cloud shares infrastructure between several organizations from a specific community with common concerns (security, compliance, jurisdiction, etc.), whether managed internally or by a third-party and hosted internally or externally. The costs are spread over fewer users than a public cloud (but more than a private cloud), so only some of the cost savings potential of cloud computing are realized.[3]




## V. Cloud Computing Architecture
Cloud computing architecture refers to the components and subcomponents required for cloud computing. These components typically consist of a front end platform (fat client, thin client, mobile device), back end platforms (servers, storage), a cloud based delivery, and a network (Internet, Intranet, Intercloud). Combined, these components make up cloud computing architecture. When talking about a cloud computing system, it’s helpful to divide it into two sections: the **front end** and the **back end**. They connect to each other through a network, usually the Internet. The front end is the side the computer user, or client, sees. The back end is the “cloud” section of the system [4].

### A. Front end platform
The front end includes the client’s computer (or computer network) and the application required to access the cloud computing system. Not all cloud computing systems have the same user interface. Other systems have unique applications that provide network access to clients.

### B. Back end platform
On the back end of the system are the various computers, servers and data storage systems that create the “cloud” of computing services. In theory, a cloud computing system could include practically any computer program you can imagine, from data processing to video games. Usually, each application will have its own dedicated server.

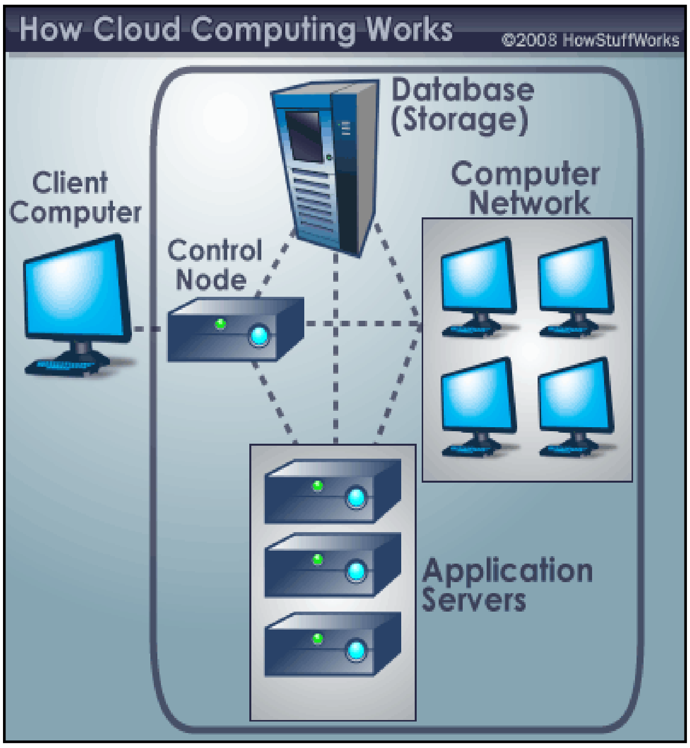
### C. Central Control Node
A central server administers the system, monitoring traffic and client demands to ensure everything runs smoothly. It follows a set of rules called protocols and uses a special kind of software called middleware. Middleware allows networked computers to communicate with each other. Most of the time, servers don’t run at full capacity. That means there’s unused processing power going to waste. It’s possible to fool a physical server into thinking it’s

ISSN : 2347 - 8446 (Online)
ISSN : 2347 - 9817 (Print)

actually multiple servers, each running with its own independent operating system. The technique is called server virtualization. By maximizing the output of individual servers, server virtualization reduces the need for more physical machines.

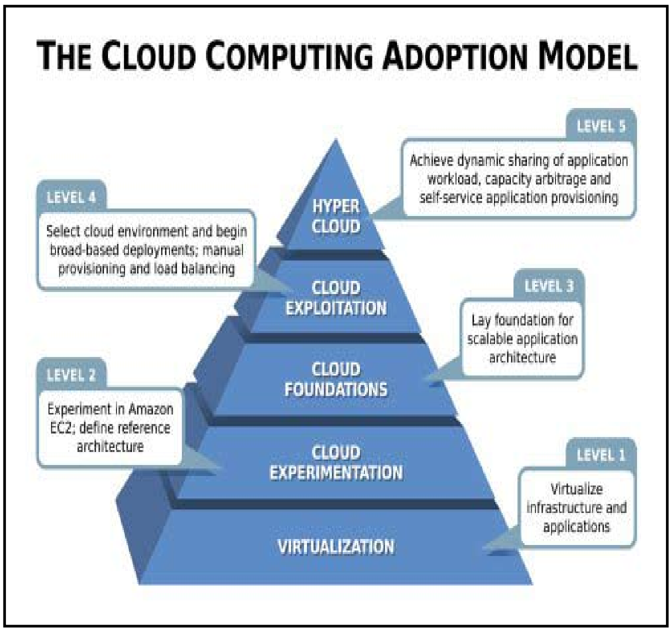
### D. Storage Space

If a cloud computing company has a lot of clients, there's likely to be a high demand for a lot of storage space. Some companies require hundreds of digital storage devices. Cloud computing systems need at least twice the number of storage devices it requires to keep all its clients' information stored. That's because these devices, like all computers, occasionally break down. A cloud computing system must make a copy of all its clients' information and store it on other devices. Making copies of data as a backup is called redundancy. [5]




## VI. Cloud Computing Adoption Model

Cloud Computing adoption requires that organizations have readiness on multiple dimensions including Governance, Process Analysis and Improvement, Application Rationalization and Modernization, and Hardware and Software Standardization. Readiness in turn determines how far organizations can go in their cloud programs with key milestones being Proof of Concepts, Infrastructure Service, Virtual Desktop, Platform Service and Enterprise Software as Service. Readiness and Milestones inform us about multiple stages in cloud adoption. The analysis also indicates that certain governance structures are most suitable for cloud adoption. The duration of cloud program for a large organization lies in years, even multiple five year plans [7]. [6]




### A. Virtualization

This is the preliminary, i.e , the first level of the cloud computing adoption model . In this level the infrastructure, applications, software's, workload and other requirements are sketched out and virtualized.

### B. Experimentation

The virtualized version is now experimented, generally, in Amazon EC2. This experiment throws light on all the pros and cons of the cloud that was virtualized in the first level.
"Cloud computing is really a no-brainer for any start-up because it allows you to test your business plan very quickly for little money. Every start-up, or even a division within a company that has an idea for something new, should be figuring out how to use cloud computing in its plan."

- **Brad Jefferson** , CEO - Animoto

### C. Foundation

After experimentation, the foundation of the cloud is created. This is done for the scalable application architecture. Without the foundation, the next levels cannot be reached.

### D. Exploitation

In this level, the cloud environment is selected and broad– based deployments are started. It also involves manual provision and the load balancing.

### E. Hyper Cloud

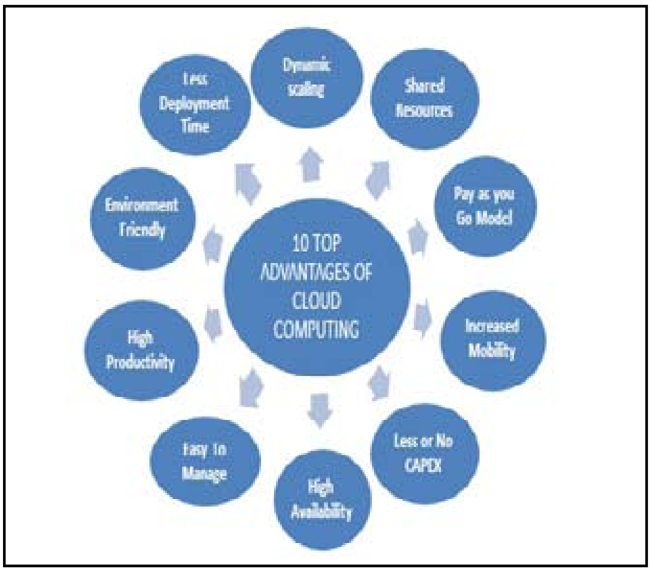
This level is the last level of the cloud computing adoption model. In this level, dynamic sharing of application workload is achieved. After this level, the cloud is complete and ready to be deployed.

## VII. Advantages Of Cloud Computing

If used properly and to the extent necessary, working with data in the cloud can vastly benefit all types of businesses. Mentioned below are some of the major advantages of this technology [8]:

- Cloud computing is probably the most cost efficient method to use, maintain and upgrade. Traditional desktop software costs companies a lot in terms of finance. Adding up the licensing fees for multiple users can prove to be very expensive for the establishment concerned. The cloud, on the other hand, is available at much cheaper rates and hence, can significantly lower the company's IT expenses. Besides, there are many one-time-payment, pay-as-you-go and other scalable options available, which makes it very reasonable for the company in question.

- Storing information in the cloud gives you almost unlimited storage capacity. Hence, you no more need to worry about running out of storage space or increasing your current storage space availability.
- Since all your data is stored in the cloud, backing it up and restoring the same is relatively much easier than storing the same on a physical device. Furthermore, most cloud service providers are usually competent enough to handle recovery of information. Hence, this makes the entire process of backup and recovery much simpler than other traditional methods of data storage.
- In the cloud, software integration is usually something that occurs automatically. This means that you do not need to take additional efforts to customize and integrate your applications as per your preferences. This aspect usually takes care of itself. Not only that, cloud computing allows you to customize your options with great ease. Hence, you can handpick just those services and software applications that you think will best suit your particular enterprise.
- Once you register yourself in the cloud, you can access the information from anywhere, where there is an Internet connection. This convenient feature lets you move beyond time zone and geographic location issues.
- Cloud computing gives you the advantage of quick deployment. Once you opt for this method of functioning, your entire system can be fully functional in a matter of a few minutes. Of course, the amount of time taken here will depend on the exact kind of technology that you need for your business.
- Collaboration in a cloud environment gives your business the ability to communicate and share more easily outside of the traditional methods. If you are working on a project across different locations, you could use cloud computing to give employees, contractors and third parties access to the same files. You could also choose a cloud computing model that makes it easy for you to share your records with your advisers.




## VIII. Shortcomings Of Cloud Computing

In spite of its many benefits, as mentioned above, cloud computing also has its disadvantages. Businesses, especially smaller ones, need to be aware of these cons before going in for this technology. Some of these are mentioned below [9] :-

- Trust between the provider and the consumer is one of the main problems that cloud computing is facing today. There is no way for the customer to be sure whether the management of the Service is trustworthy, and whether there is any risk of insider attacks. This is a major issue and has received strong attention by companies. The only legal document between the customer and service provider is the Service Level Agreement (SLA). This document contains all the agreements between the customer and the service provider; it contains what the service provider is doing and is willing to do (Weis & Alves-Foss, 2011). However, there is currently no clear format for the SLA, and as such, there may be services not documented in the SLA that the customer may be unaware that it will need these services at some later time.
- There are several regulatory requirements, privacy laws and data security laws that cloud systems need to adhere to. One of the major problems with adhering to the laws is that laws vary from country to country, and users have no control over where their data is physically located.
- Confidentiality is preventing the improper disclosure of information. Preserving confidentiality is one of the major issues faced by cloud systems since the information is stored at a remote location that the Service Provider has full access to. Therefore, there has been some method of preserving the confidentiality of data stored in the cloud. The main method used to preserve data confidentiality is data encryption; however encryption brings about its own issues, some of which are discussed later.
- The main method used for ensuring data security in the cloud is by encryption. Encryption seems like the perfect solution for ensuring data security; however, it is not without its drawbacks. Encryption takes considerably more computational power, and this is multiplied by several factors in the case of databases (Weis & Alves-Foss, 2011). Cryptography greatly affects database performance because each time a query is run, a large amount of data must be decrypted; and since the main operation on a database is running queries, the amount of decryption operations quickly become excessive.
- Some methods have been developed that serve as alternatives to encryption. These methods are generally faster than encryption but have their own drawbacks. Data Splitting was initially developed by Divyakant Agrawal and his colleagues. The idea is to split the data over multiple hosts that cannot communicate with each other; only the owner who can access both hosts can collect and combine the separate datasets to recreate the original. This method is extremely fast compared to encryption but it requires at least two separate, but homogeneous service providers.
- Typically, in a cloud, business data and applications are stored and ran within virtual machines. These virtual machines are usually running on a server with other virtual machines, some of which can be malicious. Research has shown that attacks against, with and between virtual machines are possible.If one of the virtual machines on a server hosts a malicious application that breaches legal or operational barriers; this may lead legal authorities, the service provider or other

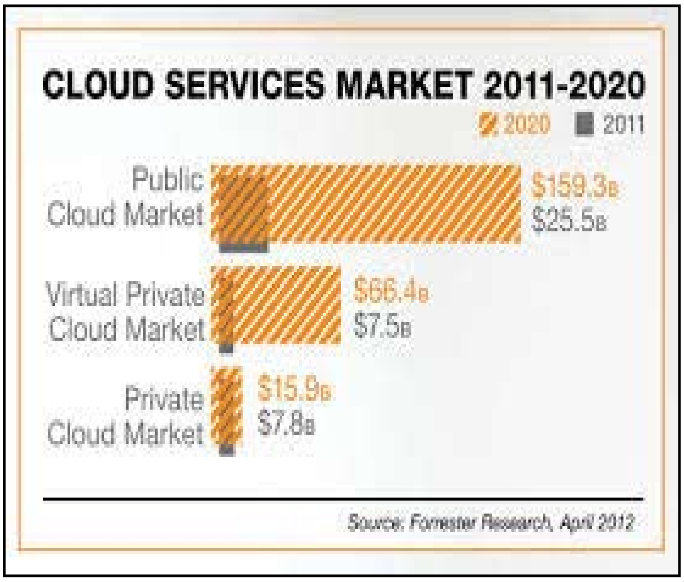
authorities to shutting down and blocking access the entire server. This would greatly affect the users of the other Virtual Machines on the server.

## IX. Growth And Market Of Cloud Computing

The use of cloud computing is growing, and by 2016 this growth will increase to become the bulk of new IT spend, according to Gartner, Inc. 2016 will be a defining year for cloud as private cloud begins to give way to hybrid cloud, and nearly half of large enterprises will have hybrid cloud deployments by the end of 2017 [10].

In India, cloud services revenue is projected to have a five-year projected compound annual growth rate (CAGR) of 33.2 percent from 2012 through 2017 across all segments of the cloud computing market. “Cloud computing continues to grow at rates much higher than IT spending generally. Growth in cloud services is being driven by new IT computing scenarios being deployed using cloud models, as well as the migration of traditional IT services to cloud service alternatives.

Forrester Research broke down its 2020 worldwide forecast as follows: $159.3 billion for public cloud, $66.4 billion for virtual private cloud and $15.9 billion for private cloud. That’s a total cloud market of $241 billion by the end of the decade [11].

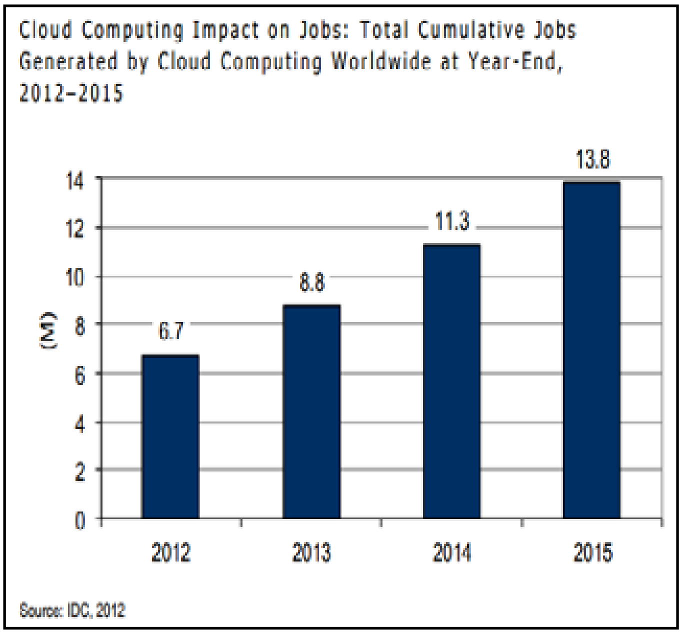



## X. Future Of Cloud Computing

While more companies are benefiting from the cloud and while the big cloud application providers have very secure data centers to secure data at rest, some companies have experienced well publicized security and reliability issues - including failed migration of data to cloud applications. In the coming years, cloud application providers will proactively tout the improved security and reliability measures they are putting in place. In fact, you’ll see them visibly differentiating on security and compliance. Cloud processes and techniques for securing data in motion will be dramatically improved. A key part of this will be ensuring that a variety of protections and risk mitigation techniques are available to enterprise customers that will require a multi-faceted approach to controlling their data stewardship and application use. Giving enterprises the ability to control data assets, throughout their entire lifecycle, in motion at at rest, will allow cloud providers and their ISV partners to address legal and legislative blockers to cloud adoption.

Auditing and monitoring will also be improved and more predictive and alerting capabilities will be built directly into the cloud services. We’ll see a rise of cloud security brokerage capabilities designed to safeguard cloud use and empower IT and Security organizations within the enterprise. Being able to anticipate issues and proactively address them with the appropriate remediation techniques will permit secure, uninterrupted use of the world’s most powerful and pervasive cloud services [13].

A study realized by IDC (PDF) has tried to measure the impact of cloud computing technology adoption on jobs. This study has used a broad definition of cloud computing including storage services, virtualized infrastructure, self configuration, and automated provisioning. IDC predicts that cloud computing will create almost 14 million jobs worldwide by 2015 [12].




## XI. Acknowledgment

Big thanks to Harman Malhotra, my elder brother and an engineer (electronics and communication) for his guidance and knowledge. Special thanks to my parents, for their extensive support and help.

## References

[1] *Cloud_Computing- http://searchcloudcomputing.techtarget.com/definition/cloud-computing*

[2] *Cloud Computing | Cloud computing training | Academic Room www.academicroom.com*

[3] *Image: Cloud-Types-Model copy.png - OhioERC: The Ohio Electronic Records Committee ohsweb.ohiohistory.org*

[4] *Cloud_Computing_architecture-http://computer.howstuffworks.com/cloud-computing/cloud-computing1.htm*

[5] *How Stuff Works "How Cloud Computing Works" computer.howstuffworks.com*

[6] *How to Achieve the Strategic Value of Cloud While Delivering Real ROI www.eweek.com*

[7] *Cloud computing adoption model for governments and large enterprises - Trivedi Hrishikesh http://hdl.handle.net/1721.1/80675*

[8] *Advantages and disadvantages of cloud computing – by Priya Viswanathan Cloud Computing Security Issues and Solutions*

[9] *Cloud Computing Security Issues and Solutions (http://www.cleverlogic.net/articles/cloud-computing-security-issues-and-solutions )*
[10] *Gartner_Research http://www.gartner.com/newsroom/id/2613015*
[11] *Outlook 2013: Cloud Computing & Communications www.channelpartnersonline.com*
[12] *Cloud_Computing_Jobs www.infoq.com*
[13] *The future of Cloud Computing=By Mike Morrissey.*