Cloud Computing: Technology Analysed

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Abstract: **The paper briefly compactly presents an analysis on cloud computing. It briefly introduces cloud computing as an emerging technology. The paper looks into the legal scope and the issues arising out of such a technology. The paper concludes on the research made leading to the current status of such a technology in India along with recommendations to resolve the grey areas.**

Keywords: **Cloud Computing, ITA, Software, Application, Law**

1. INTRODUCTION

The term cloud computing has not a specific historic derivative which can be traced. However the term cloud computing got it's terminology from the style arts created in computer subjects to denote computer network diagrams in textbooks [1]. A similar concept existed in 1960s from the ideas of pioneers like J.C.R. Licklider (instrumental in the development of ARPANET; Advanced Research Projects Agency Network) envisioning computation in the form of a global network and John McCarthy (who coined the term "artificial intelligence") [2].One of the first movers in cloud computing was Salesforce.com, which in 1999 introduced the concept of delivering enterprise applications via a simple website. Amazon was next on the bandwagon, launching Amazon Web Service in 2002. Than emerged Google Docs in 2006 which really brought cloud computing to the forefront of public consciousness [3].

Cloud computing is not just the Internet and a bunch of connected devices it is sharing of resources such as storage services which we can acquire the same way we acquire other day to day utilities. It is all about service.Cloud computing is a model for enabling ubiquitous, convenient, on - demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction[4]. According to Amitabh Sharma the senior vice-president of Microsoft Technologies, he states "Cloud is designed to be available everywhere, all the time. By using redundancy and geo-replication, cloud is so designed that services be available even during hardware failures including full datacenter failures"[5]. It allows the user to share, transfer, virtually store document, data, file, and music, videos which can be shared as a virtual storage and can be accessed from different desktops or connections.

The virtual storage acts same as the internal hard drives or the actual storage you create in your laptops. Its working is so convenient as if data is commanded for a copy from one source destination to another making it a simpler process for use. Large data can be shared and accessed in such a manner.

2. DELIVERY MODELS

Cloud computing providers offer their services according to three fundamental models [6]:infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS).

A. Software as a service (SaaS)

Software as a service (SaaS) is also known as "on-demand software". It is a model to access light weight accessory model such as media player, excel sheets. For running heavy software and applications such as animation softwares or gamming the interphase is a bit slow since it requires buffer. It has got a potential to reduce IT support by outsourcing hardware maintenance. Since there are no hardware, implementation or acquisition costs involved to run the application from the customer's side [7]. It reduces the cost and simplifies deployment [8]. Software as a Service removes the need for organizations to handle the installation, set-up and often daily upkeep and maintenance [9]. Customer relationship management (CRM) continues to be the largest market for SaaS.

B. Platform as a Service (PasS)

Platform as a Service (PasS) is service model for cloud computing. Consumer can create software with the help of tools provided. It's a virtual platform for creation. The platform with basic languages along with Application Program Interfaces (APIs) or website portals is provided on cloud interface [10]. PaaS offerings may include

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facilities for application design, application development, testing, deployment and hosting as well as application services such as team collaboration, web service integration and marshalling, database integration, security, scalability, storage, persistence, state management, application versioning, application instrumentation and developer community facilitation [11]. In PaaS model, it's the cloud provider's responsibility to secure the computing platform and development environment, while the clients must secure their applications themselves [12]. Some PasS providers are SalesForce.com, Google Docs and many more.

C. Cloud infrastructure as a service (IaaS)

The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications [13]. Clients have control over memory, CPU, IP addresses, operating systems; storage, deployed applications and possibly limited control of selected networking components e.g., host firewalls. Clients do not manage or control the underlying cloud infrastructure [14]. Here a third part service provider helps in reducing the purchasing cost.

3. ESSENTIAL CHARACTERISTICS

The National Institute of Standards and Technology's definition of cloud computing identifies "five essential characteristics":

A. On-demand self-service.

A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.

B. Broad network access.

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

C. Resource pooling.

The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand.

D. Rapid elasticity.

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

E. Measured service.

Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service [15].

4. DEPLOYMENT METHODS

The National Institute of Standards and Technology determined four different cloud computingdeployment models: private cloud, community cloudpublic cloud and hybrid cloud. There is a heavy demand of various deployment methods due to a wide increase of use of cloud computing. Selection of these models depends on clients' data sensitivity and management requirements.

A. Private Cloud

It is made for a private purpose where infrastructure is designed for use of an individual organisation. It cannot be shared with other organisations. It can be operated by a third party as well. It can be accessed by users within the private domain of the organisation with the help of an internet connection [16]. The cloud service providers and the clients have optimized control of the infrastructure and improved security, since user's access and the networks used are restricted [17].

B. Community Cloud

The cloud infrastructure is provided for exclusive use by a specific community of consumers fromorganisations that have shared concerns (e.g. mission, security requirements, policy and compliance considerations) [18]. It may be owned, managed and operated by one or more of the organisations in thecommunity, a third party or some combination of them, and it may exist on or off premises [19].

C. Public Cloud

This model is available for public use. This cloud is a cost effective way. This application involves CRM (Customer Relationship Management). This model is most preferred by most low budget organisations as is the cheapest of all the other models.

D. Hybrid Cloud

It is a combination of two or more clouds joined together. It carries multiple provides which may be internal

as well as external. By integrating multiple cloud services, users will be able to ease the transition to public cloud services while avoiding issues such as Payment Card Industry (PCI) compliance [20]. This is generally used by a large organisation.

5. BENEFITS OF CLOUD COMPUTING

A. Flexibility

Storage and access to data is simplified from any corner due to the data is stored as a virtual storage at any time anywhere with just a click of internet.

B. Reduced Cost

The need to purchase expensive machinery and software is removed where the online tools are already available. Also the payment takes place on pay and use basis whereby contract can be expanded.

C. Mobility

Information access becomes universal where people can have a viable connectivity over data with a distance of one click. This can be done wherever you are with the help of internet connectivity.

D. *Automated*

Updating software is an old business. With this technology the software are updated automatically. Also the update files are not stored on your PC Storage. Thus the problem of regularly updating software for its effective use is solved since the updates will take place on a regular basis.

E. *Storage*

The ultimate benefit arising out of this technology is that the storage on internet has become to unlimited storage. The problem of hard drives and low space on PC's can be resolved by uploading large data on this virtual storage which can be accessed easily.

6. ENCOUNTERS TO CLOUD

Although the technology is a milestone, in the fields of computer technology, there are various challenges which the technology is facing and certain issues which the cloud needs to answer. There are various legal issues revolving around such a technology.

A. Security

Security in this virtual world is always a potential threat. With the evolution of cloud computing the companies and IT Sector is still questioning the security before investing in such a market. The legal efficacy is still an issue. The data travels virtually across the open source in a virtual world where data can be retrieved from any place. Since the data many a times is of a high sensitive nature the demand for security standards increase which is a question on this technology. Thus application of law also raises serious concern on this technology. Thus accountability of data protection and safety standards is always the key concern for big organisations.

B. Data Privacy

Data Privacy and confidentiality is a serious question on such a technology. The concerns grow even more when the data is virtually available as storage and can be used by any individual.Instances such as the secret NSA program, working with AT&T, and Verizon, which recorded over 10 million telephone calls between American citizens, causes uncertainty among privacy advocates, and the greater powers it gives to telecommunication companies to monitor user activity [21]. The information of data available under whose control for IT Sectors and Companies is a question to the technology since the users never know where there data is existing. Thus in such a condition companies may not trust to a large extend while using such a cloud which can't afford to buy an individual owned cloud.

C. Laws & Regulation

The technology is of evolving nature. This leads to lack of general rules and regulations governing such a technology. There is a serious lack of laws to cover the technical aspects as well as the transitions over cloud taking place. There arises a dis-balance in application of law on the flow of data since it is available on various servers which are established in different countries. Thus it will create barrier in exchange of data where certain data cannot be disclosed due to their municipal policies. The need for a stable law and legislation is a great concern in order to resolve the legal loop holes arising out of such a technology.

D. Jurisdiction

Data is generally uncertain in a cloud computing [22]. Cloud infrastructure is still unanswered. Since the data flows from one territorial jurisdiction to another, the law application is of a serious concern. The Electronic Frontier Foundation has criticized the United States government for considering during the Megaupload seizure process that people lose property rights by storing data on a cloud computing service[23]. Possession of data is always a question mark in cloud computing leading to a lot of legal issues which relates to the scenario where preventive data

is disclosed and the juncture of jurisdiction applicable in such an instance.

E. Abuse

As with privately purchased hardware, customers can purchase the services of cloud computing for nefarious purposes. This includes password cracking and launching attacks using the purchased services [24]. In 2009, a banking trojan illegally used the popular Amazon service as a command and control channel that issued software updates and malicious instructions to PCs that were infected by the malware[25].

F. Vendor Contracts

The contract is a one sided contract where by party, can undertake to the terms and conditions which are available for using the applications. Thus such kind of a contract is a one-sided contract where by generally the buyer is unable to put forth his considerations.In these agreements the service provider generally does not incur any liability on himself. The buyer enters in such a contract taking an absolute potential risk on itself. This makes a buyer vulnerable and he is held on a lower pedestrian while agreeing to such conditions.

7. LEGAL BARRIERS IN INDIA

Until the enactment of IT Act 2000, there were no laws which governed the legal scope of computer technology. Still there are no specific laws which govern cloud computing and it still remains a grey area of research. The owner of the information never knows where his information resides in a cloud. Since public clouds operate on a non-exclusive basis, this leads to a greater threat on the ownership of data on the cloud. This is crucial flaw in the system since there are no specific laws governing the ownership of data over cloud. Certain standard needs to be followed for security purposes. As per the ITA where parties do not contractually agree to security practises and procedure, the corporate entity in receipt of sensitive personal information would need to follow a minimum standard of IS/ISO/IEC 27001 for protection of personal sensitive information [26]. There might be companies which have their own safety norms and procedure & which might not comply with the given standards as per Indian Laws thus resulting in a deadlock. Electronically concluded contracts under Section 10 of ITA will not be deemed to be unenforceable. But the ITA & Stamp Act is silent upon stamping of an E-Contract. As per ITA data security audits need to be carried out by companies through independent auditor duly appointed by government, at least once a year or when company takes significant up gradation of its process. An Audit cannot take place for a Cloud Service Provider as its existence is virtual on internet. In the event of a cloud being hacked owners' rights are not well established and there is a lack of procedure to approach for a remedy. A situation may arise where server is in one nation, the service provider in different nation and the data in third nation will lead to three jurisdictions over the case. In such a circumstance not a rich content of jurisprudence is available to deal in such issues. Application of law and jurisdiction is still a concern in cloud computing.

8. RECOMMENDATIONS

1. Customers and cloud providers must have a mutual understanding of each other's roles and responsibilities related to electronic discovery, including activities as litigation.
2. Cloud providers are advised to assure their information security systems are responsive to customer requirements to preserve data as authentic and reliable, including both primary and secondary information such as metadata and log files.
3. Data in the custody of cloud service providers must receive equivalent guardianship as in the hands of their original owner or custodian.
4. Plan for both expected and unexpected termination of the relationship in the contract negotiations, and for an orderly return or secure disposal of assets.
5. Components of the duty of care required of a cloud services client.
6. Knowing where the cloud service provider will host the data is a prerequisite to implementing the required measures to ensure compliance with local laws that restrict the cross-border flow of data.
7. As the custodian of the personal data of its employees or clients, and of the company's other intellectual property assets, a company that uses Cloud Computing services should ensure that it retains ownership of its data in its original and authenticable format.
8. Numerous security issues, such as suspected data breaches, must be addressed in specific provisions of the service agreement that clarify the respective commitments of the cloud service provider and the client.
9. The cloud services agreement must allow the cloud services client or designated third party to monitor the service provider's performance and test for vulnerabilities in the system.
10. The parties to a cloud services agreement should ensure that the agreement anticipates problems

relating to recovery of the client's data after their contractual relationship terminates.

11. Right to Audit Clause. Customers will often need the ability to audit the cloud provider, given the dynamic natures of both the cloud and the regulatory environment.
12. A right to audit contract clause should be obtained whenever possible, particularly when using the cloud provider for a service for which the customer has regulatory compliance responsibilities [27].

9. CONCLUSION

Cloud computing is gaining an unusual preference because of its ability to store data online. On top of it, cloud computing provides a virtual playground for organisations to perform, store, manipulate their stored data in the clouds which can be easily accessed. However even there are certain net negatives arising out of the use of such a technology which is still catching controversy and not disputed. There is a heavy risk which is allocated since no service provider can give you 100 percent guarantee as the most trusted vendors can also fail. An analysis can be clearly inferred that the solution to the legal scope on use of such a technology is limited in India. Due to a major loop holes in the existing IT laws which deals with this noble technology and a lack of clarity in the existing laws, India is not a successful market for organisations to deal and invest with such a technology.

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