A REVIEW TO ASSESS OPPORTUNITIES AND SECURITY RISK CHALLENGES IN CLOUD COMPUTING

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Abstract

In today's competitive world, organizations are under increasing pressure to develop efficiently and convert their IT practices to achieve more with less. Cloud Computing is a flexible technology that can support a wide variety of application. In contrast to grid computing and clustering, cloud computing is service oriented, loosely coupled, TCP/IP based Business Model technology that provides high security and advantage of virtualization and strong fault tolerance. The paper aims at reviewing cloud computing in terms of basic concepts and definitions and its adoption challenges.

Keywords— *Cloud Computing, flexible technology, Business Model technology, virtualization*

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1. INTRODUCTION

In today's competitive world, organizations are under increasing pressure to develop efficiently and convert their IT practices to achieve more with less. Business needs to have reduced time-to-market, better agility, higher availability, and reduced expenditures to meet the changing business requirements. In this, cloud computing has proved to be an infrastructure that helps in getting rid of expensive computing hardware. The term "cloud" refers to Internet or communication system that caters to heterogeneous users with varied needs by scaling and renting resources. Cloud Computing is a flexible technology that can support a wide variety of application. In contrast to grid computing and clustering, cloud computing is service oriented, loosely coupled, TCP/IP based Business Model technology that provides high security and advantage of virtualization and strong fault tolerance.

2. EVOLUTION OF CLOUD COMPUTING

As per EMC Corporation and IBM, "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."

As per Wikipedia, "Cloud computing is the delivery of services of the computing a service rather than a product, whereby shared resources, software, and information are provided to computers and other devices as a utility (like the electricity grid) over a network (typically the Internet)."

As per [1], cloud computing is a collection of IT resources (servers, databases and applications) which are available on an on-demand basis, provided by a service company, available through the internet and provide resource pooling among multiple users.

Cloud Computing is an evolution of the widespread acceptance of virtualization, service-oriented architecture, automatic, and utility computing [2][3]. The origin of term "cloud" dates back 1990s when it was used by Telecommunication companies to shift their paradigm from dedicated point to point connectivity to Virtual Private Network (VPN) services with quality service at economical cost. Different authors have given different definitions of Cloud Computing. But most popular and revelant definition as per NIST[5] is as follows"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". At architectural level cloud computing can be divided into five layers including clients, applications, platform, infrastructure and servers (Fig.1)
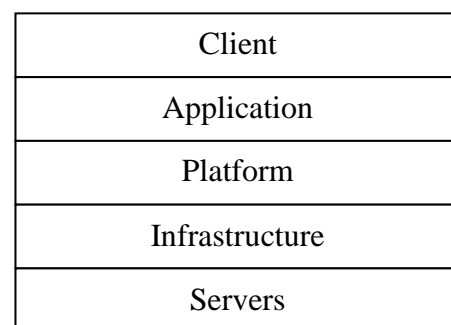
Client
Application
Platform
Infrastructure
Servers

Fig 1 Layering architecture of Cloud Computing

3. BASIC TERMINOLOGY OF CLOUD COMPUTING

The basic cloud concept has brought a list of terminology with it[1][7][8][9].

Virtualization: It is a technique that extracts the physical characteristics of IT resources from resource users. It enables users create virtual resources from the pool of resources. Virtualization provides better flexibility from stipulation of IT resources compared to stipulation in a non-virtualized environment. It helps optimize resource utilization and delivering resources more efficiently.

Cloud: The term Cloud refers to some technology which makes resources placed at remote location over public networks or private networks.

IT resources: An IT resource is a physical or virtual IT-related object that can be either software based, such as a virtual server, or hardware-based, such as a physical server.

Service: It refers to a set of related software functionalities that can be used together with the policies that control its usage.

Scalingor Resource Elasticity: Scaling refers to the availability of cloud computing resources dynamically as per users' varying demand. Scaling can be done in two ways Horizontal and Vertical . Scaling is an important feature of Cloud computing as it saves Operational expenditure of organizations by saving them from over and under provisioning.

Pay per use – The pay per use model of cloud computing provides significant reduction in cost from both OPEX(Operational Expenditure) and CAPEX(Capital Expenditure) perspectives

Cloud services: A cloud service is can be any IT resource whether software, platform or infrastructure that can be accessed remotely via a cloud. The cloud service ranges from providing a basic web based software to renting of complete infrastructure.

3.1 Cloud Computing Characteristics

Researchers have stated various characteristics of cloud computing. As per [2][4][5][6], these characteristics are as follows :
1. **On-Demand Self-Service:** The necessity of automatic operation of data centers and IT infrastructures is the need of the hour due to exponential growth of data generation, which makes possible the automatic stipulation and provisioning computing capabilities without human interaction .
2. **Broad Network Access:** This characteristic makes possible the availability of capabilities and resources over networks which can be accessed by different types of client .
3. **Resource Pooling:** The concept of multi tenancy makes it possible for Cloud Service provider's computing resources to be pooled and serve multiple consumers of varied needs as the resources are assigned to consumer according to their demand.
4. **Rapid Elasticity:** Provisioning of different resources with varied demands provides elasticity to the

resources which can be provisioned any time as per demand which makes computing capabilities flexible enough to be quickly scaled in and out.
5. **Measured Service:** In cloud computing Cloud systems are automatically controlled resource are optimized be metering capability which provides abstraction of the services provided. This provides transparency to the computing utility by automatic monitoring, controlling, and reporting of services.

4. CLOUD COMPUTING SERVICES

1. **Software as a Service (SaaS):** As per [10][11][12] SaaS is considered to be the most well known and mostly used form of Cloud Computing which is revolutionizing the basic essence of computing worldwide. (SaaS) provides remote access to all the software which are hosted in a remote location and hence can be accessed through the internet with any device such as a PC, a mobile phone or a tablet
2. **Platform as a Service (PaaS):** PaaS is a model of cloud computing by which customers do away with the traditional way of application building which is through an internal system increasing more costs, instead users with some programming knowledge have access to programming languages, libraries, and other tools required for developing and deployment of their applications and need not manage or control the network, servers, operating systems, or storage[4].
3. **Infrastructure as a Service (IaaS):** IaaS is the basic level of cloud service which includes both hardware (e.g. storage and network) and software over a network so that customers can do away with their local servers and data centers and use cloud service provider's infrastructure[13]. The Cloud Service Providers called CSPs provision capabilities like storage, networks, and other fundamental computing resources like operating systems and applications. [2][4].

There are more than one vendor who provide cloud computing services. Some of them are Google, Salesforce, Microsoft, Amazon, Zoho, Yahoo and Rackspace.
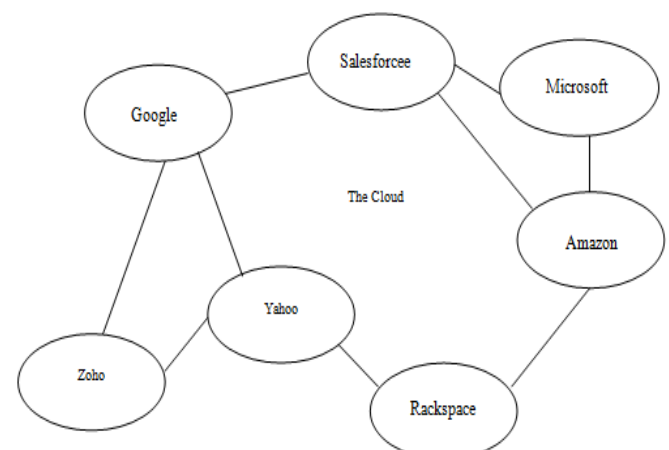
Different vendors provide different type of services dealing in different cloud models. Some of them are listed below:

Provider Name	Service Model	Deployment Model
Ninefold	PaaS	Public
LunaCloud	IaaS	Public, Private
Amazon Web Services	IaaS	Public
Windows Azure	IaaS, PaaS	Public
Google Compute Engine	IaaS	Public
GoGrid	IaaS	Public, Private
Joyent	IaaS	Private
AppHarbor	PaaS	Public
Rackspace	IaaS	Public, Private, Hybrid
EngineYard	PaaS	Public
SalesForge1 Platform	PaaS	Public
Clever Cloud	PaaS	Public
IBM Cloud	IaaS	Private, Hybrid

5.   CLOUD COMPUTING RISKS AND CHALLENGES

Cloud computing offers many advantages such as cost reduction, better service quality, increased business flexibility and anytime, anywhere services. But one the other hand, many of the issues are also associated with it. Cloud computing poses a challenge when cloud provider himself opts for some other provider's capabilities or plans to change business models . Also changing from one CSP to other due to any reason may be pose problems .-It is possible that cloud service provider who stores and manages data may not have adequate security measures. Then our data is at high security alert. Also, the providers can access the client data which could be a major risk. There is multilevel risk associated with cloud computing which is another challenge for it.

Interrupted availability of services at provider's/user's end, the limited elasticity, lack of monitoring solutions and data lock-in bottleneck in transition from one service provider to other due to lack of standards is also a major issue in cloud computing. From business perspective, the problem of one client can affect the working of another client. Regulations and laws of provider country also matters a lot.

Cloud is vulnerable to viruses, worms, hackers and cyber attacks increasing theft to private information. Google has also encountered an attack from China. The physical location of storage is one the major risk domain. Also, the organization is unaware or clueless about physical access to storage or visibility to storage and backup processes. Google Gmail went down for two hours because of this.

Service Level Agreement can be one solution to these problems. It covers all the aspects of IT Service Management.

Service Level Agreement better called as SLA document contains all the details of processes of planning, organizing, directing, and controlling the provisioning of IT services along with other details like security ,   availability, performance, accuracy, capacity etc.

Therefore, before adapting to cloud computing, one should keep in mind the below seven security concerns:
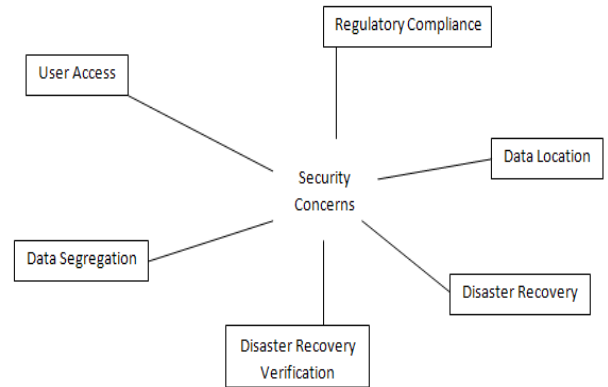
As per [10] factors like Competitive advantage, Better interconnectivity, Low start-up costs, Reduced risk associated with that cost in case of failure, less risks of purchasing servers, data-centres because of pay-as-you-go feature of cloud computing, Flexibility towards changes in demand, Security of scale contribute positively towards cloud computing decisions , there are lot of factors which contribute negatively towards this decision which are as follows

- Performance unpredictability risk
- Business risks fate-sharing, problem of one client affecting other
- Legal risks like providers' liability to protect data on cloud, regulations and laws of provider country
- Policy and original risk like risks related to compliance, insufficient expertise in Service Level Agreement, Provider's business failure, Service termination, Acquisition of cloud provider, Supply chain failure if provider outsources few services
- Insider risks
- Transit risk as data will be in transit more often between users and cloud and between several physical servers within the cloud
- Security risks like inadequate security measures taken by Cloud service provider, risk of cyber attackers such as organized criminals, hackers, terrorists and intruders it being repository of many clients so has "high value", Authentication and Authorization, Phishing, Virtual Machine attacks, Network attacks, Forensics implications. Technical Issues like interrupted availability of services at provider's/user's end such as bugs on provider's machine service bottlenecks etc or data lock-in bottleneck in transition from one service provider to other due to lack of standards[14][15]

6. SUGGESTIVE STRATEGIES FOR ADDRESSING RISKS [15]

There is need to deal with risks that an enterprise might recognize with in an effective manner with proper planning of business continuity to deal with continuously evolving information risks. The risk management program should deal with risk without hampering the privacy of enterprise customers. Properly drafted service level agreement (SLA) play an important role in curbing security problems to a large extant by taking note of few important issues like enlisting the complete information assets of the organization, proper and correct cataloguing of organization's data , data encryption before being transferred or transiting or stored from one location to the other. Any and all additional controls for information that is sensitive or of high value to the organization should be clearly defined in the agreement.

7. CONCLUSION

The paper identifies cloud computing concepts ranging from the basic definition to history and evolution. The paper also identifies the characteristics and services provided through the technology.

The paper lists various vendors in these fields to make the organizations understand the services provided by different vendors. Though the cloud computing brings with it lots of secured services and facilities it also has lot of challenges which need to be addressed while adopting the technology

ACKNOWLEDGEMENTS

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