ISSN 2320-9984

Volume 4 Issue 2 | June 2016 ISSN: 2320-9984 (Online)

International Journal of Modern Engineering & Management Research

Website: www.ijmemr.org

A Brief Overview of Cloud Computing

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Abstract*—Resource sharing in a pure plug and play model that dramatically simplifies infrastructure planning is the promise of cloud computing". The two key advantages of this model are ease of-use and cost-effectiveness. Though there remain questions on aspects such as security and vendor lock-in, the benefits this model offers are many. This paper explores some of the basics of cloud computing with the aim of introducing aspects such as: Realities and risks of the model Components in the model Characteristics and Usage of the model the paper aims to provide a means of understanding the model and exploring options available for complementing your technology and infrastructure needs.*

Keywords:— *Cloud computing, Data Security, Performance, Cloud Service Models, MonaLISA*

1. INTRODUCTION

Cloud Computing is a recent technology trend whose aim is to deliver on demand IT resources on a pay per use basis. Previous trends were limited to a specific class of users, or focused on making available on demand a specific IT resource, mostly computing. Cloud Computing aims to be global and to provide such services to the masses, ranging from the end user that hosts its personal documents on the Internet, to enterprises outsourcing their entire IT infrastructure to external data centers. Never 1 Corresponding Author. before an approach to make IT a real utility has been so global and complete: not only computing and storage resources are delivered on demand but the entire stack of computing can be leveraged on the Cloud. [4] With the advent of this technology, the cost of computation, application hosting, content storage and delivery is reduced significantly. Cloud computing is a practical approach to experience direct cost benefits and it has the potential to transform a data center from a capital-intensive set up to a variable priced environment. The idea of cloud computing is based on a very fundamental principal of reusability of IT capabilities'. The difference that cloud computing brings compared to traditional concepts of "grid computing", "distributed computing", "utility computing", or "autonomic computing" is to broaden horizons across organizational boundaries.

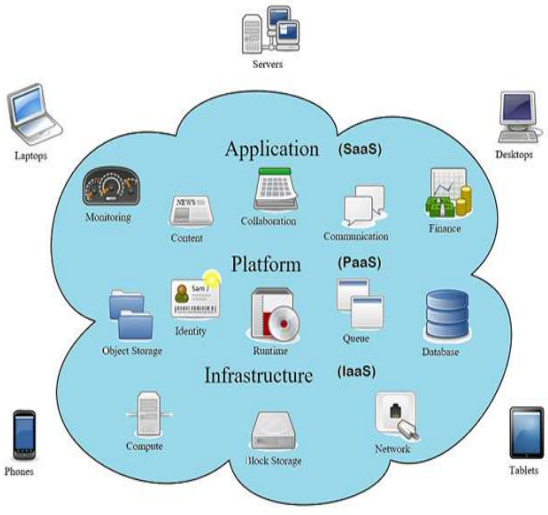

Figure 1: Cloud Computing

2. SERVICE MODELS OF CLOUD

A. Infrastructure as a service (IaaS)

Infrastructure as a Service (IaaS) is a service model that delivers computer infrastructure on an outsourced basis to support enterprise operations. Typically, IaaS provides hardware, storage, servers and data center space or network components; it may also include software.

An IaaS provider provides policy-based services and is responsible for housing, operating and maintaining the equipment it provides for a client. Clients usually pay on a per-use or utility computing basis.

Characteristics of IaaS include:

- Automated administrative tasks
- Dynamic scaling
- Platform virtualization
- Internet connectivity

IaaS is also described as one of three main categories of cloud computing service. The other two are Software as a Service (SaaS) and Platform as a Service (PaaS).

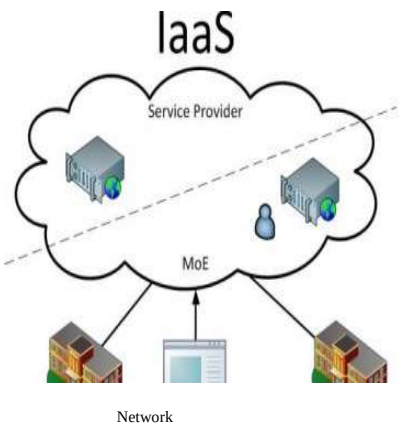

Figure 2: IaaS model

B. Platform as a service (PaaS)

Platform as a Service (PaaS) is a concept that describes a computing platform that is rented or delivered as an integrated solution, solution stack or service through an Internet connection.

The solution stack may be a set of components or software subsystems used to develop a fully functional product or service, such as a Web application that uses an OS, Web server, database and programming language. More generically, the solution stack may deliver an OS, middleware, database or application.

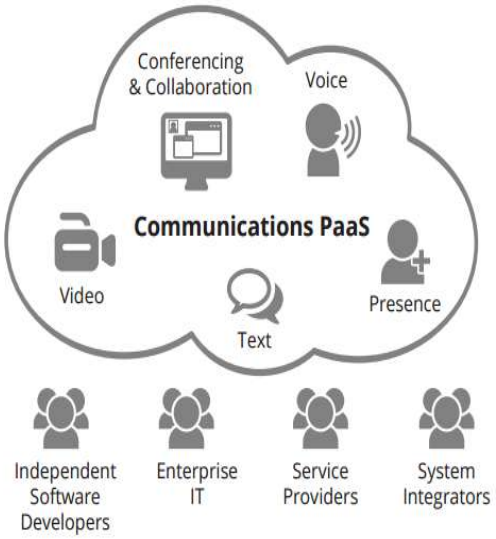

Figure 3: Pass Model

PaaS evolved from Software as a Service (SaaS), which uses the Internet to host software applications. PaaS is the center of the five layers of cloud computing. The two layers above PaaS are the client (hardware and software) and application (including SaaS) layers. Below the PaaS are the infrastructure - including Infrastructure as a Service (IaaS) - and server (hardware and software) layers.

The PaaS service delivery model allows a customer to rent virtualized servers and associated services used to run existing applications, or to design, develop, test, deploy and host applications.

PaaS offerings include a variety of services and service combinations spanning the application development lifecycle. Typical service features include source code control and tracking, versioning, testing and build process management tools.

C. Software as a service (SaaS)

Software as a Service (SaaS) is a model for the distribution of software where customers access software over the Internet. In SaaS, a service provider hosts the application at its data center and a customer accesses it via a standard Web browser.

There are a few major characteristics that apply to most SaaS vendors:

- Updates are applied automatically without customer intervention
- The service is purchased on a subscription basis
- No hardware is required to be installed by the customer
- SaaS is also known as hosted software or on-demand software.

SaaS is a natural evolution of software. The old model of getting physical DVDs and installing on local servers was the only realistic solution for many years. In fact, the client-server model is still required for many scenarios. That said, in recent years a number of developments have allowed SaaS to become mainstream. One factor is bandwidth; the Internet is simply faster than it was a decade ago. Other major factors include the evolution of both virtualization and tools in big data. All these advances have made it much easier for providers to scale and manage their own infrastructure and thus provide SaaS solutions.

SaaS is used in a number of common business areas, including customer relationship management (CRM), document management, accounting, human resource (HR) management, service desk management, content management and collaboration. There are literally thousands of SaaS vendors, but Salesforce.com is perhaps the best known example, as it is one of the first vendors to significantly disrupt traditional software vertical. SaaS is closely related to Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). It falls under the umbrella of the larger category of cloud computing, although many people view the terms as synonymous.

In a SaaS deployment model, sensitive data is obtained from the enterprises, processed by the SaaS application and stored at the SaaS vendor end. All data flow over the network needs to be secured in order to prevent leakage of sensitive information. This involves the use of strong network traffic encryption techniques such as Secure Socket Layer (SSL) and the Transport Layer Security (TLS) for security. [3]

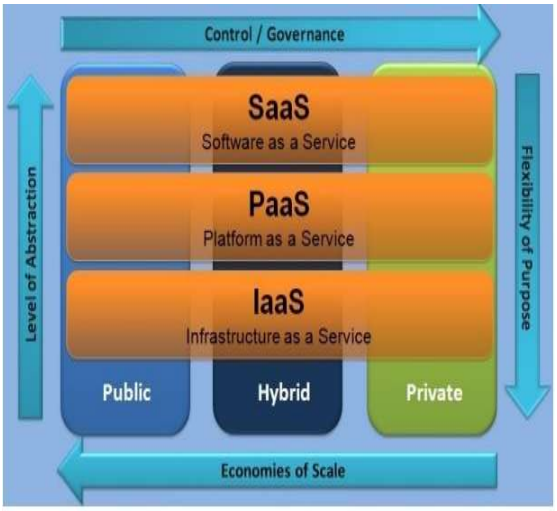

Figure 4: Cloud Computing Service Models

D. Data storage as a Service (DaaS).

The delivery of virtualized storage on demand becomes a separate Cloud service - data storage service. Notice that DaaS could be seen as a special type IaaS. The motivation is that on-premise enterprise database systems are often tied in a prohibitive upfront cost in dedicated server, software license, post-delivery services, and in-house IT maintenance. DaaS allows consumers to pay for what they are actually using rather than the site license for the entire database. In addition to traditional storage interfaces such as RDBMS and file systems, some DaaS offerings provide table-style abstractions that are designed to scale out to store and retrieve a huge amount of data within a very compressed timeframe, often too large, too expensive or too slow for most commercial RDBMS to cope with Examples of this kind of DaaS include Amazon S3, Google BigTable, and Apache HBase, etc.[5]

3. CLOUD DEPLOYMENT MODELS

A cloud deployment model represents a specific type of cloud environment, primarily distinguished by ownership, size, and access.

There are four common cloud deployment models:

1. Public Cloud
2. Community Cloud
3. Private Cloud
4. Hybrid Cloud

Public Cloud:

Public Cloud a type of cloud hosting in which the cloud services are delivered over a network which is open for public usage. This model is a true representation of cloud hosting; in this the service provider renders services and infrastructure to various clients. The customers do not have any distinguish ability and control over the location of the infrastructure. From the technical viewpoint, there may be slight or no difference between private and public clouds' structural design except in the level of security offered for various services given to the public cloud subscribers by the cloud hosting providers.[1]

Public cloud is better suited for business requirements which require managing the load; host application that is SaaS-based and manage applications that many users consume. Due to the decreased capital overheads and operational cost this model is economical. The dealer may provide the service free or in the form of the license policy like pay per user. The cost is shared by all the users, so public cloud profits the customers more by achieving economies of scale. Public cloud facilities may be availed free an e.g. of a public cloud is Google. [1]

Private Cloud:

A private cloud is set up within an organisation's internal enterprise datacenter. It is easier to align with security, compliance, and regulatory requirements, and provides more enterprise control over deployment and use. In the private cloud, scalable resources and virtual applications provided by the cloud vendor are pooled together and available for cloud users to share and use. It differs from the public cloud in that all the cloud resources and applications are managed by the organisation itself, similar to Intranet functionality. Utilisation on the private cloud can be much more secure than that of the public cloud because of its specified internal exposure. Only the organisation and designated stakeholders may have access to operate on a specific Private cloud [6].

Hybrid Cloud:

A hybrid cloud is a private cloud linked to one or more external cloud services, centrally managed, provisioned as a single unit, and circumscribed by a secure network [7]. It provides virtual IT solutions through a mix of both public and private clouds. Hybrid Clouds provide more secure control of the data and applications and allows various parties to access information over the Internet. It also has an open architecture that allows interfaces with other management systems. To summarise, in the cloud deployment model, networking, platform, storage, and software infrastructure are provided as services that scale up or down depending on the demand [8]. In deciding which type of Cloud to deploy, business managers' needs to holistically assess the security considerations from an enterprise architectural point of view, taking into account the information security differences of each Cloud deployment model mentioned above.

Community Cloud:

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. This cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models [9]. Cloud computing has

three basic abstraction layers, i.e, system layer (which is a virtual machine abstraction of a server), the platform layer (a virtualized operating system of a server) and application layer (that includes web applications) [10]. Computing is being transformed to a model consisting of services that are commoditized and delivered in a manner similar to traditional utilities such as water, electricity, gas, and telephony [11]. The cloud computing service model involves the provision, by a service provider, of large pools of high performance computing resources and high-capacity storage devices that are shared among end users as required [12-14]. Cloud computing potentially offers an overall financial benefit, in that end users share a large, centrally managed pool of storage and computing resources, rather than owning and managing their own systems [15]. Cloud service providers invest in the necessary infrastructure and management systems, and in return receive a time-based or usage-based fee from end users [16].

Cloud data storage is a technology that uses the internet and central remote servers to maintain data and share the applications. It allows consumer to use applications without installation and access their personal files at any computer with internet access. In general data property analysis system, source and destination file content is compared in the form of bytes. In the cloud environment, data verification is needed for every computation in the storage correctness. So every time the data is retrieved from local system and compared with the destination file from the cloud zone [17-19]. In cloud environment, a client device or other processing device comprises a file processing module, with the file processing module being operative to request proof from a file system that a file having a first format is stored by the file system in a second format different than the first format, to receive the proof from the file system, and to verify that the file is stored in the second format using the proof provided by the file system responsive to the request. The proof is based at least in part on application of a function to the file in the second format, and the function imposes a minimum resource requirement on generation of the proof. The file system may comprise one or more servers associated with a cloud storage provider. Advantageously, one or more illustrative embodiments allow a client device to verify that its files are stored by a cloud storage provider in encrypted form or with other appropriate protections [20].

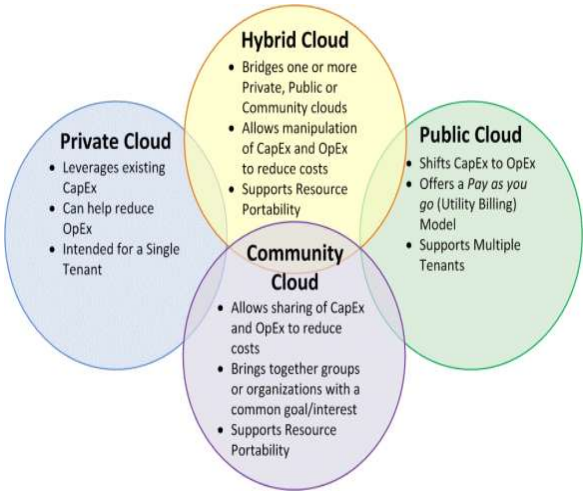

Figure 5: Cloud Deployment Models

4. DATA SECURITY

The issue of security of data and privacy raises the loud alarms among the patients. The privacy and security of data is the concern which bothered most of the users. Keeping the health information in data centers of third party cloud service provider raises the serious concern. This confidential information can be misused and will result in harmful consequences for organizations that are using cloud services. The developed countries pose the hefty fines for these privacy violations. The public cloud model posses the vital security concerns, hence private cloud model is the first choice of the organization which would like to keep their information in house. All clinical research data, organizational trends and important artifacts will remain in organization's circumference.[2]

The cloud service should use the cryptographic and remote attestation techniques to save the confidential cloud information.

The trend shown above demonstrates the buyer's response for adoption of cloud computing and depicts that they are feared the most from security threats. So serious consideration need to be given while posting the highly confidential data over cloud. To curb the security issues the clinical data need to be encrypted with robust cryptographic techniques and use other technological way to protect their data.

Reliability & Availability of service

Health care organizations planning to adopt the cloud computing paradigm are very much concerned about the service availability around the clock. Clinical data needs to be available at every moment of its operation. So, organizations are quite worry about the situation when they are unable to access data due various reasons like service unavailability, blunt shutdown of data centers, any software failures etc. There are numerous questions because patient information should be available to hospital management all the time. Consider an example, during the emergency surgery operation, cloud service provider unable to provide the patients information record which may be crucial requirement in the operating scenario. [2]

Figure 6: Cloud Computing Challenges

These kinds of situation can put the organizations in big trouble and may impact the business reliability. Such a scenario has happened in the past where business verticals have faced the service unavailability issues for quite number of hours.

These kinds of challenges are impacting the mind set of health care organization how to handle such scenarios. The cloud service providers are already working in such areas. They have devised the various fault tolerance techniques as a counter measures. Component redundancy check, geographical redundancy, software redundancy etc are various such primitives, widely used.[2]

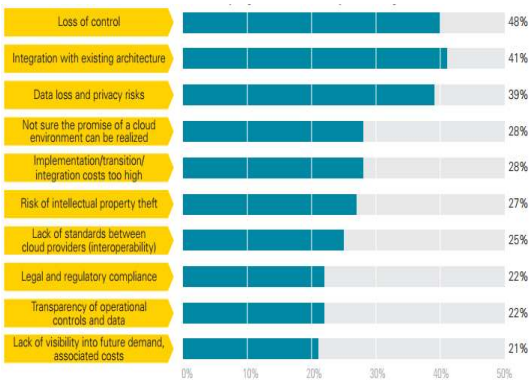

Figure 7: Challenges Adopting Cloud Computing

5. CONCLUSION

In this paper we explored the standard definition of cloud computing for building a baseline of common terminologies related to it. Understanding the essential characteristics of cloud computing platforms and cloud deployment and service models is crucial for making informed decisions and selecting the appropriate platform for your business needs.

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