Evolution and Elaboration of Cloud Computing Architecture and Layers

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Abstract: Cloud Computing system is a set of resources designed to be allocated ad hoc to run applications, rather than be assigned a static set of applications as is the case in client/server computing. We are living in the golden era of information technology. In this era we are introducing new technologies day by day. We are discussing one of the technologies named cloud computing. The history of cloud computing is not so old. But future of cloud computing is very bright. We have discussed this thing by market research in this paper that cloud computing reshaped the complete IT infrastructure. We take on rent rather than buy either one server or thousands of servers. This paper show how the cloud computing is beneficial for small and middle scale industry.

Keywords: cloud computing, SaaS, PaaS, IaaS, virtualization.

I.   INTRODUCTION

Cloud computing is a model for enabling 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. It is a type of Internet-based computing that provides shared computer processing resources and data to computers and other devices on demand. It is a model for enabling ubiquitous, on-demand access to a shared pool of configurable computing resources (e.g., computer networks, servers, storage, applications and services), which can be rapidly provisioned and released with minimal management effort. Cloud computing and storage solutions provide users and enterprises with various capabilities to store and process their data in either privately owned, or third-party data centers [3] that may be located far from the user– ranging in distance from across a city to across the world. Cloud computing relies on sharing of resources to achieve coherence and economy of scale, similar to a utility (like the electricity grid) over an electricity network.

The golden era of information Technologies is led by Cloud computing which is based on TCP/IP, high development and integrations of computer technologies such as fast microprocessor, large memory, high-speed network and reliable system architecture. Basically clouding computing concept is derived from concept of server client networking, where you need resource you ask to server and get it. The difference lies in core networking is that application or data are hosted on a single company's server and accessed over the company's network. Cloud computing is a much bigger than that. It includes multiple companies, multiple servers, and multiple networks, plus unlike network computing, we can access its services anywhere in the world over an Internet connection; with network computing, access is over the company's network only. In cloud computing, it allows the registered user to access the desire application on anywhere in the world that are actually reside in somewhere in world rather than your network device or your computer.

Standards of Cloud Computing

A cloud standard is one of a number of existing, typically lightweight, open standards that have facilitated the growth of cloud computing, including [7]:

- Application
- Communications (HTTP, XMPP)
- Security (OAuth, OpenID, SSL/TLS)
- Client
- Browsers (AJAX)
- Offline (HTML 5)
- Infrastructure
- Virtualization (OVF)
- Platform
- Solution stacks (LAMP, Space-based architecture)
- Service
- Data (XML, JSON)
- Web Services (REST)

II.   EVOLUTION OF CLOUD COMPUTING

In 2006, when Amazon proclaim from the housetops that they are launching their cloud. It [1] was a prototype named Elastic Computing Cloud (EC2) public [Business Week 2006]. This was offering and providing IT resource, and also gave the matter of thinking to the all IT world. The concept behind this idea of Amazon was to provide the complete infrastructure to the developer via internet. But the main idea behind the cloud computing is came from in the era of 1960s Mr. John McCarthy described about such type of technologies the term cloud has also already used in referenced with large ATM networks. Since 2006, there has been lots of work on standardizing the definition of cloud computing. Every cognizant of IT provide different definition of cloud computing, but we are including a standard definition of cloud computing which has taken from The National institutes of standard and technology [2]

According to NIST Cloud computing is a model for enabling 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.

III.   ARCHITECTURE OF CLOUD COMPUTING

The Cloud Computing Architecture of a cloud solution is the structure of the system, which comprises on-premise and cloud resources, services, middleware, and software components, geo-location, the externally visible properties of those, and the relationships between them. The term also refers to documentation of a system's cloud computing architecture. Documenting facilitates communication between stakeholders, documents early decisions about high level design, and allows reuse of design components and patterns between projects.

Cloud computing architecture consists of a front end and a 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. Now come to its structure, the appearance of cloud computing could be understand by dividing it into two section. First is the front end and second is the back end. The front end is the user interface and the second is the "cloud" section of the system [3]. In the architecture of cloud computing we mainly emphasis on its component and sub component. Which is consist of front end and back end, they are connected with each other by high speed internet.

We can distinguish the architecture of cloud in two parts, first one is Layers Architecture of cloud computing and another one is based on its both end (Front end and Back end) .We will discuss here layered architecture of cloud. Layered architecture has divided in to several layers; every layer has their own work module and role in cloud.
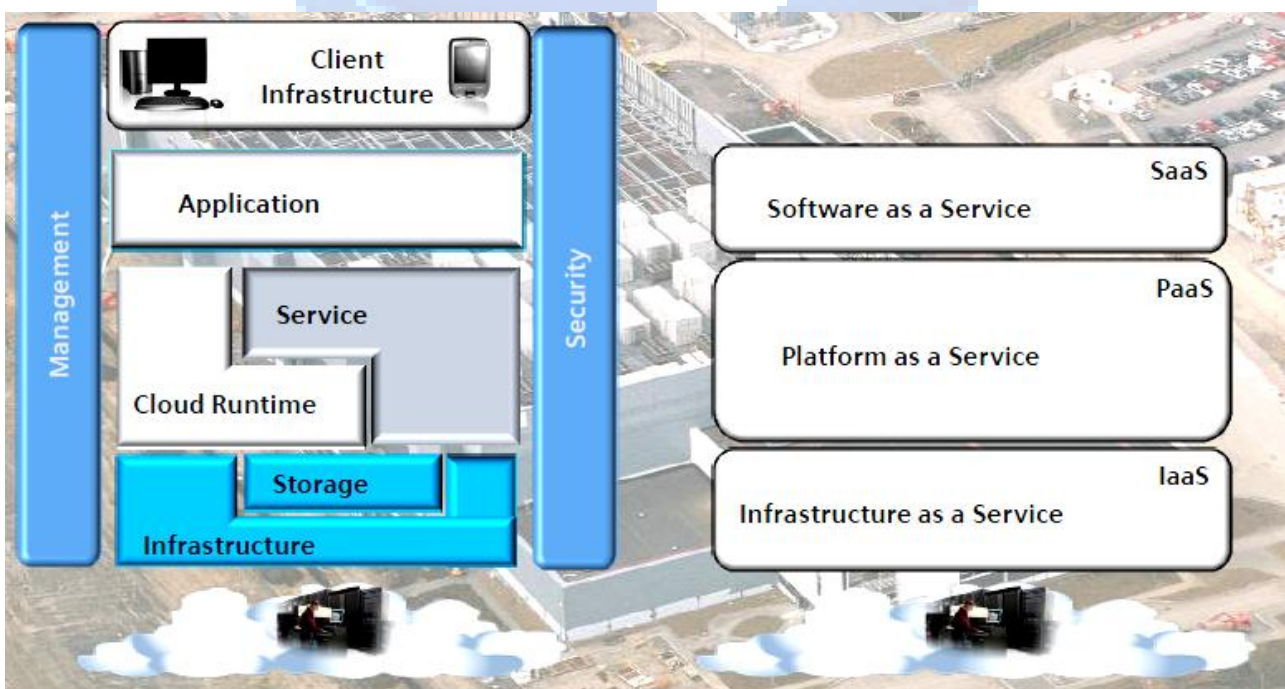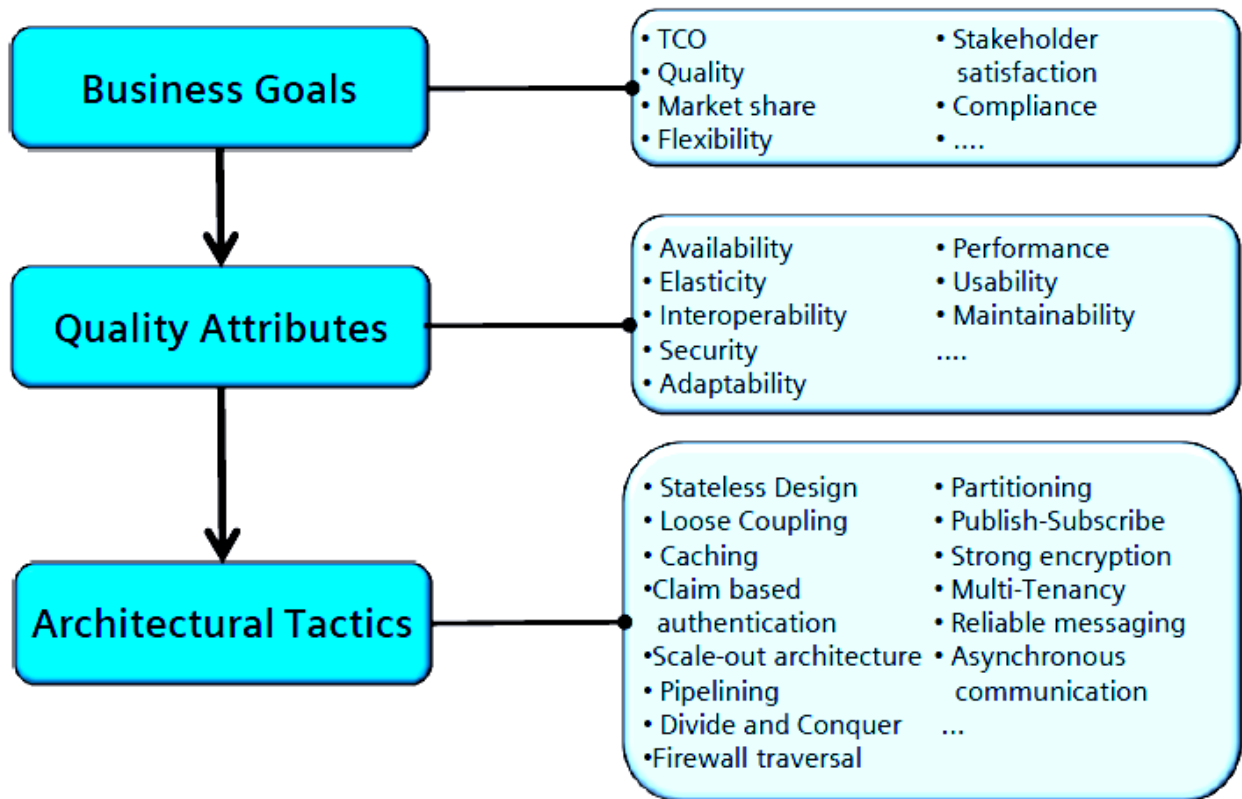

Fig 1: Architecture of cloud computing

Fig 1: High Level Architectural Approach in Cloud Computing

TYPES OF CLOUD LAYERS

The three cloud layers are:

- Infrastructure cloud: Abstracts applications from servers and servers from storage
- Content cloud: Abstracts data from applications
- Information cloud: Abstracts access from clients to data

The three cloud implementation models are:

- Private cloud: Created and run internally by an organization or purchased and stored within the organization and run by a third party
- Hybrid cloud: Outsources some but not all elements either internally or externally
- Public cloud: No physical infrastructure locally, all access to data and applications is external

Generally, the cloud network layer should offer:

- High bandwidth (low latency)

Allowing users to have uninterrupted access to their data and applications.

- Agile network

On-demand access to resources requires the ability to move quickly and efficiently between servers and possibly even clouds.

- Network security

Security is always important, but when you are dealing with multi-tenancy, it becomes much more important because you're dealing with segregating multiple customers

An **infrastructure cloud** includes the physical components that run applications and store data. Virtual servers are created to run applications, and virtual storage pools are created to house new and existing data into dynamic tiers of storage based on performance and reliability requirements. Virtual abstraction is employed so that servers and storage can be managed as logical rather than individual physical entities.

The **content cloud** implements metadata and indexing services over the infrastructure cloud to provide abstracted data management for all content. The goal of a content cloud is to abstract the data from the applications so that different applications can be used to access the same data, and applications can be changed without worrying about data structure or type. The content cloud transforms data into objects so that the interface to the data is no longer tied to the actual access to the data, and the application that created the content in the first place can be long gone while the data itself is still available and searchable.

The **information cloud** is the ultimate goal of cloud computing and the most common from a public perspective. The information cloud abstracts the client from the data. For example, a user can access data stored in a database in Singapore via a mobile phone in Atlanta, or watch a video located on a server in Japan from his a laptop in the U.S. The information cloud abstracts everything from everything. The Internet is an information cloud.

IV. ELABORATION OF LAYERS

1. **Software as a service:** In SaaS user can access any of the given service through the internet .The services are hosted in the cloud and can be used for a large range of takes [3], CRM Virtual desktop, email are the example of SaaS. SaaS in normally known for their on demand facility, means use it on rent rather than buy. In compression with traditional installation of software you would first buy the software than unpacked it and install it with manual or through Remote Installation Service , it has also limits of user or machine .However in cloud you just apply for the software and use it .No need of any update cloud vendor update it automatically. It will reduce manual intervention

2. **Platform as a service**: Platform as a service provides several application and environment to the developer for build their application [4]. It also provides many software development frameworks there are many PaaS vender who provide or offer application hosting and many integrated service. Services may vary with levels of scalability and maintenance [5].

3. **Infrastructure as a service: -** It is also same as other "as a services", it is also on demand services. It provides basic storage and standardizes services [6] over the network. It is provide on demand services, infrastructure usually in terms of virtual machine [7]. Physical infrastructure established by any cloud vender can reduce the cost of installation of new hardware on their network like Data center. IaaS help client for saving their time and cost and we can have several other benefits from cloud's infrastructure a as a service like scalability, reduce the cost of hardware, access anywhere, no need of physical security etc.

V. CLOUD COMPUTING IN IT INDUSTRY

The days have gone for traditional IT Industry, when a company had a single mainframe to maintain all types of data. Now this era of cloud computing here one stay shop of all services as, you need to develop application, need to store data, need to work on VM, don't get panic, register yourself with a cloud vendor and have a good internet connection than enjoy yourself. But emerge of cloud computing the traditional IT industry is lacking somewhere. Here we mention some point which show how cloud computing effect traditional IT industry.

Reduce manual intervention: Cloud is working pay and gets principle. You will pay only for used services no need of manual interfering. If you need any particular services like any software, hardware (data storage) you just register; if not than access your service in minutes or hours .No need to install, no need to maintain , no need to provide any space or location.

Reduce infrastructure: Cloud reduce the infrastructure cost it is the biggest impact on traditional IT. We can take all services form it "aas" model on rent. No need to install particular hardware or software.

Reduce Time: The main and basic goal of IT manager and HR manager is time you can save a lot time [9] it has low barriers to entry ,shared infrastructure , cost management (pay for used) , immediate access and terminate.

Reduce the risk factor over data storage: In small or middle segment company has extensible amount of data, on cloud computing over internet IT manager can hire storage in infrastructure as a service. And utilize this according to their requirement.

Impact on job skill: The traditional job skill has to be changed according to the new fast adaptive technology. Some skill may be remaining same like application management, and monitoring the performance, network analysis etc. But in case of application developer they have to learn how to take resource, use cloud based application, deployment test and other functionality.

VI.   CONCLUSION

In this paper, the author has discussed about the fastest growing technology cloud computing. In this paper, the author has described about cloud computing and emergence of cloud computing, how computing become the cloud computing and the definition of cloud computing. But with the emergence of cloud computing Traditional IT industry is facing some positive and negative effect that has described in this paper.

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