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EVOLUTION OF CLOUD COMPUTING NETWORKING & PRINCIPLES

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Abstract:**This is a review paper on the idea of cloud computing which is evolved from the era of internetworking. Subsequently the highlight includes classification of cloud computing, comparison of public versus private cloud infrastructure. We further the concept of SaaS and PaaS where we set in note for future work. We finally conclude with some of the salient characteristics of networks on the cloud.**
*Keywords:****Cloud computing; Networking; IoT***

I. INTRODUCTION

In the last decade the style of computing has been changed and transformed into different form, one of which is "cloud computing". In this transformation the data and computation are operated somewhere in the cloud. And these clouds are being maintained by the third party which own the data center where all the cloud data is stored.There are many types of computing which rely on **internet-based** computing one of which is cloud computing. Within the cloud computing **computer processing resources** are being shared to the computers and different kind of device as it is demanded. Cloud computing is responsible to provide the hardware, software and application delivered as a service over the internet layer.There are many benefits of cloud computing to the individual. The major benefit of cloud computing is the user will not require any complex form of computer data base.
By connecting the broadband, user can connect to the World Wide Web which is basically a cloud, it is refer to as the **point of contact** with the larger network. By using this point of contact, user who are using the cloud computing from the entire world can get the benefits of the larger processing power with just less amount of knowledge about computing.

A. *State of the art:*

In [1] authors have proposed an efficient framework for mobile edge-cloud computing networks that allows the edge and cloud to share computing resources via wholesale and buyback. To optimize the computing resource sharing process, we formulate computing resource management problems for the edge servers to manage their wholesale and buyback schemes, as well as the cloud to determine the wholesale price and local computing resources. In a cloud computing environment, data transmission and retrieval are typically handled by storage device providers or physical storage units leased by third parties [2]. In [3] authors have addressed the data duplication problem in this study by developing two dynamic models with two variant architectures to investigate the strengths and weaknesses of architectures in Big Data Cloud Computing Networks. Each model will thoroughly discuss the issues associated with the data duplication process. In [4] authors have proposed a computation offloading approach based on edge computing for addressing privacy conflicts computational tasks for the internet of connected vehicles. The privacy conflicts between the computational tasks were first formally investigated. The route vehicles from the origin vehicle to the destination vehicle were then obtained. Finally, to reduce the execution delay and energy consumption of edge computing devices, an efficient non-dominated sorting genetic algorithm was used. In [5] a reverse auction-based incentive was developed as an integer optimization problem with the goal of maximizing mobile network operator revenue under delay constraints. Deep learning algorithms are now widely used in a variety of applications, including natural language processing, gaming, IoT, computer vision, and speech recognition [6]. Reinforcement learning, in particular, has been used in a few recent studies of vehicular edge computing systems [7] to empirically deal with

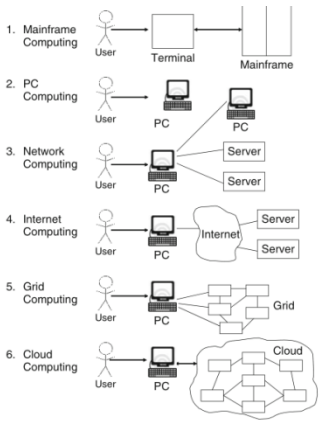
large-scale complex problems. In [8] investigated spectrum allocation as well as computing and storage resources for a multi-access edge computing-based vehicular network, with two mobile edge computing architectures formulated as multi-dimensional optimization problems.

B. History of Cloud Computing

Before we get into what the cloud computing is and how does it work we need to understand many aspects that lead to cloud computing. There is a history behind cloud computing which is chronically started from the time since computing started. People find the need to connect with each other in order to share information and data with each other in order to enhance productivity.
By advancing the technology and bandwidth power is made possible the concept of cloud computing. In the earlier days the speed in previous networks connection was less dynamic and very slow amount of bandwidth was provided so it make it difficult to upload and downloads over the internet.

C. *Evolution of cloud Computing*

The first evolution that has been started was from the mainframe computing. It was a data processing system used mainly in big organizations for different applications, which includes the data processing and control and many other related task. As the processing need changes, it grows to the internet computing, which lead to grid computing and then recently transformed into cloud computing. The different phases that took place in the evolution of cloud computing is further categorized in the following manner.



i. The main frame computing

Main frame computer are known for their fast performance and computational power. Main frame computer the dummy terminals are employed as user terminal devices.

ii. Network computing

In the network computing, the client/server architecture are used.

D. Types of clouds

For different preferences the cloud has different shapes and sizes. There are three types of cloud namely:

i. Public cloud

The most common form of cloud computing is the public cloud which can also be referred to as **external cloud**. Public cloud are being managed by the third parties. Different costumer run different application which gets mix together on the cloud's server, storage systems and network. The costumer, or any individual user or enterprises can access the

services of the cloud computing by the third-party provider who are capable of sharing multiple resources of computing with their user. Some of the most well renowned public cloud providers are the following:

- Amazon
- Microsoft
- Google

These are the ***IT*** giants who has setup their data centers in the large amount, which can enable users to freely and easily manage their provided resources with relatively less cost and require very low management. Dom of the important concerns with these clouds are the data governance and security.

ii. Private cloud

Private cloud is also known as internal cloud which is refer to as cloud computing in the private network. These cloud are being organized specifically for the individual client. This individual client has that complete control on the data storage, quality of service and the security. These cloud can be built by any company in a support with the Information technological organization.

iii. Hybrid cloud

This cloud are the combination of public and private cloud. It combines multiple public and private cloud models.it has the capability of managing the complexity of determining how the application should be distribute across both private and public network. They are reliable and most widely used.

E. major difference between public and private cloud

	Public	**Private**
Network	It works over the Internet	PRIVATE NETWORK
SERVER AND DATA CENTER LOCATION	Global	In company
Costing	By usage or free	Internal mechanism often by capacity and processor
Tenancy	Multiple	Single
Cost	Lower cost	Higher cost: which required cooling, space, energy consumption and hardware cost.
Performance	Unpredictable multi-tenant environment cause lots of problems in order to achieve the guaranteed performance.	Insured performance

II. TECHNOLOGIES INVOLVE IN CLOUD COMPUTING

Arguably the most powerful service that made the cloud computing possible will be briefly mention in this part;

- Web service also known as service-oriented architecture
- Service flows and work flows
- Web 2.0 mashup
- Virtualization

i. VIRTUALIZATION

Some of the main advantage of the cloud computing is it has the ability to virtualize, and different resources can be easily shared among the different application with the major objective for the optimum server utilization. Virtual machine techniques are used in virtualization technologies which are namely **VMware** (virtual machine ware) and Xen. Virtual private network is also the technique of virtualization. These virtual private network supports user by providing the customizable network environment which enable user to access cloud resources.

ii. SERVICE FLOWS

Service based cloud activities provided in clouds. Service flows has become one of the important area of research in the field of data base and it systems.

iii. WEB 2.0

This concept is apparently the new concept that is refer to the use of web technologies and web design, information sharing and also the purpose of the collaboration with the other user. In the other way, web 2.0 is the web application that has the ability of combining data from more than one sources into the unified integrated storage tool. Both of these technologies are very important for the cloud computing.

A. Service models

Cloud computing has the multiple services and they are categorized in the form of different layers. These layers are assign to perform the different task. Some of the main characteristic that made cloud computing different from other computing is the focus on service delivery. There are three main types of service models that are the following.

i. Software as a service (SaaS)

It is a hosted application which can be found over the "World Wide Web" using the internet browser. It is also known as **on demand software.** In this service the solution of hardware and software is manipulated by the vendor. There are many characteristic of SaaS some of them are the following.

- Software available over the internet.
- People are encouraged to collaborate with each other.
- Every user have same software version.
- Software are scalable.
- Maintenance related cost will be reduced.

SaaS has the services like drop box, google services, Prezi.

ii. Platform as a Service (Pass)

One of the main cause of platform as a service is to provide the software execute environment on which the application services are functional. Platform, as a service use as a managed environment in cloud where the complex application are develop, and tested. For supporting the cloud computing development the provider supplies the specially designed software and hardware. The some of the PaaS are the following

- Java
- Google App Engine
- Google web toolkit
- Microsoft Azure
- Force.com
- Cloud Foundry

Service type	Platform as a service (PaaS)	Software as a service (SaaS)
Service customization	Logic resource template	Application template
Service monitoring	Logic resource monitoring	Application monitoring
Service resource optimization	Large scale	Multi-tenancy
Service measurement	Logic resource usage metering	Business resource usage metering
Service integration and combination service security	SOA	SOA, Mashup

ii. SERVER STRUCTURE

The most important part that play in cloud computing is the **server structure.** The main purpose of implementing this concept because it is the brain of the overall **processing environment.** It is not necessary to have to have high end hardware for cloud computing.

B. Main features of cloud computing

Cloud computing has numerous functionality over the other computing paradigm.

i. SCALABILITY

Cloud computing provides the scalability on resources and services for users on demand. These resources has the ability if scaling over the numerous data centers.

Scalability is provided in three manners:

- Load scalability
- Space scalability
- Structural scalability
- Vertical and horizontal scalability

ii. QUALITY OF SERVICE

In terms of hardware and pc performance, bandwidth and capacity of the memory; the quality of service is guaranteed to be deliver to their users.

iii. COST EFFECTIVE

They are not required to be paid for the huge amount of money in the installation and other complexities. Instead users are only need to pay for the amount of storage they are going to use for their personal need and the services they want to use.

III. DISCUSSION

Almost all organization is willing to save money on operational cost. By implementing the cloud computing within the company or organization, one can solve the issue by saving huge capital investment out of the equation.

One to the biggest issues that's come in a way of cloud computing is the security issues. Because the cloud computing use virtualized machine, that has important application and vulnerable data on to the cloud computing environment. For that reason the potential cloud computing users are concerned about some of the main issues which are highlighted in the following.

- Do the user have the control over security?

- Is there any proved evidence that the system that is providing the cloud computing is save and fulfilling the requirement of the SLAs?

iv. HOW MUCH DO THE USER HAVE TO PAY FOR CLOUD COMPUTING?

The main expenditure of the cloud computing is categorized in the three main ways:

i. Storage

Storages are available over cloud and the user can select the etiquette amount of storage as per their need and pay for the storage. These storage can be subscribe monthly while other services provide the unlimited storage over some specific services that a user can avail free of cost.

ii. Bandwidth

Bandwidth is another key expenditure in the environment of cloud computing, as the technology is growing. The bandwidth is increasing over time and to cost over bandwidth is decreasing.

C. **RELIABILITY**

Cloud computing still have some of the reliability issues. There were lots of cases in which the services of the cloud computing has took several hours of outage. But in the near future we are expecting to see many more cloud computing service providers, a lot of new features and the optimum service, well establish standards

IV. CONCLUSION

In today's era the internet provide the content to it users in the form of pictures and videos, Electronic-Emails, and the different form of information and data are accessible through the web pages. In the upcoming era, cloud computing will have the drastic change in which the user can rents the cloud services from the virtualize store in order to build the virtual data center: these services includes the computational power, storage, memory. Cloud computing is the new form of computing that allows user to do business and other it services.

Other than this flexibility, scalability and the lesser maintenance, it has still a little doubt about the about its threats which arises by this computing environment. There still persist the privacy concern, and it also required the good connectivity. Despite all of that, cloud computing is provide the easiest way to access the virtualize environment and utilize its resources.

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