CLOUD COMPUTING ARCHITECTURE & CHALLENGES

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Abstract:
"Cloud" processing - a generally ongoing Trendy expression in IT industry that appeared following quite a while of researchin
virtualization, utility processing, circulated figuring ,systems administration and programming administrations. A cloud presents an IT climate which is concocted for thought process of remotely provisioning estimated and versatile assets. It has developed as another worldview for trading data and administrations over the web. It offers types of assistance to the clients with more prominent unwavering quality, adaptability and versatility. It is utilized as administration arranged design which lessens data related above for End-Clients. In this paper we will examine distributed computing ideas, design and we primarily center around a portion of the difficulties connected with the distributed storage.
Keywords: CloudComputing, Architecture,Challenges

INTRODUCTION

Cloud Computing referred as Utility Computing that change the statement of storing Data (information and run application).Data are stored in the “Cloud” rather than in individual computers. Cloud is referred as software and hardware datacenter that supports users need. It was proceeded from IBM’s announcement of the “Blue Cloud” effort.In this paper, we take the description of cloud computing provided by The National Institute ofStandards and Technology (NIST) [1,2] that covers all the essential aspects of cloudcomputing:

NIST definition of cloud computing: 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,andservices)thatcanbe rapidly provisioned and released with minimal management effort or service providerinteraction.

With the fast development of the internet the resources have become more powerful, more cheaper and more available. This development produced a new computing model called CLOUDCOMPUTING. In this resources are provided by On-Demand approach .It is the on-demand information technology service. It is based on dynamically virtualized resources. Example:-Network Server, Storage Application. Cloud Computing is classified into three different parts asfollows[3]:

- Public Computing-The resources are available over internet to all theusers.
- PrivateComputing-Theresourcesareprovided toan organization viaintranet.
- Hybrid Computing-It is the combination of public and private computing that is depending on requirement to provideresources.

These infrastructure enable companies to reduce overhead(cost, time) by eliminating the requirement for physical hardware by permit the companies to extract data On-Demand. It has been adopted by most popular internet application services with millions of users. Example websites like Google, Yahoo and Facebook[4].Andalsobyindustrialorganizationsuch as IBM, Microsoft and many other. Cloud Computing has made a strong impact on the information technology(IT) industry[5]. These IT industry have aim to provide more reliable, powerful and cost effective cloud platform. Cloud Computing provide various types of services such as Infrastructure as a Service(IaaS),Platform as a Service(PaaS) and Software as a Service(SaaS)[6]. This paper describes the overview of cloud computing, architecture of cloudcomputingandthenexplainthemainchallenges of cloud computing. At the end, paper concludes with conclusion.

CLOUDCOMPUTING

This section describes an overview of cloud computing including its definition and also comparisonwithrelatedconcepts.Mainreasonforthe existenceofcloudcomputingistoreduceIToverhead for the End users and also reduce the total of On- Demand services and many other things.Cloud computing uses technologies such as virtualization andutilitybasedpricingtomeetthetechnologicaland

economicalrequirementsofuser'sdemandforIT[4].

Cloud computing can be compared with following technologies:

A. *Grid Computing*

It is known as distributed computing that manage the network resources for collaboration [1]. Cloud computing and grid computing are the similar in the manner of using distributed resources to achieve application level objective. In this, virtualization technologies run at multiple levels of software and hardware platforms for dynamic resource sharing.

B. *Utility Computing*

Its aim at providing resources On-Demand and charging depends on usage. Cloud computing along with utility computing maximize resource utilization and reduce their operatingcost.

C. *VirtualizationComputing*

It forms the basic building blocks of cloud computing so cloud computing is based dynamically on virtualization resources.

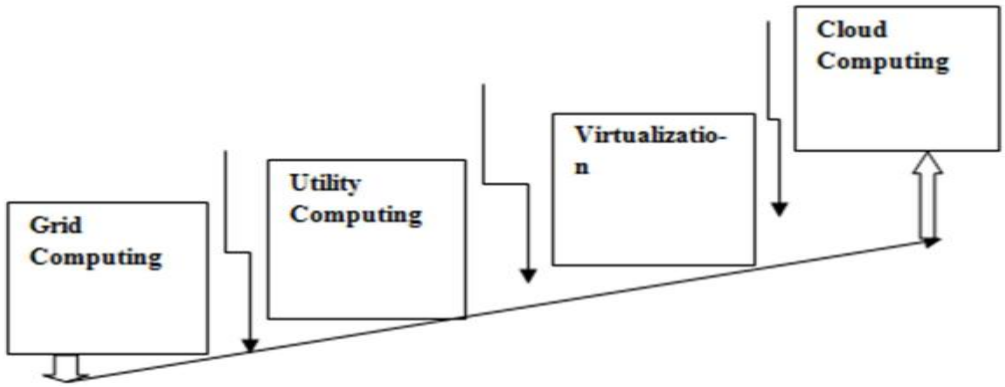

Fig.1: Grid to Cloud Evolution

Cloud computing contains virtual cloud in which user information and application are stored. User does not have to depend on computer infrastructure. A complete package of grid computing and utility computing is termed under a buzzword known as cloud computing.

Brief introduction of major cloud computing services that we have described under introduction section is as follows [6]:

- *Infrastructure as aService(**IaaS**)*

It delivers computer infrastructure that is virtualized platform as a service without buying software and servers. For example-IaaS providers include Amazon EC2 [7], GoGrid and Flexiscale [8].

- *Platform as aService(**PaaS**)*

It allows application developers to host their services. Example:Google's App Engine, Amazon E2C, Microsoft Window Azure [9] and Force.com[10].

- *Software as aService(**SaaS**)*

The application itself is given by service provider. Software can be used as a service over the internet without installing software on user's computer. Example: User mail -Gmail, Yahoo, User Picture-Picasa, Salesforce.com[10].

Cloud service model which are discussed above, shown in figure 2.

CLOUD COMPUTINGARCHITECTURE

In cloud computing resources are retrieved from the internet through web based tools and applications. This allows the users to work remotely because the cloud can be used as "Internet". Therefore it is not processed as traditional outsourcing. It is also called Massive Computing.In this the allocation of application must be dynamic. There is no need to install any type of hardware and software. The target of cloud computing is to permit the users to access the data from all the technologies, applications without any

deep knowledge about them[11]. In cloud computing architecture, there is no need of high power computer to run web based applications.In cloud computing architecture, the applications, data and services all are stored in cloud via internet and run the applications and stored data by delivering the software resources as on-demand services. Now we are describing different modes of cloud computing asfollows:

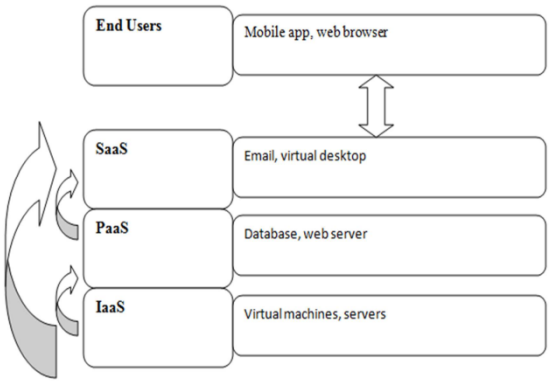

Fig.2: Cloud service computing models

A. *PublicCloud*

It can be shared by various organizations. Example- Amazon, Google. Public Computing application storage are made available to all organization. This is also known as "External Cloud". Resources are dynamically distributed over the internet via web services.

B. *PrivateCloud*

This Cloud infrastructure is dedicated to a specific organization and cannot be shared with other organization. Private cloud is more secure and more

expensive as compare to public cloud and other clouding modes.

C. *Hybrid Cloud*

It is combination of Public and Private Cloud and also composed of more than two clouding modes. Organization may host critical applications on public cloud or private cloud that's totally depending on demands. In a hybrid cloud, part of the applications, service infrastructure processedin private clouds while the remaining partprocessed in public clouds [1, 3]. And modes of cloud computing are shownbelow.

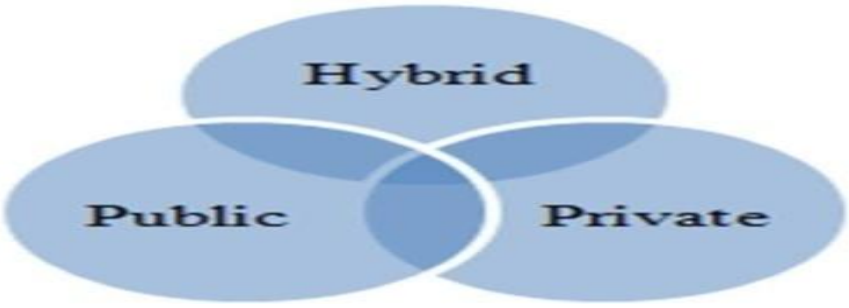

Fig.3 Modes of cloud computing

Cloud computing architecture is also called as "Layered computing model" [1]. Cloud computing architecture can be divided into four layers that is hardware layer, infrastructure layer, platform layer, application layer that are shown in fig.4:
The description of each layer is defined as follows:

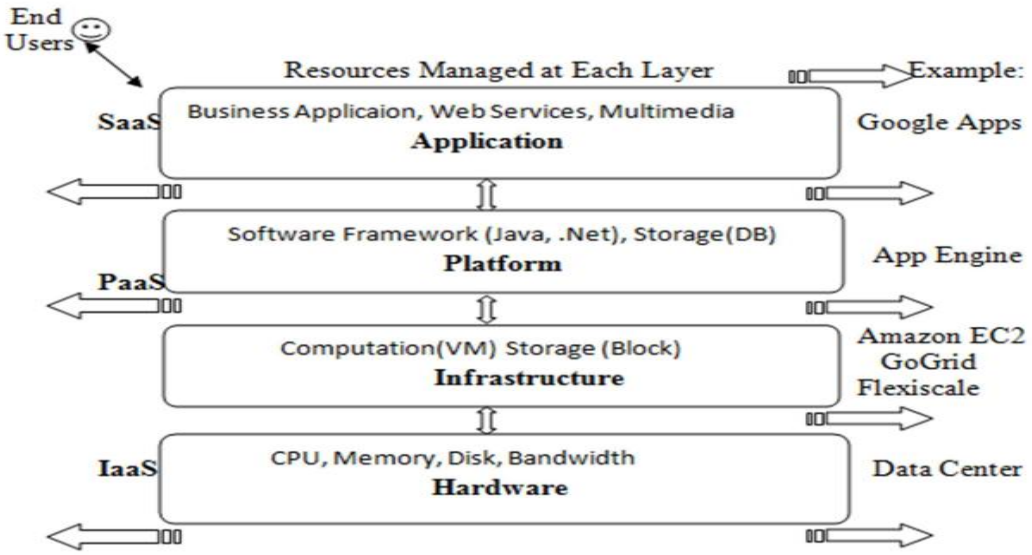

Fig.4 Cloud Computing Architecture

- *HardwareLayer*

  Physical resources of the cloud are managed by it. Controlling physical servers, switches, routers, power system is the responsibility of hardware layer. The implementation of the hardware layer is provided in data center. This data center contains several servers
  that are interconnected through routers and switches. Some issues occur in hardware layer including fault tolerance,hardwareconfiguration,trafficmanagement and resourcesmanagement.
- *InfrastructureLayer*

  It is also called "Virtualization layer". It is an essential aspect of cloud computing. Infrastructure layer based on key features such as dynamic resource assignment that is available through virtualization technology. Infrastructure layer makes the collection of computing and storage resources and partition the physical resources by usingvirtualization techniques. Example:- Xen[12], VMware[13].
- *PlatformLayer*

  Platform Layer is made up of operating system and application framework. It is built on top of the infrastructure layer. The main concept of platform layer is to minimize the overhead of deploying application directly into VM containers. For example GoogleAppEngine operates at the platform layer to allocate API supports for implementing data storage of different web application.
- *Application Layer*

  It is built on top level of cloud architecture. It is composed of actual cloud application. Cloud applications have essential features to achieve better performance, lower operating cost, availability and scalability.

  Thus this architecture is more modular than other architecture (traditional architecture). Loosely coupled concepts are used in each layer. This architecture permit cloud computing to carry a wide range of application requirements while reducing overalloverhead.

CHALLENGES IN CLOUDCOMPUTING

Cloud computing is composed of several applications, infrastructure and platforms which perform different operations [14]. So there are several securityissuesforcloudcomputingsinceitconsistsof technologies like operating systems, networks, databases, memory management etc. For smooth transition there must be a well understanding of challenges and benefits. The acceptance of cloud computing have many issues. Some of them, which we have studied from various resources on the internet, are listedbelow.

A. *Security andPrivacy*

The security of data is major concern in cloudcomputing.Sincethedataincloudcomputingis outsource to a third party, it becomes difficult to continued data integrity and privacy. It must assures that services are easily available and are safean

secure. Privacy is also provided to secure the data. Therearetwotypesofsecuritythreatsi.e.internaland external.Inexternalthreat,attackiscausedbyvarious users and organization that do not have direct access to cloud. Internal threat is "well-known securityrisk". Inthis,auserororganizationhavedirectaccesstothe cloud and cause any type of attack within the cloud. Several data storage security techniques are implemented in cloud computing such as implicit storage security, identify encryption and decryption scheme, TPA, secure storage protocoletc[3].

B. *Powered management issues*

It is also a concerning issue in cloud computing in 2006, it is reported that US has consumed more than 1.5% of the total energy generated in 2006 and it is estimated that percentage might increase up to 18%[15]. The focus should not only to reduce the energy cost but also on maintaining environment standards and to meet government regulations. Building energy efficient data center has gamedmuch attention. Two other ways for reducing power consumption are energy aware job scheduling and server consolidation[15]. The challenge is to maintain a balance between application performance and energy savings. Few researches have been started to find solution for application performance and energy consumption in cloud computingenvironment[16].

C. *Liability*

Another security challenge is liability that is incorrect behavior in terms of wrong results. For example: if data get leaks, it would be difficult to determine where fault occurs that is either at client side or at server side.

D. *Performance*

Performance is one of the biggest issue in cloud computing. Performance is generally effected by the factors such as limited bandwidth, low disk space, CPU speed etc. Generally user wants to access the data from both public as well as private cloud which becomes challenging for data intensive application to provide proper resources and results in loss of customers, end of services etc[17].

E. *Difficulty in moving application*

It is not easy to migrate the data from a source to cloud computing environment or even with in cloud computing platforms as different cloud providers have different application architectures.

F. *Dependency oninternet*

Cloud computing is fully dependent ontheavailability,quality,speedandperformanceof internet because internet act as a medium of transmissionbetweenusersandserviceprovider[18].

G. *Data confidentiality*

Only authorized users can access the protective data. Because of the increase in number of users and applications, it leads to an increase number of access points. Hence, data become accessible to more users resulting into security issues. Client should have components for ensuring that their data is secure in an untrusted cloud. By using cryptographic methods, a client can check the integrity of data by adding hash in local memory and rechecking the hash of receive data, thus authenticate server response by comparing the hash values. For large dataset,hashtreesareimplemented.Recentresearch showstheefficiencyofcryptographicmethod[19].

CHALLENGES IN CLOUDCOMPUTING

Distributed computing has acquired a lot of consideration in offering types of assistance over the web. It gives more noteworthy adaptability, dependability, on request administrations to the end clients. It is a powerful worldview for different associations. It gives every one of the necessary assets at a one spot in an exceptionally modest manner. Getting to the assets from longer distance is simple. However, sharing information through cloud isn't just protected. In this paper we have examined the ideas and difficulties that can happen in distributed computing. We trust that further explores would make momentous improvements

in this field.

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