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Cloud Computing: Evolution and Challenges

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Abstract:
Cloud computing is a most the present progressing technology which enables the organizations or individuals to share various services in a seamless and cost-effective manner over the network on public/private networks using WAN, LAN or VPN. Virtualization, grid computing and utility computing are the most popular emerged technologies, which are used in cloud computing and developed as a great technology to end users. The idea of virtualization is utilized as a strategy which permits sharing of single physical instance of an application or resource among different association's clients. A grid computing application is processor-concentrated software that splits up its processing into little lump then each piece is handled as an individual procedure and this is adopted in cloud computing. The main advantage with cloud computing is having utility computing concept which is Pay per Use model and also offers computational resources on demand as a metered service. In this paper, how cloud computing is evolved from the most popular technologies and the five essential characteristics/offerings of cloud computing application is presented in this paper. The various deployment, service models and challenges in cloud computing are addressed in this paper.

Keywords: Cloud Computing, Virtualization, Grid Computing, Utility Computing

I. INTRODUCTION

The extension of the cloud computing over the past few years has led to a state to invent many new technologies. Cloud computing is a method of computing in which dynamically scalable and a lot of virtualized resources are provided as a service over the Internet. Cloud computing is performing computing tasks via a network connection while remaining is isolated from the complex computing hardware and networking infrastructure' No User need to know about how cloud computing works, or how to control over the technology infrastructure in the cloud environment. It became common for enterprises and a person to use the services that are offered in the cloud and recognize that cloud computing is a big topic because the getting service from cloud computing is easy and worthy. Many developers in the world are currently working on "cloud-related" products. So cloud computing is becoming an adoptable technology for many of the organizations with its dynamic scalability and usage of virtualized resources as a service through the Internet. The trend toward cloud computing began in the late 1980s with the idea of grid computing when, for the first time, a large number of frameworks were connected to a solitary issue, normally logical in nature and requiring extraordinarily high level of parallel computations. Regularly, Cloud computing has attributes of four essential mainstream innovations which are grid computing, virtualization, utility computing and autonomic computing. Cloud Computing refers to both the applications, delivered as service and datacenters, where hardware and software existing to provide service to the consumers through internet. The services themselves have long been referred to as Software as a Service (SaaS), Data as a Service (Daas) is also called as a Cloud. When a Cloud is made available in a pay-as-you-go manner to the public is termed as Public Cloud; the service being sold is Utility Computing. Public Utility Computing includes Amazon Web Services, Google AppEngine, and Microsoft Azure. The term Private Cloud refers to internal datacenters of a business or other organization that are not made available to the public. Hence cloud computing is the sum of SaaS and Utility Computing, but does not normally include Private Clouds.

II. EVOLUTION OF CLOUD COMPUTING

Cloud computing has evolved from the most emerged technologies like grid computing, virtualization, utility computing in distributed computation environment with web based platforms. The concept of Cloud Computing came into existence in the year 1950 with implementation of mainframe computers, accessible via thin/static clients. The cloud computing has evolved from the concepts of grid, utility and SaaS. The development towards cloud computing started in the late 1980s with the concept of grid computing. Grid computing also named as On Demand Computing centers around moving a workload to the area of the required computing assets, which are for the most part remote and are promptly accessible for utilize. A grid is a group of servers where huge task could be separated into smaller tasks which will be keep running in parallel frameworks. Starting here of view, a grid could really be seen as only one virtual server and oblige applications to fit in with the grid programming interfaces. In the 1990s, the idea of virtualization was extended beyond virtual servers to to higher levels of abstraction. Storage and network resources, and subsequently the virtual application, which has no specific underlying infrastructure were applied in virtual platform. [1,2] Utility Computing is a concept established by John McCarthy, who predicted already in the late 1960s that "computation may someday be organized as a public utility". In utility computing, clusters are presented as virtual platforms for computing with a metered business model. Characteristics of clusters are that the computers being linked to each other are normally distributed locally, and have the same kind of hardware and operating system. Therefore cluster work stations are connected together and can possibly be used as a super computer. The utility approach also known as payper-use or metered services increasingly common in enterprise computing and is sometimes used for the consumer market for Internet service, file sharing, web site access and

other applications. More recently software as an service (SaaS) has raised the level of virtualization to the application, with a plan of action of charging not by the resources devoured but rather by the estimation of the application to supporters. In 2001, IBM began autonomic computing likewise called self-revision in which computers can naturally rectify themselves without human mediation. For example, consider a network of computers running a set of programs and when there is a hardware failure on one of the computers on the network, the programs running on that computer are transferred to other computers in the network. The following section discusses the great features exist with cloud computing which made an end user to use this computing concept easily. [4]

a. Characteristics of Cloud Computing

The following figure shows five essential characteristics that cloud computing offers for end users today and each is discussed below.

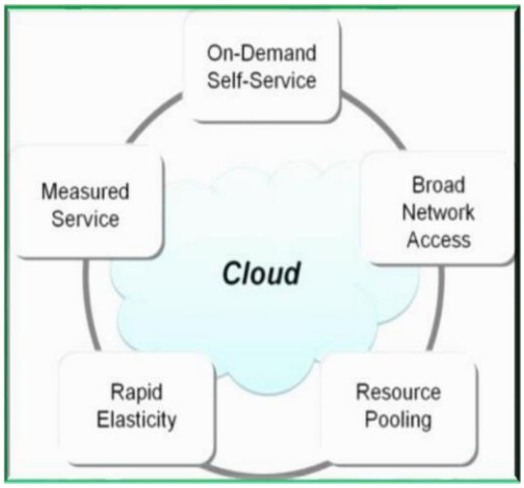

Figure.1. Characteristics of Cloud Computing

❖ **On-Demand Self Service**

On-demand self-service refers to the service provided by cloud computing vendors that enables the provision of cloud resources on demand whenever they are required. The users/consumers can unilaterally have provision to use computing power, storage, networks and software in a simple and flexible way. Most clients start by utilizing limited resources and increase them after some time. On-demand self-service strategy approves clients to demand resources on run time. [2]

❖ **Broad Network Access**

Access to resources in the cloud is accessible over different device types which are portable PCs, workstations, cell phones, tablets, workstations, thin clients etc. Resources are preserved by restricting the utilization which can be utilized in priority and significance of the workloads. Thus, network resources were additionally rare. IP-based systems were not in pervasive utilization four decades back; therefore, access to universal high-data transmission, low-latency network did not exist. Later years, costs related with the system have diminished as a result of assembling adaptability, commoditization of related innovations, and competition in the commercial center. As system data transmission has expanded, network access and scalability have also increased accordingly. [2]

❖ **Resource Pooling:** The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model in which multiple customers share adjacent resources in the cloud with their peers, are the basis of public cloud infrastructures. According to consumer demand, different physical and virtual resources are dynamically assigned and reassigned. There is a sense of area independence in that the client for the most part has no control or information over the correct area of the provided resources yet might have the capacity to indicate area at a larger level of abstraction (e.g., nation, state, or datacenter). Cases of resources include storage, handling, memory, and network transfer speed.

❖ **Rapid Elasticity**

The idea of rapid elasticity is one of the significant attributes that set cloud computing apart from customary datacenter computing. Different tenants exist in a cloud environment that share components of a common asset pool whereas on account of a private cloud, all the tenants are part of a single corporate entity. Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand ie., tenants use the networking, compute and storage assets in the shared pool, and then return them to the pool when they no longer need those assets. The well architected cloud, the acquisition and release of assets from and to the shared pool would be automated, based on service demands and driven by an intelligence policy. [2]

❖ **Measured Service.**

In the enterprise, metering services also referred to as "pay per use is a means of accountability. Metered services is necessary to the utility aspect of cloud computing. The major responsibilities of the service provider are to be transparent about how much of the shared infrastructure a particular tenant uses, and the cost of that usage. Resource usage can be monitored, controlled, and reported for both the provider and consumer of the utilized service efficiently and easily. Cloud frameworks automatically control and upgrade asset use by utilizing a metering ability at some level of abstraction fitting to the type of service like storage, preparing, transfer speed, dynamic client records etc. These are the five fundamental attributes of cloud computing which makes cloud computing all the more effective and successful innovation in today's world. The cloud model guarantees a move from an association to contribute intensely for constrained IT resources that are inside overseen, to a model where the association can purchase or lease resources that are overseen by a cloud supplier. The following section discusses about various deployment models.

b. Deployment Models for Cloud

In addition to considering five characteristics, cloud models are classified into deployment and service models. Deployment models refer to how any cloud service/services will be accessible to the users. As it known that cloud means cloud is included with virtualization and is defined as computers that are networked anywhere in the world with the availability of paying the used clouds in a pay-peruse way. The following specifies types of cloud model which are public, private, community and hybrid models that are exist in the real world and each model may have positive and negative aspects.

❖ **Public Cloud Model**

The Public Cloud Model allows systems and services to be easily accessible to public. Google, Amazon, Microsoft offers cloud services through internet are public cloud models. A public cloud encompasses the traditional concept of cloud computing having the opportunity to use computing resources,

cloud infrastructure from anywhere in the world and it exists on the premises of the cloud provider. It may be owned, managed, and operated by a business, academic, or government organization or some combination of them also has several advantages which make the people to use easily. The positive aspects are cost effectiveness, reliability, flexibility, location independence, utility style costing, and high scalability. But few limitations also exist which are low security and Less customizable. [9]

❖ **Private Cloud**

In this private cloud model, It allows the systems and services to be accessible only by the people in the organization which means other than the people in the specified organization are not allowed to use access the services. The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers. It might be claimed, managed, and worked by the association, an outsider, or some blend of them. Private clouds are typically datacenters that are utilized as a part of a private network and can consequently limit the unwanted public to get to the information and clearly along these lines has a more secure foundation and information protection than the customary public clouds. Energy is used efficiently is the other positive aspect. But still it has some negative aspects such as area is restricted to consumers, Inflexible Pricing, Limited Scalability and additional skills are required to get service. [2]

❖ **Community Cloud**

The cloud infrastructure is provisioned for selective use by a particular group of clients from a few associations that have shared concerns, for example, mission, security necessities, strategy etc. It might be managed, worked and owned by at least one of the associations in the group. This model has special advantage of sharing the data/information/resources among themselves of the same community and this sharing feature enhances cost effectiveness also. But the drawback is security aspect since all data is placed at one location, the consumer must be careful in storing data in community cloud because it might be accessible by others. In this model, the challenging task is allocating responsibilities for governance, security and cost. [6]

❖ **Hybrid Model**

The Hybrid Cloud is blend of public and private cloud. Non Critical exercises are performed utilizing public cloud while the basic exercises are performed utilizing private cloud. The cloud infrastructure is a composition of two or more distinct cloud infrastructures like private or public that remains unique entities. Application portability can be achieved by these combinations where they are bound together by standardized or proprietary technology. High scalability, flexibility, cost efficiency are the major advantages in this model. Dependency in Infrastructure may be more, than other models also some network issues and security compliance may arise in this hybrid model. The above discussed models are based on deployment where the following are different models based on services and is presented in the following section. [6]

b. Service Oriented Models for Cloud: In practice, cloud service can be grouped into three categories, software as a service (SaaS), platform as a service (PaaS), and infrastructure as a service (IaaS) [2]

❖ **Infrastructure as a Service (IAAS):** This is the most essential cloud administration and it is a development of virtual private server offerings depends intensely on the hidden infrastructure virtualization. IaaS specialist organization offer virtual server containing at least one cpu running a few decisions of working (IaaS). The end customer is purchasing raw compute, storage, and network transfer. These offerings can be delivered as a single server or as part of a collection of servers integrated into a VPDC (Virtual Private Data Center). A standardized, highly automated offering, where compute resources, complemented by storage and networking capabilities are owned and hosted by a service provider.[2]

❖ **Platform as a Service (PAAS)**

Platform as an administration typifies a layer of programming and gives it as an administration that can be utilized to construct larger amount administrations. The end client is acquiring an application domain on top of the no frills infrastructure. It offers a development platform for both completed and in progress cloud application. PaaS offer an environment where developer can develop to create and deploy applications and do not need to know how much memory and processors their application requires. The benefit of PaaS is that the engineer can purchase a completely practical improvement and additionally creation condition. Cases of this would be application stacks: Ruby on Rails, Java, or LAMP. [2]

❖ **Software as a Service (SAAS)**

In this model a software supplier permit a software application to be utilized and buy on request in multi occupant condition, keeps running on web program in customer machine. At present, this right now is the most noteworthy layer in the cloud stack. A single instance of the software runs on the cloud and services multiple end users or client organizations. For example, Gmail, NetSuite and SalesForce.com are some of the SaaS products. The SaaS may incorporate a few components which are Software can be managed from a focal area and is conveyed in a one to numerous mode, software up degree and patches require not be finished by clients.

III. CHALLENGES IN CLOUD COMPUTING

The term cloud computing is popularly used by the people in Information Technology industries because it provides various services as pay on demand. No consumer need to know working knowledge of cloud computing services and need not invest money for acquisition/maintenance to infrastructures /human resources/software &hardware. So this is becoming more worthy to any people for getting any service from cloud computing where some free services are also offered to the people. So the cloud computing becoming an emerged technology and most popular research thrust area. But it faces many challenges in different aspects of data and information handling. Some of these are presented as follows. [7,8]

❖ **Interoperability**

It means the application on one platform should be able to incorporate services from the other platforms. It is made conceivable through web administrations; yet growing such web administrations is extremely complex. [7]

❖ **Security and Privacy**

Security and Privacy of data is the greatest test to cloud computing. Security and protection issues can be overcome by utilizing encryption, security equipment and security applications.

❖ **Portability**

This is another test to cloud computing that applications ought to effectively be moved starting with one cloud supplier then onto the next. There must not be seller secure. However, it is not yet made possible because each of the cloud providers uses different standard languages for their platforms.

❖ **Computing Performance**

Data intensive applications on cloud require high network bandwidth, which results in high cost. Low data transfer capacity does not meet the coveted computing execution of cloud application.

❖ **Reliability and Availability**

It is important for cloud frameworks to be solid and strong on the grounds that the vast majority of the organizations are currently getting to be plainly subject to administrations gave by outsider.

IV. CONCLUSION

Cloud computing is the evolution of a various emerged technologies such as virtualization, grid computing and utility computing that have come together using various network capabilities to alter an organization's approach to building an IT infrastructure. Based on deployment and service, various cloud computing models are developed where each model serves differently to the end users. The coming of cloud computing lately has started an enthusiasm from various associations, establishment to exploit web applications. These model guarantees the business/benefit associations to show more enthusiasm to utilize resources pay per utilize/purchase or lease resources than contributing more cash with restricted offices This paper tended to about the development of cloud computing, advancements which are embraced in cloud computing are talked about. The characteristics of cloud computing, various deployment and service based cloud models are addressed in this paper. Despite having special features cloud computing is facing challenges to support interoperability, security, privacy, portability, computing performance, reliability and availability efficiently are also discussed. Many people believe that Cloud will reshape the entire ICT industry as a revolution so it is becoming a more thrust area to researchers to find more services efficiently facing challenges. In future, any industry may expect to use more service providers for various aspects like data as a service provider, network as a service provider and so on.

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VII. BIOGRAPHY:

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