Basics of Cloud Computing

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Abstract— Cloud computing is a transformative computing paradigm that involves delivering applications and services over the internet. Cloud computing involves provisioning of computing, networking and storage resources on demand and providing these resources as metered services to the users, in a "pay as you go" model. In this paper basics of cloud computing is presented which will help to learn about the characteristics, service models, various deployment models, driving factors and challenges of cloud computing.

Keywords: Cloud computing, cloud service models, cloud deployment models, security.

I. INTRODUCTION

The U.S. National Institute of Standards and Technology(NIST) [1] defines 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. Users can use the services available in the cloud by means of internet connection. The computing and storage resources provided by cloud service providers are pooled to serve multiple users using multi-tenancy. Multi-tenant aspects of the cloud allow multiple users to be served by the same physical hardware. Cloud computing allows the users (individuals, large organizations, small and medium enterprises and governments) to outsource the IT infrastructure requirements to external cloud providers. Thus, the consumers can save large upfront capital expenditures in setting up the IT infrastructure and pay only for the operational expenses for the cloud resources used. Many companies are delivering services from the cloud. Some of them are

Google-It has private cloud that offers an online productivity, which includes accessing email, documentations, text searching, location finding, and social applications.

Salesforce- Salesforce allows the user to deliver revolutionary services to customer from anywhere, any device at any time.

Cloud computing is a model technique found everywhere by everybody in every time, it is convenient and shared pool of configuration mainly lends enormous help in IT business. There are countless definitions and explanations of cloud can be found from various multiple resources. The term comes from network diagrams in which cloud shape is used to describe the process. A user can upload his/her data to a remote machine and retrieve it later from anywhere for their use without much struggle.

II. CLOUD CHARACTERISTICS

Cloud computing technology consists of five essential characteristics, mainly depends on its resources

A. On-demand Self Service: Cloud computing resources can be provisioned on-demand by the users, without requiring interactions with the cloud service provider.

B.Broad Network Access: Resources in the cloud can be accessed over the network using standard access mechanisms that provide platform-independent access through the use of heterogeneous client platforms such as workstations, laptops, tablets and Smartphone's.

C. Rapid elasticity: Cloud resources can be provisioned rapidly and elastically. Based on demands it can be scaled up or down. Here scaling-out involves launching and provisioning additional server resources and scaling-up involves changing the computing capacity assigned to the server.

D. Measured Service: Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth and active user accounts). Usage of resources in cloud can be utilized in a proper manner under a supervision with the knowledge of the provider and consumer.

E. Resource Pooling: The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. Customers generally has no idea about the location of the knowledge stored and the resources provided by the provider.User may be able to specify location at a higher level of abstraction (e.g., country, state or datacenter). Examples of resources include storage, processing, memory and network bandwidth.
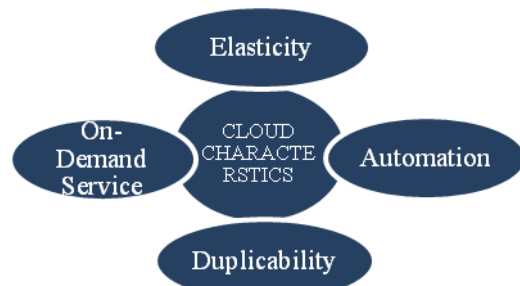

Figure 1: Characteristics of Cloud

III. SERVICE MODELS

Cloud computing follows service model architecture. There are mainly four models of cloud computing:

- Software as a Service(SaaS)
- Platform as a Service(PaaS)
- Infrastructure as a Service(IaaS)
- Network as a Service(NaaS)

A. Software-as-a-Service (SaaS): SaaS provides the users a complete software application or the user interface to the application itself. The cloud service provider manages the underlying cloud infrastructure, including servers, network, operating systems, storage and application software, and the user is unaware of the underlying architecture of the cloud. Applications are provided to the user through a thin client interface (e.g., a browser). SaaS applications are platform independent and can be accessed from various client devices such as workstations, laptop, tablets and smart phones, running different operating systems. Google Apps and Sales force are examples of this model.

B. Platform-as-a-Service (PaaS): PaaS provides the users the capability to develop and deploy applications in the cloud using the development tools, application programming interfaces (APIs), software libraries and services provided by the cloud service provider. The cloud service provider manages the underlying cloud infrastructure, including servers, network, operating systems and storage. Example is google application engine which allows applications to run on windows Azure and Google's infrastructure.

C. Infrastructure-as-a-Service (Iaas): IaaS provides the users the capability to provision computing and storage resources. Users can start, stop, configure and manage the virtual machine instances and virtual storage. Users can deploy operating systems and application of their choice on the virtual resources provisioned in the cloud. The cloud service provider manages the underlying infrastructure. Virtual resources provisioned by the users are billed based on a pay-per-use paradigm.eg: Amazon web services with EC2, Google compute Engine, Azure VMs.
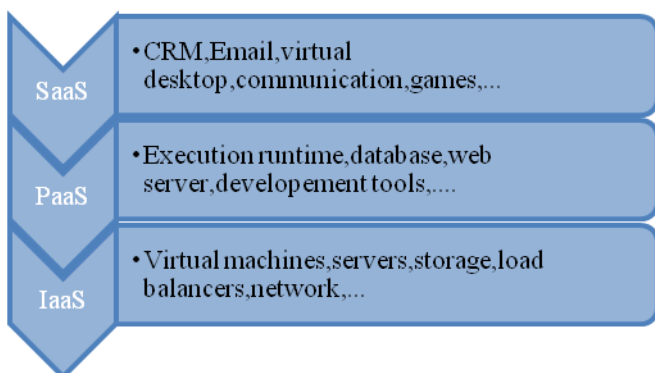
The three cloud service models are shown in Figure 2

Figure 2: Service model of Cloud Computing

D. Network-as-a-Service (NaaS): NaaS can include flexible and extended Virtual Private Network (VPN), bandwidth on demand, custom routing, multicast protocols, security firewall, intrusions detection and prevention, Wide Area Network (WAN), content monitoring and filtering, and antivirus[7]. Here you no more have to support the infrastructure, also there is no need of knowledge for developing and maintaining the infrastructure, application or development environment.

IV. DEPLOYMENT MODELS OF CLOUD

Clouds are deployed into various models in order to access the resources in commensurate way, also one can subscribe to depending upon their needs.

Public Cloud: Cloud services are available to the general public or a large group of companies. The cloud resources are shared among different users (individuals, large organizations, small and medium enterprises and governments). The cloud services are provided by a third-party cloud provider. Public clouds are best suited for users who want to use cloud infrastructure for development and testing of applications and host applications in the cloud to serve large workloads, without upfront investments in IT infrastructure
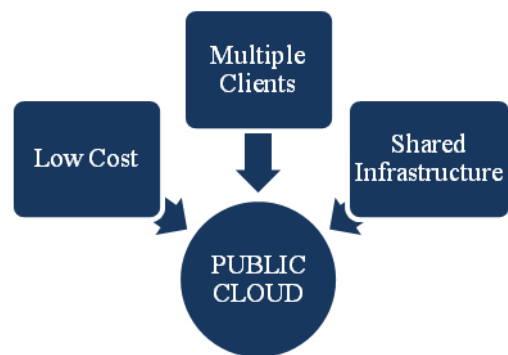
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Figure 3: Public Cloud

B. Private Cloud: In the private cloud deployment model, cloud infrastructure is operated for the exclusive use of a single organization. Private cloud services are dedicated to a single organization. Cloud infrastructure can be set up on premise or off-premise and may be managed internally or by a third-party. It is secure and valuable than public clouds.
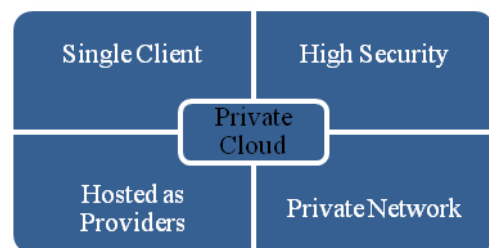

Figure 4: Private Cloud

C. Community Cloud: Community cloud services are shared by several by several organizations that have the same policy and compliance considerations. Community clouds are best suited for organizations that want access to the same

applications and data, and want the cloud costs to be shared with the larger group.
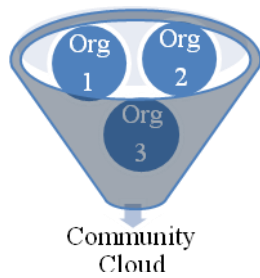

Figure 5: Community Cloud

D. Hybrid Cloud: The hybrid cloud deployment model combines the services of multiple clouds (private or public). The individual clouds retain their unique identities,but are bound by standardized or proprietary technology that enables data and application portability.
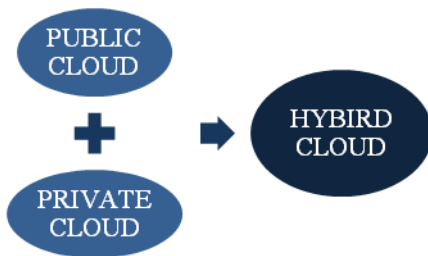

Figure 6: Hybrid Cloud

V.BENEFITS OF CLOUD

The company with cloud storage provider can have a recovery plan in place due to disaster.While it probably will not be the only a portion of the overall recovery protocol, it can be a useful tool to help get the company get back on its feet in the event of a natural disaster or system meltdown. Not only the company will get benefits each and every cloud user will enjoy the following benefits.

A. Cost Efficiency: This is the biggest advantage of cloud which eliminates individual investment. Cloud generally available for all at very low cost, there is no need for infrastructure cost.Everyone can able to utilize the resources available in cloud

B. Accessibility: You can access all files, folder, photos and videos in the cloud from anywhere in the world. Of course, provided you have the necessary credentials and internet access.

C. Recovery: One of the major advantages of using cloud storage is the users are having backup for their data storage . If something happens to the files on a computer, you can always access the cloud and retrieve any data that may have been damaged of lost.

D. Easily Upgraded: Software integration will be carried out in an automatic and organic way in the cloud installations.

Services and applications for the business process can be chosen by the organizations to suit their needs.

E. Productivity Anywhere: Cloud is a massive pool of resources; one can get what they need beyond at anytime, anywhere. Also Plethora of electronic devices able to have access to the internet.

Figure 7: Benefits of Cloud

VI.CHALLENGES OF CLOUD COMPUTING

Security is very important and biggest concern in cloud computing. Data integrity, data availability, data security, data confidentiality, transparency of data and control over data are the major issues here. Let us discuss the challenges in cloud computing.

A. Data Security and Privacy: Data protection is among the biggest concerns in cloud computing. Mainly end users security and privacy are in the hands of the service provider. It is essential to ensure the cloud provider understands the end user's security and privacy needs, which normally presents the hugest challenge. The users have to check their cloud providers data security and privacy rules and regulations because there is a big chance of third party involvement in the confidential information shared in cloud. Hence, data security and privacy remains one of the major worries when it comes to the risks and challenges of cloud computing.

B. Record Retention Requirements: If at all there are any matters to do with record retention requirements while considering adopting the cloud, then it will be a challenging factor. Thus, it is fundamental to ensure the cloud vendor considers what they are and so they can conform to them. Also, there is the aspect of what really happens when the service provider decides to shut down the business or a choice is made to terminate contract with the cloud provider.

C. Disaster Recovery: The hosting of data and IT resources on the cloud transfers most of the disaster recovery plans to the cloud provider. The cloud computing company's disaster recovery capabilities should be updated to a great extent which determines the user's disaster recovery measures. The challenge and risk here is that if the service provider's cloud platform is knocked out by let's say, an internal system issue or with malicious attackers, data could be permanently lost. Such cases have happened in the past, which makes it vital to always back up important data or persisting on data loss legal action agreement to avoid any damages if the cloud disaster recovery permanently fails.
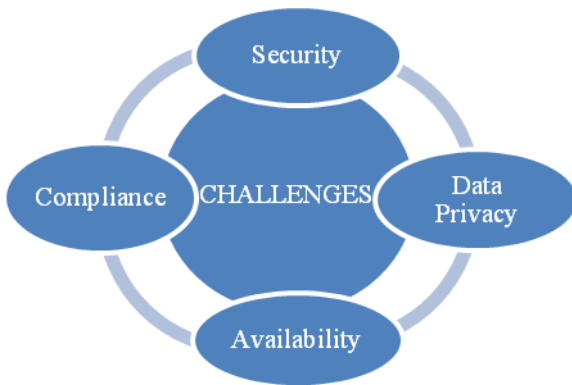
Figure 8:Cloud Challenges

D. Shared Access: One of the primary benefits that come with cloud computing, especially the public cloud, is the unrelated multiple sharing of CPU, storage, namespace, and memory. This is the out of control fact which affects the privacy of cloud users.Risk of private data and shared resources accidentally getting into the hands of other people is relatively possible. Here the access is shared so there is possibility of viewing others data easily with out that particular persons permission and knowledge.

E. Lack of Standardization: The challenge of various provider security features as there is a common lack of cloud standardization. Many facets are in play when it comes to matters of cloud safety as the regulations and systems governing the cloud service provider differ.

There are no clearly outlined guidelines that direct the operations of cloud providers. Different cloud providers built their structure differently,that is a "safe cloud system" among the providers will varies accordingly. As a result, the lack of cloud standardization signifies a challenge in cloud computing.

VII.CONCLUSION

This Survey paper presents an introduction to cloud computing, various services and models available in cloud, advantages and disadvantages. As much as there are many benefits of cloud computing, cloud adoption also brings in various risks and challenges as listed above. Security and privacy concerns extended by the providers/companies are not adequate,they have to concentrate on security issues and should provide confidentiality to cloud users.

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