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Cloud: A New Generation

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Abstract: Cloud computing is a highly discussed topic in the technical world. The software industry is entering in the development of cloud services at a faster pace. Now many corporations have involved in the cloud computing related techniques and many cloud computing platforms have been put forward. This is a favorable situation to study the applications of cloud computing related techniques. Cloud computing platforms provide easy access to a company's high-performance computing and storage infrastructure through web services. With cloud computing, the aim is to hide the complexity of IT infrastructure management from its users. This paper discusses cloud computing introduction, its various platforms and their comparison, and also discusses various requirements at different levels.

Keywords: Cloud Computing, Platforms, Comparison, Various Requirements

I. History

In the modern era Internet has been flourishing at a very fast pace. Now the users' desideratum is realized through the Internet. The cost of storage, hardware and the power consumed by computer is increasing. The large campaigns have to accumulate data source fully to accumulate their business needs. Because of all these problems, it is must to develop this new emerging technique, Cloud Computing. It utilizes the vacant resources of computer, improves utilization rate which in turn improves the economic efficiency, decreasing energy consumption of equipments.

II. Introduction

Cloud computing is an emerging computing technology due to its ability to reduce costs associated with computing. Cloud computing increases the scalability and flexibility for computing processes that uses the internet. Cloud computing allows consumers and businesses to use applications without installation and access their personal files at any computer with internet access. Cloud computing is the technique to minimize the processing burden on the users' end. This technology allows for much more efficient computing by centralizing storage, memory, processing and bandwidth. This is skilled by steadfast amending the handling ability of the "cloud", i.e. simplifying the users' terminal to a simple input and output devices, and providing the powerful computing capacity of the cloud on-demand. All this is possible with the help of an Internet connection using a regular browser or other connection.

A. Definition

"Cloud" is a virtualized pool of computing resources. It rapidly deploys and increase workload by providing speedy physical machines or virtual machines. It manages a variety of different workloads, including the batch of back-end operations and user-oriented, interactive applications [1]. It also supports redundancy, self-composed and highly scalable programming model, so that it's possible to recover from any kind of software/hardware failure. It also monitors resource usage and reshuffle the allocation of resources when needed [2].

B. Service Model

Software-as-a-Service (SaaS): It is the delivery of applications that are licensed for use, and are provided for users on demand over public or private network. It is a kind of service where in users can use this software hosted by the

service provider and pay only for time its being used. This is a “Pay-as-you-use” model. It reduces the burden of updating the software to the latest version, licensing and is much economical. It is basically deployed over Internet and/or to run behind a firewall in LAN or PC. Google Apps, Customer Relationships Management (CRM), Sales Force Automation are the examples of service providers [3].

Platform-as-a-Service (PaaS): It is the delivery of facilities that are required to support the complete lifecycle of buildings and delivering applications and services over a cloud infrastructure[**Secure cloud computing**]. This kind of service allows customers to design, build, test, deploy and update its own programs. It can be then delivered to the users through Internet and servers. Google App Engine, Sales Force, Microsoft Azure are the examples of service providers [3].

Infrastructure-as-a-Service (IaaS): It is a kind of service that delivers a platform virtualization environment. User has no need of purchasing servers, softwares, memory space or network equipments, instead can buy the resources as a fully outsourced service. Flexiscale, Eucalyptus, AWS are the examples of service providers [3].

Apart from these service models, the following extensions to services exist: Communication-as-a-Service (CaaS), Security-as-a-Service (SECaaS), Monitoring-as-a-Service (MaaS), Storage-as-a-Service (STaaS), Desktop-as-a-Service (DTaaS), Compute Capacity-as-a-Service (CCaaS), Database-as-a-Service (DBaaS), Hardware-as-a-Service (HaaS), IT-as-a-Service (ITaaS), and Business Process-as-a-Service (BPaaS) [3].

III. Deployment Model

Public Cloud: In this infrastructure resources such as storage and applications, are made available to multiple customers by a single service provider, via a web application or web service over the Internet. The resources are located at an off-site location that is managed and controlled by the service provider. The public cloud has compelling advantages such as low-cost or pay-on-demand, highly scalable, but at the same time there existing some danger of security, quality of service (QoS) [3].

Private Cloud: In this infrastructure resources are used and controlled by a private organization. It may exist at an on-site or off-site location. This model is more secure, compliant, and transparent. However, it requires more capital expenditure, operational expenditure, highly skilled team [3].

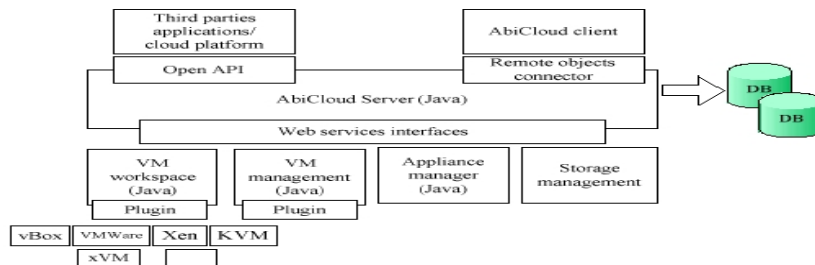
Community Cloud: In this infrastructure several organizations, who have shared interests such as mission, values, policies, requirements, construct and share the same cloud. It may exist at an on-site or off-site location. The members of this cloud have access to the data and applications. The main advantage is that, it is very economical as compared to the private cloud [3].

Hybrid Cloud: It is a combination of two or more clouds that are bound together using some standards and technologies. Applications that require less security, minimal compliance can be run on the public cloud, while private cloud is used for business-critical services, secured data. It can also ask for public cloud during peak workload [3].

IV. Comparison of Various Cloud Computing Platforms

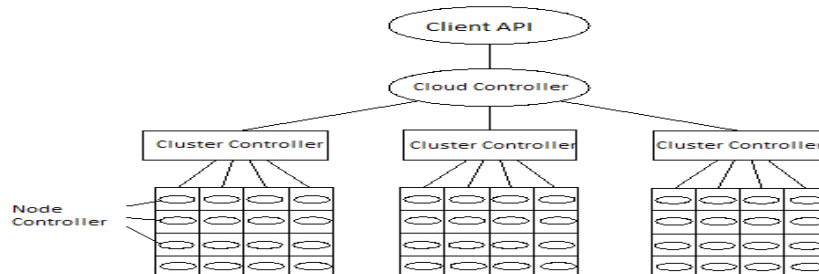
A. ABICLOUD CLOUD COMPUTING PLATFORM

Abicloud is a cloud computing platform developed by Abiquo, a company locates in Barcelona Spain that is mainly focused on the development of cloud platform [8]. It can be used to build, integrate and manage public as well as private cloud in the homogeneous environments [4]. The architecture of Abicloud is illustrated in figure 1.

Fig. 1 Abi Cloud Platform Structure

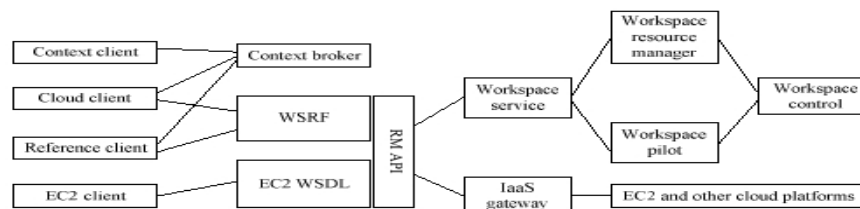
B. EUCALYPTUS CLOUD PLATFORM

Eucalyptus (Elastic Utility Computing Architecture for Linking Your Programs [8]. To Useful Systems) project began from California University Santa Barbara, and mainly was used to build open-source private cloud platform [5]. Now it has been run by Eucalyptus System Company. Eucalyptus is an open-source implementation of Amazon EC2 and compatible with business interfaces. It also implement virtualization depending on Linux and Xen as EC2 does. Figure 2 demonstrates the topology structure of Eucalyptus resources.

Fig. 2 Eucalyptus Cloud Platform Structure

C. NIMBUS CLOUD COMPUTING PLATFORM

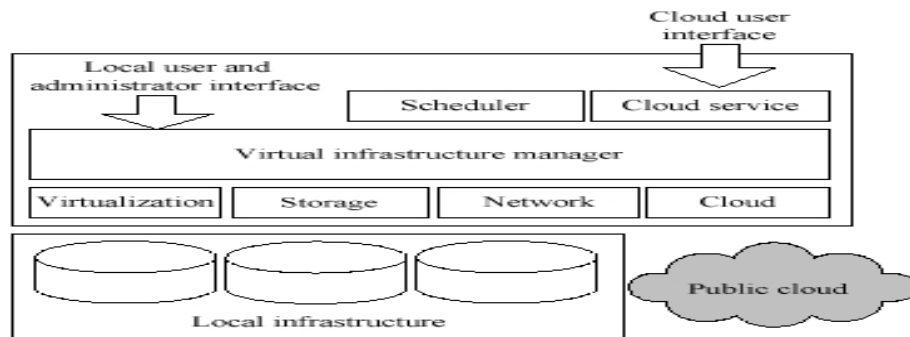
Nimbus is an open tool set, and also a cloud computing solution providing IaaS [8]. Put forward based on scientific research in the early stage, Nimbus have supported many nonscientific research domain applications [7]. It permits users lease remote resources and build the required computing environment through the deployment of virtual machines. Figure 3 demonstrates the Nimbus cloud computing platform.

Fig. 3 Nimbus Cloud Platform Structure

a. OPENNEBULA CLOUD COMPUTING PLATFORM

OpenNebula is one of the key technologies of reservoir plan and the flagship research project in virtualization infrastructure and cloud computing of European Union [8]. Like Nimbus, OpenNebula is also an open source cloud service framework [6]. The structure of OpenNebula is illustrated in figure 4.

Fig. 4 OpenNebula Cloud Platform Structure



Now we can compare various features of different cloud platforms. This comparison is shown in Fig. 5.

Fig 5. Comparison of various Cloud Computing Platforms

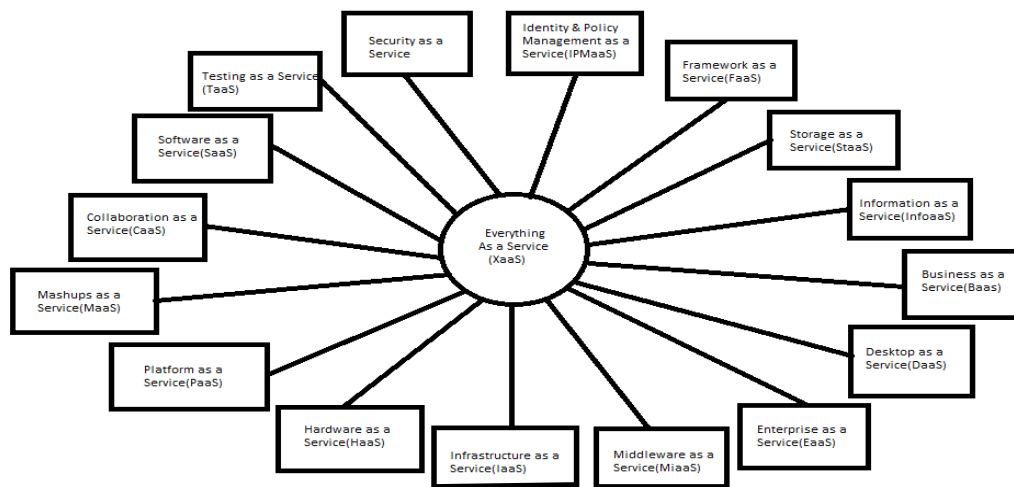
	AbiCloud	Eucalyptus	Nimbus	OpenNebula
Cloud Character	public/private	Public	public	Private
Scalability	Scalable	Scalable	scalable	Dynamical, scalable
Cloud form	IaaS	IaaS	IaaS	IaaS
Compatibility	Not support EC2	support EC2, S3	support EC2	open, multi-platform
Deployment	pack and redeploy	Dynamical deployment	dynamic deployment	Dynamical Deployment
Deployment Manner	web interface drag	Commandline	Commandline	Commandline
Transplantability	Easy	Common	Common	Common
VM support	VirtualBox, Xen, VMWare, VM	VMWare, Xen, KVM	Xen	Xen, VMWare
Web Interface	Libvirt	Web Service	EC2 WSDL, WSRF	libvirt, EC2, OCCI API
Structure	open platform encapsulate core	Module	Lightweight Components	Module
Reliability	-	-	-	rollback host and VM
OS support	Linux	Linux	Linux	Linux
Development	ruby, C++,	Java	Java, Python	Java

Language	python			
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V. Everything as a service

This cloud model promotes availability and is composed of five essential characteristics (Rapid Elasticity, Measured Service, On-Demand Self-Service, Ubiquitous Network Access, Location-Independent Resource Pooling), three delivery models (Software as a Service, Platform as a Service, and Infrastructure as a Service), and four deployment models (Public Cloud, Private Cloud, Community Cloud and Hybrid Cloud).

Fig. 6 Cloud: Everything is a service



VI. Various Requirements

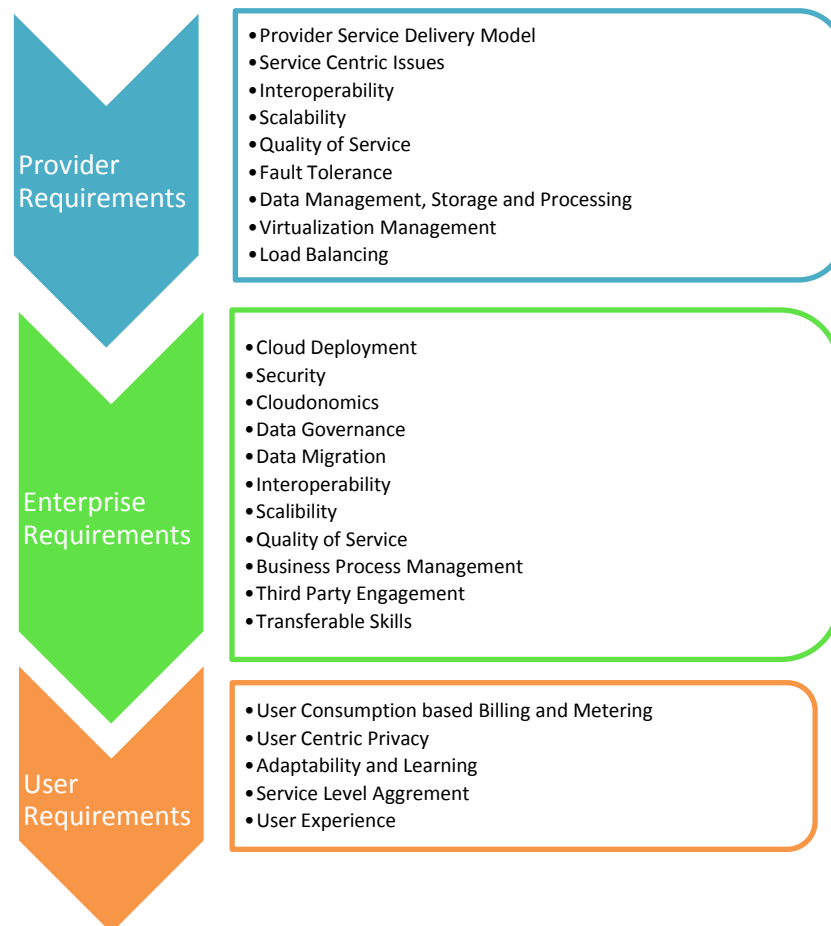
A. Provider Requirements

This section describes the requirements at provider level [9].

1. **Provider Service Delivery Model:** There are three service delivery models in a cloud such as Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS).
2. **Service-Centric Issues:** Cloud Computing has to fulfill the enterprise's IT management's requirements. For this cloud services should be autonomic, self describing and economic.
3. **Interoperability:** For easy integration and migration of applications a cloud must focuses on open protocols/API or open data formats.
4. **Quality of Service:** A cloud must provide the service quality such as security, reliability and dependability, etc.
5. **Fault Tolerance:** a cloud must be able to continue the system operations even if there is any failure of any component.
6. **Data management, Storage, and processing:** There must be replication of data and it must be stored at trusted host, so that there is no risk of data privacy.
7. **Virtualization Management:** It is a process to hide logical resources away from their physical resources, so that we can improve flexibility, enhance business value and reduce costs. It can be done in many ways, such as Server, Client/Desktop, Storage, Network, Resource, Infrastructure, Service/application.

8. Scalability: It is a technique through which a software system can manage increased complexity when given additional resources. It can be done in two ways: Horizontal and Vertical. Wherein Horizontal provides load balancing and vertical deals with resources used.
9. Load Balancing: It is the mechanism of managing the work load within the cloud entities. Its requirement is during limited resources allocation, hardware failure, power and network interruption and many more.

Fig. 7 Requirements Chart



B. Enterprise Requirements

This section describes the requirements at enterprise level [9].

1. Cloud Deployment for Enterprise: Each type of Cloud has its own Trade-offs. In case of Public Cloud resources are dynamically supplied over the internet on a self service basis. In case of Private cloud services and infrastructure is shared as a single user environment. In Community cloud several organizations as a community shares the services. In Hybrid cloud there are multiple providers to provide cost saving, scalable on-demand infrastructure and security.
2. Security: It is the major concern for data, infrastructure and virtualization. The main question arises “How to secure the data in a shared environment”.
3. Cloudonomics: It is basically cloud + economics. For finding actual cost benefits from various vendors for pay-per-use model, cloudonomics is needed.

4. Data governance: This is a major issue because data is being moved from one location to other may violate rules and regulations for data privacy at different locations.
5. Data Migration: For distributing the data to web users in an effective and efficient manner, it must ensure some goals, such as No data loss, High availability, High performance, Scalability, Cost efficiency and Security.
6. Business Process Management: It provides consistent rules, security and business structure.
7. Third Party Engagement: Their involvement helps in establishing communication plan with provider landscape, continuity of cloud service engagements, legal implications, cloud audit, and reporting capabilities.
8. Transferable Skills: It manages discussion with consulting expert groups, technical support, technology dissemination, or offshore outsourcing that help in adaptation and stability of system/application.

C. User Requirements

Users want their data to be safe and lossless. It should be available to them whenever required. This section describes the requirements at user level [9].

1. User Consumption-based billing and metering: It is similar to allocation of cost of gas, water, and electricity consumption on a consumption unit basis. It helps to check the utilized resources versus cost.
2. User-Centric Privacy: Privacy is a major issue so users want their sensitive data to be stored at mega-data centers located around the world. A corporation would never store sensitive data on cloud.
3. Service level Agreements: It is a contract between providers and users of delivering the services according to predefined agreements.
4. Adaptability and Learning: Users need to be familiar with an application presented by the enterprises when trying to deal with clouds. Providers can provide intelligent and interactive demonstration. They can design the application in such a way that it becomes user-friendly.
5. User Experience: It helps in understanding the needs and behaviors of end-user which will ultimately help in productivity, usability and desirability of the application.

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