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A Survey on Cloud Computing –Design & Architecture, Applications and Research Anxiety

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ABSTRACT: Cloud computing is the designing of parallel computing, distributed computing, grid computing and virtualization technologies which describe the shape of a new age. Cloud computing is a developing model of business computing. In this survey paper, we explain the model of cloud architecture and associates cloud computing with grid computing. We also try to define the characteristics and applications of numerous popular cloud computing platforms. In this survey, we wish to identify the challenges and problems of cloud computing. We recognised numerous challenges from the cloud computing implementation perception and we also emphasized the cloud interoperability dispute that requires significant additional research and development. However, safety and confidentiality issues present a strong barrier for users to familiarise into cloud computing systems. In this paper, we examine a number of cloud computing system providers about their concerns on security and privacy problems.

KEYWORDS: Cloud computing, architecture, challenges, cloud platforms, research issues

I. INTRODUCTION

Cloud computing is a complete new technology. It is the expansion of parallel computing, distributed computing, grid computing, and is the combination and progression of Virtualization, Utility computing, Software-as-a-Service (SaaS), Infrastructure-as-a-Service (IaaS) and Platform-as-a-Service (PaaS). Cloud is a symbol to define web as a space where computing has been preinstalled and occur as a service; data, operating systems, applications, storage and processing power occur on web are ready to be shared. For users, cloud computing is a Pay-per-Use-On-Demand mode that can appropriately access shared IT resources over the Internet. The IT resources include network, server, storage, application, service and so on and they can be organized with much fast and simple manner and also interactions with service providers. Cloud computing can improve the availability of IT resources with Pay-per-Use-On-Demand mode; this would benefit and save the cost to buy the physical resources over other computing techniques.

II. ARCHITECTURAL COMPONENTS

Cloud service models are generally categorized in 3 different models as SaaS, PaaS, and IaaS. Fig. 1 shows a cloud reference architecture that makes the most important security-relevant cloud components explicit and provides an abstract overview of cloud computing for security issue analysis.

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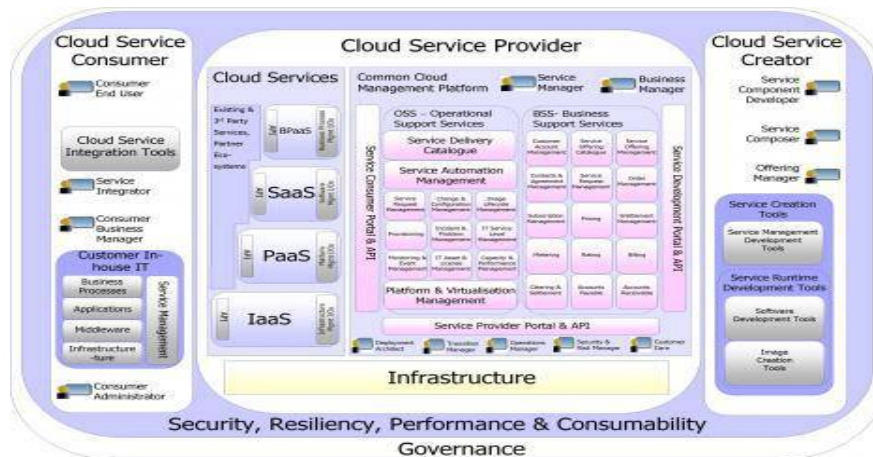


Fig: Cloud computing reference model

A. Software as a Service (SaaS)

Cloud users release their applications in a hosting environment, which can gain access through networks from different clients (e.g. Web browser, PDA, etc.) by application users. Cloud customers do not have control over the cloud infrastructure that frequently employs multi-tenancy system architecture, specifically, different cloud consumers' applications are organized in a single logical environment in the SaaS cloud to achieve economies of scale and optimization in terms of speed, security, availability, disaster recovery and maintenance. Examples of SaaS include Salesforce.com, Google Mail, Google Docs, and so on.

B. Platform as a Service (PaaS)

PaaS is an advanced platform supporting the full "Software Lifecycle" which permits cloud users to develop cloud services and applications (e.g. SaaS) directly on the PaaS cloud. Henceforth, the difference between SaaS and PaaS is that SaaS only hosts completed cloud applications whereas PaaS offers a development platform that hosts both completed and in-progress cloud applications. This requires PaaS, in addition to supporting application hosting environment, to possess development infrastructure including programming environment, tools, configuration management, and so forth. An example of PaaS is Google AppEngine.

C. Infrastructure as a Service (IaaS)

Cloud consumers directly use IT infrastructures (processing, storage, networks and other fundamental computing resources) provided in the IaaS cloud. Virtualization is extensively used in IaaS cloud in order to integrate/decompose physical resources in an ad-hoc manner to meet growing or shrinking resource demand from cloud consumers. The main approach of virtualization is to build up independent virtual machines (VM) that are insulated from both the underlying hardware and other VMs. Notice that this strategy is different from the multi-tenancy model, which aims to transform the application software architecture so that multiple instances (from multiple cloud consumers) can run on a single application (i.e. the same logic machine). An example of IaaS is Amazon's EC2.

D. Data as a Service (DaaS)

The delivery of virtualized storage on demand becomes a separate Cloud service - data storage service. Notice that DaaS could be seen as a special type IaaS. The motivation is that on-principle enterprise database systems are frequently tied in a prohibitive upfront cost in dedicated server, software license, post-delivery services and in-house IT maintenance. DaaS allows consumers to pay for what they are actually using rather than the site license for the entire

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database. In addition to traditional storage interfaces such as RDBMS and file systems, some DaaS helps to provide table-style ideas that are planned to scale out to store and retrieve a large amount of data within a very compressed timeframe, often too large, too expensive or too slow for most commercial RDBMS to cope with. Some Common types of DaaS example include Amazon S3, Google BigTable, and Apache HBase, etc.

III. COMPARISON BETWEEN CLOUD AND GRID COMPUTING

A comparison [6] can be summarized as follows:

- 1) Construction of the grid is to complete a specified task, such as biology grid, Geography grid, national educational grid, while Cloud computing is designed to meet general application and there are not grid for a special field.
- 2) Grid emphasizes the “resource sharing” to form a virtual organization. Cloud is often owned by a single physical organization (except the community Cloud, in this case, it is owned by the community), who allocates resources to different running instances.
- 3) Grid aims to provide the maximum computing capacity for a huge task through resource sharing. Cloud aims to suffice as many small-to-medium tasks as possible based on users’ real-time requirements. Therefore, multi-tenancy is a very important concept for Cloud computing.
- 4) Grid trades re-usability for (scientific) high performance computing. Cloud computing is directly pulled by immediate user needs driven by various business requirements.
- 5) Grid strives to achieve maximum computing. Cloud is after on-demand computing – Scale up and down, in and out at the same time optimizing the overall computing capacity.

IV. POPULAR CLOUD COMPUTING PLATFORMS

A. AbiCloud

Abicloud is a cloud computing platform, It is used to build, assimilate and manage public as well as private cloud in the homogeneous environments. With Abicloud, user can simply and spontaneously organize and manage the server, storing system, network, virtual devices and applications and so on. The key difference between Abicloud and other cloud computing platforms is its commanding web-based management feature and its primary encapsulation manner. Using Abicloud, user can varnish organising a new service by just dragging a virtual machine with mouse. This is much simpler and flexible than other cloud computing platforms that organise new services through command lines.

B. Eucalyptus

Eucalyptus (Elastic Utility Computing Architecture for Linking Your Programs to Useful Systems) mostly was used to form open-source private cloud platform. Eucalyptus is an elastic computing structure that can be used to connect the users' programs to the suitable systems, it is an open-source structure using clusters or workstation implementation of elastic, utility, cloud computing and a popular computing standard based on a service level protocol that allows users to rent network for computing capability.

Presently, Eucalyptus is well-matched with EC2 from Amazon, and may support more other kinds of clients with minimum modification and extension.

C. Nimbus

Nimbus is an open platform and its as also a cloud computing solution providing IaaS. It allow users let remote resources and form the essential computing environment through the organisation of virtual machines. Usually, all these functional components can be categorized into three kinds. The first kind of module is client- supported which are used to support all kinds of cloud clients. Context client module, cloud client module, reference client module and EC2 client module are all belongs to this kind of component. The second kind of component is generally service-

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supported modules of cloud platform, supporting all kinds of cloud services. It comprises a context agent module, web service resource framework module, EC2 WSDL module and a remote interface module. The another kind of component is the background resource management modules which are generally used to handle all kinds of physical resources on the cloud computing platform, comprising work service management module, IaaS gateway module, EC2 and other cloud platform support module, workspace pilot module, workspace resource management module and workspace controller.

D. OpenNebula

OpenNebula is also an open source cloud service framework. It permits user to deploy and manage virtual Machines on physical resources and it can set user's data centres or clusters to flexible virtual infrastructure that can automatically familiarise to the change of the service load. The main difference between OpenNebula and nimbus is that nimbus implements remote interface based on EC2 or WSRF through which user can process all security related issues, while OpenNebula does not.

APPLICATIONS

There are some applications of cloud computing are as follows:

- 1) Cloud computing delivers trustworthy and secure data storage centre.
- 2) Cloud computing can comprehend data sharing between different equipment's.
- 3) The cloud offers almost infinite possibility for users to use the internet.
- 4) Cloud computing does not require high quality equipment for the user and it is simple to use.

V. ISSUES IN CLOUD COMPUTING

Increasingly information on individuals and companies is placed in the cloud; anxieties are starting to raise about how safe an environment it is? Issues of cloud computing can describes as follows:

A. Privacy

Cloud computing employs the virtual computing technology, users' personal data may be distributed in several virtual data centres rather than stay in the same physical location, users may leak unseen information when they are gain access to cloud computing services. Attackers can analyse the serious job depend on the computing task submitted by the users.

B. Reliability

The cloud servers also experience downtimes and slowdowns as our local server.

C. Legal Issues

Worries stick with safety measures and confidentiality of individual all the way through legislative levels. D. Compliance

Frequent regulations affect to the storage and use of data entails regular reporting and audit trails. In adding to the requirements to which customers are subject, the data centres upheld by cloud providers may also be subject to obedience requirements.

E. Freedom

Cloud computing does not permit users to physically own the storage of the data, parting the data storage and control in the hands of cloud providers.

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F. Long- Term Viability

You should be definite that the data you put into the cloud will never become worthless even your cloud computing provider go poor or get assimilated and swallowed up by a bigger company.

G. Issues in Cloud Interoperability

1) Intermediary Layer

A number of latest works address the interoperability problem by providing an intermediary layer between the cloud consumers and the cloud-specific resources (e.g. VM).

2) Open Standard

Standardization looks to be a good solution to address the interoperability problem. Nevertheless, as cloud computing just starts to take off, the interoperability problem has not seemed on the pressing agenda of major industry cloud vendors.

3) Open API

SUN has newly launched the Sun Open Cloud Platform under the Creative Commons license. A major involvement of this platform is the proposed in the cloud API. It describes a set of clear and easy-to-understand RESTful Web services interfaces, through which cloud consumers are able to create and manage cloud resources, comprising compute, storage, and networking components in a combined way.

4) SaaS and PaaS Interoperability

Though the aforesaid solutions usually challenge with IaaS interoperability problems, SaaS interoperability often includes different application domains such as ERP, CRM, etc. A group of experts in the field of data mining increases the concern of establishing a data mining standard on the cloud, with a specific focus on “the practical use of statistical algorithms, reliable production deployment of models and the integration of predictive analytics” across diverse data mining-based SaaS clouds.

PaaS interoperability not yet discovered ever since PaaS involves the whole software development life-cycle on the cloud, it would be more challenging to extent the uniformity with regards to the way consumers develop and deploy cloud applications.

VI. SECURITY AND PRIVACY ISSUE

Cloud computing can offer infinite computing resources on demand due to its high scalability in nature, which reduces the needs for Cloud service providers to plan far ahead on hardware provisioning. Many companies, such as Amazon, Google, Microsoft and so on, quicken their steps in developing cloud computing systems and improving its services providing to a larger amount of users.

In this survey paper, we examine the security and privacy issues of present cloud computing systems provided by an amount of companies. As cloud computing states to both the applications brought as services over the Internet and the infrastructures that provide those services.

Based on the examination security and privacy anxieties provided by companies nowadays are not suitable, and subsequently result in a big problem for users to adapt into the cloud computing systems. Henceforth, more anxieties on security issues, such as availability, confidentiality, data integrity, control, audit and so on, should be consider into account.

A. Security on Demand

Cloud services are those applications that are running somewhere in the cloud computing infrastructures over internal network or Internet. Cloud computing permits suppliers to develop, organize and run applications that can

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simply grow in capacity (scalability), work speedily (performance), and never (or at least rarely) fail (reliability), without any worries on the properties and the locations of the original infrastructures.

Cloud computing systems can accomplish the following three objectives together:

1) Availability

The objective of availability for cloud computing systems is to ensure that its users can use them at any time, at any place. As its web-native nature, cloud computing system allows its users to access the system (e.g., applications, services) from anywhere. This is true for all the cloud computing systems (e.g., DaaS, SaaS, PaaS, IaaS, and etc.). Requisite to be accessed at any time, the cloud computing system should be disuniting all the time for all the users (say it is scalable for any number of users). Two approaches, say hardening and redundancy, are primarily used to improve the availability of the cloud system or applications presented on it.

2) Confidentiality

Confidentiality means to keep users' data secret in the cloud systems. There are two basic methods (i.e., physical isolation and cryptography) to accomplish such confidentiality, which are widely accepted by the cloud computing vendors.

3) Data integrity

In the cloud system data integrity means to reserve information integrity. As data are the base for supplying cloud computing services, such as Data as a Service, Software as a Service, Platform as a Service, keeping data integrity is

an essential job.

VII. CONCLUSION

This survey paper deliberated the architecture and popular platforms of cloud computing. It also speak about the challenges and issues of cloud computing in detail. Regardless of the number of limitations and the need for better methodologies processes, cloud computing is becoming a immensely attractive standard, especially for large enterprises.

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