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Brief Review on Cloud Computing

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ABSTRACT: *Cloud Computing has become a scalable services consumption and delivery platform in the field of Services Computing. The technical foundations of Cloud Computing include Service-Oriented Architecture (SOA) and Virtualizations of hardware and software. Cloud computing is the development of parallel computing, distributed computing, grid computing and virtualization technologies which define the shape of a new era. Cloud computing is an emerging model of business computing. In this paper, we explore the concept of cloud architecture and compares cloud computing with grid computing. We also address the characteristics and applications of several popular cloud computing platforms. In this paper, we aim to pinpoint the challenges and issues of cloud computing. We identified several challenges from the cloud computing adoption perspective and we also highlighted the cloud interoperability issue that deserves substantial further research and development. However, security and privacy issues present a strong barrier for users to adapt into cloud computing systems. In this paper, we investigate several cloud computing system providers about their concerns on security and privacy issues.*

The goal of Cloud Computing is to share resources among the cloud service consumers, cloud partners, and cloud vendors in the cloud value chain. The resource sharing at various levels results in various cloud offerings such as infrastructure cloud (e.g., hardware, IT infrastructure management), software cloud (e.g. SaaS focusing on middleware as a service, or traditional CRM as a service), application cloud (e.g., Application as a Service, UML modeling tools as a service, social network as a service), and business cloud (e.g., business process as a service).

Keywords- *Cloud computing, SaaS, IaaS, PaaS, DaaS.*

I. INTRODUCTION

Cloud computing has recently emerged as a technology to allow users to access infrastructure, storage, software and deployment environment based on a pay-for-what-they-use model. Traditional digital forensics cannot handle the dynamic and multi-tenant nature of the cloud environment as it has to address various technical, legal, and organizational challenges typical to the cloud systems. The dynamic nature of cloud computing allows abundant opportunities to enable digital investigations in the cloud environment. The goal of Cloud Computing is to share resources among the cloud service consumers, cloud partners, and cloud vendors in the cloud value chain. The resource sharing at various levels results in various cloud offerings such as infrastructure cloud (e.g., hardware, IT infrastructure management), software cloud (e.g. SaaS focusing on middleware as a service, or traditional CRM as a service), application cloud (e.g., Application as a Service, UML modeling tools as a service, social network as a service), and business cloud (e.g., business process as a service). This paper addresses the challenges of digital forensics in the cloud environment and existing solutions to ease some of the challenges.

Organization - The rest of the paper is organized as follows: In Section II, we define architectural components such as Software as a Service (SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS) and Data as a Service (DaaS). Then, we compare cloud and grid computing in Section III and explain some popular cloud computing platforms in Section IV. In Section V, we include few applications of cloud computing. We further explained about issues and challenges of cloud computing in Section VI, VII and VIII. Finally, we conclude in Section IX.

II. ARCHITECTURAL COMPONENTS

Cloud service models are commonly divided into SaaS, PaaS, and IaaS that exhibited by a given cloud infrastructure.

Software as a Service (SaaS)

SaaS is a model of software deployment where an application is hosted as a service provided to customers across the Internet.

SaaS alleviates the burden of software maintenance/support

but users relinquish control over software versions and requirements.

Terms that are used in this sphere include

Platform as a Service (PaaS) and

Infrastructure as a Service (IaaS)

Platform as a Service (PaaS)

The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment. In a PaaS environment, the service provider not only is responsible for provisioning and managing the lower level infrastructure resources, but also for providing a fully managed application development and deployment platform. PaaS provides the developers with the appropriate flavors of operating systems, databases, middleware, software tools and managed services, usually in a multitenant environment. The biggest added value of PaaS is that developers are completely abstracted from the lower-level details of the environment, so they can fully focus on what they are really good at (rapid development and deployment) and not worry about things like scalability, security and more that are fully managed by PaaS.

Infrastructure as a Service (IaaS)

This refers to the underlying hardware resources such as network, storage and compute resources, usually with some virtualization technology. While the advent of IaaS opened new territory for businesses to better manage IT hardware costs, it put developers in a challenging situation. Developers are now responsible for more of the operational work during development and test. They have to develop skills to provision, configure, manage and update hardware resources that they would have never needed in a traditional model.

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-premise enterprise database systems are often 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 database. In addition to traditional storage interfaces such as RDBMS and file systems, some DaaS offerings provide table-style abstractions that are designed to scale out to store and retrieve a huge amount of data within a very compressed timeframe, often too large, too expensive or too slow for most commercial RDBMS to cope with. Examples of this kind of DaaS include Amazon S3, Google BigTable, and Apache HBase, etc.

III. COMPARISON BETWEEN CLOUD AND GRID COMPUTING

A comparison [6] can be summaries 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

AbiCloud Abicloud [5] is a cloud computing platform, It can be used to build, integrate and manage public as well as private cloud in the homogeneous environments. Using Abicloud, user can easily and automatically deploy and manage the server, storage system, network, virtual devices and applications and so on. The main difference between Abicloud and other cloud computing platforms is its powerful web-based management function and its core encapsulation manner. Using the Abicloud, user can finish deploying a new service by just dragging a virtual machine with mouse. This is much easier and flexible than other cloud computing platforms that deploy new services through command lines.

B. Eucalyptus Eucalyptus (Elastic Utility Computing Architecture for Linking Your Programs to Useful Systems) [5] mainly was used to build open-source private cloud platform. Eucalyptus is an elastic computing structure that can be used to connect the users' programs to the useful systems, it is an open-source infrastructure using clusters or workstation implementation of elastic, utility, cloud computing and a popular computing standard based on a service level protocol that permit users lease network for computing capability. Currently, Eucalyptus is compatible with EC2 from Amazon, and may support more other kinds of clients with minimum modification and extension.

C. Nimbus Nimbus [5] is an open tool set and also a cloud computing solution providing IaaS. It permits users lease remote resources and build the required computing environment through the deployment of virtual machines. Generally, all these functional components can be classified as three kinds. One kind is client- supported modules 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 belonging to this kind of component. The second kind of component is mainly

OpenNebula OpenNebula [5] is also an open source cloud service framework. It allows user deploy and manage virtual machines on physical resources and it can set user's data centers or clusters to flexible virtual infrastructure that can automatically adapt to the change of the service load. The main difference of 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. OpenNebula is also an open and flexible virtual infrastructure management tool, which can use to synchronize the storage, network and virtual techniques and let users dynamically deploy services on the distributed infrastructure according to the allocation strategies for data center and remote cloud resources.

V. APPLICATIONS

There are a few applications of cloud computing [4] as follows:

- 1) Cloud computing provides dependable and secure data storage center.
- 2) Cloud computing can realize data sharing between different equipments.
- 3) The cloud provides nearly infinite possibility for users to use the internet.
- 4) Cloud computing does not need high quality equipment for the user and it is easy to use.
- 5) Computing enables companies and applications, which are system infrastructure dependent, to be infrastructure- less.
- 6) By using the Cloud infrastructure on “pay as used and on demand”, all of us can save in capital and operational investment.

VI. ISSUES IN CLOUD COMPUTING

More and more information on individuals and companies is placed in the cloud; concerns are beginning to grow about just how safe an environment it is? Issues of cloud computing [3] can summarize as follows:

A. **Privacy** Cloud computing utilizes the virtual computing technology, users' personal data may be scattered in various virtual data centers rather than stay in the same physical location, users may leak hidden information when they are accessed cloud computing services. Attackers can analyze the critical task 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** Numerous regulations pertain to the storage and use of data requires regular reporting and audit trails. In addition to the requirements to which customers are subject, the data centers maintained by cloud providers may also be subject to compliance requirements.

E. **Freedom** Cloud computing does not allow users to physically possess the storage of the data, leaving the data storage and control in the hands of cloud providers.

VII. CHALLENGES ON CLOUD ADOPTION PERSPECTIVE

Based on a survey conducted by IDC in 2008[1]

A. Security Well-known security issues such as data loss, phishing, botnet (running remotely on a collection of machines) pose serious threats to an organization's data and software. The multi-tenancy model and the pooled computing resources on cloud computing has introduced new security challenges such as shared resources (hard disk, data, VM) on the same physical machine invites unexpected side channels between a malicious resource and a regular resource. And, the issue of "reputation fate-sharing" will severely damage the reputation of many good Cloud "citizens" who happen to, unfortunately, share the computing resources with their fellow tenant - a notorious user with a criminal mind. Since they may share the same network address, any bad conduct will be attributed to all the users without differentiating real subverters from normal users.

B. Costing Model Cloud consumers must consider the tradeoffs amongst computation, communication, and integration. While migrating to the Cloud can significantly reduce the infrastructure cost, it does raise the cost of data communication.

C. Charging Model From a cloud provider's perspective, the elastic resource pool (through either virtualization or multi-tenancy) has made the cost analysis a lot more complicated than regular data centers, which often calculates their cost based on consumptions on static computing.

D. Service Level Agreement It is vital for consumers to obtain guarantees from providers on service delivery. Typically, these are provided through Service Level Agreements (SLAs) negotiated between the providers and consumers.

VIII. SECURITY AND PRIVACY ISSUE

Cloud computing can provide infinite computing resources on demand due to its high scalability in nature, which eliminates the needs for Cloud service providers to plan far ahead on hardware provisioning. Many companies, such as Amazon, Google, Microsoft and so on, accelerate their paces in developing cloud computing systems and enhancing its services providing to a larger amount of users. In this paper, we investigate the security and privacy concerns of current cloud computing systems provided by an amount of companies. As cloud computing refers to both the applications delivered as services over the Internet and the infrastructures (i.e., the hardware and systems software in the data centers) that provide those services. Based on the investigation security and privacy concerns provided by companies nowadays are not adequate, and consequently result in a big obstacle for users to adapt into the cloud computing systems. Hence, more concerns on security issues, such as availability, confidentiality, data integrity, control, audit and so on, should be taken into account. A. Security on Demand Cloud services are applications running somewhere in the cloud computing infrastructures through internal network or Internet. Cloud computing allows providers to develop, deploy and run applications that can easily grow in capacity (scalability), work rapidly (performance), and never (or at least rarely) fail (reliability), without any concerns on the properties and the locations of the underlying infrastructures. Cloud computing systems can achieve the following five goals together [2]:

1) Availability The goal of availability for cloud computing systems (including applications and its infrastructures) is to ensure its users can use them at any time, at any place. As its web-native nature, cloud computing system enables its users International Journal of Future Computer and Communication, Vol. 1, No. 4, December 2012 359 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.). Required to be accessed at any time, the cloud computing system should be severing all the time for all the users (say it is scalable for any number of users). Two strategies, say hardening and redundancy, are mainly used to enhance the availability of the cloud system or applications hosted on it.

2) Confidentiality It means keeping users' data secret in the cloud systems. There are two basic approaches (i.e., physical isolation and cryptography) to achieve such confidentiality, which are extensively adopted by the cloud computing vendors.

3) Data integrity In the cloud system means to preserve information integrity (i.e., not lost or modified by unauthorized users). As data are the base for providing cloud computing services, such as Data as a Service, Software as a Service, Platform as a Service, keeping data integrity is a fundamental task.

4) Control In the cloud system means to regulate the use of the system, including the applications, its infrastructure and the data.

5) Audit It means to watch what happened in the cloud system. Auditability could be added as an additional layer in the virtualized operation system (or virtualized application environment) hosted on the virtual machine to provide facilities watching what happened in the system. It is much more secure than that is built into the applications or into the software themselves, since it is able watch the entire access duration.

IX. CONCLUSION

This paper discussed the architecture and popular platforms of cloud computing. It also addressed challenges and issues of cloud computing in detail. In spite of the several limitations and the need for better methodologies processes, cloud computing is becoming a hugely attractive paradigm, especially for large enterprises. Cloud Computing initiatives could affect the enterprises within two to three years as it has the potential to significantly change IT.

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