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Understanding about Cloud Computing

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Abstract: ***The cloud computing is one of the emerging technology of future with great hope. Cloud Computing is evolving as a key computing platform for sharing resources that include infrastructures, Software Applications and business process. Cloud computing is the product of the fusion of traditional computing technology and network technology like grid computing, distributed computing parallel computing and so on. Main aim of the cloud computing is to make a perfect system with powerful computing capabilities using a large number of relatively low cost computing entity and using the advanced business models like SaaS (Software as a Service), PaaS (Platform as a Service), IaaS (Infrastructure as a Service) to distribute the powerful computing capacity to the hand of users. This article introduces the characteristics, Service Providers, Security and Privacy and so on.***

Keywords: Cloud Computing, Cloud, Understanding, Cloud Systems.

1. Introduction

Cloud computing originated from the earlier large-scale distributed computing technology, it is not a new one. However, it will be a subversion technology and cloud computing will be the third revolution in the IT industry, which represent the development trend of the IT industry from hardware to software, software to services, distributed service to centralized service. Cloud computing is also a new mode of business computing, it will be widely used in the near future. The core concept of cloud computing is reducing the processing burden on the users' terminal by constantly improving the handling ability of the "cloud", eventually simplify the users' terminal to a simple input and output devices, and the powerful computing capacity of the cloud.

Many big companies, such as Amazon, Google, Microsoft, etc involved in developing Cloud Computing systems and enhancing its services providing to a larger amount of users. As consisted of hundreds of thousands of commodity PCs and servers (say low prices), Cloud is more capable for competitions between companies. The successes of the above companies, say Google, Amazon and so on, are great examples and encourage an amount of other companies to step into the Cloud. Lots of services, such SaaS, PaaS, IaaS, etc. get into practice and provide it to users. On the other hand, more and more users are considering Cloud Computing is important and start to setup applications in the Cloud Computing system or adopt the services provided by it.

2. What is Cloud Computing?

2.1 Definition

"Cloud" is a virtualized pool of computing resources. It can:

- Manage a variety of different workloads, including the batch of back-end operations and user-oriented interactive applications.
- Rapidly deploy and increase workload by speedy providing physical machines or virtual machines.
- Support for redundancy, self-healing and highly scalable programming model, so that workload can be recover from a variety of inevitable hardware/software failure.
- Real-time monitor resources usage, rebalance the allocation of resources when needed.

2.2 Service Model

- Software-as-a-Service (SaaS): Software as a service is software that is deployed over the internet and/or is deployed to run behind a firewall in your local area network or personal computer. This is a "pay-as-you go" model and was initially widely deployed for sales forces automation and Customer Relationship Management (CRM).
- Platform-as-a-Service (PaaS): Platform as a service, another SAAS, this kind of cloud computing provide development environment as a service. You can use the middleman's equipment to develop your own program and deliver it to the users through Internet and servers.
- Infrastructure-as-a-Service (IaaS): Infrastructure as a service delivers a platform virtualization environment as a service. Rather than purchasing servers, software, data center space or network equipment, clients instead buy those resources as a fully outsourced service.

2.3 Characteristics of Cloud Computing

The cloud computing, grid computing, High performance computing (HPC) or supercomputing and data center computing all belong to parallel computing. HPC focuses on scientific computing which is computing intensive and delay sensitive. So high processing performance and low delay are the most important criteria's in HPC. Grid computing is based on HPC center. Many connected HPC centers form a large grid which owns a powerful underlying concept - service oriented architectures (SOA). Some other creative and impressive concepts like utility computing and autonomic computing do not come into reality. The cloud computing which is based on data center is much more widely accepted than grid computing. Data center which doesn't only pursue powerful processing performance and low delay is more balanced than HPC center. The

comparable characteristics of cloud computing and grid computing are listed in Table I. The "yes" and "no" stand for cloud computing or grid computing has the special characteristic or not. The "half" means not owning the whole characteristic to a certain extent.

Table 1: Grid Computing Vs Cloud Computing

Characteristics	*Grid Computing*	*Cloud Computing*
Service Oriented	Yes	Yes
Loose Coupling	Half	Yes
Strong Fault Tolerant	Half	Yes
Business Model	No	Yes
Ease Use	Half	Yes
TCP/ IP based	Half	Yes
High Security	Half	Half
Virtualization	Half	Yes

Conceptional characteristic – service oriented: The service oriented concept is similar to but more practical than the concept of SOA in grid computing. Abstraction and accessibility are two keys to achieve the service oriented conception. Through virtualization and other technologies, the underlying architecture is abstracted without exposing much to user. So it is opacity to cloud user. Abstraction reduces both the need for cloud user to learn the detail of cloud architecture and the threshold of application development. At the same time, the key elements of underlying architecture can be simply accessed by cloud user. Cloud user can consume all the capacity easily by exploring system parameters such as processing performance and storage capacity. In general, according to the type of provided capability, the services of cloud computing are broadly divided into three categories: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), and Software as- a-Service (SaaS).

Technical characteristic 1 – loose coupling: The loose coupling is the technical fundament of cloud computing and goes beyond the loose coupling method of application interaction. Through virtualization or other technologies, the infrastructures are separated in logic or physic. The behavior of one part hardly affects other parts. For example, the platform is an abstract layer which can isolate different applications running on it. Most important of all, whole cloud computing runs in a client-server model. The clients or cloud users connect loosely with servers or cloud providers. All the users have almost no data or control dependence.

Technical characteristic 2 – strong fault tolerant: There are many fault tolerant methods in parallel computing. At low-level, there always exist some fault correction mechanisms with specific hardware. At high-level, many specific applications are studied with methods aiming at algorithms. Checking point is one of the most effective methods at middle-level. In large scale parallel computer systems, the interval of two failures may be shorter than application execution time. For example, some scientific computing applications run for weeks or even longer but there may be several trivial or fatal errors during the whole runtime. The fault tolerant technology becomes critical in this condition. Otherwise it has only less chance to complete the time consuming computing tasks. Because a minimum error is unacceptable and redoing costs too much time in many scientific applications, so the whole computation states which are saved periodically on stable storage will roll back to a special checking point if an error occurs.

There are mainly four places where faults maybe occur in cloud computing: provider-inner, provider-across, provider user and user-across.

Economic characteristic – business model: The business model is the key characteristic to distinguish grid computing and cloud computing. The grid computing is mainly supported by government and academe.

On the one hand, this determines the nature of grid computing: the impulse of profit is not strong enough. On the other hand, the grid computing is a research for future development of information technology. But the cloud computing is mainly supported by gigantic IT companies. They plan that all investments on cloud computing should get return on investment (ROI) in the near future or beat market competitors in the long run.

There are two categories of cloud users: end user and median user. Cloud services are ends in themselves for end user. End user consumes cloud services for self use. Median user consumes cloud services and cost efficiently supplies professional services to others. End user sometimes doesn't pay for cloud services directly. For example, online game players pay for special game according to how long they stay online. And part charge is defrayed to maintain the running of cloud system. This process is opacity to end user. Median user usually pays for consumed cloud services directly. They save money on jumping to the market quickly. For median user, it is no need to manage complex hardware and software, learn how to use tools and gain experience with cloud computing technology.

User experience characteristic – ease use: User experience which belongs to the subject of human computer interaction is an important criterion when evaluating whether an application is successful or not. In cloud computing, user experience improves a lot than its ancestors like grid computing. The cloud service is a means toward the end of providing a good experience for cloud user. The valuable services should be easily accessed by cloud user. The core of user experience is achieving ease use. Ease use is not only simple but also elegant.

3. Security

Cloud services are applications running somewhere in the Cloud Computing infrastructures through internal network or Internet. For users, they don't know or care about the data where to be stored or services where to be provided. 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. The penalties of obtaining these properties of Cloud Computing are to store individual private data on the other side of the Internet and get service from other parties (i.e. Cloud providers, Cloud service providers), and consequently result in security and privacy issues. Then, what kind of security is sufficient for

users? Basically, we say the Cloud Computing systems are secure if users can depend on them (i.e. DaaS, SaaS, PaaS, IaaS, and so on) to behave as users expect. Traditionally, it contains 5 goals, say availability, confidentiality, data integrity, control and audit, to achieve adequate security. The five goals are integrated systematically, and none of them could be forfeited to achieve the adequate security. Nevertheless, few Cloud Computing systems can achieve the five goals together nowadays.

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 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. In short, Cloud Computing systems are able to provide available services in nature through hardening and redundancy strategies.

4. Privacy

As Cloud Computing system usually offers services (e.g. DaaS, SaaS, IPMaaS, PaaS, and so on) on the other side of the Internet in terms of its users, the secret information of individual users' and business' are stored and managed by the service providers, and consequently results in privacy concerns. Privacy issues exist for a long time in the computing literature, and many law acts have been published to protect users' individual privacy as well as business secret. Nevertheless, these acts are out of date and inapplicable to the new scenarios, where a new relationship between users and providers (i.e. three parties) raises. In this subsection, we investigate a few privacy acts to illustrate those acts are not applicable in the new environment, in the subsection IIIA. Data storage in the Cloud Computing system which is located in multi regions (locations) to make the system more tolerant may also raise the privacy problems.

Cloud computing systems (including applications and services hosted on them) has significant implications for the privacy of personal information as well as for the confidentiality of business and governmental information. That's because any information is shifted from local computers to the Cloud Computing systems at the Cloud Computing era, including email, word processing documents, spreadsheets, videos, health records, photographs, tax or other financial information, business plans, powerpoint presentations, accounting information, advertising campaigns, sales numbers, appointment calendars, address books, and more. Furthermore, the entire contents of a user's originally stored on local device may be shifted to a single Cloud provider or even to many Cloud providers. Whenever an individual, a business, a government agency, or other entity shares information in the Cloud, privacy or confidentiality questions may arise. A Cloud provider is the organization that offers the Cloud Computing system, it may be an individual, a corporation or other business, a non-profit organization, a government agency or any other entity. What should be noticed is that Cloud service provider is one type of third party that maintains information about, or on behalf of, another entity.

5. Conclusion

Cloud Computing becomes a buzzword nowadays. More and more companies step into Cloud and provide services above on it. There is no doubt that the cloud computing is the development trend in the future. Cloud computing brings us the approximately infinite computing capability, good scalability, service on-demand and so on, also challenges at security, privacy, legal issues and so on. More security strategies should be deployed in the Cloud environment to achieve the 5 goals (i.e. availability, confidentiality, data integrity, control and audit) as well as privacy acts should be changed to adapt a new relationship between users and providers.

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