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Basic of Cloud Computing

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ABSTRACT:
Cloud computing has come of age since Amazon's rollout of the first of its kind of cloud services in 2006. It is particularly relevant to Hong Kong because of the tremendous amounts of data that are being processed here daily in various sectors, and there are signs that subscription to cloud services by the local companies will soon be on a skyrocket course, despite a slow start in previous years. As a research theme, cloud computing now easily tops any list of topics in computer science because of its far reaching implications in many areas in computing, especially big data which without cloud computing is at best a concept. You should have a basis information about what is Cloud Computing and its history, features or architecture. To summarize it, Cloud Computing is very new and modern technology based on sharing resources (especially software, hardware and infrastructure). It helps companies but also individuals in saving costs for IT resources. All data are stored out-of-company at a providers place which brings both advantages and disadvantages especially problematic issue about security and data privacy Researchers in various local institutions already have an active agenda of important and significant problems for which they would like to seek the best and optimized solutions. We believe solving these problems will create a spot for Hong Kong in the world map of cloud computing research. The results will also benefit Hong Kong as the reliance on cloud computing services is rapidly increasing. This brief talk will outline some of the concerns pertaining to the further development of cloud computing into a mature technology that meets its original goals.

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I. Introduction

This Brief Introduction to Cloud Computing White Paper is intended to give a broad overview of what is cloud computing and how it can benefit the organizations in managing their IT. It also highlights the key features that the IT service providers can offer to their customers. The term 'Cloud' represents 'Internet'. The cloud symbol is used in the telecom world to distinguish between the responsibilities of the provider to that of the user.

Cloud computing is a paradigm shift from the client server model. Cloud computing allows users in an organization to access shared resources, applications, servers, computers, etc over the internet on demand from a service provider. The provider can calculate the time bound resource utilization as per the service level agreement and bill the organization based on the usage. This is just like using the electricity from your provider and paying the electric bill based on the usage as captured by the meter. This will help the companies to optimize their utilization of IT assets thereby cutting down on any unnecessary IT costs. So this way organization can leverage on the cloud computing model to reduce the capital expenditure on IT.

Cloud computing technology is indeed a paradigm shift in IT infrastructure management thus providing significant cost savings and increased productivity to organizations. For IT service providers, it is an excellent opportunity to provide cost effective IT solutions to their customers with improved quality of service. However, it is imperative that more and more IT skills should be trained to maintain and support the cloud infrastructure.

Key features of Cloud computing Technology

These are the below Key features of Cloud computing Technology:-

1. Cloud computing technology provides a more flexible and agile infrastructure at a low cost. It is important considering the fact that organizations have to often deal with business re-org, market fluctuations, resource resizing etc.
2. Companies can significantly reduce their capital expenditure on IT by adapting to the cloud computing model. This can be achieved especially through utility based computing where the computing resources such as hardware, software, network bandwidth and other infrastructure components are rented from a third party service providers. So this way organization will have to only worry about the operational expenses from IT infrastructure standpoint. One other advantage of utility based computing is that IT skills required for maintaining the infrastructure will reduce drastically.

3. Users can access the systems from anywhere in the world via internet regardless of where the infrastructure is located (third party service provider). All that is needed at the user end is a device that is internet enabled such as a computer, laptop or other handheld devices.
4. Different companies can share the resources under a single cloud from a third party service provider. The benefit of doing so is as follows:
a. Setting up a centralized infrastructure in a location where the cost of real estate and electricity is low.
b. Huge computing resource pool and a greater network bandwidth will increase peak load capacity.
c. Using virtualization technology for setting up the cloud infrastructure will allow new host systems to be added or the existing systems to be upgraded with additional computing resources such as processor, memory, storage etc very
d. easily without shutting down the systems thereby making the infrastructure extremely scalable.
e. Optimized utilization of the systems that are often used only 5-10%.
5. Cloud based application are easy to support and maintain as they are not installed on client machines. Any changes that are made to the application is available to the users instantly.
6. Data is more secured due to centralized location of the infrastructure.
7. Cloud computing resource usage can be measured and should be metered per client and application on a daily, weekly, monthly and yearly basis.

Survey of Existing Cloud Architecture:

A basis information about the architecture is provided in this chapter, together with the explanations of relevant terms such as virtualization, Frond/Back end or Middleware.

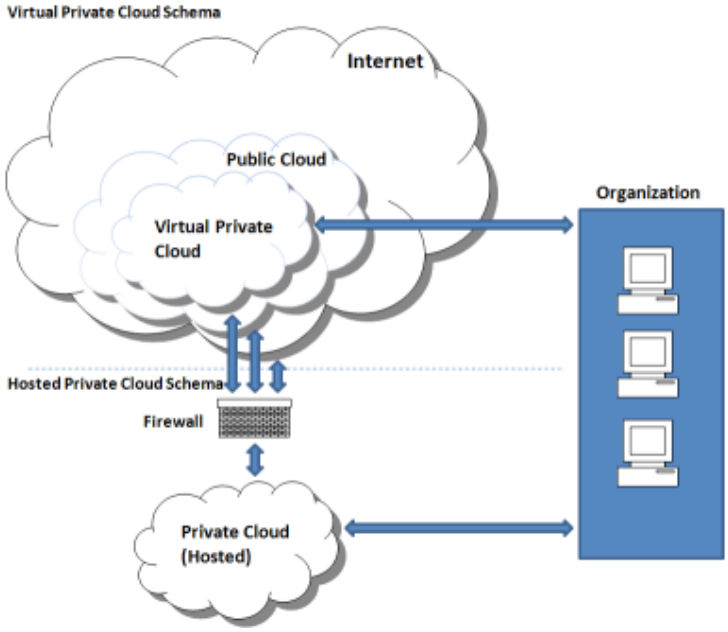
- Virtualization is best described as essentially designating one computer to do the job of multiple computers by sharing the resources of that single computer across multiple environments. Virtual servers and virtual desktops allow you to host multiple operating systems and multiple applications locally and in remote locations, freeing your business from physical and geographical limitations.

The Cloud Computing architecture can be divided into two sections, the front end and the back end, connected together through a network, usually Internet. The Front End includes the client's computer and the application required to access the cloud computing system. Not all cloud computing systems have the same user interface. Services like Web-based e-mail programs leverage existing Web browsers like Internet Explorer or Firefox. Other systems have unique applications that provide network access to clients.

The Back End of the system is represented by various computers, servers and data storage systems that create the "cloud" of computing services. Practically, Cloud Computing system could include any program, from data processing to video games and each application will have its own server.

A central server administers the system, monitoring traffic and client demands to ensure everything runs smoothly. It follows a set of rules called protocols and uses a special kind of software called Middleware. Middleware allows networked computers to communicate with each other.

Public Cloud (external cloud) is a model where services are available from a provider over the Internet, such as applications and storage. There are free Public Cloud Services available, as well as pay-per-usage or other monetized models. Private Cloud (Internal Cloud/Corporate Cloud) is computing architecture providing hosted services to a limited number of people behind a company’s protective firewall and it sometimes attracts criticism as firms still have to buy, build, and manage some resources and thus do not benefit from lower up-front capital costs and less hands-on management, the core concept of Cloud Computing.



Private/Public cloud

Cloud computing categories

There are three main categories in CC, Infrastructure as a Service (IaaS), Software as a Service (SaaS) and Platform as a Service (PaaS). All of them are described below in more details.

- Infrastructure as a Service is a provision model in which an organization outsources the equipment used to support operations, including storage, hardware, servers and networking components. The service provider owns the equipment and is responsible for housing, running and maintaining it.
- Software as a Service is a software distribution model in which applications are hosted by a vendor or service provider and made available to customers over a network, typically the Internet. It is becoming an increasingly prevalent delivery model as underlying technologies that support Web services and service-oriented architecture become increasingly available.
- Platform as a Service is an outgrowth of Software as a Service (SaaS). It is a way to rent hardware, operating systems, storage and network capacity over the Internet. The service delivery model allows the customer to rent virtualized servers and associated services for running existing applications or developing and testing new ones.

End to end design - definition

It is a major feature of the Internet. The intelligence and functions in an Internet-based application reside at both ends of the network (client side and server side), not within the Internet backbone. The Internet acts as a transport between these two.

- Technical design – in its simplest form, the end-to-end design will include the end-user device, user connectivity, Internet, cloud connectivity, and the cloud itself.

At a minimum, most organizations will have users who connect to the cloud service remotely (from home or while travelling) and through the internal network. In addition to connectivity at the network level, the interfaces at the application layer need to be compatible and it will be necessary to ensure this connectivity is reliable and secure.

- Devices – cloud services should be device agnostic. They should work with traditional desktop, mobile devices and thin client. Unfortunately, this is much easier said than done. Regression testing on five or ten client platforms can be challenging. A good start is to bundle the sets of supported devices into separate services. With Microsoft Exchange 2007 you have the option of supporting Windows platforms through HTTP (Outlook web access) and using RPC over HTTP. You can also support Windows Mobile (as well as Symbian, iPhone and Blackberry devices using ActiveSync). The platform is just beginning. You would also want to take an inventory of existing systems to determine the actual operating platforms, which might range from Mac OS and Linux to Google Chrome, Android, Symbian, RIM Blackberry and iPhones.

- Connectivity – in order to assess the connectivity demands you need to identify all required connections. At high level the connections will include categories such as:
  - Enterprise to cloud
  - Remote to cloud
  - Remote to enterprise
  - Cloud to cloud
  - Cloud to enterprise

Once you put these together into a high level connectivity diagram you can then proceed to the next step of identifying and selecting connectivity options. Unless the systems are connected they cannot operate, at least for any extended periods of time. It the case of cloud computing, data and processing are both highly distributed making reliable, efficient and secure connectivity and are the most critical.

- Management – generally, for each component in the design we need to investigate how we will manage it. This includes all the end-user devices, the connectivity, and legacy infrastructure and all the applications involved. The challenge of splitting management components will be that you may have policies that need to be kept synchronized. Imagine for example, that you have a minimum password length of 8 characters which is increased to 10. If you have only two management servers and this is not a frequent type of occurrence then you can easily apply challenge manually. However, if you are dealing with hundreds of management servers and you receive minor policy changes on a weekly basis you can imagine how cumbersome and error-prone the task will become.
- Security – the impact of Cloud Computing on security is profound. There are some benefits and unfortunately some hurdles to overcome. One challenge in trying to evaluate security is that it tends to relate to all aspects of IT and, since Cloud Computing`s impact is similarly pervasive. Security domains:
- Access control – provides mechanism to protect critical resources from unauthorized access and modification while facilitating access to authorized users
- Cryptography - presents various methods for taking legible, readable data, and transforming it into unreadable data for the purpose of secure transmission, and then using a key to transform it back into readable data when it reaches its destination.
- Operations security – includes procedures for back-ups and change control management.

The Cloud Computing Manifesto is a manifesto containing a "public declaration of principles and intentions" for cloud computing providers and vendors, annotated as "a call to action for the worldwide cloud community" and "dedicated belief that the cloud should be open". It follows the earlier development of the Cloud Computing Bill of Rights, which addresses similar issues from the users' point of view.

Comparative Study:
Neither Cloud computing is an exception and experience both pros and cons. Some of them are stated and described in more details in this chapter.

- Lower costs - the principle of sharing resources (HW, SW, infrastructure...) gives to customer also the benefit of sharing its costs. Customer do not has to buy expensive hardware, such as powerful workstations, large server solution and software applications. Customer needs only internet connection and basic PC with not high requirements. Simple laptop, netbook or mobile phone is enough. Customer also pays only for what the real usage. These could be services, hardware resources or infrastructure or its combination.
- Less IT employees - there is also no necessary by customer to employ IT department in such wide range. There is only need to provide secure connection and PC with web browser. For all other, the technical support such as back-ups, recovery, virus protection, updates, software and hardware stability and functionality, helpdesk and support is maintained by the provider of a service.
- No special knowledge - client (customer) also does not need to have a high knowledge about hardware and complex software applications at all. Client just uses a service thought us browser. Hardware resources can be shared between all clients and managed by usage or their requirements.
- Easy to upgrade - massive increase of performance (such as speed or storage size) is provided immediately after simple order and applied by “a few clicks”. Data centre can provide higher performance than common desktop PC or, on the other hand, can be very efficient and deliver just what customer needs at the moment (low performance) and thus again it saves resources and money. This approach saves also time, costs for new hardware, transport, is power (energy) efficient and as a result saves the environment, which is much discussed issue these days.

- Instant access anywhere - one of the most important benefit is availability of a service anywhere. What is needed for accessing the service is computer connected to the internet. There is no dependence on platform (PC, MAC, mobile phone, car etc.).
- Security - is a much discussed issue in the Cloud Computing service providing and could be put in both pros and cons as you see in a while. Service is protected by usage an authorization. Users identify themselves by using an ID (Username) and Password (or also more sophisticated method such as chip, fingerprint, face detection etc. can be used). Communication between client and provider servers is secured. Data centre is protected by firewalls and kept in secured buildings. There generally there is a very low risk of danger caused by attack of third parties. BUT on the other hand, a problem could be that client (customer) keeps all the data out of his computer – just at the providers´ servers. It means the client entrusts the data to the provider (Provider Company) and has in fact no physical control over them.
- Requirements - technology, which customer needs are very simple. Important is only terminal as a laptop, desktop, mobile phone, netbook etc. with web-browser, internet connection and usually also created account on a service at providers place.

II. Results:

- Legal differences – as already aforementioned, we can describe one particular example. US companies are obliged to follow the PATRIOT Act (2001) which states that companies can be watched and have to provide information and data about clients, if they are asked for in the correspondence of anti-terrorist policy.
- Dependence on provider – if company starts using the Cloud Computing service and replaces its previous information system or changes IT structure, it becomes dependant on its service provider. Risks connected with such a dependency may include sudden change of prices or conditions of a contract. Provider could be hit by bankruptcy and end its business activities. Functions and applications might be changed without will of a customer and if a provider suffers from technical problems, all the customers are out of service which means without their data.
- Reputation – Cloud Computing is very new type of service. Not many companies has an experience with such a kind of services and application outsourcing. Many users are still worried about data security transmitted over the internet.
- Migration costs – in some cases there can be higher start-up costs. Company may have to invest into users training, any amendments which allows the communication of service provider and current company software and in some cases, switching to Cloud Computing could lead to a change of business processes.
- Less functions – solutions, which are targeted to the wide range of companies that can't provide specific functions and therefore are not flexible.
- Dependence on internet connection - all the Cloud Computing applications can be used on-line only thus any connection failure could be fatal.

III. Conclusion and Future Work:

From the text and information aforementioned, you should have a basis information about what is Cloud Computing and its history, features or architecture. To summarize it, Cloud Computing is very new and modern technology based on sharing resources (especially software, hardware and infrastructure). It helps companies but also individuals in saving costs for IT resources. All data are stored out-of-company at a provider's place which brings both advantages and disadvantages especially problematic issue about security and data privacy. Most common Cloud service you as a user may come across with are Google Apps.

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