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Cloud Computing: A New Era of IT Opportunity and Challenges

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Abstract: ***This paper gives an overview at the structure and working of the idea of cloud computing. This paper consists of the basic idea of cloud computing, its various characteristics along with its components, architecture and also the different types of cloud computing. In this paper the various terms and various concepts related to cloud computing are explained. This paper concludes with the current research and projects that are being performed in cloud computing.***

Keywords: Cloud Computing, Cloud Technologies, Public Cloud, Private Cloud, Hybrid Cloud

1. Introduction

Cloud computing is a general term used to describe a new class of network based computing that takes place over the internet, using the internet for communication and transport provides hardware software and networking services to clients. It is basically a step on from utility computing. By definition cloud computing is a style of computing in which dynamically scalable and often virtualised resources are provided as a service. Users need not have knowledge of expertise in or control over the technology infrastructure in the "cloud" that supports them. With cloud computing, IT capacity can be quickly adjusted to accommodate the changes in demand.

As the computing industry shifts towards providing Platform as a Service (PaaS) and Software as a service (SaaS) for consumers and companies to access on demand regardless of time and location, there will be an increase in the number of cloud platforms available.

The data is stored in the cloud and regardless of what time it is and what location you are present we can instantaneously access the data by requesting the server.

A number of characteristics define cloud data, applications services and infrastructure:

a) Remotely hosted: Services or data are hosted on remote infrastructure.
b) Ubiquitous: Services or data are available from anywhere.
c) Commodified: The result is a utility computing model similar to traditional that of traditional utilities, like gas and electricity - you pay for what you would want. In many ways the cloud computing is simply a metaphor for the internet, the increasing movement to compute and data resources onto the web. But there's a difference: cloud computing represents a new tipping point for the value of the network computing. It delivers higher efficiency, massive scalability and faster, easier software development.

2. Types of Services on Cloud

The services that are provided by cloud computing are basically divided into 3 categories:

i) Infrastructure as a Service (IaaS)
ii) Platform as a Service (PaaS)
iii) Software as a Service (SaaS)

i) Infrastructure as a Service:
Infrastructure as a Service like Amazon Web services provides virtual server instances with unique IP addresses and blocks of storage on demand. Customers use the providers application program interface (API) to start, stop, access and configure their virtual servers and storage. In the enterprise, cloud computing allows a company to pay for only as much capacity as needed and bring as soon as more is required. IaaS clouds often offer additional resources such as a virtual-machine disk image library, raw block storage, and file or object storage firewalls, load balancers, IP addresses, virtual local area networks (VLANs), and software bundles.

ii) Platform as a Service:
It is defined as a set of software and product development tools hosted on the provider's infrastructure. Development creates applications on the provider's platform over the internet. PaaS providers may use APIs, website portals or gateway software installed on the customer's computer. For example Google apps. Some providers will not allow software created by their customers to be moved off the provider's platform. Application developers can develop and run their software solutions on a cloud platform without the cost and complexity of buying and managing the underlying hardware and software layers

iii) Software as a Service:
In the software as a service the vendor supplies the hardware infrastructure, the software product and interacts with the user through a front end portal. SaaS is a very broad market. It is also seen to be very advantageous to both service providers as well ascend users as service providers

enjoy greatly simplified software installation and maintenance and centralised control over versioning while end users can access the service “anytime, anywhere” share data and collaborate more easily, and keep their data stored safely in the infrastructure. In the business model using software as a service (SaaS), users are provided access to application software and databases. Cloud providers manage the infrastructure and platforms that run the applications. SaaS is sometimes referred to as "on-demand software" and is usually priced on a pay-per-use basis. SaaS providers generally price applications using a subscription fee. Many cloud computing offerings employ the utility computing model, which is analogous to how traditional utility services are consumed, while other providers bill on a subscription basis.

3. Main Characteristics of Cloud Computing

The main characteristics of cloud computing that make it different from the conventional ITs are Automation, Virtualisation, Redundancy and autonomy. There are other differences but those four seem to me to the most demonstrative.

i) Automation:
Think of a vast collection of computing, storage and networking components (including software operating systems and applications) that instead of being integrated into a unitary system are considered as individual elements. From this perspective, computing resources have been atomised. Cloud software configures these elements to meet the instantaneous IT requirement of each client with their very own virtual data centre.

ii) Virtualization and Redundancy:

When the application, storage and the cpu are in different location, cloud software keeps track of it all and reconfigures your virtual IT requirements change. In utility parlance, this is somewhat analogous to load optimisation. Atomisation and virtualization seems to make redundancy critically important. While redundancy is often present in conventional systems, cloud computing takes it to a new level. All of data and virtual IT configuration information is stored in three different places. The software that runs the cloud knows where the data is and will find if one or more of the atomised computing resource fails.

iii) Autonomy:

The cloud's normal operating mode is auto pilot. When a computing element dies there is no attempt to fix it. Instead, the software that runs the Cloud simply ignores it and allocates its function elsewhere. Experience has shown that reliability and availability metrics are most adversely affected by human error (connecting the wrong wires, forgetting to install a software patch).

There are special implications for utilities underlying these characteristics. Utilities operate under a regulatory umbrella that varies from state to state. The first issue to spring to mind is privacy. Here are some questions utility executives have to ask: What does the PUC allow regarding collocation and co-tenancy of data? Does the PUC understand Cloud Computing and, more specifically, its potential value to utilities and ratepayers? What privacy guarantees will be required to allow utilities to use cloud?

As Cloud Computing becomes more accepted and its ability to protect data more nuanced, regulatory bodies may well address privacy issues in a new context that takes Cloud Computing advantages into consideration. This should not be viewed as loosening privacy restrictions but as acknowledging that the Cloud's "automatic anonymity" can provide powerful privacy solutions.

In the meantime, some utilities are exploring private clouds — virtual data centres for and by utilities with the same privacy and accountability issues. Within a private, utilities-only cloud, data can be secured at appropriate levels. Individual utilities or departments within utilities can specify the sensitivity of their data and allow the Cloud to process and store it in the most cost-effective manner according to defined rules based on parameters such as location of data centres and authentication. In addition to the above mentioned characteristics there are some other features like the cloud computing is built on well established trends and the infrastructure is programmable and the cloud services are delivered over the network and the role of open source software.

4. Components of Cloud Computing

The major parts of the cloud computing are:

a)Cloud client:
It consists of hardware and/or software which relies on cloud computing for application delivery, or which is specifically designed for delivery of cloud services and which in either case is essentially useless without it. Example: android, iphone, web browsers (Mozilla Firefox).

b) Cloud service:
This includes “products, services, solutions that are delivered and consumed in real time over the internet”. Example: YouTube videos hosting, mapping, PayPal etc.

c) Cloud application:
This often eliminates the need for installing and running the application on the customers own computer, thus reducing the burden of software maintenance, ongoing operation and support. Example: Peer-to-peer(bit torrent).

d) Cloud platform:
This facilitates the deployment of applications without the cost and complexity of buying and managing the underlying hardware and software layers.

e) Cloud Infrastructure:
Such as IaaS, is the delivery of computer infrastructure, typically a platform virtualization environment, as a service.

5. Architecture

The cloud computing architecture can be broadly divided

into two major components. They are:

1. Front End:
Front end refers to client part of cloud computing systems. It has interfaces and applications that access the cloud computing platforms. Example: web browser

2. Back End:
Back End is the cloud itself. It comprises of all the resources that are needed to provide cloud computing like data storage, virtual machines, security mechanisms, services etc..Back end provides security and traffic control protocols.

There are various things that we need to keep in mind before constructing the architecture of our own comfort. They are cost, complexity, speed, cloud portability and security. There are various architectures available right now for constructing a cloud. They are:

1. Single "All-In-One" Server:
In this model we have a single server that contains a web server, application and database. We have various single all in one server available right now in the markets which are useful for right scale users and basic demos

2. Non Redundant 3-Tier Architecture:
It is used to reduce costs and resources. Since it is non redundant it is used for basic test and development purposes. It is not recommend for production purposes.

3. Redundant 3-Tier Architecture:

The cloud launched may have some issues; this architecture is basically used for failover and recovery purposes. Typically, you will use a Server Array for your application tier to take advantage of auto scaling in the cloud; however there may be some scenarios where your application is not designed to auto scale. In such cases, we use a redundant multi-tier architecture where you have redundancy at each tier of your reference architecture. In the example below, there are two load balancer servers, two application servers, as well as master and slave database servers. A redundant architecture will help protect your site/application from system downtime.

6. Multi-Datacenter Architecture

If your cloud infrastructure supports multiple data centres (or zones), it's recommended that you spread your system architecture across multiple data centres to add another layer of redundancy and protection. Each data centre in a cloud is designed to be an isolated segment inside the same geographical cloud. So if a power failure occurs in one data centre, the other data centres will be unaffected. For example, within a cloud/region there may be several resource pools called availability zones and data centres. The benefit of using multiple data centres is to protect your entire site/application from being negatively affected by some type of network/power failure, lack of available resources, or service out tag that's specific to a particular data centre. As a best practice you should always leverage multiple data centres in your reference architecture if they are supported by the cloud infrastructure.

5. Auto Scaling Architecture:

One of the key benefits of the cloud is the ability to horizontally scale (i.e. grow or shrink the number of running server resources) as the demands of your application/site change over time. With Right Scale, you can use Server Arrays to set up a particular tier of your architecture to auto scale based on predefined alert conditions. Auto scaling is most commonly used for the application tier of your cloud reference architecture. There are various scaling architectures like scalable architecture with membase and scalable multi tier architecture with memcached. In addition to the above mentioned architecture there are other hybrid architectures such as scalable multi cloud architecture, failover multi cloud architecture multi cloud disaster recovery architecture and cloud and dedicated hosting architecture.

5. Types of Cloud Computing:

There are various types of cloud computing. They are:

1. Public cloud
2. Private cloud
3. Hybrid cloud

1) Public cloud:
This is also called as external cloud. This defines the cloud computing in a traditional mainstream sense, where resources are dynamically provided on a fine grained, self basis over the internet, via web applications/web services, from an offsite third party provider who shares resources and bills the user.

2) Private cloud:
Also called as internal cloud, These are neologisms that some vendors have recently used to describe offerings that emulate cloud computing on private networks. These deliver the advantages of cloud computing without the pitfalls focusing mainly on data security, governance and reliability concerns. These are mocked on the basis that the users have to still buy, build and manage them and there is no use for lower upfront capital costs and less hands on management, essentially not having any use as of economic value is considered that makes this concept of cloud computing such an intriguing concept.

3) Hybrid cloud:
Hybrid cloud combines both public and private cloud models. In this model we own and share other parts though in a controlled way. Hybrid clouds offer the promise of on demand, externally provisioned scale, but add the complexity of determining how the applications are distributed in different environments. While enterprises may be attracted to the promise of this concept it is less likely to be reserved for stateless applications which require no complex databases or synchronisation.

7. Advantages of Cloud Computing

There are many advantages of cloud computing. The most

prominent of them are:

a) Reduced Cost:
Cloud technology is well known for its payment policy that is pay for only what you need, thereby saving the organisations money in the short run. Money can be used for other important resources.

b) Increased Storage: More data can be stored and accessed any where rather than storing data on private computer systems.

c) Highly Automated:
IT professionals need not worry about the updating of software as it is the job of the service providers.

d) More Mobility:
As stated above data can be accessed anywhere. Allows IT to shift focus. No longer having to worry about the constant server updates and other computing issues, government organisations will be free to concentrate on innovation.

Other advantages include Ubiquitous access, nearly pervasive connectivity and cheap computing power.

8. Disadvantages of Cloud Computing

Although the concept seems pretty beneficial it has its own demerits these include:

a) Losing control:
It means losing control of the infrastructure, applications, everything. Some cloud offerings do not provide sufficient controls for operational control over quality of service, location of data and so forth. But others do provide these controls.

b) Users are subject to terms and conditions:
The problem that rises out the fact that users are subject to terms and conditions are seen where certain providers of the cloud do not guarantee a backup or the fact that vendors holds the right to terminate the cloud computing account when they see fit.

c) Security:
It is one of the major questionable demerit of the cloud computing. Although we save our data in the cloud that strictly has a login and password combo, does that mean others can't access that data. The answer is partly YES. One such recent incident where the accounts of the celebrities have been hacked and their personal photos are leaked. Although the cloud is not fully responsible for this, as the incident happened the security issue once again comes into picture.

These are the major demerits of the cloud computing. In addition to above mentioned demerits there are other demerits like:

i) Overwhelming rationality
ii) Inexorable commoditization
iii) Dependency on the vendor a huge factor
iv) Change in the application can occur without the user's knowledge
v) Data stored in the hands of third party and users are dependent on internet connection

9. Conclusion

Cloud Computing can be used to address tactical problems with which IT continually deals, like resource availability and reliability, data centre costs, and operational process standardization. These near-term objectives represent sufficient justification for companies to use cloud computing technologies even when they have no need to improve their platforms or practices. But there are longer-term business imperatives as well, like the need for a company to be agile in combining their capabilities with those of their partners by creating a distributed platform that will drive aggressively toward cloud and service grid computing. We believe that clouds, service grids, and service-oriented architectures are technologies that will be fundamental to twenty-first-century corporations successfully navigating the changes that they now face.

References

[1] VOAS, J. and ZHANG, J. 2009. Cloud Computing: New Wine or Just a New Bottle? IT Professional 11, 2, 15-17.
[2] VOUK, M. A. 2008. Cloud computing — Issues, research and implementations. In Information Technology Interfaces, 2008. ITI 2008. 30th International Conference on, 31-40.
[3] FOSTER, I., ZHAO, Y., RAICU, I. and LU, S. 2008. Cloud Computing and Grid Computing 360-Degree Compared. In Grid Computing Environments Workshop *(*GCE '08), Austin, Texas, USA, November 2008, 1-10.
[4] Corbató, F. J., Saltzer, J. H., and Clingen, C. T. 1972. Multics: the first seven years. In Proceedings of the May 16-18, 1972, Spring Joint Computer Conference, Atlantic City, New Jersey, May 1972, 571-583.
[5] BUYYA, R., YEO, C. and VENUGOPAL, S. 2008. Market-Oriented Cloud Computing: Vision, Hype, and Reality for Delivering IT Services as Computing Utilities. In High Performance Computing and Communications, 2008. HPCC '08. 10th IEEE International Conference on, 5-13.
[6] CHANG, M., HE, J., and E. Leon, "Service-Orientation in the Computing Infrastructure, " 2006, pp. 27-33