Evaluation of cloud computing applications

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ABSTRACT

This paper reveals the concept of cloud computing and some of the relational aspects of such concept. We have tried identifying key attributes and validating the benefits of cloud computing on the business and the society. The current paper shall extricate the magnitude of development of cloud based services. We shall also try to include the requirements of business in context of cloud computing. We shall also try to suggest some measures to extend the scope of cloud services in other domains where applications of cloud computing may exist.

Keywords: Innovation, Services, Applications, Capabilities, Framework.

1. INTRODUCTION

1.1. Cloud Computing

The biggest thing in the web after Mainframe, Personal Computer, Client-Server Computing, is the new concept of Cloud Computing. Till now if you see, web is the biggest innovation on which the entire business and office relationships and transactions are growing day by day. But still the greatest pain is – your device (PC, Notebook, etc.) should be well configured with the latest software loaded. Though, certain services can be used through web for which software’s are not required in the local device. Now think of day when you are working on a device having no software loaded into it. You are working on your required software, which is provided to you as a service. It may be your OS or any application software, etc., which is the new concept of cloud computing (Keasy and Freeman, 2008, Nursi R Wolski, 2009).

1.2. Cloud computing- fifth generation of Computing

Cloud computing is about having a strong enough and standard enough local framework that can load your applications and even store your data “out there” somewhere in the cloud. For example, if you’re using Gmail, QuickBooks Online, Wikipedia, and almost all the so called Web 2.0 social sites out there, you’re doing cloud computing to one extent or another. As for example, your word processor could be just a web site that does word processing. Your documents could be stored on a virtual drive somewhere out on the Internet. You could, in theory, have almost nothing but a basic framework and web browser installed on your workstation. Cloud Computing can come in all kinds of designs. It may have locally installed micro-apps that communicate or store data on hosted site computers – like the Twhirl client for Twitter; you may have browser based applications, where nothing at all is stored locally; you may even have peer to peer application spaces where you never really know where data is stored and processed at all. But this doesn’t means that cloud computing is virtualization. Both virtualization and cloud computing are two different concepts. Since cloud computing is dependent on a number of technologies, a single line definition is not possible. Cloud computing is a pay and use model which enables to access services from a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, services) (Andy Bechtolsheim, 2008). Cloud model is comprised of five key characteristics, three delivery models, and four deployment models.

1.3. Virtualization

Virtualization is the creation of a virtual (rather than actual) version of something, such as an operating system, a server, a storage device or network resources. Thus, it’s really how you implement infrastructure and not as much about sharing in a multitenant environment (David Linticum, 2009). I see cloud computing is something much more encompassing than just simple virtualization, and indeed the industry seems to be moving in this direction. Cloud computing is all about managed sharing of resources, and typically includes the concept of multi-tenancy to accomplish that. Here, Multi-tenancy simply means we have a system for sharing those resources among many different users simultaneously. So, you can think if virtualization as a foundation concept around cloud computing, but not cloud computing unto itself (David Linticum, 2009). Cloud Computing enables to access the hosted services over the Internet, we can access our documents or interact with our
### 1.4. Services

Cloud Computing Provides Various Services, which are as follows:

**SaaS:** It means Software-as-a-service products that provide a complete hardware infrastructure and software applications. A front-end tool is there through which user has to interact with it no matter where he is, e.g. salesforce.com (www.articlesbase.com)

**PaaS:** It means Platform-as-a-service products and development tools also. Users have got the flexibility to create their application in provider’s infrastructure at any place, e.g. Google Apps. (www.articlesbase.com)

**IaaS:** It means Infrastructure-as-a-service products that provide virtual server and memory. To use this service users have to use providers API to start stop access and configure their virtual server, e.g. Amazon web services. (www.articlesbase.com)

**DaaS:** It means Desktop-as-a-service that enables user to use the desktop virtually from anywhere. (www.articlesbase.com)

### 2. HYPOTHESIS / ASSUMPTIONS

H0: Cloud computing affects the services of computing in business applications (Null hypothesis)

H1: Cloud computing does not affects the services of computing in business applications. (Alternate hypothesis)

### 3. RESEARCH METHODOLOGY

We have used preliminary investigation for understanding the market of cloud computing. Moreover, we also used secondary data to investigate the functions of cloud computing and its effects on the future applications. We shall also try to verify whether cloud computing is better than other existing systems prevalent in the market.

### 4. DATA COLLECTION

Data was collected using magazines, articles, journals and published documents from various sources. We also cross verified the validity of data by using multiple sources validation.

### 5. DATA ANALYSIS

#### 5.1. Key services of cloud computing

**On-demand self-service:** A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed without requiring human interaction with each service’s provider (Peter Mell and Tim Grance, 2009).

**Ubiquitous network access:** These kinds of network access promote user by heterogeneous thin or thick client platforms that are available over the network and accessed through standard mechanisms (e.g. mobile phones, laptops, and PDAs) (Peter Mell and Tim Grance, 2009).

**Location independent resource pooling:** For this kind of resource pooling the customer generally has no control or knowledge over the exact location of the provided resources. All consumers are served using a multi-tenant model through provider’s computing resources that are pooled to, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. Examples of resources include storage, processing, memory, network bandwidth, and virtual machines (Peter Mell and Tim Grance, 2009).

**Rapid elasticity:** Capabilities can be rapidly and elastically provisioned to quickly scale up and rapidly released to quickly scale down. To the consumer, the capabilities available for rent often appear to be infinite and can be purchased in any quantity at any time (Peter Mell and Tim Grance, 2009).
Pay per use: In this kind of services capabilities are charged using a metered, fee-for-service, or advertising based billing model to promote optimization of resource use. Measuring the storage, bandwidth, and computing resources consumed and charging for the number of active user accounts per month are the examples for Pay per use. Clouds within an organization accrue cost between business units and may or may not use actual currency (Peter Mell and Tim Grance, 2009). The fig. 1 is showing the different key services of cloud computing in the last section of this article (www.computinged.com).

5.2. Advantages of cloud computing
Lower computer costs: As data is stored in the web and not with us, hence it is not necessary to have high-powered computers to access web applications. Even the cheaper computer also can give efficient results (www.articlesbase.com).
Improved performance: Performance improves automatically, since everything is run in cloud so our computer doesn’t have to take much effort to run applications (www.articlesbase.com).
Unlimited storage capacity: There is no limit to store data that is based on the service provider. Hence storage is also one kind of service provided by the Cloud (www.articlesbase.com).

5.3. Disadvantages of cloud computing
A constant high speed Internet connection required: A high speed Internet connection is required constantly to get benefit of cloud computing (www.articlesbase.com).
Stored data might not be secure: There is no data security means data stored in cloud is securely protected. Intruders may access to your vital data at any time (www.articlesbase.com).

5.4. Applications of cloud computing
Refer to the table 1, showing different cloud computing application services in the last section of this article (Torry Harris, 2010).

5.4.1. Users of cloud computing
Managers or Collaborators: Whoever requires sharing and editing documents in real time between multiple users (www.articlesbase.com).
The cost conscious user: Whoever wants to invest less on hardware such as hard disks and processor are the cost conscious user (www.articlesbase.com).
Who wants more storage space: Whoever wants to store huge amount of data with low maintenance costs (www.articlesbase.com).
The fig. 2 shows the different users of cloud computing in the last section of this article (www.computinged.com).

5.4.2. Applications of cloud computing
Education
With cloud computing in education, you get powerful software and massive computing resources where and when you need them. Use cloud services to best combine:
- On-demand computing and storage.
- A familiar development experience with on-demand scalability.
- Online services for anywhere, anytime access to powerful web-based tools.
Microsoft cloud computing in education
gives better choice and flexibility to education IT departments. The platform and applications you use can be on-premises, off-premises, or a combination of both, depending on your academic organization’s needs (www.microsoft.com). The advantages that come with cloud computing can help you resolve some of the common challenges you might have while supporting your education institution (www.microsoft.com).

- Cost: You choose a subscription or, in some cases, a pay-as-you-go plan—whichever works best with your organization’s business model.
- Flexibility: Scale your infrastructure to maximize investments. Cloud computing allows you to dynamically scale as demands fluctuate.
- Accessibility: Help make data and services publicly available without jeopardizing sensitive information.

**Business**

The creation of a new generation of products and services: The economics of cloud computing lets innovative companies create products that either weren’t possible before or are significantly less expensive than the competition (or just more profitable.) Every improvement in storage, processing power, or technology enables innovations that weren’t possible before (high speed Internet, for instance, made products like YouTube possible) and cloud computing makes these opportunities unusually accessible (www.microsoft.com).

- A new lightweight form of real-time partnerships and outsourcing with IT suppliers: Companies that did traditional outsourcing of their IT services a few years ago already know what this feels like; a large part of what used to be in-house is now being done somewhere else and changing anything is hard. But unlike traditional outsourcing of IT, cloud computing will provide agility and control that traditional outsourcing cannot match for the most part. For many companies, this will actually be improvement over what they have now and give them choices they perhaps never had when everything required internal execution or to go through the outsourcing supplier relationship (www.microsoft.com).
- A new awareness and leverage of the greater Internet and Web 2.0 in particular: Most companies are still notoriously critical of Web technologies as “not serious” computing. But the Web has grown up considerably in the Web 2.0 era and the challenges in scale, performance, and satisfying fickle audiences of millions has created technologies, solutions, and architectures that can address them in powerful yet economic ways that many enterprise systems are finding hard to match. And in the end, this will serve them very well and allow many companies to acquire the skills and perspectives required to compete effectively in the 21st century (www.microsoft.com).
- A reconciliation of traditional Service-Oriented Architecture (SOA) with the cloud and other emerging IT models: Joe McKendrick illustrates how SOA is evolving because of the cloud. The advent of cloud technologies will have to be dealt with and somehow encompassed by SOA initiatives. Web- Oriented Architecture fits very well with cloud technologies which are heavily Web-based and it’s a natural, lightweight way of building SOA at virtually every level of the organization. For many organizations, the cloud will likely be the straw that broke the back of traditional SOA and move it to a place where it will meet new business and technical requirements, faster rates of changes, and new business conditions (www.microsoft.com).
- The rise of new industry leaders and IT vendors: As many of the top players in computing use their existing strengths to create successful cloud computing offerings, there were also be a new generation of companies that businesses generally aren’t used to dealing with as suppliers. Amaz and Google are two firms that generally aren’t regarded as deeply experienced in the enterprise, and there are many others. The industry landscape will be remade by cloud computing as it is one of the very few new IT developments that will be very broadly adopted in the next several years (www.microsoft.com).
- More self-service IT from the business-side: Many cloud solutions, particularly as they relate to SaaS, will require increasingly less and less involvement from the IT department. Business users will be able to adopt many future cloud computing solutions entirely using self-service (www.microsoft.com).
- More tolerance for innovation and experimentation from businesses: With fewer technical and economic barriers to creating new ways to improve the business (LOB, marketing, sales, customer service, IT, horizontal services), cloud computing will enable prototyping and market validation of new approaches much faster and less expensively than before. While legal, branding, and compliance will often struggle to keep up the pace with the rest of the organization, there will be gradual thawing of the glacial pace of change as business possibilities become, well, more possible in the cloud computing world (www.microsoft.com).
- The slow-moving, dinosaur firms will have trouble keeping up more nimble adopters and fast-followers: Not adopting cloud computing doesn’t spell the immediate demise of traditional companies that aren’t good at making technology and cultural transitions (and make no mistake, cloud computing is a big cultural change), but it will pile onto other recent advancements and make it even harder to compete in the modern business environment. In the end, those too slow to adopt the benefits while managing the risk are likely going to face serious and growing economic and business disadvantage (www.microsoft.com).

For many organizations in the short term the apparent potential of the individual changes above will often not be sufficient to them to make the transition to cloud computing, particularly as the cloud market is so new and major players such as IBM and HP have yet to arrive in full force (www.microsoft.com).

### 5.4.3. Comparison with other systems

**A comparison between cloud computing platforms:** Different cloud computing platforms are compared under different

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**Table 2**

A comparison of several cloud computing platforms

<table>
<thead>
<tr>
<th>S/N</th>
<th>Feature</th>
<th>Abicloud</th>
<th>Eucalyptus</th>
<th>Nimbus</th>
<th>OpenNebula</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cloud Character</td>
<td>Private / Public</td>
<td>Public</td>
<td>Public</td>
<td>Private</td>
</tr>
<tr>
<td>2.</td>
<td>Scalability</td>
<td>Scalable</td>
<td>Scalable</td>
<td>Scalable</td>
<td>Scalable</td>
</tr>
<tr>
<td>3.</td>
<td>Cloud Form</td>
<td>IaaS</td>
<td>IaaS</td>
<td>IaaS</td>
<td>IaaS</td>
</tr>
<tr>
<td>4.</td>
<td>Compatibility</td>
<td>Does not support EC2</td>
<td>Supports EC2, S3</td>
<td>Support EC2</td>
<td>Open and multi platform</td>
</tr>
<tr>
<td>5.</td>
<td>Deployment</td>
<td>Pack and redeploy</td>
<td>Dynamical deployment</td>
<td>Dynamical deployment</td>
<td>Dynamical deployment</td>
</tr>
<tr>
<td>6.</td>
<td>Deployment Manner</td>
<td>Web Interface drag</td>
<td>Command line</td>
<td>Command line</td>
<td>Command line</td>
</tr>
<tr>
<td>7.</td>
<td>Transplantability</td>
<td>Easy</td>
<td>Common</td>
<td>Common</td>
<td>Common</td>
</tr>
<tr>
<td>8.</td>
<td>VM Support</td>
<td>Virtual box, Xen, VMware, VM</td>
<td>VMware, Xen, KVM</td>
<td>Xen</td>
<td>Xen, VMware</td>
</tr>
<tr>
<td>9.</td>
<td>Web Interface</td>
<td>Libvirt</td>
<td>Web Service</td>
<td>EC2, WSDL, WSRF</td>
<td>Libvirt, EC2, OCCI, API</td>
</tr>
<tr>
<td>10.</td>
<td>Structure</td>
<td>Open Platform Encapsulate Core</td>
<td>Module</td>
<td>Light Weight Components</td>
<td>Module</td>
</tr>
<tr>
<td>11.</td>
<td>Reliability</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Rollback host and VM</td>
</tr>
<tr>
<td>12.</td>
<td>OS Support</td>
<td>Linux</td>
<td>Linux</td>
<td>Linux</td>
<td>Linux</td>
</tr>
</tbody>
</table>

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parameters and are shown in the second table 2 in the last section of this article (Open Nebula, www.opennebula.org)

5.4.4. Deployment models
There are different kinds of models which can be applied in various sectors. Some of these are:

Private cloud: Such cloud infrastructure that is owned or leased by a single organization and is operated solely for that organization falls under private cloud (Peter Mell and Tim Grance, 2009).

Community cloud: A community cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations) (Peter Mell and Tim Grance, 2009).

Public cloud: An organization owning the cloud infrastructure by selling cloud services to the general public or to a large industry group called a public cloud (Peter Mell and Tim Grance, 2009).

Hybrid cloud: A composition of two or more clouds (internal, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability (e.g. cloud bursting), such cloud infrastructure is hybrid cloud (Peter Mell and Tim Grance, 2009).

Each deployment model instance has one of two types: internal or external. Internal clouds reside within an organizations network security perimeter and external clouds reside outside the same perimeter (Peter Mell and Tim Grance, 2009).

Comparison
In this paper, we have tried to compare how cloud computing could perform under different platforms such as nimbus, abilcloud, Eucalyptus & open Nebula. The various services such as IaaS, Saas, Support EC2/EC2 have different applicability levels for all such platforms. Also, different developmental languages such as C++, ruby, Java can be used to construct these interfaces.

Content
According to Steve Ballmer(Microsoft CEO) in a speech delivered on March 4, 2010, Cloud computing was thought of as an opportunity, I think a lot about the things that people have done. He discussed on how small applications created worldwide could be integrated into a common structure and can serve numerous applications at a given point of time. An important step in this direction was App Store, where Apple motivated people to monetize and commercialize their intellectual property.

6. RESEARCH FINDINGS
High speed internet required – Cloud computing performance in slow speed internet connections is absurd. Slow connections like dial-up make is Cloud computing a pain for the user or it can be say it is impossible for the users to enjoy cloud computing on slow connections. Large documents and web-base applications need a lot of bandwidth to download. If you are using a low speed internet connection then you may feel Cloud Computing will take more than a lifetime to be operational on that type of connection. In simple words Cloud Computing is not for slow connections.

Constant internet connection – Cloud computing without proper internet connection is just like lifeless body. Because you are using internet for accessing both your documents and applications, in case if you don’t have an internet connection you can’t even access your documents. Departed internet connection means no work on the cloud computing and areas where internet connections are slow and are unreliable it can affect your business. Without having a internet connection it is useless to think of Cloud computing.

Limited features - Today many web-based applications are not fully featured when compared to their desktop versions. Just for an example there is n-number of things which can be done using Microsoft PowerPoint with the help of Google Presentation’s web based feature. Basics of using Microsoft PowerPoint on Cloud Computing are same but it lacks many of the advanced features of PowerPoint. If you are especially fond of power features, you will not look at cloud computing.

Data stored is not secure - All the data in Cloud Computing is stored on Cloud. It’s your duty to make sure how secure Cloud is? Only authorized persons are slowed to access to your confidential data. Concept of cloud computing is new and even if hosting companies say that the data is secured it can’t be a 100% truth. If you will see theoretically data on cloud computing is unsafe as it is replicated along multiple machines. In any cases if your data goes missing you don’t have any chance of local or physical backup. Simply depending on cloud can let you down and there is always a risk of failure. In order to save the data only solution is downloading all cloud documents on your machines. However this is a lengthy process and every time your documents upgrades you will have to download a new copy of the application.

7. CONCLUSION
Cloud computing is a new technology widely studied in recent years. Now there are many cloud platforms both in industry and in academic circle. How to understand and use these platforms is a big issue. Focused on the aspects such as the architectures, characteristics, application and so on, a detailed comparison has been presented in this paper. From the analysis and summarization, users can better understand the characteristics and better choose of cloud computing platforms according to the cloud types, interfaces, compatibility, implementation, deployment requirement, and development support and so on. Though each cloud computing platform has its own strength, one thing should be noticed is that no matter what kind of platform, there are lots of unsolved issues. For example, continuously high availability, dealt mechanisms of cluster failure in cloud environment, consistency guaranty, synchronization in different clusters in cloud platform, interoperability and standardization, the security of cloud platform and data in transmission and so on are all among the issue to be better solved. Therefore, our null hypothesis (H0), Cloud computing affects the services of computing in business applications remains true and alternative hypothesis (H1) is incorrect.

8. FUTURE WORK
Our research has been limited to conceptual study of the existing framework of cloud computing. Due to time & cost constraints, some of the elements may not have been dealt here. However, we propose to extend our research to analytical understanding of the concept of cloud computing in our future endeavors.

SUMMARY OF RESEARCH
1. The current literature on cloud computing gives an insight into the nature and characteristics of cloud computing.
2. It also highlights the possible structures where cloud computing applications exist and how such can be incorporated into future possible circumstances.
FUTURE ISSUES
From the findings, we can suggest that cloud issues needs to be addressed separately for different applications based on storage, retrieval and other technical issues of integration and support.

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