A Survey on Cloud Computing Security Issues, Vendor Evaluation and Selection Process: World Future Society

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---ABSTRACT--
Cloud computing is an emerging technology which could replace long-established IT systems. Cloud computing made big strides forward in 2013, and if a host of industry experts proves correct, it will make even bigger advances in 2014. As Forbes, CxoToday, GigaOM, and other news services that cover technology report, the experts forecast many more companies joining clouds or creating their own; new professional services emerging to manage the clouds and the data within them; and the clouds' expansion transforming IT and work life in general trough out the world. Cloud computing makes it possible for an organizations' IT to be more malleable, save costs and process information and data faster than with long-established IT. Cloud computing is the operating of programs and storage of data and files in an online network, not on physical disks and hardware's. Cloud computing arises from the IT technicians desire to add another layer of separation in processing information. Cloud Vendor Evaluation & Selection offering leverages the database to accelerate the identification and screening of candidate vendors in four-step vendor evaluation and selection process.

Keywords - **Cloud Computing, Cloud vendors, cloud risk, SAAS, PAAS, and IAAS.**
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1. INTRODUCTION

Cloud computing is not an revolution per se, but a means to constructing IT services that use advanced computational power and improved storage capabilities. The main concern of cloud computing from the provider's view as extraneous hardware connected to support downtime on any device in the network, nothing to change in the users' perspective [1]. Cloud computing provides thus a combination of economic and performance benefits. The economic benefit lies in the costs that have to be made whenever an organization needs additional IT services, and this relates to the performance benefits. The cloud computing security issues can in general be divided into seven different categories according to Brodkin [9]. These risks are from the customer's point of view [5]. The risks can be divided into two areas; these areas are privacy related risks and (data) security related risks. While cloud computing presents several economic and business benefits, in practice it also presents challenges that can diminish those advantages. It's easy for business managers to acquire and deploy cloud services outside the guidance of IT and the context of an enterprise architecture. This increases the risk of cloud stretch, resulting in an IT landscape littered with redundant and isolated services. The visualized productivity gains can be diminished by the often error-prone and lagging manual integration of data with other business tools. At some point, IT is brought in to address these issues through automated integrations at increased complexity and cost that further diminishes the envisioned benefits [2].

Business owners are attracted to cloud computing concept because of several features [3, 4].These are as follows:

- Lower initial investment
- Easier to manage
- Scalability
- Deploy faster
- Location independent
- Device independent
- Reliability
- Security

2. BACKGROUND

Cloud computing is fairly new and has thus no long history. In general it originates from the late nineties and has been further developed in the next millennium, the name was created because the data send couldn't be tracked anymore when moving towards it destination. The term cloud was created because you could not determine the path a certain data package followed. The term cloud computing changed over time (Well 2009). In the early years of cloud computing, the organization Amazon was active in the area of cloud computing. They were already a large organization investing in cloud computing. They had huge data centers which normally only use about 8 to 12% of their computing power. The rest was reserved for whenever peak usage was necessary. They started to use

cloud computing in order to save costs in these huge datacenters. After this they were the first to provide cloud computing to the outside world (the customers). This happened in the year of 2006 according to Computer Weekly (2009)[5]. Not much later IBM and Google showed interest into cloud computing and started to invest. It seemed that cloud computing showed potential.

Cloud computing is stated into different definitions. There are definitions that define a cloud as a some what updated version of utility computing (Buyya et al 2009).[11] The other, and broader, side states that anything you can access outside your firewall is cloud computing, even outsourcing (Knorr 2008).

In general there are three main components in cloud computing, these are the servers, the datacentres and the clients (Velte et al 2009). They all connect through the internet with each other and can be seen as a network.
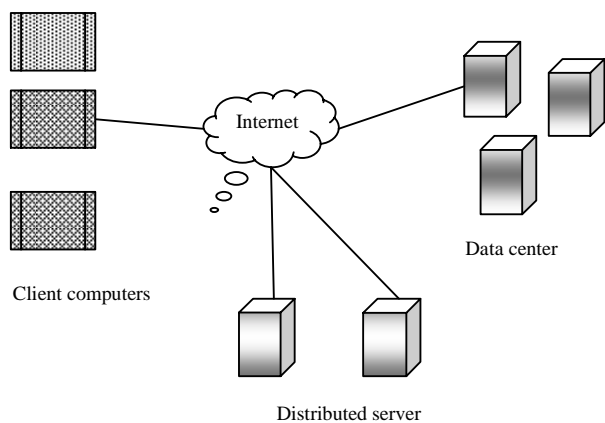
Fig 1: Cloud computing Architecture

3. CALSSIFICATION

Cloud computing is mainly classified in two ways [7]:

1. Location of the cloud computing
2. Type of services offered

### 1. Location of the cloud computing

1.1 Private Cloud.

The business implements its own server and storage hardware but can shift workloads among servers as usage spikes or it deploys new applications.

1.2 Public cloud

The business uses (via an online portal) a pre-constructed platform for computing, storage, and other utilities. Amazon Web   services (AWS) is an immensely popular public cloud platform best Buy and other e-commerce companies implement it, and Netflix is building its entire infrastructure on it.

1.3 Hybrid cloud.

The platform includes both private and public cloud services. The business would run its app primarily on a private cloud but rely on a public cloud under certain conditions, such as when usage spear. AWS struck a hybrid deal in 2011 with Eucalyptus, an open-source cloud-building software program, by which Eucalyptus might connect companies' (Eucalyptus-supported)[16] private clouds with AWS, so that the companies may be move their data and programs to and from either platform.
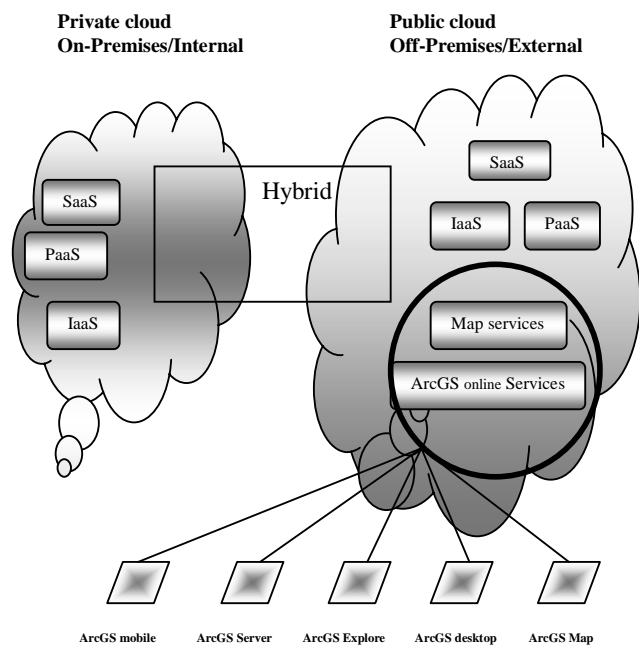
Fig 2. Private, Public and hybrid cloud services.

2. Type of services offered

Based upon the services offered, clouds are defined in the following ways:

2.1 Infrastructure as a service (IaaS)

IT involves offering hardware related services using the principles of cloud computing. These could include some type of storage services (database or disk storage) or virtual servers. Root vendors that provide Infrastructure as a service are Amazon EC2, Amazon S3, Rack space Cloud Servers and Flexi scale.

2.2 Platform as a Service (PaaS)

It involves offering a development platform on the cloud. Platforms provided by different vendors are mostly not compatible. Typical players in PaaS are Google's Application Engine, Microsoft Azure, and Salesforce.com's force.com.

2.3 Software as a service (SaaS)

It includes a complete software offering on the cloud. Users can run a software application hosted by the cloud vendor on pay-per-access basis. This is a well-established

sector. The pioneer in this field has been Salesforce.com's offering in the online Customer Relationship Management (CRM) space. Other examples are online email providers like Google's Gmail and Microsoft Hotmail, Google docs and Microsoft online version of office called BPOS (Business Productivity Online Standard Suite).

4. POPULAR METHODOLOGY

Cloud computing mainly has characteristics of all these technologies [6]:

1. Grid computing
2. Virtualization
3. Utility Computing

A quick overview of these technologies is given here.

1.   Grid Computing

Grid Computing involves a network of computers that are utilized together to gain large supercomputing type computing resources. Using this network of computers at very large and complex computing operations can be implemented. In grid computing these network of computers may be present in different area. A famous Grid Computing project is Folding@Home.

2.   Virtualization

Virtualization introduces a layer between Hardware and operating system. During the sixties mainframe started supporting many users using virtual machines. These virtual machines imitate behaviour of an operating system for each user. VMWare introduced a product called VMware Workstation in 1999 that allows multiple operating systems to run on personal computers.

Typically server utilization in data centres can be as low as ten percent. Virtualization can help in incredibly improving server utilization.

3.   Utility Computing

Utility Computing defines a "pay-per-use" model for using computing utilities. In utility computing, billing model of computing resources is similar to how utilities like electricity are long-established billed. When we procure electricity from a vendor, the starting cost required is minimal. Target upon the usage of electricity, electricity companies bills the customer (typically monthly). In utility computing billing is made using a similar protocol.

5. IDENTIFYING CLOUD COMPUTING RISKS

The risks can be divided into two areas; these areas are privacy related risks and (data) security related risks.

1. Privacy and classified risk

The users and clients of cloud computing are dependent on their cloud provider when it comes to their privacy or classified. The provider of the cloud computing services determines what policies are held. Imagine that these providers also have the ability to make changes in their policies. It could completely change the privacy for clients. (For example when the data inserted by the cloud users is protected in the preliminary made up policy being used). Changing policies which will allow insight in this data for third parties could be a serious risk depending on the importance of data that is being used (Gellman 2009).

2. Security risks

There are several risks to be found in this area, but we will only discuss the most relevant and important ones.

2.1 Attacks

The web in general is haunted by attacks on XML signatures. XML is a web based language and as cloud computing could also be web based, they are exposed to this problem. These forms of hack are usually used to obtain data without having the rights to access them.

2.2 Non attack risks

First there is the Lock in effect. This means that, in this scenario, an organization cannot move its IT around to different service providers (Arthur, 1989)[8]. Cloud computing is fairly new so there are not yet many standardized formats. Also a cloud provider could try to make it difficult for a client to move away to another source. This means that the client will be "locked in" to that particular provider.

6. VENDOR EVALUATION AND SELECTION PROCESS

The cloud computing vendor pool and product capabilities are constantly evolving [2].

- How do you ensure your evaluation of cloud products was based on an up-to-date view of the market?
- How do you distinguish marketing hype from real capabilities?
- How do you wade through dozens of competing products to hone in on their key differentiators within a reasonable timeframe?

1.   Cloud Vendor Evaluation & Selection

Cloud Vendor Evaluation & Selection offering leverages the database to accelerate the identification and screening of candidate vendors in our four-step vendor evaluation and selection process:

1.1 Prepare:

Capture and prioritize the evaluation criteria, including functional, non-functional, implement ability, supportability and cost requirements.

1.2 Narrow:

Identify a candidate list of vendors. Screen out obvious mismatches with evaluation criteria. Optionally perform an RFI and further screen the candidate vendor list to a manageable list of 2-5 for more detailed evaluation.

1.3 Evaluate:

Analyse and score each vendor solution's ability to meet each evaluation criterion individually. Optionally perform a bake-off to further vet a solution's fit as necessary.

1.4 Select:

Based on the priority-weighted score of each solution's fit and anecdotal analysis notes, select the desired solution. Optionally perform a proof-of-concept to validate the selection.

2. Benefits include:

- Provides detailed traceability and due diligence that clearly and confidently justifies your conclusions
- Leverages a scientific approach that separates evaluation criteria priorities from evaluation scoring reducing evaluation bias and facilitating what-if analysis by adjusting priorities after the completed evaluation
- Perficient's cloud computing vendor database accelerates solution identification and evaluation while ensuring the evaluation is based on the most up-to-date market information and Perficient insight

3. Cloud computing providers:

Some of the top cloud computing providers:
- Google
- IBM
- AMAZON web services
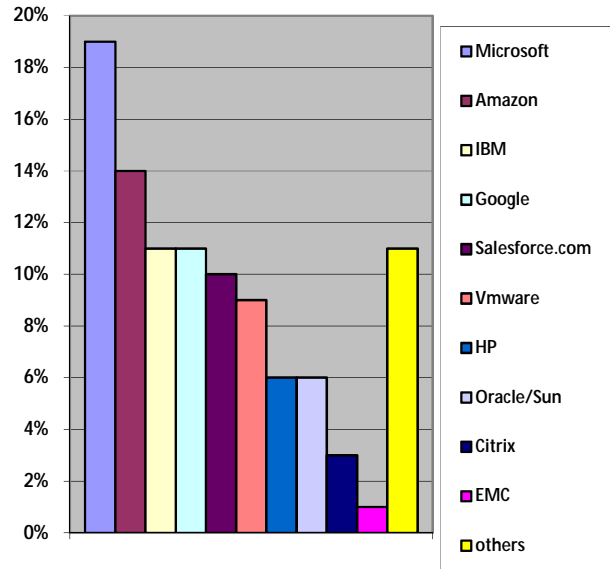- SALESFORCE
- MICROSOFT
- VMware
- HP

Fig 3. Graph shows which vendor is best suited for cloud computing needs

4. Cloud storage vendors:

Two main cloud storage vendors are as follows:

1. Google App

With the online creation and sharing features, Google app has become a major player in the cloud services market for customer and business. Google unveiled its cloud storage services earlier this year as part of its Google App business offering. For $50 per user per month, business get all the features of Google apps, including 25 GB of cloud storage per employee. [23]

2. Amazon simple storage services

Amazon s3 from amazon web services offers potentially unlimited cloud storage that also connect with various client and appliances from other vendors. Pricing based on amount of data stored and data transfer bandwidth used. The purpose is to provide cloud storage services at commodity prices [20].

7. CLOUD COMPUTING SECURITY ISSUES

Seven issues that need to be addressed before enterprises consider switching to the cloud computing model is identified by Gartner.[14] They are as follows:

1. Privileged user access

Information transmitted from the client through the Internet poses a certain degree of risk, because of issues of data ownership; enterprises should spend time getting to know their providers and their regulations as much as possible before assigning some trivial applications first to test the water

2. Regulatory compliance

Clients are accountable for the security of their solution, as they can choose between providers that allow to be audited by 3rd party organizations that check levels of security and providers that don't.

3.   Data location

Depending on contracts, some clients might never know what country or what jurisdiction their data is located.

4.   Data segregation

Encrypted information from multiple companies may be stored on the same hard disk, so a mechanism to separate data should be deployed by the provider.

5.   Recovery

Every provider should have a disaster recovery protocol to protect user data.

6.   Investigative support

If a client suspects faulty activity from the provider, it may not have many legal ways pursue an investigation

7.   Long-term viability

refers to the ability to retract a contract and all data if the current provider is bought out by another firm Given that not all of the above need to be improved depending on the application at hand, it is still paramount hat consensus is reached on the issues regarding standardization.

8. CONCLUSIONS

Cloud security issues and the risks of cloud computing are not well understood today and are one of the biggest barriers to adoption of these services. This section helps CIOs and IT managers assess the security risks of cloud computing with the latest information on cloud security standards; how to manage data security in the cloud, data privacy in the cloud and the regulatory and compliance implications of moving to a cloud model. This topic also covers auditing cloud computing service providers and cloud computing risk management. More about Security.

We found that IT organizations using cloud computing will be able to perform better, faster, more flexible and have lower costs compared to traditional IT. Cost calculations made in the interview chapters indeed showed financial benefits. Actual flexibility and higher performance were not measured with these interviews. From the literature we can say, that flexibility and performance increase compared with traditional IT. This is because cloud computing allocates services to where it is needed, so whenever a client request more processing power, the cloud assigns this to him.

Cloud applications allow companies to eliminate the need to install, run and maintain an application in house by outsourcing it to an application provider in the cloud. The most well-known of these providers today is Salesforce.com which sells CRM software as a service.

The use of cloud computing is growing as for example Rackspace has shown. The human mind has no physical limits. Imagination and creativity run as far as a person wills them to go. Computer software can doubtless go toward far greater use of it, too, frees itself from space and time. Therein lies the promise of cloud computing: Computational power that is infinitely vast and ubiquitous. Forward-thinking organizations and businesses have begun exploring cloud computing in earnest, and many more appear poised to join them in the year ahead. They and we can hope for great things to follow.

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