Trends in information security for Mexican companies, is the cloud computing the answer?

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ABSTRACT

With advances in Information Technology and Communications infrastructure, different forms and modern programming models in use have called for innovative forms of Internet and Cloud Computing has come a long way since it was first tagged as a future perspective by some researchers. Cloud Computing, where computing resources and services are offered and consumed over Internet without the users having knowledge of the infrastructure.
This idea assumes creating an Internet in which programs and data are stored at all times and is available for people who wish to access to them. The truth is that it is not a completely unknown structure for those who often use services on the Net.
Cloud Computing is convenient for users and is profitable for suppliers because, despite having some risks, working with this new type of technology, allows a saving on both licenses and administration of services and equipment needed. Therefore, they may represent an importance for businesses, particularly in Mexico. However, suppliers trying to counter the insecurity that currently is presented by the Cloud, have to abide by rules if they want to offer their services.

Keywords: The Cloud, Cloud Computing, Internet, Information Technology, Virtualization.

1. INTRODUCTION

This research focuses on "the Cloud", precisely because, it is "the place" that can store virtually all files needed at any time and place, as well as use the software tools preferred, and also consider changes that companies may need in their application. This is the impact of Cloud Computing on the organizational structure of the company, not to mention the impact of this technology on the company performance.

The only thing that has not taken the full force of the Cloud phenomenon, are the risks and fear of the unknown by organizations in Mexico and elsewhere, not knowing how secure your information is.

The objective of this work is focused on determining if current trends of the Cloud for security of information can influence the organization and, then, to investigate variations which must comply with the organizational structure of Mexican companies to embrace change and obtain better results by taking advantage of the implemented services features that make a business organization "flexible".

The three levels the Cloud offers that enterprises should pay more attention to are Platform as a Service (PaaS) Infrastructure as a Service (IaaS). Since the first is basically a development environment where companies can create other applications, it makes use of the characteristics of Cloud Computing and IaaS focuses on the possibility of providing companies with all necessary hardware resources for its operations in the Cloud, from storage to computer processing power.

At a time like the present in which video conferencing reduces problems, shift managers and associated costs, it is important to note the role that information has assumed over the past decades. Thus, during the 80s and based on data processing systems, which help the company, there has been a move towards the vision of the company as an information system.

Any company can be seen as a knowledge network that provides the necessary infrastructure to maintain the exchange of information among its members. Cloud Computing was born from the idea that the information, data and programs to manipulate them, must reside in Internet servers, that is to say, applications and data files currently used in the office computer or corporate, would be located on Internet.

2. CLOUD COMPUTING

There are countless definitions about the Cloud Computing developed by different researchers. Armbrust, University of Berkeley, defines it as follows: "Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and software in the datacenters that provide those services". [1]

Peter Mell and Timothy Grance, [2] have defined cloud computing as "Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."

Cloud computing, indeed, is a wide-ranging term that transmits hosted services over the Internet. These hosted services are generally separated into three broad categories: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS). The internet is usually represented as the "Cloud".

It is considered that the onset of Cloud Computing can be attributed to the emergence of Amazon Web Services [3], which started production in 2006 offering the model IaaS (Infrastructure as a Service) with basic processing capabilities and storage on the Internet [4].

Amazon Web Services popularized the IaaS model, making it one of the main concepts of Cloud Computing [5]. The Cloud Computing is considered as a paradigm for growth [6], whose maturity can be considered right now in development [7].

As one of the latest computing paradigms [8], there are still no detailed general agreements for its definition, and there is also disagreement as to their possible architectures, models and standards.

However, Cloud Computing is considered the successor paradigm of network environments [9], especially because it is a disruptive evolution of it to aim the customization and delivery of computer infrastructure, software and applications as services, high usability.

These services hide the user most of the complexities associated with the administration of the base infrastructure can be deployed on demand, are billed on a pay per use and are generally accessed remotely through the Web.

The Cloud Computing has become one of the most important technology has to talk in recent years and has also grabbed the attention of analysts because of the opportunities it offers.

The Cloud is a metaphor for the Internet and is an abstraction for the complex structure hiding. Cloud computing differs from traditional computing paradigms as it is scalable, can be encapsulated as an abstract entity that provides different levels of services to customers and services are dynamically configurable.

There are many benefits that researchers have declared about Cloud Computing, which makes it a preferred technology to be adopted by companies, allowing them to achieve greater efficiency in the use of their hardware and software.

As large organizations are complex, it is important that the Cloud Computing and deliver added value not only as a platform to perform simple tasks. For this reason, you should explore problems on migrating applications and meet organizational needs.

Companies need to consider the benefits, disadvantages and impact of Cloud Computing in their organizations, so they can make a decision on the use and adoption of this technology, in a company, its adoption will be dependent on the maturity of organizational processes and cultural. [10].

Some of the main features available to the Cloud Computing and notably for its preponderance are:

1) Is a new computing paradigm.
2) Resources infrastructure (hardware, storage and software) and applications are provided as services.
3) Virtualization and dynamic scalability on demand are key aspects of this technology.
4) Remote access to services via the Cloud Web Browser from anywhere with an Internet connection.

Cloud Service Models
As known, cloud computing provides with diverse hosted services. The above models offer various services described below:

1) Infrastructure as a Service (IaaS) also referred as Resource Clouds generally provide resources which are managed and can easily be scaled up, as services to a variety of users. They essentially supply superior virtualization capabilities. Consequently, diverse resources may be offered via a service line: Data and storage clouds have to offer a dependable access to data of a potentially large size. The success rate of data access defines the quality of these cloud servers. As infrastructure can be dynamically scaled up or down based on the need of application resources, it helps to equip multiple tenants at the same time. Moreover, the resources that are used are generally billed by the providers on the basis of the computational usage by the users.
2) Platform as a Service (PaaS) supply computational resources via a platform upon which applications and services can be urbanized and hosted. In other way, it supplies all the needed resources to build an application and service via the internet, without downloading or installing it. PaaS classically makes use of fanatical APIs to organize the performance of a server hosting engine which completes and replicates the execution according to consumer requests. As each supplier exposes their own API according to the individual key potentialities, applications developed for one precise cloud provider cannot be enthused to an additional cloud host; there are though attempts to make bigger broad programming models with cloud abilities.

3) Software as a Service (SaaS): It is also referred to as Application or a Service Clouds. SaaS is the model which hosts the application as a service to its various cloud users via internet. The user utilizes the software out of the box without any integration or patching up with any infrastructure. Service clouds provide an implementation.

The three cloud services described above attract some highly significant amount of threats. This includes modification of data without proper backup, leading to data breaches or unauthorized access to sensitive data. In case of proper data backup being taken, it is vulnerable if it is not encrypted properly. Unsecured access to resources over the cloud may lead to unauthorized usage of service, platform or even an infrastructure of the provider or other users due to the associated disadvantages of virtualization.

As on date only few threats have been revealed but there still exists many a more threats that are yet unsolved. As stated by Paul Hoffman and Dan Woods [11], security is one of the major challenges to the cloud and it is often a disturbing.

The Four Deployment Models

Private Cloud: The cloud infrastructure is operated solely for an organization. It may be managed by the organization or a third party and may exist on premise.

Community Cloud: The 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). It may be managed by the organizations or a third party and may exist on premise or off premise.

Public Cloud: The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services.

Hybrid Cloud: The cloud infrastructure is a composition of two or more clouds (private, 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 for load-balancing between clouds).

In Illustration 1, the clearest and most comprehensive definitions of cloud computing, describes it as having five essential characteristics, three service models, and four deployment models.
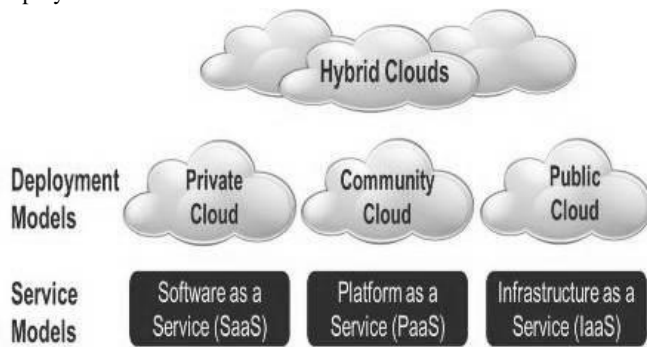

Illustration 1. Cloud computing service models and deployment

Areas to be strengthened in the cloud computing
Some areas where standards are considered to facilitate the adoption of cloud computing are to be developed:

1) Interoperability. Currently, customers are limited to using cloud services from a single provider, as for example can be no collaboration between different cloud providers. The true value of the cloud will be permitted when interoperability, so that in this way the users can combine service offerings from different vendors to create custom [12] solutions.
2) Description of services. Currently when a service is hired, it is difficult to know the characteristics of the team that is hiring, standards governing this, customers could compare offers from different providers and choose the one that best suits your needs, thereby also drives the market more competitive [12].
3) Management and common policy. Standards are needed in this area to ensure that both suppliers and customers to meet the regulatory guidelines of cloud computing.
4) Storage. Standards required for data storage and accessing documents.
5) Security. Standards are needed to ensure protection and transparency of data.

Information Management and Security in the Cloud
Many companies tend to migrate their data to the cloud and thus save costs this way is that you get space for data storage, this storage is cheaper compared to own data centers, but the question is, if these stores are also insurance companies. Therefore, one of the most important concerns is security of these data stores. A survey conducted in 2008 shows that the area of security is one of the biggest concerns that companies have about the Cloud Computing [13]. To understand the issue of security of Cloud Computing is important to know the architecture of this. Most problems or safety issues that can be found. Some safety issues are more related to problems in Web Services and browser.

Security checks in Cloud Computing are not so different from the security controls in other settings, but here different service models are implemented, operating models and technologies, then presents different risks to the organization. The security responsibilities of the provider and consumer are dependent on the models in the cloud. On the other hand, the consumer is responsible for the security level systems (operating systems, applications and data).

There are safety arguments in favor of Cloud Computing assuming you can handle well the risks, as it has much potential to improve safety for businesses.

It is a fact that all types of security measures are implemented on a large scale are cheaper; therefore, in adopting Cloud Computing, companies will get better protection with the same amount of money.

It should be mentioned that to try to build confidence in the cloud, there are researchers working on information security, taking into account that one of the points that interested companies to accept the technology of cloud computing. For example: Eduardo Fernández-Buglioni in his book "Security Patterns in Practice: Designing Secure Architectures with Software Patterns", Wiley, May 2013, described using UML models, and some examples patterns and architectures that are applied in the building of secure systems, including cloud architectures.

Some trust management experts recommend applying multiple security policies to authenticate users, manage identities, and

protect data from unauthorized users. Amazon administrators, for example, log and routinely audit any access to customers [14] data or operating systems.

Because business users rely heavily on third service providers, there are serious concerns about how threats to the reliability and availability of service-from a unstable economic situation of the service provider to natural disasters.

Disasters and cyber-attacks could affect service and consequently, a user business cloud. To alleviate these threats users, services and the cloud should check their data backup plan, system robustness, contingency and recovery plans to support service and incident history before using a particular service.

Cyber-attacks are a particularly serious threat. Services and systems on cloud computing provide rapidly and flexibly huge computing resources according to user demands. For users, computing capabilities and resources often appear to be unlimited, since they are available for purchase at any time and in any amount.

However, cyber-attackers can also buy large quantities of computing resources, allowing them to launch more Powerful cyber-attacks. Attackers have already used the Amazon EC2 and Google AppEngine cloud, for example.[14][15]

To address this problem, services and cloud service providers need effective software engineering techniques to monitor and detect the malicious activities of users as well as strict user authentication and access control

3. ADVANTAGE SYSTEMS IN THE CLOUD

The goal of Cloud Computing is about the users relying less on a physical location to work. Therefore as time goes on, it is no longer necessary to use different hardware elements, such as hard drives or processors, thereby achieving common free users and of course also for businesses using large sums of money in investments needed to purchase hardware.

One of the most interesting approaches to the idea of software as a service is the ability to work without installing any hardware equipment or software, as well as economically sustaining managing, maintaining and modernizing. It is a company service provider responsible for providing appropriate solutions to the availability problems or otherwise that may arise.

Many of the incipient ideas in cloud computing are not exactly new (in fact, it was as far back as 1965 that Western Union dreamt up the future role of the company as a nationwide "information utility" as part of the company's strategic plans [16]), which have led several observers such as Oracle's CEO Larry Ellison to declare the whole concept as a product of hype [17].

Cloud computing evolved from the knowledge and experience of managed services, Internet services, application service providers, etc. Its technology is the result of a paradigm shift and is improving business computing because:

1) it is modular, compartmentalizing software applications and associated hardware and infrastructure;
2) it is uniform, utilizing the same resources that customers share.

A business using cloud computing can avoid large outlays of capital expense as well as perpetual maintenance costs, thereby aligning cash flow with total system cost.

In general, some of the advantages that the Cloud offers to enterprises are:

1) Costs. The users of these services only pays for the resources they use, designing a payment plan usually from the time when it is used (memory, processing, storage). Hence, it can be considered the most attractive advantage presented by the Cloud Computing and if not, at least the most obvious of all this technology. Responsibility for the implementation of the infrastructure is for the provider and the client does not have to worry about buying computer equipment, train personnel for the setup and maintenance and in some cases, for software development.
2) Competitiveness. Thanks to the Cloud, any organization can compete on equal terms in areas of Information Technology with companies of all sizes, and whereas, the competitive advantage is with the one that has the better computing resources. The Cloud gives the possibility of not having to buy expensive equipment; small businesses can have access to the latest technology at prices within reach, paying only for consumption.
3) Availability. The supplier is obliged to ensure that the service is always available to the client.
4) Abstraction of the technique. Cloud Computing allows the customer the ability to forget about deployment, configuration and maintenance; transferring this responsibility to the service provider.
5) Access from anywhere in the world with access to Internet. Using applications designed on the paradigm of Cloud Computing can be accessed from any computer equipment in the world that is connected to the Internet. Access is usually made from a web browser, which enables the application to be used not only from a desktop computer or a laptop, but goes beyond, allowing the user to use the application from any mobile device.
6) Scalability. The client (user or company) does not have to worry about updating the computer equipment on which they are running the application, nor by the operating system upgrade or installation of security patches. It is the responsibility and obligation of the service provider to perform these updates. In addition, they are transparent to the client, so that the application must still be available to the user at all times even when performing the process of updating the provider side. Updates and new features are installed almost immediately.
7) Companies can concentrate on business processes. The client (user or company) can focus more resources and efforts towards a more important strategy, having a direct impact on the business processes of the organization, transferring responsibility to the provider and the deployment, configuration and maintenance of and infrastructure necessary to run the application.

4. PROBLEMS IN CLOUD SERVICES

Cloud Computing is a paradigm that can provide computing services via the Internet and in this context the Cloud is a metaphor for the Internet [18]. Currently, there are many important players in the Cloud and also many services.

However, between 2010 and 2011 many, either by faults or vulnerabilities in their infrastructure, were not 100% reliable. Even now, companies have to resolve the legality of the information circulating in these business models. Richard Stallman [19] believes that Cloud Computing endangers user liberties, because they allow their private and personal data to be held by third parties.

Service providers for Cloud Computing should pay attention to the following points, considered as disadvantages for companies in their use of information management:

1) Perception of loss of security and privacy. Understandably the perception of insecurity generated by a technology that takes information (important and sensitive in many cases), from servers outside the organization, leaves the data to the provider. Therefore, for many (users or a company) it is extremely difficult to believe that their sensitive information to others and considers that the proposals of Cloud Computing threatens the vital information for business processes.
2) Availability. Availability was formerly listed as an advantage, but because it remains a matter solely for the responsibility of the service provider, the system can fail to keep the service available to the user, and not perform a corrective action to restore the service. In this case, the client should wait until the problem is resolved by the provider. It is in this sense that it becomes a small disadvantage too.
3) Lack of control over resources. By having all the infrastructure and even the application running on servers located in the Cloud, i.e. the supply side, the client lacks complete control over resources and even on the information once it is uploaded to the Cloud.
4) Dependence. The client becomes dependent not only on the service provider, but also the efficiency of the internet connection, because the user must be permanently connected to the system to achieve what is in the Cloud, (including data and software to use it.).
5) Integration. The user of the Cloud must follow certain rules established; otherwise, it is not at all easy or practical to integrating the available resources through infrastructure Cloud Computing with systems developed in a traditional manner. This is an aspect that should be consider by the client to see how feasible it is to implement a Cloud-based solution within the organization.

5. VIRTUALIZATION AND CLOUD COMPUTING

Zhiguo Wan et al. [24] states that "cloud computing is a new computing paradigm that is built on virtualization, distributed computing, utility computing and service-oriented architecture."

Virtualization is an emerging paradigm of information technology that separates the functions of computer technology and implementation of hardware. [25]

With the advancement of the IT industry, the emerging paradigm is that of Cloud computing which promises reliable services delivered through large-scale data centers that are based on compute and storage virtualization technologies.

Virtualization is essential for the optimal development of Cloud Computing and refers primarily to the platform issue. It can be said that virtualization is an abstraction of the technological resources that allows servers to create virtual devices which can be used to increase the resources rather than as discrete systems.

Cloud Computing is an interesting topic of virtualization, allowing a server to treat many users. Another issue that goes hand in hand with virtualization is clustering, which allows treating many servers as one, and this allows quickly incorporating new resources to virtualized servers, reducing space and power costs and simplifying overall administration.

This makes it easier to create test environments that allow implementing new applications without impacting production, streamlining the testing process, and general system failures isolated from a virtual machine without affecting the other virtual machines, and finally bringing a direct benefit in reducing the hardware needed, as well as their associated costs.

Virtualization can offer a drastic and significant change on how Business pays for its technology and handles the associated risk. First, by removing the hardware associated with IT functions, capital costs are virtually eliminated. Secondly, the remaining costs are strictly transferred into an operating expense with on-demand or subscription based on Cloud Computing applications.

Three commonly used virtualization technologies are: VMware Infrastructure, Xen and KVM.

VMware Infrastructure is a software suite designed to centralize and optimize desktop management and data center resources through virtualization. Every component of the suite can function with diverse operating systems, applications and hardware devices. [26]

The Xen hypervisor is estimated to have about 20% of the server virtualization market and close to 100% of the existing cloud infrastructure including Amazon EC2, Rackspace Cloud Servers, and GoGrid. [27]

KVM (for Kernel-based Virtual Machine) is a full virtualization solution for Linux on x86 hardware containing virtualization extensions (Intel VT or AMD-V). It consists of a loadable kernel module, kvm.ko that provides the core virtualization infrastructure and a processor specific module, kvm-intel.ko or kvm-amd.ko. KVM also requires a modified QEMU although work is underway to get the required changes upstream. [28]

6. CONCLUSIONS

Cloud Computing is a natural evolution of the widespread adoption of virtualization, service-oriented architecture and utility computing.

Cloud computing offers several opportunities of using Information Technology infrastructures as a utility with the possibility of scaling up or scaling down depending upon the needs an organization.

This technology usually has a gradual growth. While it is true that Cloud Computing is a technology that has been used for some years, it has yet to be fully absorbed as a central tendency

in organizations, with the problems and disadvantages presented in this investigation.

The level of acceptance in organizations varies depending on the size of small and medium enterprises in Mexico, and implementing solutions based on Cloud Computing, while larger organizations do so according to individual needs.

However, more and more end users, to whom Cloud Computing has changed the way they carry out their activities, which are improved in most cases, allows them to collaborate in a different way with others in different locations, accessing applications that require the web browser from virtually any computer, even from mobile devices.

Cloud Computing is suitable for business and is profitable for suppliers because, despite presenting some risks to work with this new type of technology, it allows a saving of both licenses as well as administration services and equipment required for these.

Currently, any company that wants to offer Cloud Services is free to do so and the situation will change dramatically in a few years. It is important for security that providers will have to abide by the rules if they want to offer their services and businesses and change their philosophy and abandon traditional means of building information systems. They must work on turning disadvantages into advantages and pave the way for growing companies in the acceptance of this not so new paradigm which is the Cloud.

The cloud computing is gaining worldwide visibility and can say it is a technology that is just reaching maturity, there are currently no standards accepted by all those involved in providing services in the cloud, it brings problems in the adoption of this technological model because services do not have that added value that encourages customers to use reliably.

Cloud computing makes it possible for content providers to quickly deploy and scale services and benefit from low-cost, pay-by-use models, while service users enjoy the flexibility that Internet-based computing provides.

However, the computer industry moves toward providing PaaS and SaaS for consumers and businesses, there will be an increase in the number of cloud platforms available to meet the needs. Several industrial organizations and academic and Open Source Initiative (OSI) have had to develop their own technologies and infrastructure.

It can be concluded, that the Cloud is the answer regarding cost, availability, competition, location and scalability for Mexican companies and that they can devote themselves to pay more attention to changes in their business processes facilitating their position in the market.

Cloud Computing should be adjusted specifically for Mexican companies needs as follows: Being available off the shelf; User friendliness; Ubiquitous systems; Low price; Having a variety of options to choose from; Customer support/communication; Availability of staff to work with and maintain the system; Strategic impact; Software already existing to implement customizable Enterprise Resource Planning (ERP); Existence at

least in some countries of Government/tax regulation and policies that support IT projects based on Cloud computing.

In the case of companies in Mexico, access to cloud services is becoming a critical element for their competitiveness and efficiency.

Inversely, lack of access mean that companies do not achieve their full potential.

In general, cloud computing services provide an open business platform for everyone, everywhere, for all countries, for each company, for each organization and for each type of business and new opportunities for collaboration and social networking between trading partners, to allow access to sources of information regardless of distance and time shortening.

Industry observers say that cloud computing has great commercial potential.

Cloud computing has a bright future. In the future, the Internet of things combined cloud computing will promote the success of cloud computing. It is must to make the standards of the interface in cloud computing.

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