Associated Risks of Cloud Computing for SMEs

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Abstract

Cloud computing is an emerging computing model, which changed the whole picture that distributed computing used to present. Although, Cloud offers great benefits, it introduces a myriad of threats. These threats must be overcome in order to benefit fully from this new computing exemplar. This paper reveals benefits of exploiting cloud computing for small medium enterprises. Additionally, we identified risks associated with leveraging cloud in SMEs. Finally we conclude that a well-defined risk management program that focused on cloud computing is vital for success of SME transformation to cloud.

Keywords: CLOUD COMPUTING, SECURITY, SME, RISK

1. Introduction

Cloud Computing has raised the rate of concern about outsourcing. Despite the similarity between Cloud Computing and its previous generation, Grid Computing, it is more resilient and can be used for various types of applications. This paper classifies the risk associated with Cloud Computing in SMEs. We will describe what risk users. In addition, SME information increases the following issues: Protection of Critical Infrastructures; Information Assurance and Trusted Computing; Privacy and Freedom of Information; and Laws and Regulation of IT Security. Hardware, software, back up, operations, and help desk are conducted by cloud vendor. Also software as a service, software development and platform control are managed by vendors. In early 2009, there is a 320 percent raising of using Cloud Computing[1]. Cloud Computing contributes to reduce the cost of IT projects[2]. Most governments like to migrate to Cloud Computing. In 2008, The United State government spent $277 million and tends to increase it to $792 by 2013. This matter is also true for other governments around the world. The government of Japan has set up many private cloud environment, and in the future host all government's systems[3]. And the European Union is going to establish cloud-based IT infrastructure for members of EU[4].To mitigate the risk and utilizing Cloud Computing effectively it is vital to understand the meaning of Cloud Computing, defining risks and standard related to them. Indeed, by considering them, companies and governments can estimate objectives and strategy.

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2. An overview of cloud computing

Cloud Computing is a network-based environment and shares resources, even they can be hardware or software. The virtualization is the technology, which all providers employ in Cloud Computing, and provides abilities for resources through network infrastructure. Moreover, instead of having only one system on a physical server, several systems with different OS (Operating System) can be run with that hardware. This is a special advantage of using Cloud Computing allowing sharing hardware and software, which it leads to reducing cost. The Customers only pay for what they have to use not for all other resources such as hard disk, memory, cooling system and etc.[5]. According to the capability, there are three types of deployments: SaaS (Software as a Service), PaaS (Platform as a Service) and IaaS (Infrastructure as a Service) and they are shown in Fig 1.

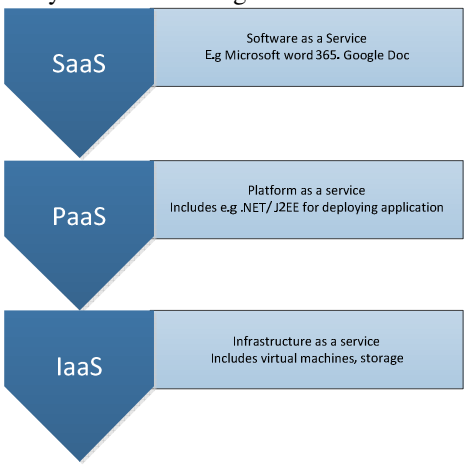

Fig.1.Different deployment types

Indeed, another kind of classification is based-on access or deployment model, which entails Private, Public, Hybrid and Community Cloud Computing.

- Private cloud: This kind of cloud is used, managed and maintained by a business unit or organization.
- Community cloud: The Cloud infrastructure is shred between several organizations or businesses with common concerns (security, policy, forensic, etc.)[6].
- Public cloud: The public can use applications, storages and other resources freely or by pay-per-usage. The owners of this sort of cloud are organizations and businesses such as Google, Microsoft and Amazon, to name a few.
- Hybrid cloud: It is a combination of two or more clouds(public, private, community[6]Fig 2 illustrates an overview of Public, Private and Hybrid Cloud Computing.

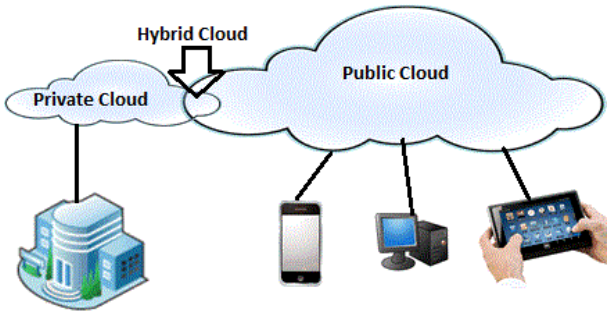

Fig.1. Public, Private and Hybrid Clouds

3. What is SME?

Different industries and different countries define Small-medium enterprises differently and they use adverse classification for different fields[7] regarding to employment, sales or investment[8]. At present, there is no common definition for SME. European Commission has developed a tangible criteria for SME[7] including employee numbers, turnover and balance sheet statistics[9]. However, all these criteria were afforded equal consideration, attributes of a modern day small to medium sized firm argued to not be undertaken. They called the backbone of economy breeding industrial development. Regarding to size and operations, SME assists endogenous sources and reinforces economy infrastructure. According to the Secretariat to National SME Development Council approved on 9th of June, 2005; SME is based on Number of employees and annual sales turnover, and it is employed in three sectors, Primary Agriculture, Manufacturing (including agro-based), and Services (including Information and Communications Technology). SME characteristics and market attributes bring some obstacles including limited capital, cash flow and human resource. Cost effectiveness, flexible service and personal accountability are more important for customers. Migration to Cloud Computing with a standard IT model is difficult for SMEs, although long-term benefits are more tangible in comparison with short-term. IT partner of SME should be convinced about the benefits of leveraging Cloud services.

4. Cloud Computing benefits for SMEs

Computing became more pervasive within the organization, the increasing complexity of managing the whole infrastructure of disparate information architectures and distributed data and software has made computing more expensive than ever before to an organization. For small and medium businesses that their capital and cash flow is very limited and they hardly afford investment for IT infrastructure, it is a bad news. Nevertheless, the promise of cloud computing is to deliver all the functionality of existing information technology services, even as it dramatically reduces the upfront costs of computing that deter many organizations from deploying many cutting-edge IT services. For several years, CIOs were freely working and their focus was IT effectiveness. Despite CFOs unhappiness of spending much capital on IT, they were spreading IT infrastructures and try to adjust all these fees by saying it can provide competitive advantages but after economic recession, CIOs felt heavy pressure on them to justify expenditures and business advantages. Growing IT infrastructure needs more support human resource and even using different technology and tools need different expertise, which costs more and makes it complicated. By decreasing IT budget, it was obvious that cost effective solutions would become hot topics[10]. The

philosophy behind cloud computing is very simple. Get rid of any IT burden. Utility computing is another definition, which makes it clear that it would become 5th utility[11].

4.1. Cost

In a "Cloud Migration: A Case Study of Migrating an Enterprise IT System to IaaS", Khajeh-Hosseini et al. [3] talked about the third party cloud infrastructure. According to them if the third party cloud infrastructure is introduced then it presents many opportunities for enterprises to improve the management of income and outgoings for both finance staff and customers. It also helps the easing of cash-flow management for finance stuff as the cloud-pricing model has minimal upfront cost and monthly billing and it lessens the variability of expenditure on electricity. These are the benefits comparing to the in-house data center, as it can be costly to buy hardware and cash flow can be slow and difficult from clients. Along with that, energy costs will also go down; as you are not running, your own data center and third party cloud will be responsible for that. The Cloud infrastructure is also very helpful for the finance department of the company to reduce the administrative burden. Third party cloud infrastructure solutions offer new pricing models, which help in managing income for customers, sales and marketing staff[12]. Economics, simplification and convenience of the way computing-related services are delivered seem to be among the main drivers of cloud computing[13].Dorey and Leite[14]mentioned the cost reduction as one of the items that drive the IT environment to go for cloud computing. In providing a future perspective of cloud computing, Lillard et al [15]announced that supplying on demand computing power in a very low-cost fashion was the main driver of cloud computing emergence. Furthermore, Marston et al[16] highlighted the lower cost of entry for small business as one of key advantages of cloud computing not only for SMEs but for third world countries as well. Cloud computing represents a huge opportunity to many third-world countries that have been so far left behind in the IT revolution[16]. Also they pointed out that cloud computing does not need heavy upfront capital investment as another benefits offering by cloud computing[16].

4.2. Agility

In today's economic environment, the ability to respond to rapidly changing customer needs is a key competitive differentiator. However, Agility for SMEs is not only a competitive advantage rather it is vital for them to survive in nowadays-fast changing business environment. By enabling businesses to rapidly adjust processes, products and services to meet the changing needs of the market, cloud increase agility of business[17].By the help of cloud, enterprises can offload three kinds of low-level administrations. First is system infrastructure which includes hardware maintenance, spare parts, adding new machines and infrastructure software is taken care by cloud. Second, once the enterprises define the backup policy, cloud provider is responsible to execute it. Lastly, a single application becomes available to all authorized users. Though the management of the application i.e. application support, upgrade issues and user management is not included as moving to cloud does not change much in these tasks [9]. Outsourcing those kinds of low-level maintainability and keeping infrastructure operational brings the agility to firms to focus on their business processes and improve them. Cloud computing can lower IT barriers to innovation, as can be witnessed from the many promising start-ups, from the ubiquitous online applications such as Facebook and YouTube to the more focused applications[18]. Get rid of unnecessary IT related concerns increase the opportunity of facilitating business processes and operations with innovative solutions.

4.3. Others

Knowing highlighted benefits above, researchers and practitioner address more advantages for using cloud computing such as scalability of services[17-19],different billing types[17].Cloud computing also makes possible new classes of applications and delivers services that were not possible before. Such as mobile interactive applications that are location-, environment- and context-aware and that respond in real time to information provided by human users, nonhuman sensors (e.g. humidity and stress sensors within a shipping container)[18]. Another type of new applications that cloud computing made possible is parallel batch processing that allows users to take advantage of huge amounts of processing power to analyse huge amount of data for relatively small periods[18].Business analytics that can use the vast amount of computer resources to understand customers, buying habits, supply chains and so on from voluminous amounts of data is another application that storing data in cloud made it easier and more applicable[17, 18].In addition, cloud computing offers offloading sophisticated technical IT related tasks and management that needs deep knowledge and skills to maintain IT infrastructure. By hiding those complexities, while it attract any one to approach it and benefit IT advantages, end user can produce sophisticated products or services without need to high level IT knowledge[17].Establishing a fair competition environment and lowering the barriers is another benefit of cloud invent. In the past, large corporations have had an advantage over small corporations in their access to capital and their ability to leverage their existing human, software, and hardware resources to support new marketing and strategic initiatives. However, since the advent of cloud computing, the barriers to entry for a particular market or market segment for a start-up company have been dramatically reduced and cloud computing may have tipped the balance of strategic advantage away from the large established corporations towards much smaller or start-up companies[17]. These facts are relevant to developing countries or poor countries that their situation in terms of available capital, resources and skilled human resource is like SMEs. Another benefit that is available by cloud computing is green computing. These days that environmental issues are considering more and business care more about running firms in green way. Electricity usage by servers and cooling devices in data centres should decrease to help earth. Cloud vendors can do much better than the typical on premise computing centres, or even institutional data centre, based on better management of voltage conversions, cooler climates and better cooling, and lower electricity rates (cloud vendors tend to cluster near hydropower)[18]. They also often locate where they can do cooling easier and with less energy consumption. In conventional systems, system resource utilization is low, estimated at 15–20% for data centres; other estimates are lower. In contrast, clouds smooth these effects across many customers, and today may attain 40% utilization, with higher values plausible in clouds (e.g., as load sharing over time zones becomes more mature, and exploiting more diverse user bases). One virtual server seems likely to do the work of at least 2.5 typically utilized servers[18]. Consequently, higher utilization means less power usage that helps the environment to keep safe. In 2008, IBM did more than 30 energy assessments around the world and found that 60–70% of the energy used in the data centres was used for indirect purposes such as cooling and lighting the facilities with only 30–40% of the energy being used directly by the computing hardware[20]. Public cloud providers locate their data centres where bandwidth, cheap energy, abundant water for cooling, and proximity to markets are optimal. They have focused on creative approaches to efficient resource usage including not only electricity usage but also water recycling and equipment recycling upon disposal[19].

5. Associated risks

We categorized associated risks as below:

5.1. OUTSOURCING OPPORTUNISM RISKS

The outsourcing risks are mainly related to three forms of deliberate, self-service vendor behaviour.

- Shirking and deliberate under performance [21-26].
- Poaching and the theft of intellectual property, proprietary software, critical confidential data[22, 25, 27-29]
- Opportunistic reprising, client lock-in, and vendor hold-up [22, 24, 30-34].

If output of vendor and its effort are inspected by client, shrinking will not be probable. There are three forms of shrinking in Cloud Computing. (1) Under consolidate server or network intentionally; (2) Not controlling back-up system, firewall; (3) Under investment for extra equipments for unpredicted events. Poaching occurs when ISP abuse the user's data and resources supplied under contract. Vendor may grant the data directly to the challenger, or other provider. This function can expose secret plan, design or strategies of a customer. The greatest challenge that e-government services concern about is misusing of private data. If an ID bank is compromised, the result only effects on financial. In contrast, a compromised e-government ID always can get the personal information exposed, and full identity theft[35, 36].Among Cloud's services, IaaS is safer when two rest services are vulnerable to vendor lock. While an application is developed on special vendor platform, it is not plausible to move it to another vendor. A Google application could not be easily moved to Amazon or Salesforce.com development platform. A significant risk is created by lack of interoperability at the levels of SaaS and PaaS. Vendor lock-in always is considered as a factor in renting a Cloud system especially for governments which are eager to use [37-39].

5.1.1. Technology development risks

Some kinds of risk are different from ones created by vendors. Technical and operational limitation get complex project to have operational risks. The contract design can mitigate or manage risks associated with outsourcings. In contrast, contract is not able to manage risks associated with deployment of novel technologies. Some types of risks are fixed from one program to another.

5.1.2. Functionality Risk

When vendor does not know what system should do, or what is the user's needs [23, 40]. The capability of the Cloud Computing is not clear yet. We do not know to what extend legacy systems will be integrated with Cloud system. Furthermore, it is not clear or even possible to merge applications in different Clouds. Likewise, the data storage is placed in various geographical locations and it is not obvious that they stored inside the country or outside.

5.1.3. Political Risk

It is common that the members of an organization oppose against new technology and adapt to it. Migrating to Cloud can reduce number of system Administrators and software developers. The inactive

employees in these fields will become unnecessary; therefore, companies or organizations must be careful to keep their best staff until find new employees to replace.

5.1.4. Project Risk

Mixing of technologies and scope of development makes implementation hard to manage. Testing will not be completely done, and it will affects the quality and time of completion[41]. In Cloud Systems, some portion of applications run in the server side and some on the client side, therefore, ensuring about the correct running or performing of application is unpredictable and hard.

5.1.5. Technical Risk

It happens when hardware or software technology becomes complex [40, 42]. The existence of unsolved technical problems related to security and privacy in client's or vendor's site could make hard the Cloud Computing implementation. Identity theft is one thing that e-government always is worried about and it became more sensitive when Cloud Computing implementation encounters the security problems.

5.1.6. Financial Risk

If project could not meet benefits, financial risk will occur. For small or medium enterprises, the benefits are nearly acceptable if they reduce the cost of system administrator, maintaining hardware and software. SaaS and IaaS suggest opportunities for those companies that are going to start.

6. Conclusion

Small Medium Enterprise (SME) is infrastructure of economy in each country. They usually do not have enough budgets to spend so much on IT program, enhance their software and upgrading and maintaining their hardware. Cloud Computing plays an important role to contribute SMEs to decrease their expense and time on IT field. It enables SMEs to develop application-driven their needs with less price in the long-term. Although this technology has positive advantage, Cloud Computing-related risks should be considered. Most governments are not sure about the future of this scientific achievement, and are worried about security and private data. In this paper we identified what are the significant risks that may each SME deciding to move towards Cloud comes across. Two categories are described, Outsourcing opportunism risks and Technology development risks, and in the future work we will work on ways to solve the problem by reducing these risks, and suggesting the best approach.

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