SIE 2015
6th International Symposium on Industrial Engineering
24th-25th September 2015
FACULTY OF MECHANICAL ENGINEERING
STEINBEIS ADVANCED RISK TECHNOLOGIES
INNOVATION CENTER FME

GUIDELINES FOR SUCCESFUL CLOUD SELECTION

Marija Rakic-Skokovic[1], Darko Stefanovic[1], Bojan Lalic[1]
[1]Faculty of Technical Sciences, University of Novi Sad, Serbia

Abstract. *In order to be successful and become a leader in their market area* ***o****rganizations need IT to be an enterprise backbone, focused on core goals of organization business. In past decade Cloud computing has become more and more significant as a potential solution in delivering greater business and IT agility, quicker access to application enhancements or innovative new cloud-optimized applications. Cloud computing offers many features, which when properly utilized can unleash exponential results. Selecting the appropriate solution and moving to a cloud is complex process that has to be properly managed. Once organization makes a decision about moving to a cloud, it steps to the next phase of choosing provider of cloud computing services. In this paper some of the main questions that organization should take under consideration when choosing the cloud solution are presented.*

Key words: *cloud computing****,*** *cloud provider, cloud service.*

1. INTRODUCTION

In recent years, cloud computing has been considered to be one of the most important paradigm shifts in computing technologies. As an emerging concept, it has attracted much attention in both academic and commercial area. Metaphor "cloud" refers to the ubiquitous accessibility and availability to computing resources by means of Internet technologies [7][8]. There are a large number of cloud computing definitions given by different technologist. From a business perspective, Marston, et al. [4] define cloud computing as "an information technology service model where computing services (both hardware and software) are delivered on-demand to customers over a network in a self-service fashion, independent of device and location. The resources required to provide the requisite quality-of service levels are shared, dynamically scalable, rapidly provisioned, virtualized and released with minimal service provider interaction. Users pay for the service as an operating expense without incurring any significant initial capital expenditure, with the cloud services employing a metering system that divides the computing resource in appropriate blocks."

Cloud computing is enabled through the use of virtualization technology. As a base there is an application (hypervisor) that runs on a host computer. This application simulates physical computers which can run any type of software (operating systems or end-user applications) by creating one or more virtual machines, [5]. Hardware level consists of independently located datacentres which incorporate a variety of physical devices (hard drives, processors, network devices). The effective management of servers is enabled in the next layer - the combination of the virtualization and the management software layers. Thanks to the virtualization technology, cloud computing offers robustness and reduce traffic congestion. The management layer has ability to monitor traffic and respond to changes by creating or the destroying necessary server nodes. Implementation of security monitoring and rules throughout the cloud it is also possible. The diagram below shows common cloud architecture.

Figure 1 Cloud architecture

2. NEED FOR CLOUD COMPUTING

In order to scale up company's IT infrastructure so it can meet ever changing business needs, organizations have to invest time and money. The scaling process can be slow and inefficient if entire IT infrastructure is located on premises. As a more agile and efficient way of building their IT platform, companies nowadays are adopting cloud computing as a solution. Cloud computing technology enables companies to maintain their data and applications by using central remote servers over internet. It provides on demand resources and services over the internet with the power of scalability and reliability.

Some of key cloud computing characteristics are [9]:

- **Flexibility/Elasticity**. Computing resources and capabilities can rapidly and elastically be delivered to users, as needed (in some solutions automatically), to promptly scale up or down.
- **Infrastructure scalability**. According to demand, new nodes of cloud architecture can be added or removed from the network, with few modifications to software and infrastructure set up.
- **Access over broad network**. All capabilities are available and can be accessed by use of various devices over the network (e.g., mobile devices, PCs, PDAs).
- **Independence of location**. Resources provided are situated in geographically independent locations, generally unknown to the customer.
- **Reliability.** The use of multiple redundant sites improves reliability, making cloud computing suitable for disaster recovery and business continuity.
- **Cost effectiveness and economies of scale**. In order to be cost effective, cloud implementations have a tendency to be as extensive as possible. To lower costs large-scale cloud deployments can often be situated in low-priced real estate and close to inexpensive power stations.
- **Sustainability.** It offers more efficient systems and improvement of utilization of resources.

3. CLOUD COMPUTING DEPLOYMENT MODELS

Architecture solutions for cloud computing have four deployment models described below [1][2][6][8]:

- **Public cloud**. Computing infrastructure and/or application is shared across different business units, large industry group or personal users and available to general public. It is owned and managed by a provider of cloud service.
- **Private cloud**. The cloud infrastructure is implemented within the organization's private firewall. It can be located on or off corporate premises, and it's usually controlled by the organization's IT department, but it can be hosted and managed by a third-party service provider.
- **Community cloud**. This type of cloud supports a specific community that has common business objectives and concerns (e.g., compliance considerations, policy, mission, security requirements, or legal issues). The infrastructure is shared by several enterprises in the group. It can be located on or off corporate premises and it can be governed by one or all of the organizations in the group or by cloud service provider.
- **Hybrid cloud**. It represents a combination of a private (or community) cloud platform with the use of services provided from a public cloud provider. One or several touch points between the environments enable portability of data and applications. The communications between different infrastructures (public and private), which operate independently of each other, is empowered over an encrypted connection with the use of standardized or proprietary technology.

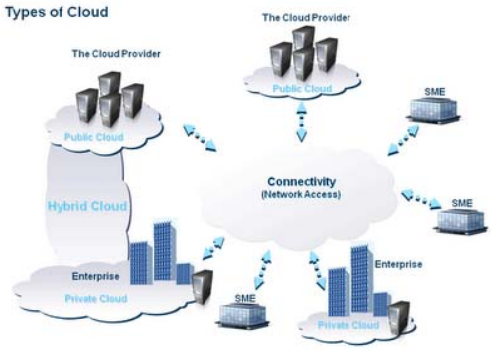

Figure 2 Different cloud types

4. CLOUD COMPUTING SERVICE MODELS

Cloud Computing Framework is defined as a Service Oriented Architecture (SOA) in majority of literature reviews, offering three main areas of services [1][2][6][8]:

- **Software as a Service (SaaS).** This type of cloud service represent software distribution model which offers a large range of applications from productivity applications (e.g., word processing, spreadsheets, etc.) to software for Enterprise-Resource Management (ERM) or Customer Relationship Management (CRM). Instead of installing and maintaining software, users access the applications that are developed and owned by service provider and centrally hosted on the cloud, by using a thin client (mobile application or web browser). Benefits of this model include centralized configuration and hosting; software release updates without requiring reinstall, and accelerated feature delivery.
- **Platform as a Service (PaaS)**. This category of services provides platform (hardware and software tools) for the creation of application, delivered over the Internet to their users as a service. An advantage of this model is the ability to provision all aspects of software development (design, testing, hosting, version control and maintenance) over the Internet.

- **Infrastructure as a Service (IaaS)**. This mode of services refers to remote on-demand delivery (through the Internet) of a full cloud computing infrastructure (e.g., storage devices, virtual computers, servers, network…). Benefits of this model include pay-per-use and resource elasticity to match the computing demands.

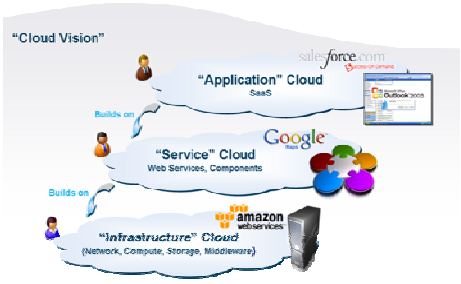

Figure 3 Services of Cloud Computing

5. CHOOSING CLOUD SOLUTION

One of the several IT technologies that are making today's headlines is Cloud computing. Vendors that provide various cloud services aggressively promote a large number of different ways organizations can benefit from choosing their solution. These benefits are presented in a way that on the first look it seems that organization should move entire IT "into the cloud". However, it is obvious that questions can also be raised for every named benefit. Choosing one solution among variety of cloud computing solutions that are offered by a large number of companies can be very challenging.

Starting point in process of selecting a cloud solution should be to conduct a basic analysis of requirements based on: organization business needs; benefits that organization is looking for; parts of business that are suitable for moving to a cloud; the use of the system by employees; should organization use cloud-based infrastructure and keep control in-house, buy the entire process as a service, or do it partially; are selected services enterprise-ready and do they offer the high enough levels of security and governance; how much money and time organization can invest in this project; how can organization make use of new capabilities?

Once organization makes a decision to move to a cloud, the next step is to choose right cloud computing service provider. Some essential questions that has to be taken under consideration when evaluating if the potential provider is right one for organizations particular needs are listed below, [3].

5.1. What types of cloud services are provided?

Making decision on which type of services to choose will be dictated by organization's cloud computing needs. There are software-based cloud offerings from various vendors, such as for online storage, accounting or customer relationship management (CRM). A large range of general-purpose cloud computing services is available in the cloud market. These services include IT networking infrastructure with on-demand access to application software and virtual servers.

5.2. What is a pricing structure?

As a cloud user, organization should only pay for services that uses. Organization has to be aware or possibility of initial indirect costs, which can be hidden in case of some none reputable cloud vendors. From the starting point the pricing structure should be pay-as-you use, with the possibility to add or scale services as needed. In this case organization should be informed of a price for scaling options. Depending on the vendor, fees can be charged annually, semi-annually, monthly or hourly.

5.3. What type of security is offered?

A major concern when investigating a possibility to store company's critical data in the cloud should be issues of security. Standard security measures should be implemented and constantly updated by provider. Among measures that it would be good to have are: anti-virus detection, firewalls, routine security audits, data encryption and multifactor user authentication. It's also important to ask does cloud provider checks background of employees who will have access to cloud data in order to prevent potential cybercriminals or stealing of identity. Providers should also answer questions about compliance with industry specific government legislation.

5.4. What is data centre location and is it safe?

Along with online security, the actual location and security of the data centres of cloud infrastructure where company's information will be physically stored are also important. There are questions regarding data centre protection from natural disasters (e.g. floods, fires, storms, earthquakes…) and thieves. Standards for Attestation Engagements 16 (SSAE 16) certification demonstrates that a company's products, systems and data are compliant with the industry security standards for customer access and privacy, data centre physical security and data redundancy.

5.5. What happens in case of data lose?

There should be some mechanism to solve the problem in case that cloud provider loses organization's data. Organization should carefully examine company's Service Level Agreement (SLA) and look at provisions dealing with this issue. Users are entitled to know will there be adequate compensation for their losses. Cloud provider should have some procedures in place to mitigate the risks of data loss. History of any significant issues that came out as a result of losing customer data should also be known.

5.6. What customer support services are available?

It is important to know when technical support will be available online or by phone (every day, working hours?) and what is average response and resolution

time. Is there a partner network which can provide local support, if it is needed?

5.7. Can a cloud scale up to meet organization's business needs?

As business grows, so will cloud storage needs also grow. Cloud provider should be flexible. Users should be able to extend storage capacity or add new services over time. If there is a plan to increase staff, it is important to know if additional users can easily be added to organization's account.

5.8. What's provider's history of downtime?

A period of time during which users cannot access a cloud provider is called downtime. The best option would be if this kind of situation never happens, or at least on very few occasions. Not being able to access the cloud data and application can be very disruptive and costly for organization's business. It would be prudent to ask vendor of their downtime history logs if not posted online.

5.9. How difficult is to set up?

First step after choosing and signing with a cloud provider usually is to configure organization's account and add employees as users. At most cases cloud vendors will provide introductory guides that can be accessed on line. Large vendors help users by walking them through the process of installation and setting up of their services. Additionally, organization needs to consider are the new services like anything that the staffs already use and how much training will be needed in order to use the new system?

5.10. Can organization get data back?

Important question to consider is what will happen with data if an organization decides to change cloud providers. Is it possible to retrieve all the data without loses and in what form?

5.11. Can it be tested?

Before organization makes a commitment a good idea would be to first try out chosen solution. Possibility of running a new cloud service in parallel with organization's existing systems will enable exploration of new features and benefits. Also, organization can consider a pilot wider deployment, as another option.

6. CONCLUSIONS

Cloud-based solutions provide organizations with an access to enormous computing power at a cost that is in line with their own business model. By relaying on a highly scalable IT platform it helps companies to reduce the cost of operating, provisioning and deprovisioning of IT resources. It is essential to examine organization's current IT system and business needs in order to determine which type of cloud computing solution can be of best help in achieving specific goals. Considering the fact that the cloud computing does not represent one explicit term, but more of an analogy for a global network, it is clear that best utilization of its advantages depends on individual cloud focus.

When revising business reasons to move partially or entirely to the cloud organizations can face a multitude of good reasons, but none of them is absolutely perfect. While some companies are looking for solution to cut costs, another will take advantage of the flexibility offered through cloud solution. In order to take the best advantage of implementing cloud solution, organization needs to make sure that entire project is fully planned, monitored rigorously and accurately costed.

If an organization makes wised choices when selecting cloud solution it can fully benefit from getting information technology on enterprise-level at negligible costs.

ACKNOWLEDGMENT

Research presented in this paper was supported by Ministry of Science and Technological Development of Republic of Serbia, Grant TR-35050, Title: "Development of software for the repair management and assembly of rail car brake system", for the period 2011th-2014th year.

REFERENCES

[1] Chang, V., Wills, G., & De Roure, D. A review of cloud business models and sustainability. In IEEE Cloud 2010, the Third International Conference on Cloud Computing Miami, Florida, USA, 5-10 July 2010. Pp. 43 - 50

[2] Foster, I., Yong, Z., Raicu, I. and Lu, S. Cloud Computing and Grid Computing 360-Degree Compared. Grid Computing Environments Workshop, 2008. GCE '08, 12-16 Nov. 2008. Pp.1-10.

[3] Lachance Shandrow, K. (2013). 10 Questions to Ask When Choosing a Cloud Provider. Published: June 04, 2013. Available at: http://www.entrepreneur.com/article/226845

[4] Marston, S., Li, Z., Bandyopadhyay, S., Zhang, J., Ghalsasi, A. Cloud computing — The business perspective, Decision Support Systems, 51 (2011) pp. 176-189

[5] Naone, E. Technology overview, conjuring clouds, MIT Technology Review, July–August, 2009.

[6] National Institute of Standards and Technology (NIST). The NIST Definition of Cloud Computing, Information Technology Laboratory, 2011.

[7] Oliveira, T., Thomas, M., Espadanal, M. Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors, Information & Management (2014), http://dx.doi.org/10.1016/j.im.2014.03.006

[8] Sultan, N. Reaching for the "cloud": How SMEs can manage. International Journal of Information Management 31 (2011) pp. 272–278

[9] Zissis, D., Lekkas, D. Addressing cloud computing security issues. Future Generation Computer Systems 28 (2012) pp. 583–592