Towards the Effective Requirements for Building a Cloud Computing Infrastructure

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Abstract: In order to be competitive enterprises are rapidly changing in terms of technology and moving towards emerging technology trends. Recently cloud computing has emerged as a revolutionary trend and become an integral part of business organizations. However, it is important for organizations to consider a best cloud computing infrastructure that may best fit to the business needs. In this study different types of cloud computing infrastructures have been discussed. The study discusses and analyzes the essential requirements for effective cloud computing infrastructure and concludes the best infrastructure requirements for business organizations before they build a cloud computing infrastructure.

Keywords: cloud computing; requirements; infrastructures; requirements analysis; cloud architecture

1. INTRODUCTION

Organization are adopting information technology at fast pace to be competitive in market. Emerging technologies have forced firms to integrate technology in business processes, but to keep updated with latest technologies is cumbersome. In turn software and hardware become obsolete soon which may affect business performance. Companies consider a viable option using of IT resources and infrastructure from outside of their sites which is more cost effective that prevents from acquiring and maintaining resources. Organizations see flexibility, scalability and availability with appropriate security in cloud services and applications. This is why applications available on cloud are more popular among business organizations due to their immediate availability and cost-effectiveness [1]. Since companies are adopting cloud services so rapidly that extensive study of requirements has become almost irrelevant, consequently infrastructure of cloud services is not implemented properly. Requirements engineering is an essential but complex process that is required among other processes prior implementation of a system [2]. A cloud computing infrastructure can be effective provided requirements have been elicited and understood.

Researchers and practitioners have presented different cloud models and architectures at times. Such model and architectures aim to provide various business solutions. These models and architectures include, a cloud model for mobile platform [3], Google computing model for cost effectiveness [4], cloud model for development of communities [5], hybrid cloud computing model for higher studies [6], cloud architectures related to security [7][8], cloud computing architecture in three layers [9], a cloud architecture for enterprises [10], etc.

1.1 Cloud computing services

Cloud computing services include software, hardware, networking devices, data storages, servers, applications etc. that are available on-demand to any organization. The cloud resources are allocated dynamically to organizations depending on their needs.

1.1.1 Infrastructure as a Service (IaaS)

This service of cloud computing comprised of servers, networking and storage devices. This service allows users to access and manage resources including data, applications and operating systems. Through virtualization resources are integrated or fragmented depending on the demands by customers at times. Nevertheless, users do not manage underlying cloud infrastructure and they can request to the cloud provider for some resources as need arises.

1.1.2 Platform as a Service (PaaS)

This service is available on top of the IaaS, which allows users to access operating systems, develop and deploy user-built applications to the cloud. Clients develop and manage applications and data whereas cloud providers manage operating systems, servers, networking devices, bandwidths, storages etc.

1.1.3 Software as a Service (SaaS)

This service is at top on the services and most widely used among businesses, as clients do not need to install or download any software to run their business processes. Cloud providers manage all software applications and data that prevent clients from worrying about acquiring software, configuration, deployment, security and renewal of licenses etc. Figure 1 shows different services available in cloud
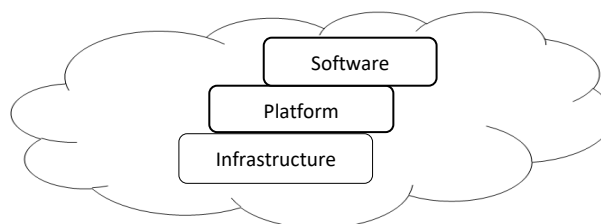

Figure. 1 Cloud services

1.2 Cloud computing models

There are different type of cloud computing models available for clients and clients may select any of the models depending on the resources and services they require.

1.2.1 Public cloud

This cloud computing model provides analogous services and infrastructure to the users including scalable applications, data storages, message services, security and testing services. The servers with resources are shared among multiple customers (i.e. general customers). The cloud service provider maintains the infrastructure.

1.2,2 Private cloud

Organizations provide computing resources and services intended for their specific clients. A secure work space in a well organized manner is provided to the clients (i.e. private customers). The cloud service provider maintains all the resources and infrastructure with quality of service.

1.2.3 Hybrid cloud

This model is composed of a public cloud and a private cloud. In this cloud model physical computing resources available on public cloud ae used whereas important data is stored on private cloud. This model provides flexibility to organizations so that they can use resources and deploy data as per needs and costs.

1.2.4 Community cloud

Community cloud model allows various organizations or communities to use shared computing resources, services and self-built datacenters to meet their similar business requirements and objectives [11].

2. COMPONENTS OF CLOUD COMPUTING INFRASTRUCTURE

Cloud infrastructure is a virtual infrastructure that is accessible by internet to a user. Users can access the infrastructure via internet without constructing the infrastructure physically on their premises. The cloud infrastructure consists of various components that are depicted in Figure 2 and discussed in the following section.

2.1 Servers

Since cloud services are shared among different clients, a server is to monitor and compute resource sharing, dynamically allocation of resources, security and services like that.

2.2 Hypervisor

It is a low level program that works like a mainframe operating system or a manger that helps allocation of a resource to multiple clients. It loads an application or operating system and shows it on multiple systems without making physical copy of it.

2.3 Networking

Networking is an essential component of cloud infrastructure as it is used to integrate and provide cloud services over internet. Different virtual resources such as routers,

bandwidth, security firewalls etc. are the parts of networking that clients use and manage them within their organizations or in the cloud.

2.4 Storage

This component of cloud infrastructure helps clients to store their data on physical hardware of the cloud service provider. A storage can be as small as a single system to hundreds of servers linked together to act as storage. Multiple replicas of storage are kept in the cloud and in case, one storage fails te data can be accessed from another storage.

2.5 Cloud management software

In order to support cloud services and manage them effectively and efficiently, a management software consisting of various tools is required. A cloud management software ensures cloud services availability to clients for contract uptime and downtime. The software helps setting up hardware and monitors security and performance of cloud services in order to run system smoothly.
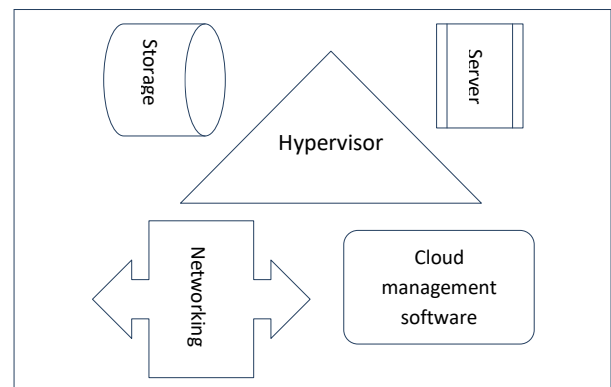

Figure. 2 Cloud infrastructure components

It can be observed that all risk assessment methodologies have some disparities in terms of scope or application. Some of them require expertise and thorough knowledge whereas some methodologies work in combination of generic framework of risk assessment.

3. REQUIREMENTS FOR CLOUD INFRASTRUCTURE

Cloud computing is striking to many business organizations today, but there are some intricacies associated such as integration of software and hardware from multiple companies that make system expensive and hard to build and maintain.

In order to use cloud computing services and perform IT operations for long run it is important that both cloud providers and business organizations clearly understand their need of building cloud infrastructure. Following are the main requirements for building an effective cloud infrastructure.

3.1 Data center management tools

Many data centers host a number of tools that are used for system management, security, customer support and billing etc. As the businesses are rapidly adopting technologies, new trends are emerging. Now data centers and cloud services are being complemented by Edge technology which mainly

focuses on decentralization. Organizations experience huge amount of data with speed which, in turn, affects efficiency as it has to be processed at data centers. Organizations are striving to keep the data at the edge i.e. nearby place where the data is generated [12].

3.2 Resource and service management

Resource management has been a critical issue in cloud services. Clients of cloud services always demand dynamically changing services, which a cloud provider cannot deliver within the limited resources. It is important to meet the customer quality of service requirements [13]. In a data center, its components are virtualized and resources are provided to customer in form of a package. The package which is a service management, consists of applications and services that a customer can deploy and manage through cloud computing provider. In order to provide better and efficient service to customers priorities of resources are set dynamically so that business needs are fulfilled as agreed in service level agreements.

3.3 Security and reliability

Cloud services are delivered to customers who always expect the continuity of the services without any interruption. Researchers and practitioners have reported many security threats and attacks on cloud services [14]. Therefore, there is a need to develop a trust between cloud providers and clients of cloud services. This trust cannot be developed as there are no such rules which can govern both source and destination servers. However, some cloud service providers have started filtering spam mails in messaging services. In order to safeguard privacy in cloud services, cloud providers must manage accessibility, user privileges, credentials etc. [15]. Only authorized users should be allowed to access the cloud services in secure manner.

3.4 User interfaces and developers

Users of client services like to access the service by user friendly interfaces that make cloud services easy to users. Usually users access different cloud applications everyday which may impact on their performance and efficiency. There is no such standard and unified interface that users can use for different type of applications. This unified interface may save operating cost and increase efficiency and productivity. However, self-service interfaces help users to use cloud services easily and effectively.

3.5 Reporting and visibility

Cloud services are successful only when they are managed regularly in terms of performance and efficiency. This requires a continuous report and visibility mechanism to ensure customer service, system performance, billing etc. Data centers need real-time infrastructure visibility and reporting and for this a mechanism should be in place. A visibility monitoring is comprised of machine agent that functions with an app agent. The two agents collects metrics about network, applications and server and determine the reasons of issues among network, applications, hardware etc.

4. CONCLUSION AND DISCUSSION

Cloud services are useful for business organizations and the rapid development in internet technologies more firms are adopting cloud services. However, cloud services should be delivered with proper infrastructure and effective requirements in order to provide customer with effective and seamless services. In this study we have determined effective requirements for an effective cloud infrastructure encompassing data center and service management tools, security, and monitoring mechanism. If these requirements are adopted and implemented, cloud infrastructure could provide smooth services to users to their level of satisfaction.

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