Chapter 20
Design Challenges of Cloud Computing

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ABSTRACT

Cloud computing has recently emerged as a new paradigm of computing for hosting and delivering services over the Internet. It replaces computing as a personal commodity by computing as a public utility. It is attractive solution to business owners as it eliminates the requirement for users to plan ahead for provisioning, and allows enterprises to start from the small and increase resources only when there is a rise in service demand. However, despite the significant benefits, these technologies present many challenges including lack of security. The chapter presents an advanced survey focusing on cloud computing concept. It highlights its key concepts and presents a physical architecture of this environment. Finally, the chapter defines virtualization technology as a factor for cloud computing surge and discuses security issues that damage these systems. The aim of this chapter is to provide a better understanding of the design challenges of cloud computing.

INTRODUCTION

With the advent of information technologies, society relies heavily upon software. In fact, software is found in automobiles, airplanes, chemical factories, power stations and numerous other systems in which it plays a critical role. Software or business applications need computing resources and hence important investment in IT infrastructure. The infrastructure is often very costly ranging from a small number of servers to an entire data center. However, provisioning and managing computing resources is so costly. There are three major costs: (1) capital costs, i.e., the cost of buying the hardware, software, and installation costs, (2) maintenance and operation costs, i.e., the cost of personnel to maintain the infrastructure as well as cost of power, cooling, and sever storage, and (3) additional costs, for example, to buy extra

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hardware and software to provide high availability, reliability, scalability, and security (Minhas, 2013). This creates a high barrier in adopting software.

In contrast to traditional information technology (IT), Cloud computing, as a new technology, aims to solve many problems like problems outlined above. In fact, it provides computing resources at a low cost while at the same time freeing users from the tedious and often complex tasks of maintaining and provisioning resources (Minhas, 2013). It offers on-demand resource provisioning. It provides three types of services: Software as a Service (SaaS), Infrastructure as a Service (IaaS) and Platform as a Service (PaaS) which promise potential cost savings for businesses by offering remote, scalable computing resources. However these services benefits, migrating to a cloud computing infrastructure poses several security risks to an organization's data and customer applications (Buecker et al., 2009 ; Cloud Security Alliance, 2009; Hanna, 2009; Heiser & Nicolett, 2008; Subashini & Kavitha, 2010; Wooley, 2011). As an initiative to address such risks, we outline security threats in this environment and identify customer's needs on security context.

The purpose of this chapter is to give a state of the art to cloud computing technologies. In fact, we present, firstly, the basic concepts related to this term. Then, we introduce the cloud computing environment. Finally, we identify threats and security attributes occurred in this environment.

The remainder of this chapter is organized as follows:

1. In the first part we introduce and define cloud computing environments, its history and its essentials characteristics.
2. In the second part, we show motivating factors in cloud computing adoption
3. In the third part, we present essential characteristics of these systems and discus the benefits and drawbacks of public cloud services.
4. In the fourth part, we provide an overview of cloud computing environment. We introduce a detailed architecture, stakeholder's categories and services offered by cloud computing systems.
5. In the fifth part, we present an overview of virtualization technology.
6. In the sixth part, we study security issues on cloud computing systems as well as it was cited as major risk in these systems.

1. HISTORY

In the early days of computing, computer resources were a centralized organizational asset, that represents a massive investment of money, time and labor; only large organizations could afford to acquire, maintain and operate such infrastructures. With the advent of personal computers in the 1980s, the prevailing computing paradigm changed drastically: first, the low cost of personal computers opened a worldwide market of people and organizations large and small; second, this situation fostered, in turn, a large pool of talent that was able to develop and distribute PC-based applications, at the same time as it was creating a market for such applications; third, the centralized paradigm of mainframe-based computing at large organizations was progressively replaced by local area networks, linking servers and terminal computers within an organization; fourth, the pervasiveness of the internet transformed the global mass of personal computers into a massive network of nodes, sharing information, services, software, and. . . malware of all kinds (Ben Arfa Rabai et al., 2013).