Chapter 102
Is the Cloud the Future of Computing?

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ABSTRACT

Cloud computing as a technology is difficult to define because it is evolving without a clear start point and no clear prediction of its future course. Even though this is the case, one can say that it is a continuous evolution of a computer network technology. It extends client-server technology that offers scalability, better utilization of hardware, on-demand applications and storage, and lower costs over the long run. It is done through the creation of virtual servers cloned from existing instances. The cloud technology seems to be in flux; hence, it may be one of the foundations of the next generation of computing. A grid of a few cloud infrastructures may provide computing for millions of users. Cloud computing technology consists of and rests on a number of sound, fundamental, and proven technologies. This includes virtualization, service-oriented architectures, distributed computing, and grid computing. Based on these fundamental and sound computing principles, one wonders whether cloud computing is the next trajectory of computing. This chapter discusses this in depth and also looks at the security issues involved.

1. INTRODUCTION

Cloud computing as a technology, in its present form, is difficult to define because it is evolving without a clear start point and no clear prediction of its future course is known yet. However, one can say that cloud computing has gone beyond the client-server paradigm in networking environment which offers scalability, increased utilization of hardware, on-demand software applications and storage. Cloud computing lowers cost of operation over the long run through employing virtual servers which lead to instantaneous increased performance and fast response to any emerging hardware, software or service demands. With the current trends in cloud technology, it may be that in the next few years, a grid of a few cloud infrastructures may provide computing for millions of users.

Cloud computing technology consists of and rests on a number of sound, fundamental and proven fundamental technologies including virtualization, service oriented architectures, distributed computing, grid computing, broadband networks, software as a service, browser as a platform, free and open source software, autonomic systems, web application frameworks and service level agreements (Mell, 2011). We will discuss cloud computing based on these technologies.

First let us start by giving a broader but specific view of the technology, what it is composed of and how it works. According to NIST (Mell, 2011), cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources like networks, servers, storage, applications and services that can be rapidly provisioned and released with minimal management effort or service provider interaction. So for the remainder of this chapter, we are going to focus on this model of computing and discuss its benefits and security concerns.

2. HISTORICAL DEVELOPMENT OF THE CLOUD INFRASTRUCTURE

Traditionally data center computing models were mainly based on a client-server model architecture and design relying firmly on a three-tier architecture design that included access, distribution and core switches connecting relatively few clients and meeting limited client needs compared to today's cloud services models. Each server was dedicated to either a single or limited applications and had IP addresses and media access control addresses. This static nature of the application environment worked well and lent itself to manual processes for server deployment or redeployment. According to both Jim Metzler and Steve Taylor of Network World (Metzler, 2011), they primarily used a spanning tree protocol to avoid loops. Recent dramatic advances in virtualization technology, distributed computing, rapid improvements and access to high-speed Internet have all had dramatic influences on the current models of computing and data center. From services on demand to unprecedented elasticity in resource acquisition, users now have an array of choices at hand on demand and in quantities of choice. The services are fully managed by the provider, with the user as a consumer. Let us briefly look at those characteristics that have come to define cloud computing as a technology (Mell, 2011).

Ubiquitous Network Access: The recent ubiquitous access to computer networks and services attribute to advances and use of high speed Internet and virtualization technology. Advances and development in these technologies have increased the repertoire of computing services a customer can select from. With more options came the high specialization and quality of services that a customer can expect.

Measured Service: The increase in the repertoire of services available to users has been enhanced by cloud services' elasticity, flexibility, on demand capabilities thus allowing for these services to be metered. The concept of metered services allows customers to get what they want in the required amounts at the time they want the service. One of the most popular characteristics of cloud computing technology is measured or metered service for most, if not all, of the cloud services including storage, processing, bandwidth and active user accounts. This *pick-what-you-can-afford-to-pay-for* principle based on metering results in an automatic control and optimization of cloud technology resource use based on the type of service and these statistics can be reported as needed thus providing transparency for both the provider and consumer.

On-Demand Self-Service: Traditionally, acquisition of computing services demanded perpetual ownership of software or computing hardware and sustainable technical support to help with computing services. Those models are phasing out when we have cloud computing as a flexible

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