

Chapter 9

Cloud Computing

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ABSTRACT

Cloud computing makes use of many standard technologies in surprisingly novel ways. It leaves many people bewildered, even confused, especially as it is an area of computing that is undergoing rapid change in terms of a diversification of available services and the growth in underlying contingent technologies. This chapter shows how the cloud has changed the user experience and goes on to discuss the definition of cloud computing most commonly used. It describes the three service models of infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS) and then discusses the four deployment models of private cloud, public cloud, hybrid cloud, and community cloud. It concludes with how the cloud impacts security and how most organizations will likely make use of multiple cloud providers. This chapter introduces key concepts and characteristics of cloud computing, in this way covering in broad terms what it is and how it essentially works.

INTRODUCTION

In some ways it is easy to see the impact cloud computing has had on the way people interact with technology. Users need not depend on a single device, but can instead access their data from a range of devices. Someone may for instance begin working on a presentation on a PC, continue working on it on a tablet, and decide to do some light editing on a smart phone. When people purchase a new phone these days, they need only to link it to the appropriate provider in order to access their contacts, calendar and other data, whether it be documents, photographs or financial statements, and they can exchange one device for another seamlessly and still be able to do what they wish to do. If an individual device fails, it may be inconvenient, but ultimately it does not destroy data or prevent access to it from another device, as one or more third-party providers hold an up to date copy of the data somewhere. Everyone can see these changes, what is not clear are the underlying enabling technologies that make this all possible and how organizations can best leverage them.

DOI: 10.4018/978-1-5225-7598-6.ch009

BACKGROUND

A common view of the cloud is that it is nothing new, that people have been using centralized computing in the form of mainframes for instance. While this sheds light on some of the similarities between mainframes and the cloud, it does not reflect the differences between them, differences that are significant. One useful analogy is to compare the cloud and earlier technologies, with the smart phone and the traditional telephone. While the telephone as such is not new and the smart phone can do the same kinds of things as the traditional phone, it is much more flexible and powerful, and this is down to, in large part, how mobile devices take advantage of the cloud, making them more functional and helping extend battery life (Liu, Chen, Ma, & Xie, 2016). As a term “cloud computing” is problematic because it does not mean one thing, but is “an umbrella term” (Missbach, Stelzel, Gardiner, Anderson & Tempes 2013) that refers not just to a set of technologies but a new model of delivering a wide range of computing resources, services and solutions.

Fortunately, the National Institute of Standards and Technology (NIST) has made a deliberate effort to define cloud computing and done this well, so much so that its three-page description of this term is now considered the standard for the industry. NIST defines cloud computing as “a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” (Mell & Grance, 2011). This definition is comparable to the four key characteristics of cloud computing as “pay-per-use”, “elastic capacity and the illusion of infinite resources”, a “self-service interface” and “resources that are abstracted or virtualised” (Voorsluys, Broberg, & Buyya, 2011). The cloud is “ubiquitous”, “convenient”, and “on-demand” in the sense that users can access applications and data from anywhere and at any time, and because organizations (or “customers” as the literature often calls them) can, without having to talk to anyone, provision computing resources and services from a “shared pool of configurable computing resources,” a business model that involves renting multi-tenanted infrastructure.

SERVICE MODELS

Cloud providers, through the use of virtualization, essentially abstract the software, whether it be a server, a database or a network from the underlying physical infrastructure, and offer customers logical software-defined computing resources and services that they can customize, secure, provision and manage in a way that meets their needs and requirements (Buyya, Vecchiola, & Thamarai Selvi, 2013). The service models in cloud computing all reflect this principle of abstraction and represent different sets of responsibility depending how much or how little customers wish to outsource. Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS) therefore represent progressively lower levels of engagement on the part of customers, as they cede more of their responsibilities to the cloud provider.

With IaaS, customers no longer need to purchase physical equipment and associated infrastructure, and manage it, whether it is a server in the case of a small business or a large datacenter in the case of a large business. They can instead utilize the provider’s resources presented to them in the form of *virtual* infrastructure such as virtual machines (VMs), networks, storage, firewalls, and load balancers, all on a granular pay-as-you-go basis, so that the customer pays for example for each hour of use of a small VM,

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