# Outsourcing Computing Resources through Cloud Computing

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## INTRODUCTION

Outsourcing is a business term to describe a mechanism in which a company utilizes services provided by another company, normally through a contract, to fulfill some of its required business resources or functions. Outsourcing is commonly practiced by business organizations, as it believes it can cut cost and simplify management. For service providers, outsourcing gives them a long-term source of revenue.

Nowadays most business organizations outsource some part of their business operations. One of the most common is information systems (IS) outsourcing. This may range from computer maintenance, website development and maintenance, e-Business to the whole IS function (Dibbern, Goles, Hirschheim, & Jayatilaka, 2004). Actually, IS outsourcing is an old story which started as early as 1963 when Frito-Lay and Blue Cross & Blue Shield outsourced their data processing jobs to Electronic Data Systems (Lacity & Hirschheim, 1993). In fact, Eastman Kodak outsourced the whole of its IS functions to IBM, DEC and Businessland in 1989, 25 years ago (Gupta & Gupta, 1992).

The advancement of the Internet technology, especially the Web as well as high-speed and broadband access to the Internet, enabled a new computing model, "cloud" computing. The new model allows organizations to outsource some components or whole of their IS in the cloud that can be controlled and utilized from anywhere with a web browser. With this model organizations do not need to purchase hardware and expensive software licenses and surely they do not need to worry about software and hardware maintenance, which is normally a large portion of the total ownership costs of an IS to estimate the overall cost (direct and indirect) of an IS in a given time frame. Cloud computing

vendors normally offer a pay-per-use method for their services, making cloud computing services like paying utilities. Perhaps cloud computing is the realization of McCarty's dream of utility computing, a package of computing resources that can be rented or subscribed just like other utilities (Garfinkel, 2011).

What makes the cloud computing system different with the conventional computing systems? In conventional computing systems (mainframe, client-server or personal computer systems), most of the computing resources owned by an organization normally reside in the organization's premises. The organization has to manage these resources to make sure they can be utilized to support the organization in attaining its goals. The organization incurs all costs in owning these resources, which may include investment, operation and maintenance costs. In contrast, an organization does not need to own most of the computing resources in a cloud computing system. Instead, the organization utilizes computing resources offered by a provider and accesses the resources as needed. The organization only needs to own client devices (low cost terminals or thin clients) to utilize the computing resources through the Internet. Consequently, the organization does not need to bear the burden of all the costs mentioned previously. Of course, the organization needs to pay the provider for using the resources with a pay-per-use method of payment.

The numbers of providers offering various computing resources in the cloud are growing and some big players are IBM, Amazon.com, Google and Microsoft. These companies foresee a lucrative business in cloud computing as it offers a new business model that may attract many customers. There are three types of customers: small organizations, medium and large organizations, and consumers, However, there are some

adoption issues that need to be addressed properly by providers (Kim, Kim, Lee, & Lee, 2009).

This article discusses concepts and applications of cloud computing. The history of the development as well as some related computing concepts such as grid computing will be highlighted. Advantages and disadvantages of cloud computing, including several issues, including adoption issues will be discussed. Future direction will be presented in the last part of this article. The next section will discuss the development of cloud computing, computing models and available services. Section 3 will focus more on core technology, business model and related issues, including some critics on cloud computing. Section 4 is the future direction and the last section (Section 5) is the conclusion.

## BACKGROUND

There are many definitions of cloud computing. A study on definitions of cloud computing (Vaquero, Rodero-Merino, Caceres, & Lindner, 2009) found there are at least 20 definitions. This study summarizes three necessary components of cloud computing: a large pool of computing resources accessible through a computer network, dynamically and scalable resource allocations, and a pay-per-use method of payment.

The National Institute of Standards and Technology (NIST) at the U.S. Department of Commerce provides a short definition for cloud computing: "Cloud computing is 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). Figure 1 illustrates a cloud computing models where clients' machines access computing resources offered by cloud providers. The client machines can be desktops, laptops, smartphone, terminals or thin client machines that access the computing resources (normally computer servers) offered by cloud providers through the Internet or other networks.

There are many services that can be provided through cloud computing. In general, these services can be grouped into three service models: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). Organizations can outsource their IS through these three models. We will discuss these services with examples in the next section.

There are some pros and cons of cloud computing. However, many experts concur with McCarty's prediction. In the consumers' level, people, especially mobile users access software and storage online as they are connected to the Internet most of the time. According

Figure 1. The cloud computing model
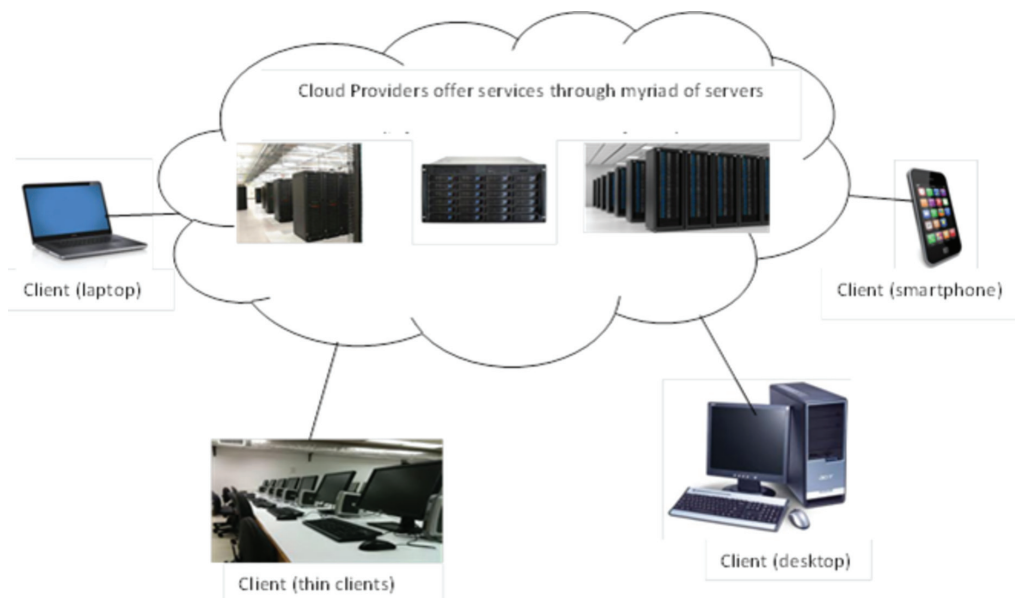
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