International Journal of Information Management 31 (2011) 272–278

Contents lists available at ScienceDirect

International Journal of Information Management

journal homepage: www.elsevier.com/locate/ijinfomgt

Reaching for the "cloud": How SMEs can manage

Nabil Ahmed Sultan*

Liverpool Hope University, Faculty of Sciences and Social Sciences, Hope Park, Liverpool L16 9JD, United Kingdom

ARTICLE INFO

Article history:

Keywords:
Cloud computing
Web services
Virtualization
Grid computing
Small and medium enterprises (SMEs)

ABSTRACT

Cloud computing is an emerging new computing paradigm for delivering computing services. The approach relies on a number of existing technologies e.g., the Internet, virtualization and grid computing. However, the provision of this service in a pay-as-you-go way through the popular medium of the Internet renders this computing service approach unique compared with currently available computing service modalities. This article highlights some aspects of this uniqueness and also explores some of the concerns that might be preventing some companies from adopting it. Notwithstanding these concerns, it is argued in this article that cloud computing is likely to prove commercially viable for many small and medium enterprises (SMEs) due to its flexibility and pay-as-you-go cost structure, particularly in the current climate of economic difficulties. A case study of a cloud experience by a British SME is also presented in this study in order to further highlight the perceived values of cloud computing in terms of cost and efficiency for real small enterprises.

1. Introduction

Not long ago, SOAP (Simple Object Access Protocol) Web services emerged to represent a model of software delivery based on the notion that pieces of software applications can be developed and then published to a registry where they can be dynamically discovered and consumed by other client applications over a number of transport protocols (e.g., HTTP, TCP/IP, etc.) irrespective of the language used to develop those applications or the platforms (e.g., operating systems, Internet servers) on which they were implemented.

However, for the last two years cloud computing was receiving all the publicity and adulation from almost every corner of the computing landscape that were once the reserve of Web services. Admittedly, there seems to be real justification for this excitement, as will be explained in this study.

Interestingly, Web services (as a concept involving the consumption of software over the medium of the Web) are now one of the building blocks that underpin this new computing paradigm (namely cloud computing) that promises to deliver not only software remotely (as Web services once did) but also other computing-related functionality (thanks also to other relatively new technologies namely "virtualization" and grid computing).

Virtualization is a technology that masks the physical characteristics of computing resources (e.g., a PC, a Server) in order to simplify the way in which other systems, applications, or end users interact with them. For example, a PC running Windows can use virtualization to enable another operating system (e.g., Linux) to run besides Windows. Furthermore, the technology also enables single physical resources (e.g., a server, an operating system, an application, or storage device) to appear as multiple logical resources.

Grid computing involves the use of software to combine the computational power of many computers, connected in a grid, in order to solve a single problem (often one that requires a great deal of computer processing power). Furthermore, grid computing also uses software that can divide and farm out pieces of a program to as many as several thousand computers. Grid technology, therefore, can be thought of as the technology that enables the establishment of network-distributed parallel processing and distributed and large-scale cluster computing.

Both virtualization and grid computing have become two fundamental technologies underpinning cloud computing (see Carr, 2009).

2. Methodology

In order to demonstrate the economic viability and efficiency of cloud computing for SMEs and its other likely benefits, this study will look into the type of services offered by this new computing paradigm and explain how those services differed from anything experienced so far by those businesses in terms of flexibility, availability and cost structure. Furthermore, the study will also examine the findings of some surveys which not only reveal the preparedness of many SMEs to use cloud computing but also show that many of those businesses are already using some of the cloud services on offer. A case study of a British SME will also be presented in order

* Tel.: +44 (0) 151 2913110.
E-mail address: sultann@hope.ac.uk.

0268-4012/$ – see front matter © 2010 Elsevier Ltd. All rights reserved.
doi:10.1016/j.ijinfomgt.2010.08.001

to further demonstrate the economic and efficiency merits of cloud computing.

3. Cloud computing: definition

No common standard or definition for cloud computing seems to exist (Grossman, 2009; Voas & Zhang, 2009). However, the definition that describes it as clusters of distributed computers (largely vast data centers and server farms) which provide on-demand resources and services over a networked medium (usually the Internet) seems to be commonly accepted. The word "cloud", a metaphor for the Internet, was likely to have been inspired by IT text book illustrations which often depicted remote environments (especially the Internet) as cloud images.

The services that can be offered by cloud computing can be listed in the following three main areas (see Miller & Veiga, 2009; Salesforce.com; Sultan, 2010):

- Infrastructure as a Service (IaaS): Products offered via this mode include the remote delivery (through the Internet) of a full computer infrastructure (e.g., virtual computers, servers, storage devices, etc.). The most notable vendors under this category are Amazon's EC2, GoGrid's Cloud Servers, and Joyent;
- Platform as a Service (PaaS): services provided by the traditional computing model which involved teams of network, database, and system management experts to keep everything up and running (e.g., operating systems, databases, middleware, Web servers and other software) are now provided remotely by cloud providers under this layer. Among the early market leaders in this area are Google's App Engine, Microsoft's Azure, Amazon Web services, and Force.com (by Salesforce.com);
- Software as a Service (SaaS): Under this layer applications are delivered through the medium of the Internet as a service. Instead of installing and maintaining software, one can simply access it via the Internet; thus freeing oneself from complex software and hardware management. This type of cloud service offers a complete application functionality that ranges from productivity applications (e.g., word processing, spreadsheets, etc.) to programs such as those for Customer Relationship Management (CRM) or Enterprise-Resource Management (ERM). For example, products under this category include Yahoo mail, Google Apps, Saleforec.com, WebEx and Microsoft Office Live.

Fig. 1 gives a simplified pictorial impression of how cloud computing works. A cloud provider maintains a number of data centers (possibly scattered in different parts of the world and interconnected) stocked with servers that provide the three types of cloud services listed above. Cloud users access and interact with those services through the cloud (i.e., the Internet). Typically, users do not have to worry about the location of their data. In some cases, however, they could be presented with an option to choose the preferred locations of data centers. This would be useful for organizations that are legally required to maintain their clients' personal data in certain geographical locations.

Some analysts question the appropriateness of using the term "new paradigm" to cloud computing arguing that this approach is largely dependent on existing technologies and approaches such as utility computing, software as a service (SaaS), distributed computing and centralized data centers. Cloud computing's only innovation, according to this view, is that it combines and integrates these approaches (Weinhardt, Anandasivam, Blau, & Stößer, 2009). Other authors equate the service of cloud computing with the practice of "timesharing" that existed in the 1970s when small companies relied on other companies (that had access to mainframe computers) for processing some of their data (e.g., payrolls) for a fee

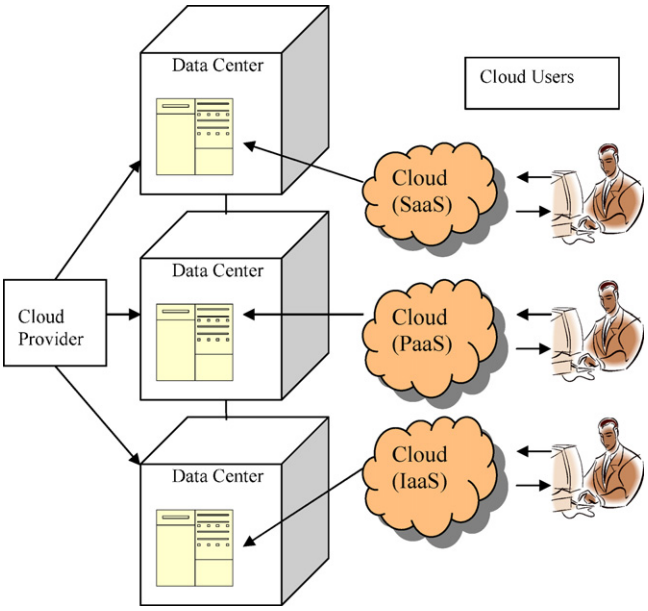

Fig. 1. A simple representation of information communication via cloud computing.

(Campbell-Kelly, 2009). One particular author calls it "Timesharing 2.0" (Campbell, 2009).

It should be noted that not all cloud products can work out of the box (i.e., plug-and-play). Some development (i.e., programming) will be required through the use of the cloud providers' APIs (application programming interfaces). These are the instructions created and offered by the cloud service providers to those who want to access the functionality of their products.

However, the notion of providing a wide array of computing-related services on the fly on a pay-as-you-go basis opens many opportunities for the providers of those services to exploit this expanding market which (according to Merrill Lynch) is worth 100 billion US dollars (Buyya, Yeo, & Venugopal, 2009). At the same time, it increases the options available to policy makers entrusted with the job of ensuring the efficient functioning of their organizations' IT resources. For example, managers need not waste resources by over-provisioning for a service whose popularity does meet their predictions or under-provisioning for one that becomes wildly popular, thus missing potential customers and revenue. The elasticity of using resources in this way, without having to pay a premium for large scale investment, is unprecedented in the history of IT (Armbrust et al., 2009). On that basis, cloud computing represents, arguably, a paradigm shift in the way IT (in its all aspects) is being sold to and consumed by clients.

4. The rationale

It is argued that the main drivers of this computing approach are economics and simplification of software delivery and operation (Erdogmus, 2009). Some see huge potential of the technology in reducing the cost of IT to organizations and freeing them from the expense and hassle of having to install and maintain applications locally (Leavitt, 2009). Providing IT services in the cloud shifts much of this expense to a pay-as-you-go model and consequently offers significant cost advantages according to one view (Lin, Fu, Zhu, & Dasmalchi, 2009).

However, there are serious doubts and concerns surrounding this new computing approach. In some cases, there is an outright rejection of this model. Richard Stallman, creator of the GNU operating system and founder of the Free Software Foundation, described cloud computing as a "trap" aimed at forcing people to