Cloud Computing as a Model

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INTRODUCTION

Cloud computing offers a utility computing model, where computing services are purchased on demand. Hardware, software, storage, and network bandwidth are delivered over the public Internet. When using this model, a business no longer needs to design, own, and operate a data center. Rather, data processing, access bandwidth, and storage capability can be rented on-demand from a cloud service provider. This allows easy adaptation to changes in the marketplace since IT capabilities can be scaled when there are rapid changes (increases or decreases) in demand.

The National Institute of Standards and Technology defines cloud computing as "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction. (Mell & Grance, 2010)." Other definitions of cloud computing have focused on virtualization of devices, and dynamic scalability of storage, processing, or bandwidth (Vaquero, Rodero-Merino, Caceres, & Lindner, 2009; Regalado, 2011). Services are delivered over the Internet and usage levels are managed by the user. Cloud computing shares the vision of grid computing in reducing computing cost while increasing reliability and flexibility (Foster, Zhao, Raicu, & Shiyong, 2008). Although processing and storage are moved from the desktop to remote data centers, it is not a return to the centralized computing of the mainframe era (Hayes, 2009), since there is no single hub and the net provides access to the service. From the users perspective, the network becomes the computer, when cloud computing is used. The shift to cloud computing has been driven by the growth in collaborative computing, real time data analysis, mobile applications, and Web 2.0 services which are naturally suited to the cloud model.

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BACKGROUND

The utility model of cloud computing holds that it is optimal any general-purpose technology to be centralized where the marginal cost of producing the resource is the lowest (Carr, 2008). The argument has been challenged on the basis that utilities, such as electric power utilities, provide fungible commodities which are freely interchangeable, while computing services have a rich feature sets and impact multiple dimensions of user experience. Supporters of the utility model argue that basic computing such as raw processing power for business computations, storage for digital media, or access bandwidth are commodities; albeit commodities what multidimensional features.

The growing consumerization of information technology, with employees preferring to use personally owned portable devices to interact with the corporate information system, rather than office desktops, creates additional impetus for the adoption of cloud computing by organizations. Users who favor consumerization, often perceive in the house IT as an impediment to technology use, rather than a supporter of new technology. In this scenario, cloud providers, who merely provide access to data and analytics, are perceived as more user-friendly.

Server virtualization is a technology that enables the software image of a machine to function within another machine. Corporate data centers tend to have low utilization of servers, which are typically dedicated to individual applications. Server virtualization optimizes the usage of hardware by allowing multiple images of servers to function within a physical device, resulting in scalable architecture for hardware. Applications requiring few resources can share a physical device, while applications requiring more resources can use multiple devices. Virtualization offers easy scalability of hardware for applications with widely

varying demand, as well as rapid recovery from failures, since backed up virtual images of servers can quickly restore a compromised unit. Cloud computing uses server virtualization extensively in large data centers. Much of the economic benefits of cloud computing have derived from rapid improvements in server virtualization technology.

Strategic Benefits

Since cloud computing is available as a publicly available utility to the business and its competitors, competitive advantage must be developed through technical, managerial, and relational capabilities in using cloud computing (Garrison, Kim, & Wakefield, 2012). At present, cloud computing offers hardware, software, and network bandwidth in the form of a utility, to all businesses. For example, IT software applications for most established business models are readily available in the marketplace, and are available through the cloud. However, even in the case of established products, such as ERP systems, a business can gain strategic advantage over the competition, that also has access to the same products, if the business has the ability to use the product more effectively than the competition (Ragowsky & Geffen, 2008). When cloud computing is used, the chief information officer (CIO) becomes the business architect, managing the interdependencies that arise from cloud computing. Rather than focusing on the specific type and quantity of hardware, or even software to be acquired and managed, the CIO of the cloud enabled firm, should focus on managing the information assets, to gain strategic benefits for the firm. A tight integration between the business process and information technology used is necessary for success (Brynjolfsson, Hofmann, & Jordan, 2010). Cloud Services have been used to deliver features such as on-demand big data analytics and social collaboration tools for employees.

In-house IT is often not competent at delivering these leading edge services, and cloud providers can focus their offerings for a highly specialized domain. The in-house IT unit should be capable of seamlessly integrating in-house operations with the cloud service provider. If a business chooses to have no in-house IT, the employees must be capable of directly interacting with the cloud service provider. The business needs to manage its long term relationship with the cloud service provider, who becomes a part of the critical supply chain of the company. A high trust relationship is necessary for the business to gain strategic benefits from cloud computing.

Infrastructure Requirements

Cloud computing depends on a robust Internet infrastructure. Reliable cloud services are hosted in Tier 3 data centers (Uptime Institute, 2013) and accessed by users via the Internet. Four parts of the system should be functional for cloud services to be effective. These are the data center, links from the data center to an Internet backbone, availability of bandwidth on the net backbones, and user access to the Internet. Failure in any part of the system can render cloud computing unusable. For example, Internet outages due to routing protocol failures (Goldberg, Schapira, Hummon, & Rexford, 2010), or traffic delays in Internet service providers, or even a WiFi chokepoint at the user location, can disrupt cloud computing. Infrastructure needs, such as additional bandwidth, or alternate routes for traffic, must be available when needed. Often, automated provisioning, is used to provide resources on demand.

CLOUD MODELS

Cloud services can be offered as server hardware, storage, or network bandwidth provided on demand to the customer (infrastructure as a service, IaaS), business applications software available through the Internet (software as a service, SaaS), or as a platform with a suite of pre-built modules to create information systems that support unique business models (platform as a service, PaaS). The software and staff needed to operate a specific process within a business, can be offered through the cloud, in the business process as a service, BPaaS model. Cloud-based models that manage individual desktop machines, the hardware and software, as well as device security, using virtualized machine images, offer desktop as a service cloud computing (DaaS).

Another way in which cloud models are classified, is based on whether cloud services are acquired on an on-demand basis from publicly available cloud providers, or are provided through dedicated hardware and systems. This leads to a classification of clouds as