Understanding Cloud Computing in a Higher Education Context

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INTRODUCTION

This chapter explores cloud computing (CC)—an internet-based type of computing which allows users to share resources which are provided to computers or other remote devices (Hasan, 2011)—within a higher education (HE) context. The study is premised on the view that university students increasingly rely on online resources, electronic media and computing applications for nearly all their work, which has been seen as improving the quality of university studies (e.g. Robinson & Schlegl, 2005). Given the limited number of studies in this area—reviewed in the next section—this chapter aims to advance understanding of CC in HE by adopting an innovative methodological approach involving suppliers, implementers, and end users of CC in a selected HE context. The study—which is qualitative and exploratory, and draws on interview data—informs the extant literature and offers recommendations for researchers, practitioners, and universities. In what follows, the authors discuss the extant literature and then move on to present the research study.

BACKGROUND

CC is a relatively new phenomenon in the technology industry, developed from traditional hosting, which is becoming pervasive in numerous sectors (Armbrust, 2010). Mell and Grance (2011) consider it *"a model for enabling ubiquitous,* *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"* (p.2). It is not clear when the term CC was officially coined, because it has been used for many years in network diagrams to depict an area of uncertainty (Stevenson, 2009). It is believed the term was coined in 2006 when large companies such as Google and Amazon Web Services started naming their hosting services as CC (Regalado, 2011). CC has been viewed as a disruptive technology; as Krikos (2011) puts it, *"CC has all the markings of a disruptive technology—those that change the game as it's currently played both by traditional software licensing companies and by private, on-premises datacenters"* (p.2). A disruptive technology often begins by only satisfying a niche segment of the market—for example CC being best suited to businesses *'born on CC'*—and later expanding to other sectors (Danneels, 2004).

From a technical perspective, the extant CC literature posits different CC service models:

- **Infrastructure as a Service (IaaS):** When the customer is able to provision processing, storage, networks, and other fundamental computing resources.
- **Software as a Service (SaaS):** Which allows the consumer to access the provider's applications running on a **cloud solutions (CS)** but cannot manage the underlying infrastructure.

- **Platform as a Service (PaaS):** Where the customer can control the applications but not the infrastructure (e.g. Mell and Grance, 2011).

Further, CC types may also vary; from *'Private Cloud'* (a high cost option but also the most secure, often preferred by banks and governments), through to *'Community'* (shared by multiple organizations), *'Public'* (allowing pay-per-use) and finally *'Hybrid'* (a mix of the previous) (Chou, 2015).

However, this chapter is interested in CC in the HE sector in particular. Within this context, Sultan (2010) discusses the reasons that it adds value for universities: Firstly, the rapid amount of change in the technology industry puts a lot of pressure on universities to keep up with the ever changing software and hardware; this is not always easy for institutions as they are often under governmental pressure to reduce spending. Therefore, investing in CC prevents universities from having to purchase hardware, which is costly (Wheeler & Waggener, 2009). In turn, it also means that universities can reduce labor costs relative to the management of information technology (IT) systems. Moreover, it is difficult for universities to develop their own premise infrastructure to achieve the economies of scale that a CC provider can achieve, which also leads to cost savings (Katzan, 2010). By allowing a CC provider to maintain the infrastructure, the pressure is also taken off the IT staff at the institution (Ercan, 2010). Further, moving staff away from the low skill tasks can potentially allow them to be reallocated to more value adding activities (Low, Chen & Wu, 2011). Another important feature that CC can bring to universities is collaboration, by, for example, the sharing of resources, such as lecturers, learning content, and amongst students too. This could happen not just internally, but with other universities as well (Wheeler & Waggener, 2009).

In the UK, universities have begun to take CC seriously. For example, London South Bank University (2014, May 6) have recently adopted CS, confirming a deal for £14 million for IBM's Exceptional Student Experience. This has numerous benefits: it (a) incorporates analytics, mobile, social and IT security; (b) allows students to access university applications from mobile devices, and use social communities for file sharing; (c) encourages more interaction between students; and (d) gives access for teachers to assess and feedback online (Miller, 2008; Rao, Sasidhar & Kumar, 2012; Sasikala, 2011).

Katz (2008) sees CC in HE as more of a necessity. As he puts it, *"students will arrive on campus with their own IT architectures and service arrangements. These students... will have little use for or patience with college or university offerings that underperform or force them to lose precious connections to people and processes that they have accumulated since childhood"* (p.18). Therefore, whereas Sultan (2010) believes moving to CC is more of a logical step for universities, Katz (2008) argues they will have to out of necessity. Building on this view, Alabbadi (2011) proposes that universities should carefully assess budgets and challenges to choose CC infrastructure which is best suited to their current IT activities.

Recently, however, it has been argued that CC in the HE context does not come without challenges. For example, Culley and Panteli (2015) found that IT staff at universities may view CS as a threat for their jobs; thus, a repositioning of IT services in the HE sector might be necessary. As they put it,

[HE IT staff should] develop a new suit of capabilities, so that the IT department can function when most of the technology is delivered by the cloud […] IT staff can act as the bridge understanding the business and the technology. (p.60)

Clearly, as it follows, CC is a new, prevalent and disruptive technology with unprecedented benefits for both universities and students and yet there is a clear lack of empirical evidence to enable understanding of CC within the HE context, since much of the extant literature is based around

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