Chapter 4
Cloud Computing in Academia, Governments, and Industry

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ABSTRACT
Cloud Computing is gaining a considerable attention in the past few years, where hardware and software are provided on-demand as a service through internet following the simple pay-as-you-go financial model. Using such powerful technology, several projects, in different areas, have been built like supporting academic and scientific researches, providing governmental services, and developing business applications. Unfortunately, the previous works and ongoing researches in these areas are scattered among the literature, on the internet, and from research groups, which makes it hard for researchers to be involved in such vast wave of researches. This chapter carefully reviews the emergence of the Cloud in all of the above mentioned areas through a wide range of well classified researches, projects, and applications that have been either innovated or improved due to the Cloud disclosure. Moreover, the chapter comparatively discusses the previous work done in these fields and explores the opened research points.

INTRODUCTION
Cloud Computing is gaining a considerable attention in the past few years, where hardware and software as a service are delivered on-demand through internet following the simple pay-as-you-go financial model. The source of the Cloud power is its ability to stand at different levels of service: (i) Infrastructure-as-a-Service (IaaS), where Cloud enables access to hardware resources such as servers and storage devices, (ii) Platform-as-a-Service (PaaS), where Cloud allows the access to software resources such as operating systems and software development environment, and (iii) a Software-as-a-Service (SaaS), where Cloud is an alternative to classical software applications running locally on personal computers which are, instead, provided remotely by the Cloud. Such service-oriented diversity makes the Cloud Computing a very powerful technology and it becomes crucial to understand and explore its methodologies.

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Cloud Computing has emerged in several spectrums of our life. It invigorates the academic field, the scientific research conduction, the governmental services provisioning, and business applications development, by methods that have been either innovated or improved by the emergence of such promising technology. Each spectrum has taken advantage from the Cloud by its own means. For example, the academic and scientific researches benefit from the Cloud’s high performance computation capabilities. Governments gain from the Cloud’s availability, infrastructure, and software services offered on demand, while cost minimization and globalism were the main benefit for the business domain.

In the academic field, the emergence of the Cloud is invigorating all of the educational activities and scientific research. For example, the UK government funded MaterialsGrid project inherently encompasses many concepts of the Cloud computing before the term “Cloud” emerged (Yang X. et al. 2010a, Yang X. et al. 2010b, Yang X. et al. 2012b). Various educational platforms have been innovated based on Clouds (Burd, Seazzu, & Conway, 2009), (Erkoç & Kert, 2011), (Tao & Long, 2011) (Cappos, Beschastnikh, Krishnamurthy, & Anderson, 2009), as well as research platforms (IBM/Google Academic Cloud Computing Initiative (ACCI)). Also, academic libraries started moving their systems to the Clouds (OCLC WorldShare), (DuraSpacce), cutting down their costs. Multiple research projects in several areas; such as image processing (Alonso-Calvo, Crespo, Garcia-Remesal, Anguita, & Maojo, 2010), data mining (Grossman & Gu, 2008); are now using the required computational resources from the Clouds, instead of building complex computing infrastructures.

The Governmental services are strongly interested in using Cloud Computing to reduce IT costs and increase capabilities. A growing number of government entities are immigrating to Cloud in order to acquire the infrastructure and software they need while making operations faster, cheaper and more sustainable. Experts predict that government IT shops can save on equipments, licensing, staffing resources, office space, storage and more. Now, there are Governments that provide IT Cloud service platforms (Catteddu & Hogben, 2009) for governmental use, for offering either IT end-solutions services (Public Works and Government Services Canada (PWGSC)) or public service portals in health (State Legislatures, 2010), business, and schools directories. In addition, governments work on providing Cloud platforms and products for research projects purposes (Seventh Framework Programme).

In the businesses domain, many companies, not only the IT specialized ones, use Cloud-based services such as infrastructure and platform. Such technology helps them to pay as they go without the need of hiring in-house IT services or spending money for hardware. Besides, services are automatically scaled whenever the requirements or utilization are increased or decreased. The advent of Cloud Computing has driven euphoria of what IT and business can do with the access to applications and services across the Internet. Many companies providing web operations; e.g. web hosting (Liu & Wee, 2009), deployment and monitoring (Sedayao, 2008); such as Microsoft, Google and Amazon, took the lead to move to Cloud platforms. Pharmacy management (Lamont, 2010), real-time financial systems (Aymerich, Fenu, & Surcis, 2009) and enterprise fraud management (Unal & Yates, 2010) are examples of the enterprise services that took the lead to employ the Cloud services. The benefits will be tangible and will fundamentally transform enterprises of all sizes around the globe access information, share content and communicate.

Though the heavy rely on Clouds, yet Cloud failures are as complex as the underlying software that powers them. During the past two years, Cloud services have reported a minimal rate of outages in a subset of the entire network. Very few Cloud outages have caused massive data losses, and after reviewing most of these outages, it is clear that
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