Chapter 62
Using Obstacles for Systematically Modeling, Analysing, and Mitigating Risks in Cloud Adoption

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ABSTRACT

In this chapter, the authors motivate the need for a systematic approach to cloud adoption from the risk perspective. The enormous potential of cloud computing for improved and cost-effective service delivery for commercial and academic purposes has generated unprecedented interest in its adoption. However, a potential cloud user faces numerous risks regarding service requirements, cost implications of failure, and uncertainty about cloud providers' ability to meet service level agreements. Hence, the authors consider two perspectives of a case study to identify risks associated with cloud adoption. They propose a risk management framework based on the principle of GORE (Goal-Oriented Requirements Engineering). In this approach, they liken risks to obstacles encountered while realising cloud user goals, therefore proposing cloud-specific obstacle resolution tactics for mitigating identified risks. The proposed framework shows benefits by providing a principled engineering approach to cloud adoption and empowering stakeholders with tactics for resolving risks when adopting the cloud.

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1. INTRODUCTION

The ever increasing need for data processing, storage, elastic and unbounded scale of computing infrastructure has provided great thrust for shifting the data and computing operations to the cloud. IBM advocates cloud computing as a cost efficient model for service provision (IBM, 2008). The adoption of cloud computing is gaining momentum because most of the services provided by the cloud are low cost and readily available. The pay- as-you- go structure of the cloud is particularly suited to Small and Medium Enterprises (SME) who have little or no resources for IT services (Biggs, Vidalis,2009).

The growing trend of cloud computing has led many organisations and even individuals to move their computing operations, data, and/or commissioning their e-services to the cloud. Moving to the cloud has reduced the cost of computing and operations due to resource sharing, virtualization, less maintenance cost, lower IT infrastructure cost, lower software cost, expertise utilization and sharing etc. (Miller, 2008). For example, the New York Times managed to convert 4TB of scanned images containing 11 million articles into PDF files, which took 24 hours for conversion and used 100 Amazon EC2 Instances (Gottfrid, 2007). Such relatively quick conversion would be very expensive if done in-house. The term cloud computing may simply refer to different applications over the Internet or the hardware shared between different users (Armburst et al, 2010). Buyya et al have defined cloud:

A Cloud is a type of parallel and distributed system consisting of a collection of inter-connected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service level agreements established through negotiation between the service provider and consumer (Buyya et al, 2008).

In a cloud, hardware/software are shared and utilized as services at lower cost. Many services are now offered in the realm of cloud computing. These are:

- **Infrastructure as a Service (IaaS):** A model in which an organization outsources the equipment required to perform operations like storage, hardware, servers etc. Cloud service provider provides all the hardware needed for operations and is responsible for maintaining it. The client pays for what he uses. Amazon's Elastic Compute is an example of such a service.
- **Platform as a Service (PaaS):** Cloud Service Provider provides a platform to the user on which a user can develop an application. The applications are delivered to the users through cloud service provider's infrastructure. Coghead and Google App Engine are examples of PaaS.
- **Software as a Service (SaaS):** Delivers a single application through the browser to thousands of users. Users are not required to invest on purchasing servers or software licensing. Payment is made on the basis of the data transferred and some fixed rent. Google App Engine is a representative example of SaaS.

This chapter is structured as follows. We motivate the need for a requirements engineering framework for cloud adoption in Section 2. Risks that were identified from different cloud service providers' SLAs are presented in Section 3. Section 4 introduces goal-oriented requirements engineering for the process of cloud adoption. We define obstacles in Section 5 and argue that obstacle analysis should be part of the lifecycle for cloud adoption process. We have modelled a case study with two different perspectives (user and cloud service provider) using goal-oriented