Chapter 10
Operational Cost of Running Real-Time Mobile Cloud Applications

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ABSTRACT
This chapter describes the concepts and cost models used for determining the cost of providing cloud services to mobile applications using different pricing models. Two recently implemented mobile-cloud applications are studied in terms of both the cost of providing such services by the cloud operator, and the cost of operating them by the cloud user. Computing resource requirements of both applications are identified and worksheets are presented to demonstrate how businesses can estimate the operational cost of implementing such real-time mobile cloud applications at a large scale, as well as how much cloud operators can profit from providing resources for these applications. In addition, the nature of available service level agreements (SLA) and the importance of quality of service (QoS) specifications within these SLAs are emphasized and explained for mobile cloud application deployment.

INTRODUCTION
Cloud is the platform of multiple servers over a widely disbursed geographic area, connected by the Internet for the purpose of serving data or computation (Bansal, 2013). Mobile Cloud Computing (MCC) can be described as a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (Shanklin, 2014) from mobile devices. MCC therefore refers to both the applications delivered as services over the Internet and the hardware and system software in data-
centers that provide those services. The services themselves have long been referred to as Software as a Service (SaaS). Some vendors use terms such as Infrastructure as a Service (IaaS) and Platform as a Service (PaaS) and others to describe their products, but we abstain from these because accepted definitions for them still differ widely. The datacenter hardware and software is what we will call a cloud. When a cloud is made available in paying costs as they occur to the general public, it is called a public cloud and the service being sold is utility computing. Private cloud on the other hand refers to internal data centers of a business or other organization (Armbrust, et al., 2010).

The point at which these internal data centers are large enough to enable organizations to benefit from the advantages of cloud computing are the subject of much debate. (Kovachev, Cao, & Klamma, 2013) described cloud computing as the sum of SaaS and utility computing, but does not include small or medium-sized datacenters, though some of these rely on virtualization for management. People can be users or providers of SaaS, or utility computing. The focus here is on SaaS providers (cloud users) and cloud providers, who have received less attention than SaaS users. Mobile computing is the delivery of services, software and processing capacity over the Internet, reducing cost, increasing storage, automating systems, decoupling of service delivery from underlying technology, and providing flexibility and mobility of information. However, the actual realization of these benefits is far from being achieved for mobile applications (Kovachev, Cao, & Klamma, 2013).

MCC is introduced as an integration of cloud computing into the mobile environment. It is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (Mouftah & Kantarci, 2013). MCC is a model for transparent elastic augmentation of mobile devices via ubiquitous wireless access to cloud storage and computing resources, with context-awareness and dynamic adjusting of offloading in respect to change in operating conditions, while preserving available sensing and interactive capabilities of mobile devices (Fesehaye, Gao, Nahrstedt, & Wang, 2012).

However, there has been some confusion about the mobile cloud computing model about its capabilities and can sometimes be described in general terms that includes almost any kind of outsourcing of hosting and computing resources. In other words, mobile represents a relatively new and fast growing segment of the cloud-computing paradigm (Rimal & Choi, 2012).

In view of the inherent advantages of this technology, enterprises today are looking to cloud computing to help them better deliver existing as well as new, innovative services on demand across network, computing, and storage resources at reduced cost (Chappel, 2013). This is because cloud economics will play a vital role in shaping the mobile cloud industry of the future (IBM, 2013). In a recent (Microsoft, 2010) white paper titled “Economics of the Cloud”, it stated that the mobile computing industry is moving towards the cloud driven by three important economies of scale because: 1) large data centers can deploy computational resources at significantly lower costs than smaller ones; 2) demand pooling improves utilization of resources; and 3) multi-tenancy lowers application maintenance and labor costs for large public clouds. The cloud also provides an opportunity for IT professionals to focus more on technological innovation rather than thinking of the budget of “waiting to force things to move.” However, many organizations find it difficult to determine the total operating costs of using cloud services (Microsoft, 2010).

The recent survey conducted by (Prasad, Gyani, & Murti, 2012) supports this view and it was revealed that, user and potential users of mobile cloud services would reduce costs and time needed to deploy tools for quicker analysis and planning. 14% somewhat disagreed and in helping to improve planning and performance management in users’ organizations, 42% believed they would be helped by use of mobile cloud computing for rapid deployment of specific applications. Respondents also favored cloud usage.