Chapter 9
Cloud-Assisted Services for Mobile Applications: CLASS-MA

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ABSTRACT

This chapter discusses those mobile applications that are assisted with services provided by the cloud. This combines the two most pervasive topics within information technology today: cloud computing and mobile computing. This chapter describes the challenges and opportunities offered by these technologies and the issues arising during their implementation. Some representative cloud services for mobile applications are offered as part of an on-going CLASS research project.

INTRODUCTION

Unquestionably, over recent years, mobile computing and cloud computing have been the buzzwords within information technology (Adelstein, Gupta, Richard & Schwiebert, 2004; Sosinsky, 2011). Computers have become increasingly smaller and blend-in with the other devices around us. Consequently, mobile computers, in the forms of smart phones or tablet PCs, are becoming bestsellers and the fastest growing market for technical products. The same computer evolution has led to the emergence of large computer centers, the clouds, which offer a wide-variety of services to both companies and individual users. Nevertheless, there are differences in the usages of these technologies. Most applications for mobile computers today are designed for exclusive use on mobile devices. On the other hand, cloud computing represents the replacements of those computer servers and computer clusters utilized by a large number of clients. The majority of services they offer are designed for desktop computers. Is it possible to merge these two technologies together within a single solution, namely mobile computing in ‘the clouds’? The answer is obviously ‘yes’. This

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chapter attempts to demonstrate the possibilities of using cloud-computing services for mobile devices and mobile applications.

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**Mobile Computing**

Mobile devices and mobile applications are different from those on personal computers in several respects. The most obvious difference is the user interface. Due to the smaller sizes of mobile devices, the sizes of the displays have been significantly reduced; there is no room for large keyboards, mouses, and the like. For that reason, mobile devices depend on the other kinds of interaction technologies such as touch, voice control, device orientation and tilt, etc (Hoober & Berkman, 2011). Similarly, due to its limited size, the mobile device cannot be connected to massive secondary storage devices, thus reducing the total amount of internally accessible information. Another distinctiveness of the mobile device is its limited energy-supply. Its processing capabilities and memory capacity have to be sacrificed, and have to be significantly smaller than on desktop computers, where the power supply is not an issue. For the same reason, rich and high-resolution graphics, 3D graphic accelerators, etc., are usually limited to desktop applications. In view of their mobility, many mobile applications utilize the known locations of their users. Therefore, such devices are often equipped with global-positioning systems (GPS), electronic compasses, accelerometers, etc. Desktop computers are stationary and usually do not benefit from such services.

These dissimilarities also create differences in the usages of both kinds of devices. PCs are frequently used for business, at work, for research, for education, etc. Such support on mobile devices is usually limited. The main purposes of mobile applications are communication, entertainment and delivering different kinds of information.

**Cloud Computing**

By using cloud computing, companies and individuals, in part or entirely, transfer their IT infrastructures to powerful host servers – the clouds. The motivation for this is the reduced costs of obtaining and maintaining the hardware, lower costs for IT staff, etc. Of course, the usage of cloud resources and services is not free. Solution providers in the clouds charge for the use of disk and processing capabilities.

Because of the abundance of computing and storage resources, the clouds can be dynamically adapted to the actual loads for individual users. When the workload is small, only part of a single server would be utilized. With the higher demands, data processing can take place over several servers simultaneously. Such a model also greatly increases reliability in case of hardware failure. Cloud computing introduces a new model for developing software applications. Generally, there are three levels of cloud resource utilization, as portrayed in Figure 1.

- **Infrastructure as a Service – IaaS:** In this model, the cloud provides the bare-bone servers. It is the user’s responsibility to maintain the operating system, the system’s software, and the applications. Ideally, the solutions in CLASS-MA should be independent of the underlying hardware infrastructure.
- **Platform as a Service – PaaS:** In this case, the operating system, the system’s software and other supporting software are