Programming Model and Execution Framework for Developing Mobile Cloud Applications (PI: Prof. Cao Jiannong; 2012/13)

Cloud computing is an important transition and paradigm shift in IT service delivery driven by economies of scale. It provides a computing paradigm that enables a shared pool of virtualized, dynamically configurable, and managed computing resources to be delivered on demand to customers over the Internet and other available networks. As such and with the "pay-as-you-go" business model, cloud computing will also lead to changes and transformation of many industries.

On the other hand, with the advances in technologies of wireless communications and portable devices, mobile computing has become integrated into the fabric of our every day life. With increased mobility, users need to run stand-alone and/or to access remote mobile applications on mobile devices.

The application of cloud services in the mobile ecosystem enables a newly emerging mobile computing paradigm, namely Mobile Cloud Computing (MCC). MCC offers great opportunities for mobile service industry, allowing mobile devices to utilize the elastic resources offered by the cloud. It is predicted that MCC services will be the platforms of choice of IT industry for the next 20 years and generate huge revenue.

In this project, we study how to provide support for developing high performance MCC applications. We have done a literature review and classified MCC models into three approaches: 1) extending the access to cloud services to mobile devices; 2) enabling mobile devices to work collaboratively as cloud resource providers; 3) developing next generation mobile applications by leveraging cloud computing technologies, e.g., by offloading the computing resources required by applications on mobile devices to the cloud so we can create applications that far exceed traditional mobile device capabilities. In this proposal, we focus on the third approach, which

sets the future trend and represents the major effort in research. It also poses some completely new challenging issues. Neither the existing mobile computing models nor the existing cloud computing models fit well for the development of this kind of MCC applications. New programming models, mechanisms and algorithms are urgently desired. Although there are works done on some aspects of the study, how to provide a systematic approach to support the programming and execution of applications under this MCC model is yet to be effectively addressed.

We will carry out a systematical investigation on the new requirements and issues, and propose a programming model and execution framework for developing the advanced MCC applications. The model enables component-based programming to allow the application developer to define components and specify their connections. The execution framework consists of mechanisms and algorithms that automatically map the components onto the cloud and client sides, allowing the application to adaptively shift computation/data between mobile devices and the cloud. It will handle issues such as computation partitioning between mobile and cloud, scheduling across resources, recovering from failures, and data management so that the developer are enabled to concentrate on the application logic. To demonstrate the effectiveness and performance of our proposed middleware platform, we will build a prototype test-bed with demonstrations of example applications.

This project will make significant contribution in cloud and mobile computing for developing next generation mobile applications. Both the application developers and end users will benefit from our research outcome. The proposed programming model and execution framework will provide developers the abstraction and runtime support to create and execute high performance MCC applications in face of unpredictable load from mobile users and unstable conditions of the network and operation environments. The end users will be able to experience more

computation-intensive and data-intensive mobile applications, which are now still of limited use because of the capability and resource constraint of the mobile devices.