Chapter 17
Virtualization in Mobile Cloud Computing (VMCC) Environments

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ABSTRACT

Unfortunately, most of the widely used protocols for remote desktop access on mobile devices have been designed for scenarios involving personal computers. Furthermore, their energy consumption at the mobile device has not been fully characterized. In this chapter, we specially address energy consumption of mobile cloud networking realized through remote desktop technologies. In order to produce repeatable experiments with comparable results, we design a methodology to automate experiments with a mobile device. Furthermore, we develop an application that allows recording touch events and replaying them for a certain number of times. Moreover, we analyze the performance of widely used remote desktop protocols through extensive experiments involving different classes of mobile devices and realistic usage scenarios. We also relate the energy consumption to the different components involved and to the protocol features. Finally, we provide some considerations on aspects related to usability and user experience.

INTRODUCTION

Mobile devices discussed by authors Rajkumar Buyyaa, Chee Shin Yeoa, Srikumar Venugopala, James Broberga, and Ivona Brandicc (2009), ranging from smart phones to tablets, have recently become so pervasive that they are increasingly replacing personal computers in everyday activities related to both

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entertainment and work. However, due to their limited resources, mobile devices cannot or the same performance of personal computers and workstations. To this regard, one of the prominent approaches to overcome such limitations consists in adding computational and storage resources to the cloud. With adding, the mobile device runs only a thin layer of software which interfaces with application-specific services in the cloud. For instance, software for picture organization and categorization can exploit powerful and accurate face recognition algorithms discussed by author Huaglory Tianfield (2011) running on the cloud without the need of any computation at the mobile device. However, such an approach requires that source data are available to the remote service. This may require transferring data from the mobile device to the cloud, which incurs in both communication and energy consumption overheads, discussed by authors P. Sefton (1980). A different option is given by remote desktop access. In this case, the mobile device uses thin client software which connects to a remote desktop server providing an operating system and its applications. The thin client shows the desktop user interface and handles the related interactions. Specially, input events captured by the client are transferred to the server and the display of the mobile device is updated according to the received response, in order to match the content of the desktop screen. To a certain extent, remote desktop access can be seen as an extreme case of mobile cloud computing, wherein the mobile device only acts as remote display and input device, while all the rest is demanded to the remote system. When the remote server is virtualized, this access scheme corresponds to a special case of mobile cloud networking. While research targeted to mobile cloud computing has considered resource utilization as the primary design objective, most of the commonly used solutions for remote desktop access were originally designed for personal computers. As a consequence, the reference scenario was represented by systems which have enough resources, are static and access the Internet through a wired connection. Even though there are some solutions specially designed for mobile devices, they are usually not publicly available, or they cannot be easily integrated in the existing infrastructure. As a consequence, the vast majority of remote desktop protocols available for mobile devices are still those designed for personal computers. In this chapter, we aim at characterizing the energy consumption of mobile cloud computing realized through remote desktop technologies. Our goal is to analyze the performance of widely used remote desktop protocols through experiments involving different classes of mobile devices and realistic usage scenarios. Consequently, we have to ensure the reliability and consistency of all experiments discussed by author D. Rowe (2011). Finally, we also seek to relate the energy consumption to the different components involved and to the protocol features discussed by author D. E. Y. SAR NA (2011).

Cloud is a parallel and distributed computing system consisting of a collection of inter-connected and virtualized computers discussed by authors M. Cafaro and G. Aloisio (2010) that are dynamically provisioned and presented as one or more unified computing resources based on service-level agreements (SLA) established through negotiation between the service provider and consumers discussed by authors Souvik Pal and P.K.Pattnaik (2012).

CONCEPT OF MOBILE CLOUD COMPUTING

The mobile cloud computing shows Figure 1 was outlined because the convenience of cloud computing services during a mobile scheme discussed by authors Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper (2010), which contains several components together with shopper, enterprise, femtocells, transcending, end-to-end security, home gateways, and mobile broadband-enabled services. In fact, the