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Partitioning and Offloading in Smart Mobile Devices for Mobile Cloud Computing: State of the Art and Future Directions

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Abstract

Mobile applications, such as augment reality, natural language processing, object recognition and multimedia-based services, are becoming increasingly ubiquitous and can provide better user experience on mobile devices. However, such applications are draining increasingly more computational resources and energy of mobile devices. Partitioning and offloading some parts of mobile applications is a promising method of saving time and energy for mobile devices with con-strained resources. Most of the current research work has focused on how to design effective offloading systems to save time and energy while giving limited consideration to enabling techniques. Moreover, researchers have seldom paid attention to different computation resources in offloading frameworks. In this paper, we present the state-of-the-art enabling techniques and different computational resources used for partitioning and offloading. We investigate mobile cloud computing and relevant paradigms from the perspective of partitioning and offloading enabling techniques. We propose a taxonomy of these partitioning and offloading techniques and survey some well-established offloading frameworks. Based on our proposed taxonomy, we compare these offloading frameworks and show some offloading schemes. Furthermore, we discuss open research issues and challenges to partitioning and offloading.

Keywords: Mobile cloud computing; Partitioning; Offloading; Computation and communication overheads; Energy consumption

1. Introduction

With the development of wireless technology, mobile devices, such as smartphones and smart watches, are becoming the most effective tools for communication in human's daily life (Dinh et al., 2013)(Widodo et al., 2017)(Bai et al., 2004). The popularity and availability of mobile devices can help mobile users enrich experience of various services provided by mobile applications without the constrain of time and place (Sanaei et al., 2014)(Fu et al., 2005a)(Fu et al., 2005b). However, the resources of mobile devices are constrained. With limited weight, size and battery life, the computational resources of mobile devices, such as disk capacity, memory size and running speed, are restricted (Shaukat et al., 2016). Since the computation technologies on mobile devices are evolving day by day, the performance of mobile devices still lags behind that of traditional nonmobile computers. While running on mobile devices with constrained resources, mobile applications, such as speech recognizers (Kristensen, 2007)(Su and Flinn, 2005), natural language translators (Balan et al., 2007)(Flinn et al., 2002), optical character recognizers (Balan et al., 2007), wireless network scheduling (Yu et al., 2017)(Reaz et al., 2006), network analysis (Chowdhury et al., 2006)(Fu and Atiquzzaman, 2005) and image processors (Kristensen and Bouvin, 2008)(Porras et al., 2009) require higher disk capacity, computing speed, and battery lifetime than other applications. Moreover, compared with other applications that are currently supported on mobile devices, these applications require faster responses.