

Chapter 13

High Performance Computing on Mobile Devices

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ABSTRACT

Mobile devices are gaining high popularity due to support for a wide range of applications. However, the mobile devices are resource constrained and many applications require high resources. To cater to this issue, the researchers envision usage of mobile cloud computing technology which offers high performance computing, execution of resource intensive applications, and energy efficiency. This chapter highlights importance of mobile devices, high performance applications, and the computing challenges of mobile devices. It also provides a brief introduction to mobile cloud computing technology, its architecture, types of mobile applications, computation offloading process, effective offloading challenges, and high performance computing application on mobile devices that are enabled by mobile cloud computing technology.

INTRODUCTION

In the past few years, smartphones have emerged as a new computing platform that provides a wide range of applications, multifunctional sensors, and powerful operating systems. The smartphones support for complex applications from various domains, such as education, entertainment, business, and healthcare, has contributed much to its popularity.

It is expected that the number of smartphone shipments will increase each year with a record growth of about 16%-18% reaching a total of 2.6 billion units by 2016 (Canalys, 2015; IBM, 2010). According to the International Data Corporation (IDC), by 2015 (in USA) the number of mobile device Internet users will surpass the number who uses personal computers, making smartphone a primary computing platform for mobile users (IDC, 2013).

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High Performance Computing on Mobile Devices

The advancing features and complexity of smartphone applications demand an ever increasing computational power and energy (IBM, 2010). To cater to these demands, manufacturers release new models of smartphones with enhanced features on a regular basis. However, due to size constraint of the smartphones, the advances in hardware are unable to cater to users/applications computational power and energy demands. Consequently, many applications are considered resource intensive for the smartphones due to their limited processing power, memory, storage, and battery life.

To make the smartphones more energy efficient and computationally capable, major software level changes are needed, because hardware level changes alone may not enable smartphones to achieve true unlimited computational power. Considering this, researchers envision the usage of cloud computing technology for mobile device (A. Khan, Mat Kiah, Ali, Shamsirband, & Khan, 2015).

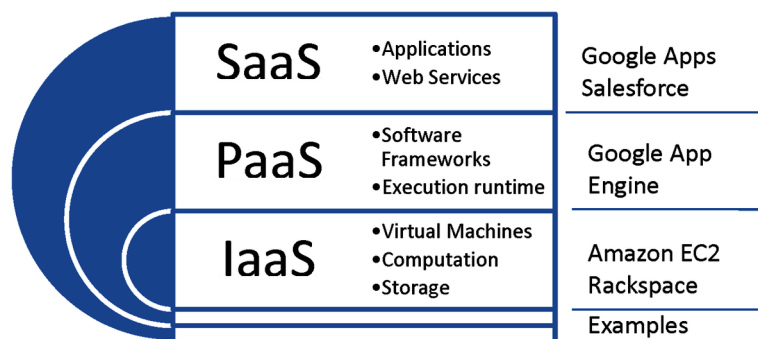
This chapter provides a brief introduction to cloud and mobile cloud computing technology, mobile cloud architecture, types of mobile applications, computation offloading process, types of offloading, mobile cloud application models, offloading challenges, and high performance computing applications on mobile devices that are enabled by mobile cloud computing technology.

CLOUD COMPUTING

Cloud computing is a coalesce of many computing fields and is widely used in multiple domains (A. R. Khan, Othman, Madani, & Khan, 2014). By using cloud computing, small businesses can expand their IT resources based on service demands and avail equal opportunities of growth to compete with other businesses within the market. Cloud Computing has gained much popularity in the recent years due to features, such as virtually unlimited resources, low capital cost, ease of adoption, flexible resource provisioning, and high scalability (A. R. Khan, Othman, Xia, & Khan, 2015).

The cloud platform has three main layers, namely IaaS (Infrastructure as a Service), PaaS (Platform as a Service), and SaaS (Software as a Service). In most cases, the cloud layers are more of a pyramid structure where IaaS has enormous resources, PaaS runs a smaller number of software development frameworks and tools, and SaaS runs a number of applications that use the underlying resources and functionality (Hassan, 2011). Figure 1 shows the execution support and example services of each layer.

Figure 1. Layers of cloud platform



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