Chapter 11
A Qualitative Resource Utilization Benchmarking for Mobile Applications

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ABSTRACT

There are many mobile applications currently available on the market, which have been developed specifically for smart phones. The operating system of these smart phones is flexible enough to facilitate the high level application development. Similar to other pervasive devices, mobile phones suffer from limited amount of resources. These resources vary from the power (battery) consumption to the network bandwidth consumption. In this research the mobile resources are identified and classified. Furthermore, a monitoring approach to measure resource utilization is proposed. This monitoring tool generates traces about the resource usage which is followed by a benchmarking model which studies monitoring traces and enables users to extract qualitative information about the application from quantitative trace of resource usage.

INTRODUCTION

According to Compass Intelligence studies, U.S. companies will spend $11.6 billion on mobile applications by 2012 (Burney, 2009). This indicates a significant increase in the number of mobile applications from both quantity and quality perspectives. Consequently many duplicate applications with similar functionalities and features will enter into the market.

Mobile phones as wide accepted pervasive devices have finite energy sources (Satyanarayanan, 1996). Pervasive devices also suffer from client thickness (Satyanarayanan, 2001) which implies

DOI: 10.4018/978-1-60960-563-6.ch011

that there will always be the challenge of willingness to increase the quality of an application while dealing with the shortage of existing resources.

Studies revealed that users prefer buying mobile phones with more features (Thompson, Hamilton, & Rust, 2005). Adding more features increases the resource utilization and fosters more powerful devices. Using less resources and providing the desired functionalities increase the application efficiency.

Developers and researchers try to handle resource shortages of the pervasive devices in different ways, such as studying the context and adapting the device to the current context (Alia et al., 2007), optimizing energy usages with a CPU scheduler (Yuan & Nahrstedt, 2003) and so forth.

Such research results suggest that the resource usage of an application is an important factor for mobile devices, which could affect the application's quality. In addition to other performance metrics such as application response time, throughput, reliability and availability (Jain, 1991), resource utilization is an important performance metric also.

For instance consider a scenario where a user intends to purchase an audio player for his smart phone. There are many different choices on the market, "Music player X" is an audio player which plays user desired audio formats such as MP3 and gets some information about the current music track from the Internet. "Music player Y" is another audio player which not only play the desired audio format and gets the information from the Internet, but also sends the audio track name to the user's micro-blog account (such as Twitter or Friendfeed accounts). These features might be attractive for some users, but wireless network bandwidth might be limited and expensive. A quality operator can study which application performs the assigned task with less network activities as a capability indicator and decides upon choosing the appropriate application. Large scale industrial mobile device producers, who are interested in purchasing applications from third parties and embed them into their devices, can benefit from studying resource usage of the applications. In this context, small amount of disk space or memory allocation plays an important role.

This paper focuses on measuring resource usage of applications via a monitoring tool, and benchmarking capability of the target application from the resource consumption point of view. Qualitative features such as user interface design or application features are not within the scope of this paper. The proposed monitoring tool tracks resource usage of the device during the runtime of the target applications. It generates a trace from the resource usage which can be used to study capabilities of the application or for studying QoS issues. Our monitoring approach which resides on the same device, does not require any information about the target application and monitors resources during the application execution. In order to be flexible and scalable, the proposed approach is designed independent of the target application.

The remainder of this paper is organized as follows. Next section describes the resource classification; afterward the related works will be introduced. Then we discuss controversies and restrictions. Afterward we introduce the benchmarking model,and utility function and finally resource monitoring methods will be described. Then the experiment evaluation will be described and last section concludes the paper.

RESOURCE CLASSIFICATIONS

As the first step, the resources of the mobile devices, which are worth measuring and affect the capability of the application must be identified. Each mobile application consumes five type of resources namely *CPU*, *memory*, *battery* and probably *disk* and *network* activities.

These resources can influence each other, for example CPU utilization affects battery consumption, but we intend to study them separately regardless of their interdependencies. Currently