

Chapter 37

Quality of Context and Mobile Systems: Past, Present, and Future

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ABSTRACT

Mobile and pervasive environments are characterized by a plethora of handheld computation and communication enabled devices working as a smart assistant for users by collecting context from the environment and adapting to dynamically changing situation in the environment. Their capabilities are heavily affected by the quality of context information that has been considered unsatisfactory since the start of research in context-aware systems. Early context-aware systems have also tried to collect extra information that can make the applications aware of the quality of context information. Subsequently term Quality of Context (QoC) is coined to indicate quality of context information. In this chapter, the authors present an overview of research efforts undertaken to realize QoC parameters. They also present a summary of works that have used QoC parameters to optimize the performance of different tasks in context-aware systems. Finally, the chapter discusses future directions of QoC research efforts.

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1. INTRODUCTION

Context-awareness is a key requirement for applications in mobile and pervasive environments. Several middleware solutions have supported the design and development of these applications by performing different tasks, such as, acquiring data from sensors, extracting high level context information, and providing context information to mobile applications (Baldauf et al. (2007)). However, as observed, many conflicting situations can arise during the execution of these tasks (Chantzara et al. (2006), Ranganathan et al. (2004)). These conflicting situations affect the quality of context information that has been considered imperfect since the start of the research in context-aware systems (Dey et al. (2005)). Awareness about the quality of context information can help the applications to use context information effectively.

Research efforts have been undertaken to design context models that consider the imperfection of context information and strive to present and associate it with context information. Few works have also used metadata to indicate the characteristics of context information and discussed the advantages of presenting metadata with context information (Hönle et al. (2005)). Subsequently, the term Quality of Context (QoC) has been coined in (Buchholz et al. (2003)) and is defined as “*any information that describes the quality of information that is used as context information*”. Later on, QoC has also been defined in (Krause et al. (2005)) as “any inherent information that describes context information and can be used to determine the worth of information for a specific application”. Important QoC parameters that have been identified are up-to-dateness, trustworthiness, resolution, precision, probability of correctness, and completeness of context information (Buchholz et al. (2003), Gray et al. (2001), Krause et al. (2005)). The characteristics of sensors, situation of a specific measurement, values expressed by context information object itself, and the granularity of representation format have also been

recognized as the significant sources to determine QoC (Krause et al. (2005)).

In this article we discuss the state of art of the research that has been undertaken to realize, support, and apply QoC parameters to improve the performance of context-aware systems and to optimize the utilization of the scarce resources in mobile and pervasive environments. First we discuss the concept of QoC and analyze QoC parameters that have been presented in literature. Then we examine the context models that have been designed to present QoC along with context information (Section 2). Later, we present the analysis of the approaches, algorithms, and mechanisms that have been used to evaluate various QoC parameters (Section 3). Afterwards, we discuss about how context-aware systems can take advantage of QoC parameters in performing the tasks to acquire and provide context information to context-aware mobile applications (Section 4). Finally, we discuss future research directions to realize and apply QoC in context-aware mobile applications (Section 5) and conclude this study (Section 6).

2. QOC AND CONTEXT MODELS

Context-aware systems aim to adapt their behaviour to the prevailing situation in the environment by sensing and using context information (Buchholz et al. (2003)). But sensing context information is a far more difficult task than explicit input to a system (Gray et al. (2001)). Sensors generate a volume of data that can also differ with each other considering the frequency of updates, capability of sensor to collect a specific type of context information, accuracy of sensor that is used to collect information, processing that has been done on that information, and representation format (Chantzara et al. (2006), Cook et al. (2007)). Continuously emerging situation and dynamic nature of the entities in mobile and pervasive environments also imposes major limitations to the quality of

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