Chapter XXVI
Context Modelling Approaches for Mobile Systems

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ABSTRACT

The actual mobile technology and the increasing need to obtain rich multimedia content about each and every aspect of the human life are changing the approach of the users to the World Wide Web. Indeed, the pervasive use of mobile devices and the heterogeneity of the provided services and information make the accessibility and usability of the Web resources a hard assignment. In particular two main tasks have been identified as focal issues, the first one regards the choose of a suitable model to express the complex activities of the Web (context modeling approaches), and the second one regards the translation of the different schemas, representing these Web activities, in a more suitable, manageable and standardizing schema. In this chapter we will present the problems related to the modeling of context data, and we will describe the actual and future approaches of Context Modeling according to the mobile devices world.

INTRODUCTION

World Wide Web represents the global interface to access all information and the growing number of devices (such as smart-phones, PDAs, etc.) able to access the Web anytime and anywhere is a clear proof of this trend.

However, the fast and uncontrolled spread of this kind of devices has raised several challenges that are still unsolved. Modern Web applications are claimed to solve this problems.

More relevant Web-based applications are data intensive applications. These systems must automatically (or at least semi-automatically)

present heterogeneous information collected from different Web sources.

It is clear that a main requisite for these systems should be the ability to adapt and personalize this piece of information according to the client context (either human or machine).

There a lot of definition for the term "context" that are different from each other, in this case we want to address "a set of attributes that characterizes the capabilities of the access mechanism and the preferences of the user" (i.e., the delivery context as described by Gimson (2003)).

The context expresses the capabilities and preferences that may constrain the acceptable range of user experiences that can be delivered via a given access mechanism. In particular, the capabilities of the device, including the modalities and representations it supports, the characteristics of the network over which delivery occurs, and the preferences of the user will all potentially affect the user experience provided.

There are several coexistent standards to describes context data both for structured data (RDF, CC/PP, XML, etc.) that the unstructured ones (HTTP header). It is clear that the most important issue in this "context" is the interoperability management.

In this chapter we will present the problems related to the modeling of context data, and we will describe the actual and future approaches of Context Modeling according to the mobile devices world. These approaches will be evaluated showing their importance in the field of adaptive application systems. Finally we present an approach to perform the integration of different context profiles.

CONTEXT MODELING MOTIVATIONS

The increasing spread of mobile devices (such as PDAs, smart phones, etc.) is inspiring new kinds of applications that are more and more dynamics, distributed and highly customizable. These applications represents an interesting challenge to the developer, because they must be independent from the context's features such as location, time, user's preferences or used device.

In Web adaptive systems, for example, the management of context information represents an important requirement to analyze the available resources of a mobile devices, to select relevant data for the users, to improve interoperability with other systems and, in general, to make the interaction with the system more simple and natural. This scenario changes the role of context information especially if compared with traditional information systems (Kaschek, Schewe, Thalheim & Zhang, 2003; Motschnig-Pitrik, 1995). Another key element of these applications is the interoperability, in which metadata play a fundamental role.

The reliance on the context is one of the most important results in the area of ubiquitous computing systems (UCS) that represent a specialization of mobile and distributed systems as shown in Figure 1.

CONTEXT MODELING APPROACHES: CLASSIFICATION AND EVALUATION

In the field of context representation there are different modeling approaches, most of them present only simple changes from the others. In this section we present a classification of these approaches and then we discuss and compare them. In particular we distinguish: (i) Graphical Models; (ii) Key-Value Models; (iii) Markup Schema Models; (iv) Object-Oriented Models; (v) Ontology Based Models; (vi) Logic Based Models.

Graphical Models

One of the most important tools for modeling is the Unified Modeling Language (UML) that has high expressive graphical components (UML Diagrams). Another example of graphical model