Chapter 3.10
Mobile Users in Smart Spaces

Loreno Oliveira
Federal University of Campina Grande, Brazil

Hyggo Almeida
Federal University of Campina Grande, Brazil

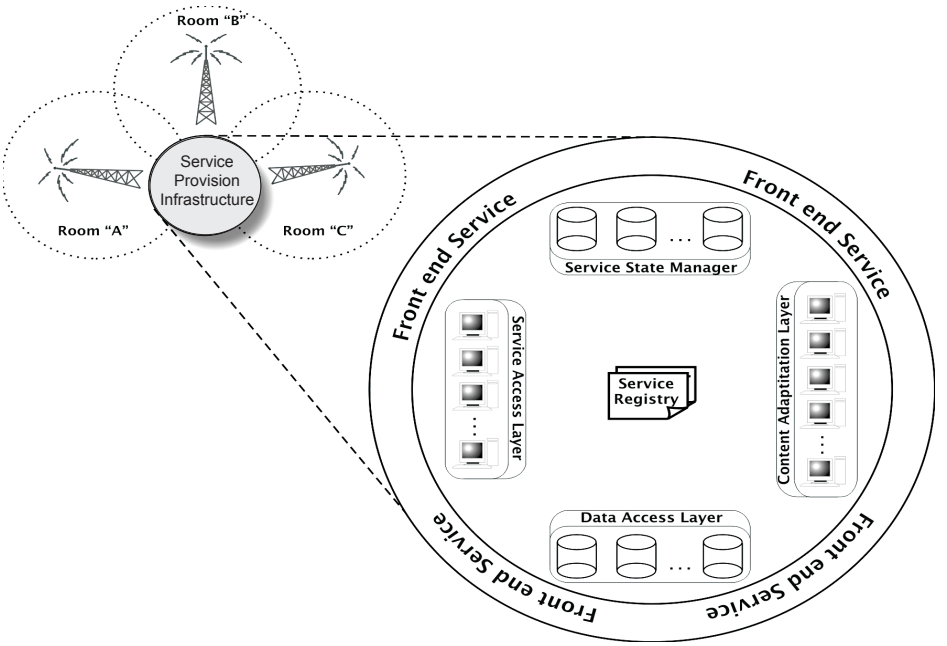
Angelo Perkusich
Federal University of Campina Grande, Brazil

INTRODUCTION

Constant technological advances are making *pervasive computing* (Weiser, 1991) a reality. Such advances have been enabling the rise of devices increasingly smaller, with larger storage space, novel wireless interfaces, and lower battery consumption. These innovative technologies are contributing to the emergence of a new sort of personal portable device, as well as a large number of sensors and actuators. Sensors and actuators are embedded into objects spread across the environment, while portable devices quietly inform such environments how users wish to interact with them. Therefore, personal mobile devices stand out currently as the interface between people and smart spaces.

A basic requirement in the context of pervasive computing is to allow users to access services seamlessly as they move across environments. This requirement demands from the underlying infrastructure the ability to transfer user sessions among access points (*handoff*), which is a well-known concern in the context of pervasive computing (Cui, Nahrstedt, & Xu, 2004; Banerjee, Das, & Acharya, 2005). Nevertheless, the effective delivery of services in smart spaces requires conceiving mechanisms for handling localized scalability, availability, and redundancy of services; load balancing among providers; and on-demand content transformation for different devices (Satyanarayanan, 2001; Raatikainen, Christensen, & Nakajima, 2002; Raman et al., 2002), henceforth *QoS issues*. These requirements rise as fundamental for promoting transparency

Figure 1. Conceptual infrastructure for dynamic provision of services



and invisibility to the service usage, as well as delivering some level of QoS and optimized resource utilization (Kalasapur, Kumar, & Shirazi, 2006).

Currently, there are still no efforts for conceiving solutions to provide ubiquitous access and seamless usage of services while taking into account QoS issues. In this context, we define the dynamic provision of services as a set of requirements relevant to the seamless provision of services for mobile users plus mechanisms for dealing with QoS issues.

In this article we define and present the basis of our work about dynamical services provisioning for mobile users in smart spaces. We present an overview about our envisioned service provision infrastructure, as well as the main research challenges related to it. Finally, we discuss issues related to the current state of our research and point out research directions in this field.

BACKGROUND

The interaction between users' devices and smart spaces occurs primarily through services advertised in those environments. The *service-oriented paradigm* (Papazoglou & Georgakopoulos, 2003) is especially suitable due to the dynamics of smart spaces, where resources may exist anywhere and applications running on mobile devices must be able to find out and use them at runtime.

In the context of smart spaces, user mobility is the main cause of such disturbances, but other factors may also cause temporary unavailability or degradation of services, for example, crash failures in the service providers, temporary network congestion, or peaks of overload on service providers. Smart spaces are primarily service-oriented environments, where part of the application logic is at the client side (e.g., in the form of helper applications for user profiles) and part at the server side (e.g., in the form of services