

Chapter 13

Discovering Services in Mobile Environments: Discussion and Evaluation of Trends

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ABSTRACT

Mobile services have gained in importance for their ability to be consumed by mobile users regardless of their location. Mobile consumers are exposed to a large pool of services such as location-based applications, medical information, financial management, investments, and more. However, mobile service discovery needs further research to efficiently and effectively support mobility-related constraints such as availability, heterogeneity, and resource constrained devices. In this chapter, the authors define several criteria relating to mobile service discovery and categorize state-of-the-art service discovery approaches according to those criteria while paying particular attention to architectural choices, service description, and service discovery using semantic and reasoning techniques. The authors evaluate the approaches to identify their advantages and shortcomings and propose guidelines for future research for service discovery in mobile environments.

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INTRODUCTION

The need for increased wireless communication between mobile devices requires their cooperation in order to perform tasks that cannot be done alone due to their inherent resource limitations. Machine-to-machine (M2M) technology puts this real-time intelligence capability directly into mobile devices by cooperatively achieving interdependent operations. Cooperation between devices is achieved through Web services exposing a described interface. The success of this cooperation is important and depends on service discovery among the mobile networks.

With device diversity, mobile consumers are exposed to a large pool of services such as location based applications allowing user awareness of nearby restaurants, fitness centers, or any place of interest; health care applications (Toninelli et al., 2009) that deliver medical information; dictionary applications (Mohamed & Wijesekera, 2012); and thousands of other services. Faced with that diversity, discovery of Web services that best meet user requirements is an ambiguous task hindered by the intrinsic complexity of mobile wireless connected devices. In addition, users do not have the knowledge about devices and their hosted services available in the network. If they did, they would be interested in discovering services that meet or satisfy their interests.

Recently, several changes in the design of mobile devices and wireless technologies have affected the area of service discovery, including the creation of new *Service Discovery Protocols* (SDPs). These protocols lead to a successful coupling between mobile devices and exposed services. Current SDPs depend on the type of service discovery architecture especially when delivering user queries on the network. For example, Universal Plug and Play (UPnP) and Devices Profile for Web Services (DPWS) allow a device to act as a provider and/or consumer of services in a local

network (Meshkova et al., 2008). But their obvious shortcoming is the lack of semantic support. With this diversity of protocols, it is necessary for the discovery systems to adjust according to the system policies and objectives.

Several researchers have published articles in the fields of service and resource discovery (Meshkova et al., 2008; Ververidis & Polyzos, 2008); however, the objective of our survey is more focused and devoted to service discovery in the context of mobile and resource constrained devices. Meshkova et al. (2008) generalize search resource methods and algorithms and provide an overview of SDPs. They also cover P2P networks on top of DHT routing protocols. However, they do not emphasize ontology-based semantic reasoning or techniques for hiding network heterogeneity and mobility. (Toninelli et al., 2009; Ververidis & Polyzos, 2008) focus mostly on network architecture and taxonomy rather than mobility issues.

In this chapter, we discuss all aspects of service discovery in mobile environments - especially mobility, availability, heterogeneity, and resource constraint problems and provide direction based on our evaluation of various approaches. We focus on choosing the appropriate architecture and methods for hiding device mobility related constraints and propose recommendations for the design of future service discovery systems in mobile environments. To achieve this goal, our approach consists of investigating existing approaches and their methods and comparing them according to several defined criteria to identify their strengths and weaknesses. However, security related issues are out of scope for this chapter.

This chapter is structured as follows. In the background section, we provide information related to defining criteria for service discovery in mobile environments and extract architectural methods and solutions according to those criteria. We also determine the strengths and weaknesses of the methods being evaluated. In the following

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