Chapter 7.27
Advanced Resource Discovery Protocol for Semantic-Enabled M-Commerce

Michele Ruta
Politecnico di Bari, Italy

Tommaso Di Noia
Politecnico di Bari, Italy

Eugenio Di Sciascio
Politecnico di Bari, Italy

Francesco Maria Donini
Università della Tuscia, Italy

Giacomo Piscitelli
Politecnico di Bari, Italy

INTRODUCTION

New mobile architectures allow for stable networked links from almost everywhere, and more and more people make use of information resources for work and business purposes on mobile systems. Although technological improvements in the standardization processes proceed rapidly, many challenges, mostly aimed at the deployment of value-added services on mobile platforms, are still unsolved. In particular the evolution of wireless-enabled handheld devices and their capillary diffusion have increased the need for more sophisticated service discovery protocols (SDPs).

Here we present an approach, which improves Bluetooth SDP, to provide m-commerce resources to the users within a piconet, extending the basic service discovery with semantic capabilities. In particular we exploit and enhance the SDP in order to identify generic resources rather than only services.

We have integrated a "semantic layer" within the application level of the standard Bluetooth stack in order to enable a simple interchange of semantically annotated information between a mobile client performing a query and a server exposing available resources.

We adopt a simple piconet configuration where a stable networked zone server, equipped with a Bluetooth interface, collects requests from mobile clients and hosts a semantic facilitator to match requests with available resources. Both requests and resources are expressed as semantically annotated descriptions, so that a *semantic distance* can be computed as part of the ranking function, to choose the most promising resources for a given request.

STATE OF THE ART

Usually, resource discovery protocols involve a requester, a lookup or directory server and finally a resource provider. Most common SDPs, as service location protocol (SLP), Jini, UPnP (Universal Plug aNd Play), Salutation or UDDI (universal description discovery and integration), include registration and lookup of resources as well as matching mechanisms (Barbeau, 2000).

All these systems generally work in a similar manner. Basically a client issues a query to a directory server or to a specific resource provider. The request may explicitly contain a resource name with one or more attributes. The lookup server—or directly the resource provider—attempts to match the query pattern with resource descriptions stored in its database, then it replies to the client with discovered resources identification and location (Liu, Zhang, Li, Zhu, & Zhang, 2002).

These discovery architectures are based on some common assumptions about network infrastructure under the application layer in the protocol stack. In particular, current SDPs usually require a continuous and robust network connectivity, which may not be the case in wireless contexts, and especially in the ad-hoc ones. In fact in such environments, network consistence varies continuously and temporary disconnections occur frequently, so bringing to a substantial decrease traditional SDP performances (Chakraborty, Perich, Avancha, & Joshi, 2001).

Actually, there are several issues that restrain the expansion of advanced wireless applications, among them, the variability of scenarios. An ad-hoc environment is based on short-range, low power technologies like Bluetooth (Bluetooth, 1999), which grant the peer-to-peer interaction among hosts. In such a mobile infrastructure there could be one or more devices providing and using resources but, as a MANET is a very unpredictable environment, a flexible resource search system is needed to overcome difficulties due to the host mobility. Furthermore, existing mobile resource discovery methods use simple string-matching, which is largely inefficient in advanced scenarios as the ones related to electronic commerce. In fact, in these cases there is the need to submit articulate requests to the system to obtain adequate responses (Chakraborty & Chen, 2000).

With specific reference to the SDP in the Bluetooth stack, it is based on a 128-bit universally unique identifier (UUID); each numeric ID is associated to a single service class. In other words, Bluetooth SDP is code-based and consequently it can handle only exact matches. Yet, if we want to search and retrieve resources whose description cannot be classified within a rigid schema (e.g., the description of goods in a shopping mall), a more powerful discovery architecture is needed (Avancha, Joshi, & Finin, 2002). SDP should be able to cope with non-exact matches (Chakraborty & Chen, 2000), and to provide a ranked list of discovered resources, computing a distance between each retrieved resource and the request after a matchmaking process.

To achieve these goals, we exploit both theoretical approach and technologies of semantic Web

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