

Chapter 51

To Implement an Open–MAS Architecture for Semantic Web Services Discovery: What Kind of P2P Protocol Do We Need?

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ABSTRACT

Recently, several models have been proposed to design distributed and collaborative infrastructures for web services based systems. In this area, Peer-to-Peer (P2P) networks and Multi-Agents Systems offer many techniques for web services discovery and composition. However, both of the two combinations (P2P/web services and MAS/web services) have suffered from some problems. This article presents a generic P2P/MAS architecture for semantic web services discovery. It tries to merge these two distributed technologies and demonstrate how P2P networks can implement open-MAS architectures to build a collaborative distributed system. The main objective of this article is to find the most appropriate P2P protocol to make such systems. Before the presentation of the proposed architecture, it already presents a background of P2P categories and models. After, it chooses four different P2P protocols wherever it analyzes and discusses, for each one, the stabilization and traffic generation of the network.

1. INTRODUCTION

Distributed computing technologies such as P2P systems and web services have emerged as the main means for realizing scalable and interoperable distributed applications. Until now, several models have been proposed to design collaborative information systems in heterogeneous, distributed and dynamic environments. In this area, P2P systems offer many techniques for web services discovery in large-scale networks over the Internet.

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In the same context, the convergence between the MAS (Multi-Agents systems) and web services has produced several architectures and solutions for cooperative information systems. However, the MAS/web-services relationship was generally bidirectional. On the first hand, agents can use web services to expose their capabilities to the other participants on the network. In this case, heterogeneous MAS use web services as a standard of interoperability (El Fallah-Seghrouchni, Haddad, Melitti, & Suna, 2004). On the other hand, the MAS are, generally, used to implement choreographic composition of web services. The choreography of web services needs the agents' intelligence for negotiation and selection of provided web services.

However, both of the two combinations (P2P/web services and MAS/web services) have suffered from some problems. For the first part, it is plain that neither P2P nor web services technologies can provide by themselves the autonomy nor social and proactive capabilities needed to build a dynamic and homogeny system (Mari, Poggi, Tomaiuolo, & Turci, 2008). Also, despite several P2P applications/protocols have been realized, they are not able to exchange complex information and to cope with heterogeneity and information integration problems. Explicitly, autonomous network users often use simple systems (PC, laptops, wireless devices, etc.) and their network accesses are characterized by variable connectivity (Penserini, Spalazzi, & Tacconi, 2002). Furthermore, Peers are not fit by the factor "intelligence" required for requests analysis, evaluation and comprehension, especially, for semantic requests used for web services discovery.

In the other side, in MAS, agents cooperate with each other to complete a specified task. As opposed to closed-MAS where each agent knows all other agents it needs to interact with, in open MAS such knowledge is not available. To find an agent, most open MAS infrastructures use, generally, a central directory. With this approach, agents register their resources to a central directory (e.g., a middle agent (Sycara, Klusch, Widoff, & Lu, 1999)). An agent that requests a resource contacts the directory which in turn replies with the contact information of some agent that provides the particular resource. However, in such approaches, the central directories are potential bottlenecks of the system both from a performance and from a reliability perspective (Dimakopoulos, & Pitoura, 2003).

Motivated by such facts, several research works have been undertaken with the aim of tackling the problem of integrating P2P and service-oriented technologies with multi-agent systems (Mari, Poggi, Tomaiuolo, & Turci, 2008). This incontrovertible fact seems that P2P could play a fundamental role in realizing such applications. Especially, to implement open MAS infrastructures that employed in services oriented architectures.

In this work, we want to extend the capabilities of a Multi-Agent System in order to realize a new form of distributed and cooperative discovery method, of semantic web services, based on the P2P model. In particular, each representative peer of a cluster (super peer) is characterized by his intelligent agent. The main task, of this last, is to realize the semantic matchmaking to evaluate the received request and to discover a requested service over a P2P network. Thus, the main objective of this paper is to propose a generic P2P/MAS architecture for semantic web services discovery, where we will demonstrate which kind of P2P protocols is the most appropriate to implement this architecture.

The rest of this paper is structured as follows. In Section 2, we briefly introduce the MAS and web services relationship. Section 3 presents the use of P2P systems for semantic web services discovery. In this 4, we present a background of P2P systems and we realize a comparative study between the different P2P architectures. In section 5, we describe a generic P2P/MAS architecture for semantic web services discovery. In section 6, we discuss some experimental results to demonstrate which the most

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