Chapter 10
Mini-ME Matchmaker and Reasoner for the Semantic Web of Things

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ABSTRACT

The Semantic Web of Things (SWoT) aims to support smart semantics-enabled applications and services in pervasive contexts. Due to architectural and performance issues, most Semantic Web reasoners are often impractical to be ported: they are resource consuming and are basically designed for standard inference tasks on large ontologies. On the contrary, SWoT use cases generally require quick decision support through semantic matchmaking in resource-constrained environments. This paper describes Mini-ME (the Mini Matchmaking Engine), a mobile inference engine designed from the ground up for the SWoT.

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INTRODUCTION

Semantic Web technologies have been acknowledged to promote interoperability and intelligent information processing in ubiquitous computing. Scenarios include supply chain management (Giannakis & Louis, 2016), ubiquitous commerce (Liu, 2013; De Virgilio, Di Sciascio, Ruta, Scioscia, & Torlone 2011), peer-to-peer resource discovery (Ruta, Di Sciascio, & Scioscia, 2011; Ruta, Scioscia, Ieva, Capurso & Di Sciascio, 2017) and so on. The ever-increasing computational resources and communications effectiveness of mobile devices enable ubiquitous processing and exchange of rich and structured information for context-aware resource discovery and decision support. The Semantic Web and the Internet of Things paradigms are converging more and more toward the so-called Semantic Web of Things (SWoT) (Ruta, Scioscia & Di Sciascio, 2012; Pfisterer et al., 2011). It enables semantic-enhanced pervasive computing by embedding intelligence into ordinary objects and environments through a plethora of heterogeneous micro-devices conveying short information seeds.

Such a vision requires increased flexibility and autonomy of ubiquitous knowledge-based systems in information encoding, management, dissemination and discovery. User agents running on mobile personal devices should be able to discover dynamically the best available resources according to user’s profile and preferences, in order to support her current tasks through unobtrusive and context-dependent suggestions. Reasoning and query answering are particularly critical issues, stimulating the need for further specialized inference services in addition to classical ones (like subsumption and satisfiability check). Furthermore, mobile computing platforms (e.g., smartphones, tablets) are still constrained by hardware/software limitations with respect to typical setups for Semantic Web reasoning engines. In fact, architectural and performance issues affect the porting of current OWL-based reasoners, designed for the Semantic Web, to mobile devices (Bobed, Yus, Bobillo, & Mena, 2015).

This chapter describes the Mini Matchmaking Engine (Mini-ME) (Scioscia et al., 2014b), a compact matchmaking and reasoner for the attributed language with unqualified number restrictions (ALN) Description Logic (DL). It is aimed to semantic matchmaking for resource/service discovery in mobile and ubiquitous contexts, although it is also a general-purpose Semantic Web inference engine. Optimized non-standard inference services allow a fine-grained categorization and ranking of matching resources w.r.t. a request, providing both a distance metric and a logic-based explanation of the outcomes. Mini-ME is suitable to a widespread class of applications where large sets of low-complexity component resources can be aggregated to build composed services with growing semantic complexity. This is fit for the computational and power supply limitations of resource providers in ubiquitous contexts and to their short storage availability. An “agile” service discovery architectures able to select, assemble and orchestrate on the fly many elementary components is more manageable and effective in mobile and pervasive applications.

Mini-ME uses the OWL API (Horridge & Bechhofer, 2011) to parse and manipulate Knowledge Bases in all supported syntaxes of Web Ontology Language (OWL) version 2 (World Wide Web Con-