Chapter 10
Evidential Reasoning-Based Evaluation of Services

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ABSTRACT

Evaluation of services plays an important role in the pre-negotiation process for negotiations over services between autonomous agents. Typically, the service evaluation problem can be regarded as multi-attribute decision making, possibly with uncertainty. This chapter first presents an overview on some decision models, which have been used for evaluating service offers in negotiations, and then discusses the issue of handling uncertainty and imprecision in the service evaluation process by a combined approach for evaluation in order to provide decision support in the pre-negotiation process. Finally, the chapter introduces an evidential reasoning-based model for evaluation of services illustrated by a numerical example.

INTRODUCTION

With rapidly increasing acceptance of e-commerce, the research and development of decision support systems allowing on-line negotiations intelligently and automatically has recently received great attention in both academic and industry. In such systems, autonomous agents are increasingly being used, in which they need to interact with one another in order to procure services and to manage their action interdependencies (Vulkan and Jennings, 2000). In doing so, these agents have a high degree of self-determination, i.e. they decide for themselves what, when and under what conditions their actions should be performed (Faratin et al., 1998; Sierra et al., 1997). In addition, as autonomous agents often represent different organizations or individuals, for example in an online trading system one agent may represent a buyer whilst another one may represent a seller in some particular transaction, the predominant form of interaction is negotia-

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tion (Vulkan and Jennings, 2000) – a process by which a joint decision is made by two or more parties. The parties first verbalise contradictory demands and then move towards agreement by a process of concession making or search for new alternatives (Pruitt,1981).

During the last decade, various models of negotiation between autonomous agents have been proposed in the literature (Lopes et al., 2002). Notably, Sierra et al. (1997) presented a formal model for the so-called service-oriented negotiation in the context where one agent (the client) requires a service to be performed on its behalf by some other agent (the server), and the negotiation aims at reaching an agreement between these agents about the provision of the service. Then, this service-oriented negotiation model between autonomous agents has been comprehensively explored and developed in Faratin et al. (1998). In service-oriented negotiations, it necessarily requires an evaluation process of service offers and decision-making during the so-called pre-negotiation phase (Tsvetinov, 2003). However, as also mentioned in Tsvetinov (2003), very few studies have addressed the reasoning and actions that may take place during the pre-negotiation phase of an automated negotiation. Typically, the pre- negotiation evaluation problem in negotiations over services can be regarded as a multiple attribute decision-making (MADM) problem. In addition, properties (attributes) of services are often of both qualitative and quantitative nature; such as price, service quality, availability, security and trust; of which evaluation may be associated with incomplete information, uncertainty and imprecision (Lin et al., 2006; Mudgal and Vassileva, 2000; Mikhailov and Tsvetinov, 2004).

So far, several decision models have been applied to evaluation of services. In (Raiffa, 1985), Raiffa presented a multi-attribute model for bilateral negotiation (two parties, many issues negotiation), in which the multiattribute utility theory (Keeney and Raiffa, 1976) was used as a tool for ranking service offers, by introducing utility functions as a measure of the goodness of a service package. Consequently, this model requires preferential and utility independence among the attribute of services (Mikhailov and Tsvetinov, 2004), which is difficult to be justified or even not satisfied in the context of service evaluation. Faratin et al. (1998) introduced a transformation of Raiffa's model for bilateral negotiations about a set of quantitative variables into a model for multilateral negotiations (many parties, many issues model) and also used a multiattribute representation and evaluation model based on an additive scoring function similar to multiattribute utility function for decision-making. Then, by extending Faratin's model, Paula et al. (2001) proposed a bilateral agent negotiation model for e-commerce, where an e-commerce negotiation process has been usually modeled as a self-interested multi-agent system. On the other hand, the authors in (Lin et al., 2006) have proposed a model of an automated agent for bilateral negotiation with bounded rational agents with incomplete information by using a qualitative decision-making approach (Dubois et al., 2001).

Tsvetinov (2003) presented a framework for evaluation and selection of service offers during the re-negotiation phase in automated negotiations over services. In this framework, the author proposed an integrated evaluation approach with the simultaneous use of three MADM weighting methods in support of a pre-interaction selection of service providers. Interestingly also, Mikhailov and Tsvetinov (2004) then developed a new approach for tackling the uncertainty and imprecision of service evaluations during pre-negotiation stages, by using a modification of the analytic hierarchy process (AHP) (Saaty, 1988) as an evaluation tool.

This chapter first provides an overview on service evaluation models for the pre-negotiation problem in negotiations over services between autonomous agents, and then introduces a combined approach for evaluation of services under uncertainty and vagueness. In the next section a