Proyecto de tesis:

A framework for automated negotiation of agreements

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Abstract

In recent years, Internet and web services have opened new ways of subcontracting in the software industry through the use of services provided by a company in the business process of another one. To offer a guarantee on the quality of the service, service agreements may be settled to establish both functional and non-functional requirements that must be observed by the service provider during the service execution. Automating the creation of agreements, so that the human participation in the process was reduced to the minimum possible shall bring the following advantages: cutting the cost of reaching an agreement, increasing the speed in the contracting process, and allowing the establishment of new business relationships in a more flexible way.

We focus on an automated negotiation between providers and consumers to reach mutually acceptable service agreements. These negotiations pose several problems in the development of automated negotiation systems. First, we are interested in multi-issue negotiations, i.e., when the negotiation process involves reaching an agreement on several terms, in contrast with other negotiation processes where only price or price and quantity are negotiated. Therefore, an automated negotiation system must be able to represent complex agreements and support protocols that enable a multi-issue negotiation. Second, there are many different scenarios depending on the negotiation context (e.g. the number of terms that must be negotiated, the eagerness of the parties to reach an agreement, or the trust a party has about the other parties). Therefore, an automated negotiation system must be able to adapt itself to these different scenarios. Third, to negotiate in an open environment, it is essential to possess information about the other parties and the characteristics of the market and, hence, an automated negotiation system must be able to build advanced models so that it can use this information during the negotiation with other parties.

In the last years, much work has been done in automated negotiation and most of these efforts have been centred in the development of negotiation protocols and strategies. That is, the algorithmic aspect of automated negotiation. However, no proposal outperforms the others, but its goodness depends on the negotiation context. Therefore, a framework that integrates several negotiation techniques is very appealing because it would make the development of automated negotiation systems easier. Several frameworks for automated negotiation have been proposed in the literature. Nevertheless, they lack support for advanced negotiation techniques. In particular, their ability to build models of the market and other parties is very limited or inexistent.

To make automated negotiation widely used in real scenarios, it is necessary to develop advanced software systems that are able to tackle the aforementioned problems. To this end, instead of focusing on the algorithmic aspect of automated negotiations, we take a software engineering approach. Specifically, we face the problem in two levels of abstraction. First, we focus on how to develop an automated negotiation system and describe a set of principles shared by those systems. Later, we develop a concrete software framework that makes it easier the development of automated negotiation systems.

Therefore, we start describing a reference architecture for automated negotiation systems that identifies and describes the elements (subsystems, components, interfaces, data types, or collaborations) that must be implemented in those systems and gives
guidelines on how to develop them. We specify the reference architecture following a role-based approach. This means that the reference architecture is described through the roles and collaborations that are necessary to develop an automated negotiation process. This reference architecture may be later used to define concrete automated negotiation architectures in concrete domains and using a variety of technologies.

Based on this reference architecture, we develop a concrete software framework for automated negotiations of service agreements. In particular, we focus on the problem of several concurrent bilateral negotiations. This software framework must make use of industry standards, deal with complex service agreements, support a wide variety of negotiation protocols, facilitate the selection of the best decision-making technique based on the negotiation context, and incorporate mechanisms that make it easier to build advanced models of the world and the other participants in the negotiations. The advantages of developing such framework are three: first, it provides us an infrastructure that facilitates the development of automated negotiators; second, it can serve as a testbed for the development of new automated negotiations protocols or techniques; and third, a framework of these characteristics involves a classification and categorisation effort of many different proposals of automated negotiation of service agreements.

In summary the contribution of this work is threefold. First, we analyse, categorise and classify the most significant proposals of service agreements automated negotiation. Second, based on this analysis, we develop a novel reference architecture for automated negotiation systems. And third, we build a software framework based on that reference architecture for concurrent bilateral negotiations.