Chapter 3
A New Framework for Intelligent Semantic Web Services Based on GAIVAs

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ABSTRACT

The Semantic Web has been recently developed to provide end users with suitable tools and strategies to process information from their Web pages. The Intelligent Semantic Web Services is a new approach aimed at extending Semantic Web capabilities for Services by applying Artificial Intelligence techniques while maintaining the good properties of the standard Semantic Web schemes. However, many current Web services neither consider this approach nor include a powerful user-interface and, consequently, are very limited and difficult to use. This paper introduces a new framework for Intelligent Semantic Web Services that overcomes these drawbacks. Our approach is based on the Graphical Autonomous Intelligent Virtual Agents (GAIVAs), virtual agents that exhibit a human-like appearance and behaviour and are able to take intelligent decisions and perform actions without human intervention. To this purpose, the framework comprises a collection of powerful Artificial Intelligence techniques along with a natural and intuitive Graphical User Interface.

INTRODUCTION

If we might summarize our current world in just a few keywords, one of them would likely be “information.” Today’s society is often labelled as the “information society.” The extraordinary advances in hardware and software, the wide availability of computers and other electronic devices and the rapid development of Internet and its rich collection of tools and resources have opened the door to new ways to store, query, retrieve, and manipulate information. Nowadays, we can easily access to huge amounts of information just surfing at the Web from link to link, querying sophisticated search engines, or just attempting to reach a site by using its domain name, to mention just a few examples. And perspectives are even much better: it is expected that the number of services
available on the Web will increase dramatically for the next years.

There is, however, a “bottleneck” in this process: the conversion of all this resulting information into useful knowledge. In just a few minutes, we might become literally collapsed by an impractical load of information coming from hundreds of thousands of Web pages. Thus, even the pre-processing of all this information may typically require several weeks in order to make it suitable for knowledge processing and acquisition.

Several approaches have been described to overcome this limitation. Perhaps the most promising one is Semantic Web. First introduced by Tim Berners-Lee, it represents a step further in order to provide the users with suitable tools and strategies to process information from their Web pages. In words of Berners-Lee, Hendler, and Lassila (2001), the core of Semantic Web is “to bring structure to the meaningful content of Web pages, creating an environment where software agents roaming from page to page can readily carry out sophisticated tasks for users.”

Behind this approach is the underlying problem that, while the Web pages may be appealing for humans, for the software they are not more than a string of random characters. Because the meaning of a sentence or paragraph embedded into a Web page cannot be determined automatically by software, this task has been progressively assigned to users and programmers. But this is a very hard, tedious, and time-consuming process. Of course, there are specific tools (mostly based on HTML or XML tags or similar approaches) to deal with this problem. However, they still provide particular and incomplete solutions and are very prone to errors. Consequently, the programmers are getting more and more involved in the process to assign meaning to the Web page contents (in other words, to “capture” the semantics of those pages). Unfortunately, this strategy generates new problems: some desirable features such as information confidentiality and privacy and other security issues are missed. Furthermore, the subjectivity inherent to the human processes becomes evident here: the meaning assigned by two programmers might be drastically different. In addition, we would expect such tasks to be done automatically. In fact, it has been remarked, “the potential of the semantic Web, however, goes well beyond information discovery and querying. In particular, it encompasses the automation of Web-based services as well.” (Bryson, Martin, McIlraith, & Stein, 2003). However, this automation requires specific tools to convert the current Web contents into information understandable by the machines.

These and other problems were already envisioned some years ago. As a consequence, several appropriate mechanisms and strategies to solve them have been suggested during the last few years. Among them, the Semantic Web is complementary to the World Wide Web and consists of machine-readable information. Its goal is to develop standards and technologies to help machines to understand information on the Web (not the natural language, as it will be remarked later on) so that they can support features such as data integration, navigation, automation of tasks, and services or declaration of the kind of information one might trust. The last step in this semantics-oriented software development process is given by the intelligent Semantic Web services, a new approach aimed at extending the Semantic Web capabilities for services by applying artificial intelligence techniques while maintaining the good properties of the standard Semantic Web schemes. As it will be described in the next sections, this work presents a novel approach that falls into this last category.

On the other hand, we noticed that many Web services require a degree of technical comprehension on the user’s part. In fact, this is one of the most common complaints of any user: the service can work very well, but the user interface is quite complex to use. Very often the users fail to achieve the service successfully just because