

An Adaptive e-Commerce System Definition

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Abstract. The emergence and growing popularity of electronic commerce and more specifically of catalogue-based sales, has made it a necessity to define flexible and adaptive e-commerce systems and architectures. Our work describes an e-commerce system that is suitable for small and medium enterprises, where several enterprises share a common e-commerce site, which automatically adapts its interface to offer end-users the products organised in electronic catalogues (e-catalogues). To be precise, in this paper we present the overall architecture of the e-commerce system, an architecture that is based on an agent-oriented technology. We also describe the actual state our system, which is called e-CoUSAL, and implements an adaptive agent in the server side of the architecture.

Keywords. Adaptive agent; E-commerce; Adaptivity in E-commerce; Adaptive interface; E-catalogue; XML.

1 Introduction

Inspired by the growing popularity of new technologies and owing to the increasing use of the Internet, several kinds of systems with worldwide scope have appeared recently. Perhaps the major application area of Internet development is precisely e-commerce. An especially popular e-commerce segment is the one based on product catalogues, also known as electronic catalogues or e-catalogues. An e-catalogue can be defined as the electronic presentation of information about the products and/or services of an organisation. While other applications can provide similar services, e-catalogues provide a range and effectiveness of service that exceeds the capability of any competing application, such as physical or CD catalogues. The interactive possibilities of e-catalogues eliminate physical storage and make continuous updating possible and efficient [1].

The entry of an enterprise into the e-commerce world involves strategic decisions [2] that are not cost and risk free, this is often an obstacle for the integration of an organisation into the virtual commerce community. The impediments are more important in small organizations or business, the so-called Small and Medium Enterprises (SME), in which the amount of investment in technology solutions cannot be very large.

In this work the overall e-CoUSAL architecture [3] is presented from an agent-based perspective, and we also describe the first prototype of this e-commerce system; it implements an adaptive agent in the server side of the architecture. Thus, the remainder of this paper is organised as follows: Section 2 explains the proposed agent-based e-commerce architecture with their components, Section 3 examines the adaptive components of this architecture that are actually implemented. Finally, Section 4 closes the paper, presenting our conclusions and some ideas on further work needed.

2 An Agent-Based e-Commerce Architecture

2.1 Components of the e-CoUSAL e-Commerce Architecture

In a schematic way, we show in Fig. 1 the major components of the proposed architecture. As we stated above, the main commercial policy is based on e-catalogue shopping, supported by two main components: the e-commerce web server and the visual catalogue-designer tool. The e-commerce server is the central element, which interconnects the different parts involved in a typical commerce environment but more dynamically. The e-catalogue is the element by means of which the end-user views the seller’s information and interacts with it.

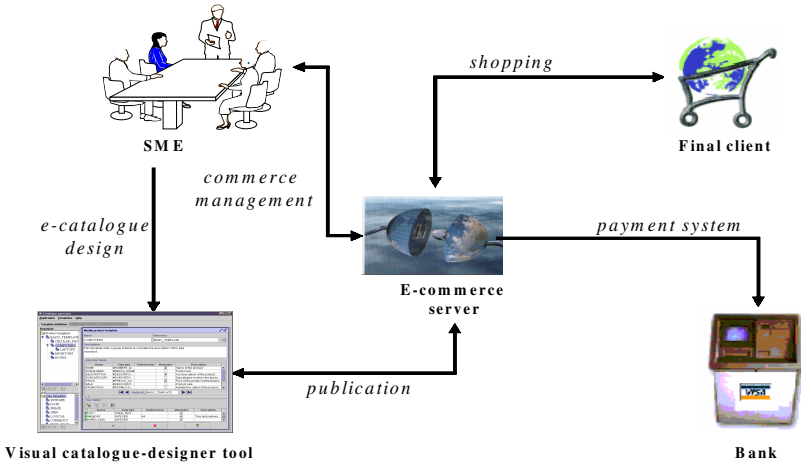


Fig. 1. Components of the e-CoUSAL e-commerce architecture

The SME becomes the main actor of its own virtual business approach as an active element within the commercial process. It is the responsible for the inclusion and management of its own contents in the e-commerce site through the use of a specialised software tool. The designer tool permits the definition, publication and update of an e-catalogue, and also the configuration of a web server architecture that allows end-users to have access to this e-catalogue.

The relationships between the SME and the e-commerce server, through the catalogue-designer tool and also through the server management services, represent a

B2B dimension in this e-commerce model. Moreover, the server has to provide the end-users with the commercial services needed for browsing the e-catalogue and for purchasing; these functionalities in the server site define a B2C dimension of this model. Thus, the overall architectural model defined above presents a B2B/B2C hybrid e-commerce model [2].

2.2 Agential View of the Defined Architecture

In a multi-agent e-commerce environment it is necessary to organise agents into different categories, depending on their functionality and competencies. Several different forms of agents for e-business systems are distinguished in [5].

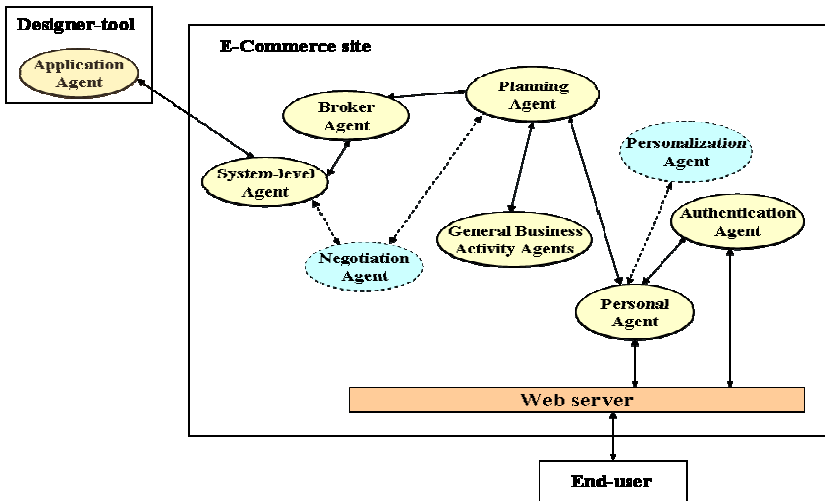


Fig. 2. Agents in e-CoUSAL architecture: ovals represent agents and arrows represent communication between them or between external entities, as end-users. Bold shapes or lines mean that the agent is actually completely or partially implemented; dotted shapes or lines mean future development in our architecture.

According to this classification, we have identified the agents and relationships needed to support our e-commerce architecture proposal, in Fig. 2. We present the agent-based architecture in coarse granularity and in high abstraction levels, because we are defining the architectural layer of the system, relating the agents to the main components presented in Fig. 1.

The *application agent* is the visual designer tool used by a SME to create e-catalogues.

The *broker agent* is in charge of receiving the e-catalogues, expressed in XML format, validating and storing information in the proper internal database. The tool sends these catalogues through the *system-level agent*.

The *negotiation agent* is still in its first stages of development. This kind of agent will receive the business components of each SME in the same way that the broker agent receives the e-catalogues. This property will allow SMEs personalize their business policies (discount, payments and so on) through these components.

General business activity agents are a set of agents that manage the typical e-commerce services of the site: shopping-cart management, selling certificates...

The authentication agent is a security agent type that is in charge of identifying the end-user, which makes it possible to adapt its interfaces to the user's shopping tastes.

The personal agent is the responsible of customising the interaction with the user into the e-catalogues and therefore it is implemented as an adaptive agent.

Finally, a planning agent is needed. The presence of heterogeneous problems to be faced and the fact that many tasks could be carried out at the same time invite to design the multi-agent architecture outlined above. Its responsibilities include publishing the e-catalogues that are sent by the SME, managing the e-catalogues database, accepting the orders of the e-commerce service agents, and giving to the personal agent the proper data to generate customised information pages.

3 Personalizing Capabilities in e-Commerce Server Site

The e-commerce site offers its clients efficient access and shopping management for the different products that are published in the server. Customizing capabilities of the site are very important to tailor all the kind of customer preferences and they are actually supported by the personal agent. Concretely, the implementation of this personal agent is based on an adaptive agent-pattern derived from the adaptive agent model proposed in [4], including a meta-level layer that gives each agent the ability to take appropriate decisions about control or adapt the specific attributes of the system over time to new circumstances. The user interacts with the e-commerce server that presents the customized pages to offer relevant information to the client. The hypermedia pages that represent the e-catalogues are generated on the fly, getting the contents from the e-catalogues that were sent by the SMEs, which is the knowledge layer.

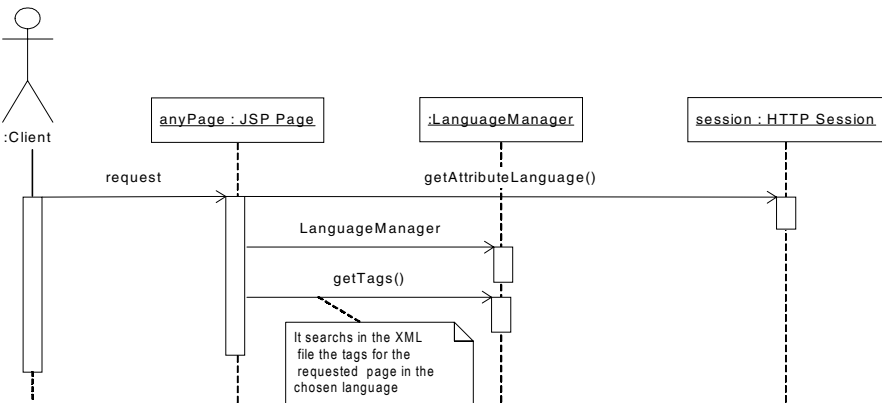


Fig. 3. DTD of the idiomatic XML file

Other interesting part of this adaptive process is the internalisation capability of the server site. In this system there are not pre-compiled pages because all of them are generated to support the chosen language by the end-user. To perform the dynamic

generation of the language-independent pages there exists a database where the elements that have language dependencies are stored. This mechanism is XML-based.

The idiomatic XML-file is hierarchically organised, and it has as many nodes as languages supported by the e-commerce site. Each language includes the contents shown by the system, these contents are classified by the elements that use them (JSP pages in this case). Each JSP page has an object, called **LanguageManager**, which is in charge of extracting the necessary elements for the requested page from the XML file. The selected elements are expressed in the same language as the language of the session. This scenario is depicted in Fig. 3.

4 Conclusions and Further Work

As it's defined in [6], adaptable systems are systems that allow one to modify some of their parameters and then adapt their behaviour accordingly. If the system adapts to the user automatically it is called adaptive. According to this definition, in this paper we have introduced an adaptive system for e-commerce proposal, a system that is especially suitable for SME, called e-CoUSAL, an agent-based architecture for the e-commerce system, and two main components are identified: a visual catalogue-designer tool to generate e-catalogues and an e-commerce server site that stores the generated catalogues.

Various types of adaptation can be supported by a system. Currently the server site implements an adaptive agent that performs the interaction with the user, adapting the content, the presentation and the navigation properties of the dynamically generated information-pages from the e-catalogues stored in the server.

Further work is needed to implement the whole architecture, in which there are two more adaptive agents: the negotiation agent and the customisation one. The definition and implementation of these two agents are very important to achieve a flexible and adaptive e-commerce system, because we have now an adaptive system in the interface area, but with the new agents we will have customisation profiles that allow a more usable and flexible system for the end-user, and, on the other side, the enterprises.

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