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Workflow support for electronic commerce applications ☆

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Abstract

Internet-based electronic commerce is becoming the next frontier of new business opportunities. However, commerce on the Internet is seriously hindered by the lack of a common language for collaborative commercial activities. Although Extensible Markup Language (XML) allows trading partners to exchange semantic information electronically, it does not provide support for document routing. In this paper, we describe various inter-organizational electronic commerce applications and discuss their needs for workflow support. Then, we propose a blueprint for XRL, an Extensible Routing Language that enables routing of commercial documents over the Internet and helps in creating truly intelligent documents. This routing language is simple, yet powerful enough to support flexible routing of documents in the Internet environment. © 2002 Elsevier Science B.V. All rights reserved.

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1. Introduction

The Internet and the World Wide Web (WWW) have changed the landscape of networked computing and have become the de facto environment for elec-

tronic commerce. However, the current electronic commerce technologies rely on much in-house programming activities and are inefficient and lack interoperability. The trend is to develop more standardized architectures and techniques for open electronic commerce services [4,5,11,17]. One important thrust for increased productivity and interoperability is to develop more homogeneous languages for various electronic commerce activities [9]. A second thrust is towards developing autonomous, cooperating agents that can communicate intelligently with one another [16]. In this paper, we focus on the development of a language that provides support for routing of workflow for Internet-based electronic commerce services. In the spirit of HTML which provides support for rendering documents in a platform independent manner, and XML (Extensible Markup Lan-

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guage) which allows exchange of semantic information, the proposed language called Extensible Routing Language (XRL) provides support for routing documents and managing workflows across trading partners.

The Web has evolved through various stages. It started as a way of accessing distributed information on the Internet using a GUI interface based on the HTTP protocol and the HTML language. It was a successor to Gopher, WAIS and Archie, which were also information access and knowledge discovery tools but were based on text-based interfaces [13]. The next important advancement was to make the HTML protocol more interactive using the FORMS feature so that commercial tasks such as buying and selling, filling in surveys, searching databases, etc., could also be performed. In 1997, about US$40 billion worth of transactions were performed over the Web. This figure has grown exponentially since then, and is now around several hundred billion dollars. Several architectures for Web commerce have been proposed, e.g. Commerce Net, etc. [10] and protocols like SSL and SET [6] have been developed to address security issues that arise on the Web.

Table 1 summarizes the main stages through which the web has evolved. Stages 2 and 3 reflect the current stage of development of the web. XML [19,20] makes it possible to add semantic information to an HTML document so that trading partners can understand the meaning of various fields in the document. Fig. 1 shows a common model of how the web operates to provide interactive services such as shopping, database access, etc. The various steps are as follows:

(1,2) A client connects to the server and downloads a form.

Table 1
Stages of Web evolution

Stage 0: Gopher, WAIS and Archie [8] were primitive, text-based tools for knowledge discovery.
Stage 1: Web as a hypertext navigation tool for knowledge discovery using GUI interface.
Stage 2: Web users could interact with a server program and databases using CGI [6] gateways (see Fig. 1).
Stage 3: Asynchronous mode interaction between a series of trading parties using a semantic language XML [12].
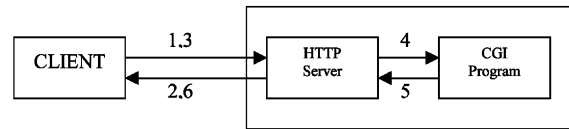Stage 4: Add workflow features with routing semantics and enable interoperability.

Fig. 1. Existing model of the Web using CGI-gateways.

(3) The client fills in information on the form and submits it.
(4,5) A CGI program on the server processes the form.
(6) The server sends a reply to the client.

The features of this model are that all interaction is in *synchronous* (request, reply) mode.

While it works very well for a variety of applications, there are other instances where it is not so effective. In particular, some of the problems are as follows. First, it is not always possible to establish a connection between the client and server either because the underlying network is unavailable or the server is overloaded. Secondly, this is not a very efficient way of communication when a large amount of information has to be exchanged. Thirdly, this form of communication is not very conducive to *flow-type applications*, which involve a flow of information/documents through multiple workers in several organizations. Thus, there is a need for a framework that exploits the advantages of the web, and yet provides better support for *asynchronous*, *flow-type* commercial applications. This kind of situation arises frequently in supply chain management [2,3,15]. In such situations, asynchronous transmission of messages can be more reliable and efficient. For instance, it is considerably easier and more efficient for a customer to place large numbers of orders (for stocks, etc.) or make bids in an electronic market (for several products at the same time) asynchronously.

This paper is organized as follows. Section 2 discusses the need for workflow support in Electronic Commerce. Section 3 gives an overview of the intelligent document architecture based on routing slips. Next, Section 4 describes the XRL language. Then, Section 5 presents a preliminary design of the document routing assistant based on the XRL language. Section 6 discusses various theoretical issues