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The formation of virtual organizations by means of electronic institutions in a 3D e-Tourism environment

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ABSTRACT

In this article we showcase an agent-mediated B2C and B2B e-Marketplace. This e-Marketplace is part of the social and immersive 3D e-Tourism environment "Itchy Feet". We give an overview of the framework that forms the basis of the e-Marketplace and show how it is used to create B2C-, B2B- and Virtual Organizations that are visualized in a 3D Virtual World. This interface provides users with an intuitive and easy way to interact with humans and software agents by means of a 3D Virtual World. The business logic is realized by autonomous software agents offering services to customers. The e-Marketplace is regulated by Electronic Institutions to ensure that all participants adhere to the rules of the market. The article is concluded with a detailed discussion on bridging the gaps between Multi-Agent Systems and 3D Virtual Worlds and the preliminary results of a conducted usability study of "Itchy Feet".

1. Introduction

Electronic Marketplaces (EMs) are electronic platforms enabling buyers and sellers to conduct business. Various definitions of the term Electronic Marketplace exist of which two have been formulated by Grieger [13]. He defines an EM as an institutional medium that assigns different roles in a community, facilitates the exchange of information such as goods, services and payment and provides an infrastructure with protocols and processes to regulate the interaction in this community. The second definition describes an EM as a social community consisting of buyers and sellers which can be described by a certain condition that can be changed through market transactions according to the intentions of the participants. Possible conditions include the participants knowledge, intention, contracts or goods at a certain time. The most salient characteristic of an EM is that multiple buyers and sellers conduct business, whereas in other mediums only one seller and multiple buyers or one buyer and multiple sellers are present.

Wang et al. [32] did a comprehensive literature review of EM research and ascertained that most marketing and economic researchers studied decentralized electronic markets but paid less attention to central platforms. However, EMs are not only distinguished by their structure, but they can also be distinguished by the participating parties – whether both emerge from the consumer domain (C2C), the business domain (B2B) or different domains such as business to consumer (B2C) or government to business (G2B). Fisher and Craig [11] discovered that the lack of social interaction in online channels and the conflict between online and traditional channels are crucial issues that hinder the adoption of EMs. Furthermore, it is important to be aware of the fit between services that are provided by the EM and those actually needed by users [22]. Especially in the B2C domain it is important to bind customers to the platform by providing additional services.

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To address the lack of social interaction in online channels and to ensure trust and security within EMs our work concentrates on the development of an extensible framework supporting the creation of a regulated B2C and B2B e-Marketplace in a 3D Virtual World. The framework consists of a Multi-Agent System to define and regulate the marketplace, a 3D Virtual World as user interface and communication facilities to support community interaction. A simplified illustration of the e-Marketplace with two sample organizations is depicted in Fig. 1. The e-Marketplace comprises two different types of organizations (i) B2C organizations and (ii) B2B organizations. B2C organizations can be further classified into autonomous organizations that are independent of other organizations and those relying on the services of B2B organizations. A communication facility is provided by the framework which is used by organizations to exchange data and facilitates the formation of Virtual Organizations. The term "Virtual Organization" has been defined differently in the literature. Oliveira and Rocha [21] define a Virtual Organization as a cooperation of legally independent enterprises, institutions or individuals. This cooperation provides services on the basis of a common understanding of business and appears as a single corporation to externals. A comprehensive description of Virtual Organizations and their role in e-Commerce is given in Travica [30].

Within our e-Marketplace a Virtual Organization (VO) is a federation of autonomous organizations forming a single (virtual) organization that jointly conduct business and appear as single organization to all members of the marketplace as depicted in Fig. 1. A VO may contain an arbitrary number of B2C and B2B organizations and every organization can be a member of several VOs. All members of a Virtual Organization define the inputs they need and the outputs they generate, but only B2C organization may receive input data from customers of the e-Marketplace. Therefore, if a Virtual Organization wants to offer services or products to customers of the e-Marketplace, at least one B2C organization needs to be a member of that Virtual Organization. Otherwise, if a Virtual Organization only comprises B2B organizations, it can act as a supplier to other organizations of the e-Marketplace. We use the metaphor of a building to visualize an organization in the 3D Virtual World. Since customers only interact with B2C organizations, only these need to be visualized in the 3D Virtual World as depicted in Fig. 1. Consequently, if a Virtual Organization comprises B2B and B2C organizations, the B2C organizations are visualized in the 3D Virtual World and represent the Virtual Organization. In other words, the visualization of the B2C organizations resemble business office(s) of the Virtual Organization to provide their services and products to customers. Customers interact with software agents that implement the business processes of an organization.

On base of this framework we created "Itchy Feet", a 3D e-Tourism environment that supports the complex interaction patterns of providers and consumers in e-Tourism. Autonomous software agents are used to render the environment information rich and Electronic Institutions (EIs), a Multi-Agent System methodology, are used to regulate the actions of all participants, software agents as well as human users.

In this article the framework and the implementation of Itchy Feet are presented. The focus is laid on three major parts: (i) the framework and the e-Marketplace Itchy Feet, (ii) the interaction between users and software agents as part of the e-Marketplace, and (iii) the challenges of creating the framework that connects EIs with a 3D Virtual World. The remainder of this article is structured as follows. EIs and the framework are introduced in Section 2. The Itchy Feet environment and its key features are presented in Section 3. In Section 4 we discuss the restrictions and issues that arise when connecting EIs with a

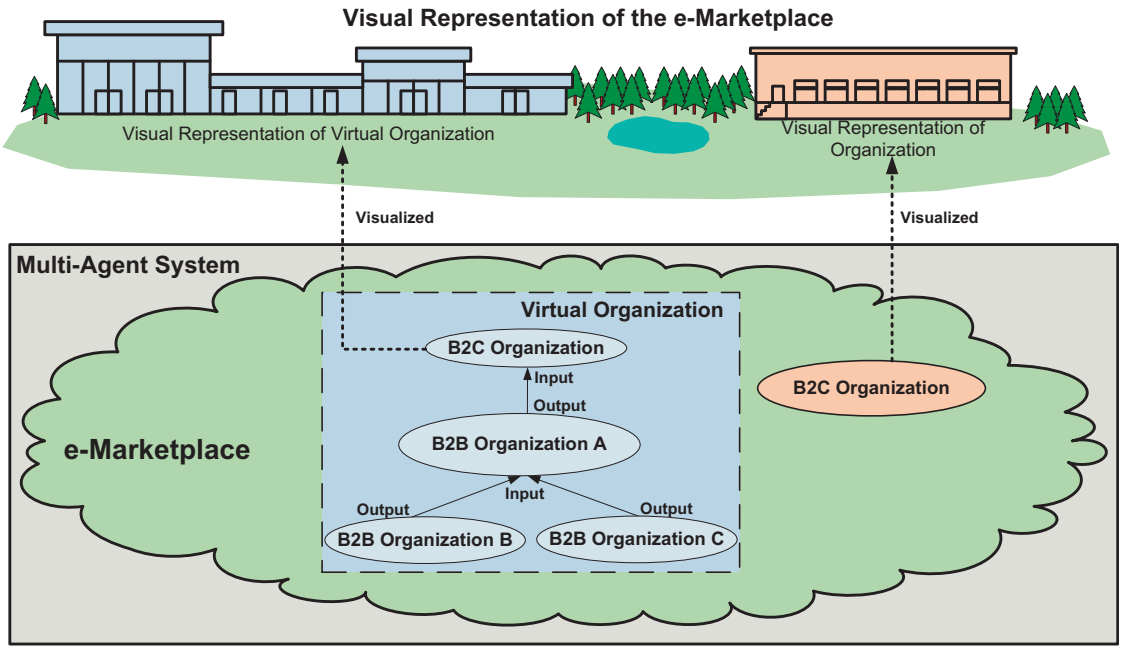

Fig. 1. Organizations in the e-Marketplace.