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Efficient communication architecture for the C2C agent

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ABSTRACT

In C2C communication, all necessary information must be collected promptly when a buyer and a seller communicate. That is, an intelligent C2C agent is needed to provide information to buyers and sellers. Along with the evolution of computing technology, C2C agents can exploit the efficient delivery capabilities of peer-to-peer (P2P) technology. However, P2P also increases traffic between agents, but communication faults are a fatal problem for C2C business. This study proposes a robust communication architecture based on current P2P content-delivery standards and its efficiency and robustness have been verified from an experiment.

1. Introduction

E-commerce involves the trade of products or services over networking systems. Electronic trade has grown exponentially as communication technology has spread [7]. Especially in the consumer-to-consumer (C2C) market, buyers and sellers communicate increasingly frequently as networking technology improves [7]. The C2C market refers to business transactions between consumers conducted through a networking platform [19]. For example, online auctions are a typical C2C business, and allow users to employ C2C platforms to act as either sellers or buyers. However, such platforms are not free. Generally, the networking services provided for C2C users are based on charging a flat fee or commission to sellers or buyers.

C2C platforms allow users to extend their reach in terms of communicating with buyers or sellers. Such are convenient but users are concerned with the associated charges [32]. C2C platform providers charge users fees that increase with increasing communication frequency. That is, for users, it is important to discuss how to use C2C platform that involves cost-benefits. Additionally, the evolution of computing technology is increasing the frequency of communications via C2C [26]. Buyers can analyze goods of interest from the perspectives of price, discount and appendages numerous times before completing a transaction. That is, buyers like to analyze all collected information, including text, picture, movie, and animation files, before making a decision. Notably, sellers also want to analyze information regarding goods offered for sale to improve sales. However, frequent communications are time consuming and costly. Therefore, time and money can be saved if users collect all required information before communication. An automatic mechanism thus is required to help users understand required information.

The intelligent agent can be adopted to release user efforts to analyze information. Intelligent agents enable users to obtain useful information in a timely manner [3,6,16]. However, while intelligent agents can analyze information, considering efficient methods of data collection is important. Restated, speed and convenience are important for agent communication [5,6]. Currently, the high efficiency of the peer-to-peer (P2P) application makes it a good means of collecting information [8]. P2P allows all data related to goods to be duplicated among peers automatically. That is, when a peer requires data on a good, that information can be retrieved from nearby peers rather than searching the whole network. However, such a P2P environment causes heavy network traffic, because of continuous data duplication. It may stop applications and consume resources heavily issued by C2C platform providers owing to network congestion [6,17]. Therefore the agent application based on P2P standards is insufficient, and the P2P protocol must be modified to balance efficiency and robustness.

This study proposes a robust communication architecture of the C2C intelligent agent named C2CIA. The C2CIA architecture can assure efficient and robust communication between agents. C2CIA allows C2C users to extend their reach in terms of communicating with buyers or sellers. The remainder of this paper is organized as follows. Section 2 reviews the literature on the architecture of the intelligent agent. Section 3 then describes the conceptual architecture of C2CIA. Next, Section 4 illustrates the correctness of C2CIA communication. Subsequently, Section 4 presents the performance evaluation of C2CIA communication. Finally, Section 5 presents the conclusions.

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2. Related works

2.1. C2C e-commerce

The Internet has fundamentally changed the environment of business, because it offers sellers and buyers a powerful communication channel and makes it possible for the two parties to come together in the e-marketplaces. In this era of e-commerce, an increasing number of consumers not only purchase but also resell merchandise via C2C Web sites [4]. C2C e-commerce is becoming more widespread as more people come to recognize its convenience and its ability to offer a quick response to requests and as more products or services become available. C2C e-commerce is a business practice associated with e-buying and e-selling information, products, and services on the Internet. The C2C market means the business transaction between consumers through networking platforms [19]. For example, the online auction is a typical C2C business. Each user can play the role of seller or buyer through C2C platform.

The recent research related to C2C is various. For example, Lu et al. (2010) propose and empirically test a model of trust in virtual communities (VCs) based on the trust formation mechanism [23]. The results have shown that familiarity, perceived similarity, structural assurance, and trust propensity are important antecedents to trust in members in VCs. Li et al. (2008) focus on the general market structure of Taobao in terms of three factors: market distribution, market growth, and market concentration [21]. Based on these factors, the differences between Taobao and eBay have been revealed. One research establishes a dynamic game-theoretic model that interprets the mechanism of reputation feedback systems in online C2C auction markets. Based on the model, a numerical study is conducted to reveal the effects of feedback systems on auction markets [31]. C2C e-commerce has proven to be a distinct area of research, requiring new models of operation [15].

2.2. Intelligent agent application

C2C platform is convenient but how to use C2C platform with cost-benefit is important to discuss. Each buyer must communicate sellers with prices, discounts, and appendages. Currently, C2C e-commerce offers functions focusing on catalogue browsing, term screening and searching. Consumers have to spend much time searching and scanning to find products which achieve their demands. It can be seen that although users can get a lot of information, it will take much time to filter useful information [12,16]. If users can collect all needed information before communication, the time should be reduced. That is, an automatic mechanism to help users understand needed information is necessary. Therefore, the intelligent agent could be adopted to release user's efforts on communications. Through intelligent agents, user can obtain information on time efficiently [3,5,6].

Sycara et al. (2003) precisely defined intelligent software agents as programs acting on behalf of their human users to perform laborious information-gathering tasks [29]. The opportunities for using agents in e-commerce applications are enormous. Agent characteristics, like autonomy, abilities to perceive, reason and act in specialized domains, as well as their capability to cooperate with other agents, make them ideal for ecommerce applications [6,25]. Gregg and Walczak (2006) present a multi-agent Auction Advisor system designed to collect data related to online auctions and use the data to help improve the decision making of auction participants [9]. Biswas (2008) extends and formalizes an agent-oriented modeling approach to the conceptualization process [2]. It defines agent models and proposes a high-level methodology for agent oriented analysis. Ito et al. (2002) propose a new cooperation mechanism among seller agents based on exchanging their goods in agent-mediated electronic market system, *G-Commerce* [14]. In *G-Commerce*, seller agents and buyer agents negotiate with each other. In the model, seller agents cooperatively negotiate in order to sell goods in stock. Buyer agents cooperatively form coalitions in order to buy goods based on discount prices. Seller agents' negotiations are completed by using an exchanging mechanism for selling goods. One research is to design a lab prototype of a sales agent with persuasion and negotiation capabilities and to evaluate its effectiveness as a virtual clerk in an e-store. The experimental results reveal that an e-store embedded within such a sales agent can improve a seller's surplus and increase a buyer's product valuation, willingness-to-pay, and satisfaction with the e-store [13]. Nguyen and Jennings (2005) proposed a model for the buyer agent consisting of three main components: a coordinator, several negotiation threads and a commitment manager [24]. The objective of each agent is to complete an acceptable deal based on the user-specified constraints such as initial asking (or bidding) price, a reservation price, a date by which to complete the transaction, and restrictions on which parties to negotiate with and how to change the price over time [18]. However, using intelligent agents can analyze information, but how to collect data with efficiency must be considered.

2.3. Peer-to-peer (P2P) application

The peer-to-peer (P2P) application seems good for communicating agents because of the efficiency [8]. The P2P applications adopted pull-based methods to deliver contents mainly. The pull-based method means that a receiver sends requests to the sender for retrieving an item, and then the required items are retrieved by the receiver actively [20]. The bandwidth of the sender is controlled by receivers. Additionally, the correctness of the transferred packets under the pull-based mechanism is still needed to check. The approach to check the correctness of a retrieved file is checked by verifying the file size. Once the file size is incorrect, the receiver retrieves the file again [27]. After checking the correctness of the file, the procedure of file delivery has been finished. Adopting a pull-based mechanism could make thousands of receivers retrieve contents from a sender. However, such pull-based application has a defect: exhausting the connections of a sender when too many retrievers take back contents simultaneously [20].

The modern P2P approaches have the same defect as pull-based methods although it can speed up the transmission of a large file among peers because the file is divided into chunks and each chunk is transmitted independently. A file is retrieved successfully after all chunks of the file are collected and merged correctly [1]. Existing solution for relieving network congestion caused by a modern P2P method is restraining connections of the sender. Fortunately, the push-based method should avoid abovementioned problem [10].

A push-based method represents a sender actively deliver files to receivers [11]. To adopt active method to transmit files, a sender could control its connections. However, through the theory of push-based mechanism, the sender controls no sent files. Therefore, the push-based method must be fault-tolerant that ensures a packet is transmitted [30]. To ensure fault tolerance, two solutions are typically employed, namely: adding information to the sending files to verify the accuracy, and utilizing the signal to let senders and receivers decide the next-action [20]. For example, whenever a sender sends a file to a receiver, the receiver could verify the correctness of the received part through comparing the real file size with the file size recorded in the information. A receiver could send a message to the sender to retransmit the file again whenever file size is incorrect.

Apparently, using push-based method or pull-based methods merely is inadequately. Through the pull-based method, the file delivery is fast, but the networking load is heavy. Using the push-based method, the networking load is light, but the file delivery is slow. Therefore, for C2C communication, it is necessary to build up architecture to adopt both pull- and push applications to deliver files.

3. System architecture

This section designs a novel P2P based C2C intelligent agent (C2CIA) communication architecture to enhance the existing C2C e-commerce