整合商品搜尋與中介者的 Internet 購物系統之研究

Research on Intermediary-based Internet Shopping Systems Incorporated with Search of Goods

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一、摘要

網際網路購物的交易過程中，可使用各種不同的交易方式與協定，而交易方式之資訊傳遞流程、傳遞資訊內容以及交易處理流程不盡相同，替每一種交易協定設計出相對的應用程式，不僅成本高且不切實際。所以發展出一個各種不同的交易協定都能共用的交易模式，是一個相當重要的研究課題。此外，隨著網路虛擬商店數目與商品資訊的急驟增加，使得消費者在網際網路上查詢商品資訊更加困難。要達到一整合式搜尋，其困難之處在於各虛擬商店的商品資訊儲存格式不同，而不同的產品種類會有不同的產品屬性，目前之搜尋引擎無法滿足消費者的需求。

本研究分析探討網際網路購物環境下，各種交易協定、中介者角色以及彈性化購物模式，進而建構一個結合基本交易功能及彈性處理交易流程，以滿足不同商務協定的彈性商務模式。所提出的模式整合中介者以涵蓋交易付款、產品搜尋以及售後服務等功能的各種商務交易協定。本研究應用軟體代理程式技術發展中介者之搜尋架構來輔助消費者查詢各種產品種類的商品資訊，並提出三層式的資料描述架構來使網路商品資訊搜尋更為有效。所提出的架構可以提供資源發掘、資料轉換以及彈性化的模式來描述各產品種類的屬性定義。藉由三層式的資料描述和軟體代理程式技術提供整合式搜尋，有效地搜尋各種產品種類的異質商品資訊。最後，本研究建構了一個以中介者為基礎之彈性化電子商務模式與商品搜尋之雛形系統。

關鍵詞：電子商務；網際網路；購物模式；中介者；代理程式

Abstract

In Internet shopping, there are many different commerce protocols for processing transactions between customers, merchants, and intermediaries. Each protocol handles different messages and a different flow of transactions. Developing applications for each commerce protocol not only requires a higher cost but is also not practical. Furthermore, with the vast amount of goods information on the Internet, customers are experiencing difficulties in searching for goods information satisfying their needs. To conduct an integrated search, data translation is a problem because virtual stores use their own data formats to store goods information. The characteristics of goods may also vary in different goods categories.

In this work, we propose a flexible intermediary-based commerce model. With the integration of primitive transaction functions and the flexible processing of transaction flow, the proposed model facilitates flexible commerce interactions to support various commerce protocols. The commerce model incorporated with the intermediaries provides various services in Internet shopping. Moreover, agent technology was applied to develop an intermediary-based search system enabling users to search various goods categories. We propose a three-level metadata architecture to facilitate resource-discovery and format translation, and to flexibly model the definitions of diverse attributes for describing goods in various goods categories and data resources. With the metadata architecture and the agent technology, an integrated search for goods information can be performed effectively. Finally, a prototype system was developed to demonstrate our work.

Keywords Electronic Commerce, Internet, Shopping Model, Intermediary, Agent, Metadata

二、緣由與目的

With the growing popularity of the Internet, trading on the Internet has shown a dramatic increase. The problems of realizing Internet shopping have become an important subject. In Internet shopping, there are many different commerce protocols for processing transactions between customers, merchants, or intermediaries.

Each commerce protocol manages transaction flow in a different sequence. Each protocol may also use different message concepts and message sequences to communicate among the parties participating in the shopping. This not only imparts higher costs but it is also impractical to design all applications to accept each individual commerce protocol.

The idea of a flexible shopping model has been introduced by Ketchpel et. al [15] . However, their model does not integrate the role of the intermediary, who plays an important role in Internet shopping. Although the customer can deal with the merchant directly on the Internet, some services provided by the intermediary still can not be replaced. To promote Internet shopping, it is important to integrate the intermediary with Internet shopping mechanism to support various services including search, compare, order, payment and after-sale services.

As the Internet grows, more virtual stores will be selling goods on the Internet. With the explosive growth in the number of virtual stores and goods information, customers are experiencing difficulties in searching for goods information to satisfy their needs. The difficulty is that the characteristics of goods may vary in different goods categories and the virtual stores (resources) may use their own data format to store goods information. Traditional search services like Yahoo, AltaVista and Bargain Finder Agent provide search using keywords search that is difficult for customers searching goods information. Some search engines may also provide search by metadata. However, customers may still have no idea what attributes can be used to search for the goods information. As a result, it is not convenient for customers to search for goods information on the Internet. Furthermore, resources (virtual stores) may use different methods and data formats to query and store goods information. The integration of heterogeneous goods information as well as interoperation among the search system and diverse resources will be issues.

The objective of this research is the following. (1) Develop a flexible commerce system that can adapt to various commerce protocols in different trading phases including pre-trade, trade and post-trade phase. (2) Integrate the intermediary into the commerce architecture to build a flexible intermediary-based commerce model. (3) Design metadata architectures to model the resources, diverse attributes of goods categories and goods information. (4) Apply agent technology to develop a flexible search system enabling users to conduct an integrated search for heterogeneous goods information on the Internet.

三、研究方法及成果

The research results of this work have been published in conference and workshop[17] [18] . The main research results are summarized as follows.

(1) In this work, Internet commerce is separated into two parts, the service system that provides primitive transaction functions, and the commerce model that controls the process of commerce interactions among the participants. The commerce model can integrate with service systems through Application Program Interface. Using the event driven approach, the proposed commerce model facilitates flexible commerce interactions to support various commerce protocols.

(2) This work integrates the intermediary into the commerce architecture to build a flexible intermediary-based commerce model. With the incorporation of the intermediary, the proposed commerce model can support various commerce protocols covering pre-trade, trade and post-trade phases, beyond the scope of the work proposed by Ketchpel [15] in which only the trade-phase was considered. With the intermediary's critical role, the emergence of intermediaries is inevitable in Internet shopping. Our work will be a basis for further research on intermediary-based Internet commerce.

(3) We propose three-level metadata architectures to model the resources, diverse attributes of goods categories and goods information. Resource-level metadata is used to describe the information about resources. Category-level metadata describes the information of a goods category provided in a resource. In addition, Category-level metadata models the specific attributes of a goods category. Attribute definitions of a goods category such as attribute names, types and domains, are specified in the Category-level metadata. Goods-level metadata describes the goods information. The design of the Category-level metadata is flexible to model specific attributes of diverse categories. Goods-level metadata is able to provide the

translation between the data resources (virtual stores) and the search system to integrate heterogeneous data formats of goods information.

(4) Agent technology is adopted to construct the search system. The proposed metadata is used as the basis of the ontology (vocabulary). Resource-level metadata and Category-level metadata are used to create a Directory Information Tree (DIT) that enables the system to perform resource-discovery service and to search goods information in an effective way. Our proposed search system consists of a resource agent, broker agent, user agent, category model agent and control agent. Agents communicate and cooperate with other agents to achieve search results satisfying the customers' needs.

The major works of this research are summarized in the following.

3.1 Intermediary-based commerce model

(1) We divide the transaction process of Internet shopping into three phases: Pre-trade, Trade, and Post-trade. Table 1 shows some commerce protocols available in each phase as well as the primitive functions provided in each phase. Even though different commerce protocols may apply different sequences of primitive functions, they all use some basic and common functions such as order, payment, delivery, return, and refund, etc. No matter how many different commerce protocols are used, an intermediary, a merchant or a customer only needs to provide basic functionality.

Table 1: Commerce Protocols & Primitive Functions

PHASE	Commerce Protocols	Primitive Functions
Pre-trade	Consultation-Service Search-Service	Search, Suggest, Compare
Trade	Subscription, Session Shareware, Pre-paid	Order, Payment Delivery, Negotiation
Post-trade	Repair Service Exchange Service Refund Service	Service-Request, Return, Repair, Refund, Negotiation, Payment, Delivery

(2) The proposed model is built on top of the service systems that provide various payment, search and delivery mechanisms, etc. Adding the intermediary makes the interactions of trading among the participants more complexes. The trading interactions may occur among all of the participants. The customer module handles the transaction events of the shopping process at the customer site. The merchant and intermediary modules handle the transaction events of shopping process at their own site. The service server provides various APIs of primitive functions. The event handler of each participant handles the transaction events.

(3) Each commerce protocol has a steady sequence of transaction states. When the participant receives a specific event, it determines which event handler should handle this message to take the corresponding actions according to the transaction state information. The commerce model determines the next step of the transaction according to the current transaction-state and the transaction flow of the commerce protocol. All tasks in each commerce protocol can be constructed using transaction states. Table 2 shows sequences of transaction states for some commerce protocols. The architecture provides the flexibility for adapting to various commerce protocols.

Table 2: State Sequences of Commerce Protocols

Protocol Name	Sequence of transaction states
Exchange-Free Service	*Requesting Service -> Returning Goods -> Exchanging New Goods*
Exchange-Bill Service	*Requesting Service -> Returning Goods -> Negotiating -> Making Payment -> Exchanging New Goods*
Refund-Service	*Requesting Service -> Returning Goods -> Refunding*
Repair-Bill Service	*Requesting Service -> Returning Goods -> Negotiating -> Repairing Goods -> Making Payment -> Delivering goods*

Some examples are illustrated to show how the proposed commerce model can be applied to support various commerce protocols. These examples demonstrate that the system is flexible to adapt various commerce protocols using the primitive functions[17] .

3.2 Internet search for goods information

(1) The proposed metadata architecture is used to organize and integrate the distributed information about resources (virtual stores), goods categories and goods for sale. A data resource contains sets of collections of data, and is described using the Resource-level metadata. A goods category is also a collection of goods that have common attributes. Different good categories have different set of attributes. The Category-level metadata describes the general information of a goods category as well as models the specific

attributes of a goods category. It records the definitions of specific attributes including names, types and domains for describing goods in a specific goods category. The Goods-level metadata describes the individual goods.

(2) We adopted agent technology to construct the search system on the basis of the proposed metadata architectures. The architecture consists of resource agent, broker agent, user agent, category model agent, and control agent. The agent communicates with other agents to achieve the search for goods information effectively. We used the elements of our metadata architecture to be the set of the vocabulary for ACL, and to form the KIF and KQML to communicate with other agents. According to ACL, KIF, and KQML, the agent is able to advertise resource capabilities as well as request other agents to cooperate in the search.

The three-level metadata architecture facilitates an integrated search for goods information. First, Resource-level metadata, which records the basic information about resources (virtual stores), is used to discover possible resources. Second, Category-level metadata records the general information (e.g. second-hand, Italy-style) of a goods category provided in a resource. It can be used to further filter possible resources that may satisfy customers' requests. Category-level metadata is also used to model the definitions of specific attributes (search-able attributes) for diverse goods categories provided in various resources. With category-level metadata, the search-able attributes of a specific goods category, i.e., the query capability, supported in a resource can be known to the system to facilitate query formulation and translation to each resource. Moreover, providing attribute search for diverse goods categories can be achieved. Third, a virtual store may use its own data format. To perform an integrated search, Goods-level metadata is used as a unified format for translation between the search system and various resources.

(3) DIT is the essential structure for managing the resources and categories information and is a hierarchical structure to describe what the resource is and what categories it sells. DIT contains information objects to represent the information of resources and information objects to represent the information of goods categories. The broker agent uses DIT to check possible data resources that may sell goods satisfying the customer's request. By this approach, the system only needs to submit customer's query to target resources without submitting to all resources. The integrated search on the Internet can thus be conducted in an effective way.

(4) We used JAVA and Voyager, a JAVA-based agent class by ObjectSpace Inc. to develop the proposed system. We also developed an Applet in a Web browser to communicate with the user agent. The demonstration of the prototype system is described in [17] [18] .

四、結果與討論

In this work, a flexible intermediary-based commerce model is proposed to support various commerce protocols in different trading phases. With the growth of electronic commerce, more protocols will need to be deployed. The proposed model is able to flexibly adapt to new commerce protocols. A commerce system integrated with an intermediary is inevitable for alluring more customers to use Internet shopping. Our work will be a basis for further research on intermediary-based Internet commerce.

We also propose a three-level metadata architecture to make an Internet search for goods information more effective. Resource-level metadata and Category-level metadata are used to construct the Directory Information Tree (DIT). With the DIT, resource and sub-resource discovery services can be achieved to make searching more effective. Category-level metadata also models the diverse attributes of goods categories. Using the three-level metadata architecture and the agent technology, the proposed system effectively performs integrated searches for goods information on the Internet, as well as flexibly supporting the diverse attributes of goods categories.

五、計畫成果自評

We have accomplished 90% of the work described in the proposal. The research achievements include (1) proposing novel approach: A flexible intermediary-based commerce model is proposed to support various commerce protocols in different trading phases. The proposed model is able to flexibly adapt to new commerce protocols. We also propose three-level metadata architectures to model the

resources, diverse attributes of goods categories and goods information. The design enables the system to perform resource-discovery service and to search goods information in an efficient way. Moreover, the design of the metadata is flexible to model specific attributes of diverse categories; (2) applying new technology: We used Java and agent technology to develop the system; and (3) deploying a prototype system.

A commerce system integrated with an intermediary is inevitable for alluring more customers to use Internet shopping. Our work will be a basis for further research on intermediary-based Internet commerce. Our work not only contributes to further research on Internet commerce but also contributes to the application of electronic commerce. In summary, we have proposed novel idea, investigated new technology and developed a prototype system. The work has been published in the conference and workshop in information management and electronic commerce, respectively[17] [18] . We are highly satisfied with the research achievements of the project.

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