國立交通大學

網路工程研究所

碩士論文

整合 OpenID 的 P2P 拍賣系統

P2P Based Auction System Integrated with OpenID

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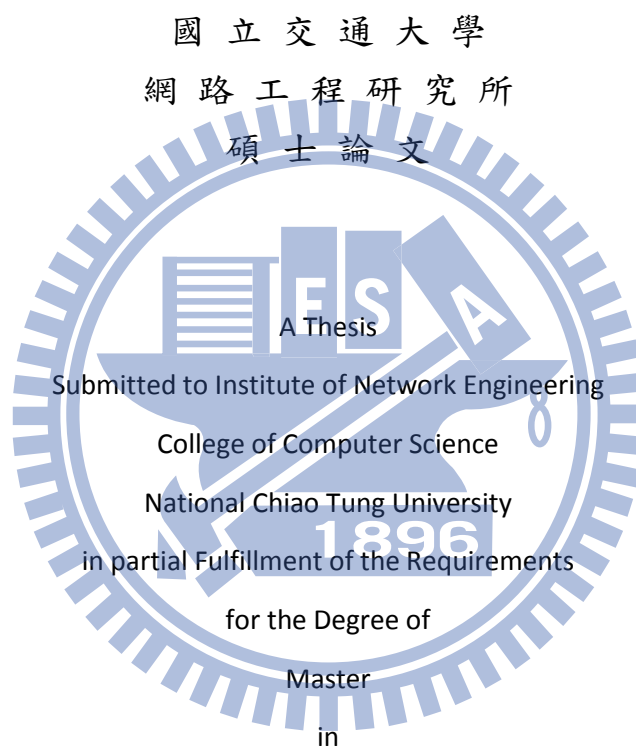
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摘要

網路服務被廣泛的使用，通常使用 Client/Server 架構來管理資料，資料流量過大和儲存裝置不足接有其瓶頸。近年來，線上購物日趨頻繁，大型網站紛紛向賣家收取刊登功能使用費、交易手續費、直購價設定費...等，讓小物賣家轉而尋求其他方式來拍賣商品。近年來，點對點技術發展蓬勃，並可解決 Client/Server 架構的瓶頸，運用點對點技術建置拍賣網站，藉由點對點技術資源分享的能力及高度的人機互動性，而新興的 OpenID 則以解決頻繁且多餘的網路身份認證而崛起，並提供安全、統一的認證機制。本研究針對未來網路發展趨勢將點對點技術整合 OpenID 技術為平台，建置點對點拍賣系統。

P2P Based Auction System Integrated with OpenID

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Abstract

Network services are widely used in recent years. They often adopt the architecture of server/client to manage information and this leads to some problems such as bottleneck at server, mass data flow and storage not enough. Moreover, recent years, it is common to purchase online, people get use to selling or buying product on auction sites like Yahoo. And it is trend to charge fee. Therefore, our thesis based on P2P technology and integrates with OpenID login to build a distributed environment with consistent and secure authentication mechanism. And also provides the functionalities just like the server based auction system. With peer to peer technology, problems of server/client architecture could be solved. Along with OpenID login, user needn't to register another username and to remember another password.

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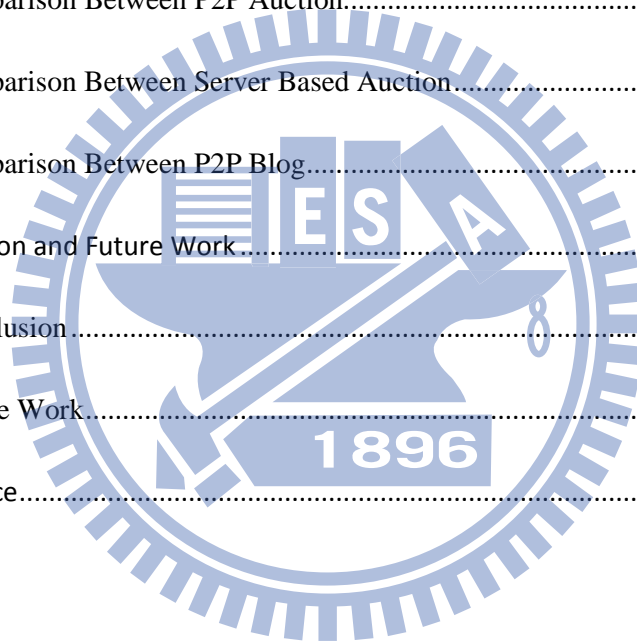
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Chapter 1 Introduction

1.1 Preface

On internet, users register on different site for different usernames and passwords. It becomes bothersome to memorize all the information. And to register on different site also means that user must fill in some personal information again and again. Along with the widespread of internet, it is common to search information online. Most of people may have online auction experience. The growth rate of online auction keeps fifty percent every year. To buyers, online purchase saves a lot of time and to sellers they can save the rent for opening the store or the salary for hiring a person.

Online store open twenty four hours a day and even a whole year. It almost likes an independent economic entity and there are more and more people regard online selling as a formal career. To network service provider such as Yahoo and EBay, they provide "space" for user to selling product with fee. The rising of peer to peer (P2P) technology affects network servers on the internet. Based on P2P technology, we can regard every end user as a new type of server. Usually end user plays both the role of receiving data and propagating data. Network service like blog has successfully built on top of P2P technology. The remaining service will also turn into decentralized in the future.

1.2 Motivation

With the widespread of internet and the popularity of online auction, the online auction system is nearly mature. Due to the convenience of online auction, user can bid for products at any place or any time as long as the user can go onto the internet. But there are some unsolved problems in the current auction system such as the

communication between seller and buyer seen not smoothly, the credit and security mechanism is not completely safe for buyers. To network service providers such as Yahoo, the company will face bottleneck problems or insufficient of storages at server side. And to sellers, the disadvantage is that Yahoo announce to charge seller for fee at 2004[1]. Before the announcement, online auction doesn't charge user for fee, so many people sell some second hand product online to earn extra gains or even regard online selling as a formal career. And now user must be charge for an announcement of selling product or even some additional functionality. This makes the online selling career not easy. Although there exist another online auction site (EBay) haven't charge user for fee, driving by the trend, it will charge for fee someday. As a result, we provide another way for users to selling things. They can make their own decision to choose the way suitable for them.

1.3   Objective

The thesis based on P2P technology builds an auction system on P2P network to overcome the problem above and to provide a system like the current server based online auction system. We provide another choice for seller to selling things. P2P auction system provides basic operations of store management; subscribe some products, list to memorize products, bid for products, message leaving or instant message and evaluating process. Using network time protocol [20] to consist the time on network and integrate with OpenID login which provides a consistent and secure authentication mechanism.

1.4   Outline of the Thesis

In Chapter 2, we introduce the backgrounds and related works. In Chapter 3, we show the overall architecture and system architecture including the description of every component. Chapter 4 describes the system functionalities and depicts several complicated system flows. Chapter 5 presents the demonstration of our system and operations. Chapter 6 we give some comparison tables to show the difference between our system and related work. Finally, in chapter 7 we describe the conclusion and discuss the future work.

Chapter 2 Background and Related Work

2.1 Background

2.1.1 Peer-to-Peer (P2P)

A coarse but intuitive definition of Peer-to-peer is given by Clay Shirkey [2] : "Peer-to-peer is a class of applications that take advantage of resources storage, cycles, content, human presence available at the edges of the Internet. Because accessing these decentralized resources means operating in an environment of unstable connectivity and unpredictable IP addresses, peer-to- peer nodes must operate outside the DNS and have significant or total autonomy of central servers."

A Peer-to-peer (P2P) system has often been described as the counterpart of client/server networks [3][4]. In client/server systems, centralized servers manage and control the network, provide services and resources whereas the clients consume these resources [5]. P2P systems have two main key characteristics:

i. Scalability: there is no algorithmic, or technical limitation of the size of the system, e.g. the complexity of the system should be somewhat constant regardless of number of nodes in the system.

ii. Reliability: The malfunction on any given node will not affect the whole system (or maybe even any other nodes) [6].

2.1.2 Peer-to-Peer (P2P) network

P2P network allows computers to communicate directly with one another rather than through a central server like server-based network, or client/server module does.

"There are two classes of P2P overlay networks: Structured and Unstructured" [7]. An unstructured P2P network is formed when the overlay links are established arbitrarily. Such networks can be easily constructed as a new peer that wants to join the network can copy existing links of another node and then form its own links over time. Structured P2P networks have been widely used in file sharing [8][9], network data storage [10], and distributed indexing [11]. Structured P2P networks usually designed with four criteria: low degree, low diameter, greedy routing, and robustness [12]. And it usually uses a distributed hash table that is using hash function to give endpoint a hash value, and determine the endpoint to be responsible for which content according to specific protocol. Many studies are published about DHT in the P2P network, such as Pastry [13], Chord [14], CAN [15]. Structured P2P network employ a globally consistent protocol to ensure that any node can efficiently route a search to some peer that has the desired file, even if the file is extremely rare. Such a guarantee necessitates a more structured pattern of overlay links [16].

The advantage of P2P network is to provide resources, including bandwidth, storage space, and computing power. It also increases robustness because there is no single point of failure in system. On the other hand, the disadvantages of P2P network are decentralized which means no central repository for files and applications.

2.1.3 Peer-to-Peer Publish/Subscribe

The publish/subscribe interaction scheme is receiving increasing attention and is claimed to provide the loosely coupled form of interaction required in such large scale settings. Subscribers have the ability to express their interests in an event or a pattern of events, and are subsequently notified of any event, generated by a publisher, which matches their registered interest. An event is asynchronously propagated to all

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subscribers which have registered interest in the given event. The strength of this event-based interaction style lies in the full decoupling in time space and synchronization between publishers and subscribers. That is publisher is data producer, which sends data using publication messages. And the subscriber is data consumer, which has the capability of define its interest event and subscribe them.

Subscribers are usually interested in particular events or event patterns, and not in all events. In the area of distributed systems and networks various pub/sub systems with data models based on channels, topics and attribute-value pairs have been developed over the years [17]. Systems based on attribute-value pairs are usually called content-based because their data models are flexible enough to express the content of messages in various applications. And the most widely used schemes are topic-based and content-based publish/subscribe are describe as follow. Topic-based publish/subscribe, which based on the notion of topics or subjects is extends the notion of channels used to bundle communicating peers, with methods to characterize and classify event content. Participants can publish events and subscribe to individual topics, which are identified by keywords. Content-based (or property-based) [18] publish/subscribe variant improves on topics by introducing a subscription scheme based on the actual content of the considered events. In other terms, events are not classified according to some pre-defined external criterion (e.g., topic name), but according to the properties of the events themselves [19].

The main advantage of publish/subscribe model are loosely-coupled and scalable. Publishers are loosely coupled to subscribers, and needn't even know of their existence. This is different form client/server architecture, which client can't post message while server is not running. Publish/subscribe provides the opportunity for better scalability than traditional client/server, through parallel operation, message caching, tree-based or network-based routing. On the other hand, the disadvantage of

publish/subscribe model is that the side-effect of the advantages, that is the decoupling of publisher from subscriber. The publish/subscribe system will give up deliver message if it has try a while, this will not guarantee the message will always to be deliver.

There are many deployments on P2P protocols, all of which have implemented some function in common, such as queries and inserts data. The auction system uses the P2P library, FreePastry to implement. FreePastry is an open-source implementation of Pastry intended for deployment in the Internet. The initial release of FreePastry is intended primarily as a tool that allows interested parties to evaluate Pastry, to perform further research and development in P2P substrates, and as a platform for the development of applications.

2.1.4 Network Time Protocol(NTP)

By far, the most widely used and accepted method for maintaining accurate time across entire networks is an implementation of the Network Time Protocol (NTP). The Network Time Protocol is a protocol which is used to synchronize timekeeping among a set of distributed time servers and clients. NTP has undergone significant evolution over the years since it was first proposed, cumulating in the most recent NTP Version 3 described in RFC 1305 [20]. NTP is built on the Internet Protocol IP [21] and the User Datagram Protocol UDP [22] , which provides a connectionless transport mechanism. It is specifically designed to maintain accuracy and robustness, even when used over typical Internet paths involving multiple gateways, highly dispersive delays, and unreliable nets. There are many time servers at different countries. We can implement Network time protocol to get the correct time we need.

2.1.5   OpenID Authentication

OpenID is an open, decentralized, free framework for user-centric digital identity. And up to Januarys first, 2009, there are over 35,000 unique OpenID relying parties. The figures below show that how does OpenID works. There are nine steps to get personalized content form OpenID relying party [23]. Figure 2 - 1 show the first four steps of how OpenID works and the rest of five steps are shown in Figure 2 - 2.
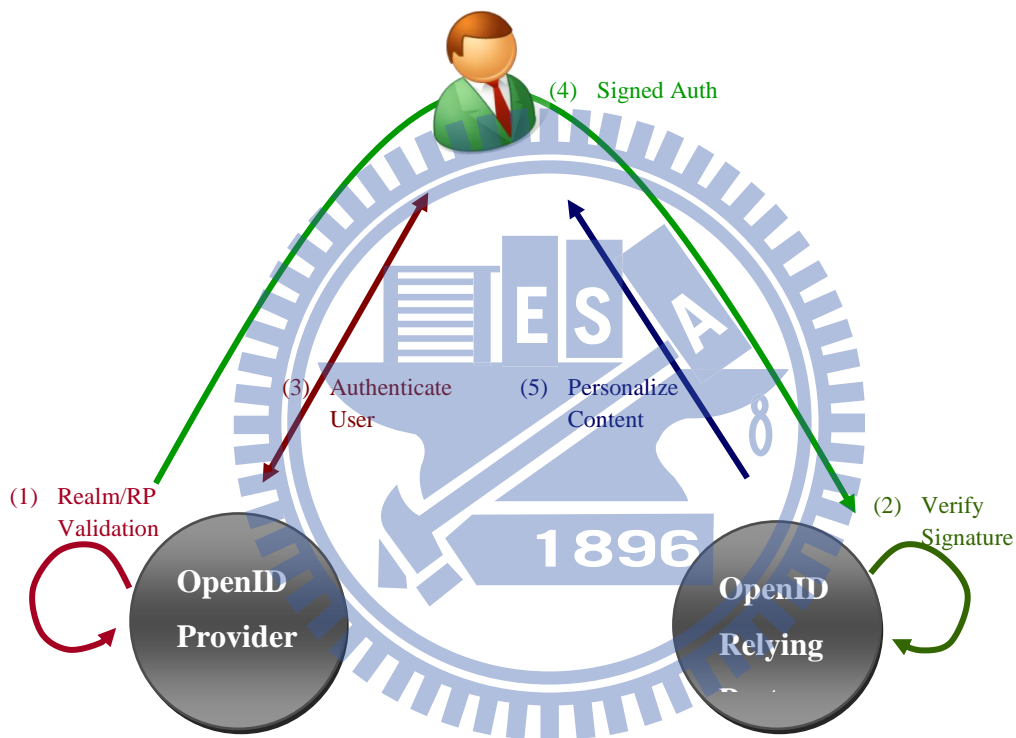
Figure 2 - 1   the First Four Steps Shows How OpenID Works
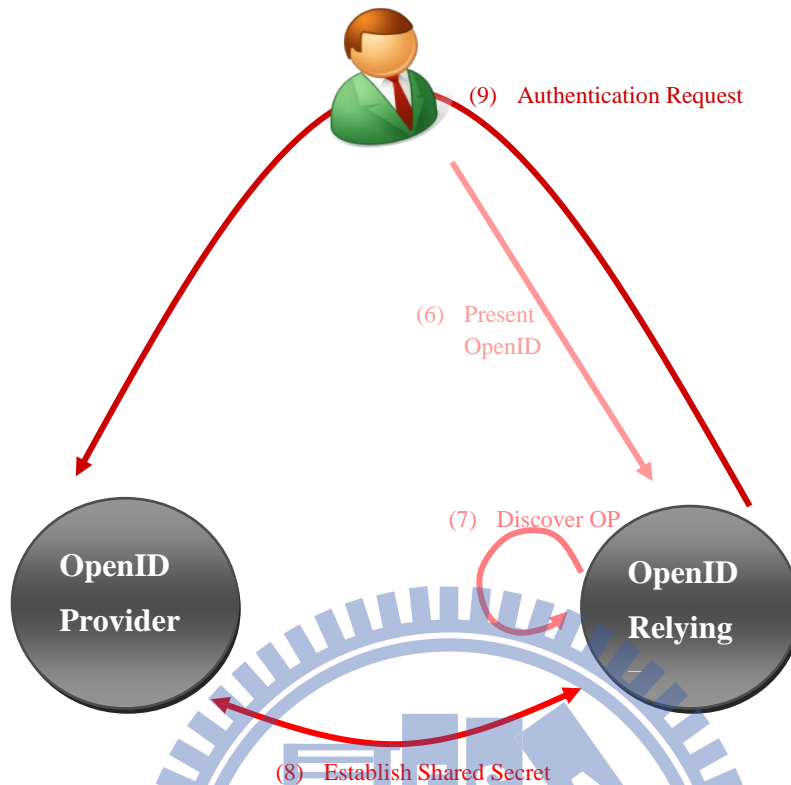
Figure 2 - 2   the Remain Five Steps of How OpenID Works

The following are terms in OpenID protocol [24]:

i.   Identifier: The URL or XRI chosen by the End User as their OpenID
identifier.

ii.   End User: The person who wants to assert his or her identity to a site.

iii.   Relying Party: The site that wants to verify the end user's identifier.
Sometimes it is simply called site.

iv.   OpenID Provider: A service provider offering the service of registering
OpenID URLs or XRIs and providing OpenID authentication (and possibly
other identity services).

OpenID allows users to log onto many services with the same digital identity. An
OpenID is in the form of a unique URL, and is authenticated by the user's OpenID

provider. The OpenID protocol does not rely on a central authority to authenticate a user's identity.

OpenID Authentication uses standard HTTPS requests and responses, so it does not require any special capabilities of the User-Agent or other client software. OpenID doesn't use cookies or any other specific mechanism of Relying Party or OpenID Provider session management.

2.2   Related Work

The related applications, ItsKarma and EzBas are based on P2P technology, but they are not maintaining now. So here we only refer their basic information and their GUI design. Besides, PeerMart is born to solve the centralize problem of double auction. The typical circumstance is the stock markets. The reason for listing in related work is that it is based on P2P technology and implement with FreePastry which builds a decentralized auction-based pricing mechanism.

2.2.1   ItsKarma

ItsKarma releases on 2001 and it uses P2P technology to bring online auctions into home. ItsKarma is returning the power back to users. Under the auction machine format, users have to adhere to a strict set of rules and procedures if they are to have a reasonable chance of having a successful sale. Users must choose a limited number of days to present their item. They must relinquish control of the ultimate decision to buy or sell, to a machine. To properly prepare an item for sale on an auction web site, users must give a highly detailed description and attach digital photos. In other words, the user has to put in a lot of work with no guarantee that the sale will be successful. ItsKarma let users have complete control of the sales process. The functionality of

ItsKarma provide are seek, find, post, buy, sell, trade, auction. And the three feature of ItsKarma are as follow [25].

    i.   There are no listing fees: you pay only on successful truncation.

   ii.   There are no restrictions to the amount of item you can list. Keep as many items online as you can fit your hard drive.

  iii.   There are no time limits, keep things online for as it takes to sell them.

Figure 2 - 3 shows the Graphic User Interface (GUI) of ItsKarma.
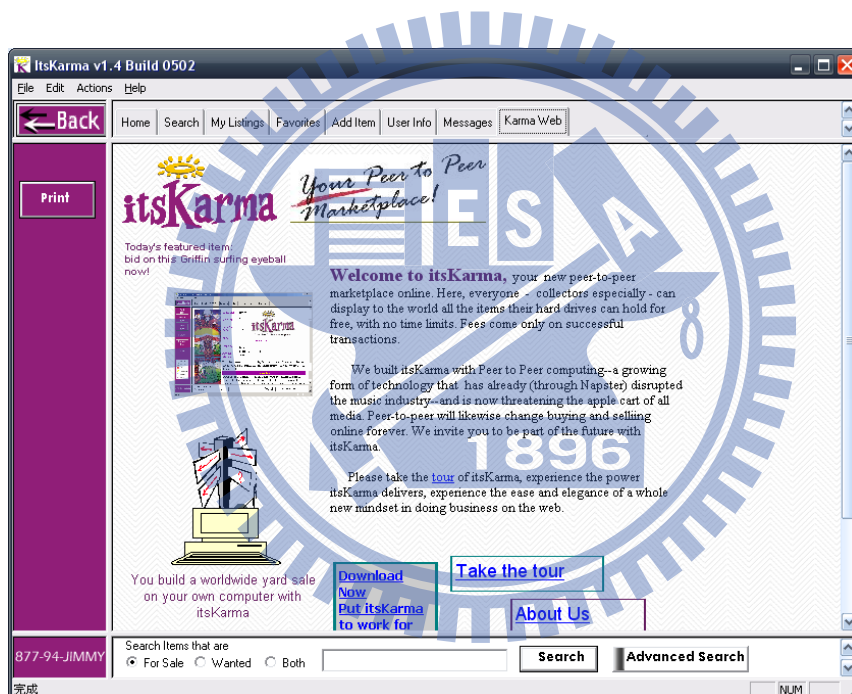

Figure 2 - 3   ItsKarma

2.2.2   EzBas

EzBas is developing to cooperate with EzPeer. It is a direct trading platform; users don't need too much technique to build their own selling store. Seller can use EzBas to publish the information of the products, build customize store information, including personal photograph, the name of store, and even open user's contact

information. The buyer can search for product on EzBas and don't need to wait until the product sell due. Buyer can contact seller immediately and make a deal. EzBas break the tradition online selling model and provide faster marketing model [26]. The functionality of EzBas provides are search, subscribe, discuss, and store management. Figure 2 - 4 shows the Graphic User Interface (GUI) of EzBas.

Figure 2 - 4   EzBas

2.2.3 PeerMart

PeerMart[29] has been implemented as a prototype on top of FreePastry [32], an open source implementation of Pastry and it is structured and redundant P2P overlay network design which is applied to achieve scalability and robustness even in the presence of malicious peers. The basic idea of PeerMart is to distribute the broker load of an otherwise centralized auctioneer onto clusters of peers, each being responsible for brokering a certain number of goods.

The core economic mechanism used in PeerMart's design and subsequent implementation is the Double Auction which has also been adopted by "Toward Peer-to-Peer Double Action" [27] and "A Peer-to-Peer Agent Auction" [28]. PeerMart is use in the circumstance such as stock markets. The main features that PeerMart emphasize on are scalability and robustness [29].

The basic pricing mechanism in PeerMart works as follows, providers and consumers which are interested in trading a particular good, initially send a price request to the responsible broker. As described later on, brokers are realized by clusters of peers. In the following, the term service is used to refer to the good being offered by a peer, e.g., a content service. The responsible broker answers requests for a particular service with the current bid price (ask price), which is the current highest buy price (lowest sell price) offered by a peer. Based on this information, providers and consumers send price offers to the broker, using a particular strategy which can arbitrarily be chosen by the peer. Continuously, a broker runs the following matching strategy:

- Upon every price offer received from a provider (consumer), there is no match if the bid (ask) is lower (higher) than the current ask price (bid price). However, the offer may be stored in a table for later use.
- Otherwise, if there is a match, the offer will be forwarded to the consumer (provider) that made the highest bid (lowest ask).

The resulting price for the service is set to the mean price between the two matching price offers [29].

Chapter 3 System Architecture

3.1 Overall Architecture

Before we describe the auction system architecture, we talk about some overall architecture that is components or concepts which are used all over in the system. There are as follows: P2P pub/sub system, observer pattern and network time handler. The P2P pub/sub system handles all quires which are about data store and retrieve on the P2P network. Observer pattern is the concept use all over the system, and network time handler implements network time protocol which uses to retrieve the consistent time in the network.

3.1.1 P2P Pub/Sub System

The P2P system of manages the faculty of P2P network, that is builds a new network or joins an existent network, maintains DHT table, communicates with other peers on the P2P network and handles the file storage.

Our pub/sub system is implementing with FreePastry. The purpose of P2P pub/sub system is to provide some basic operation such as storing data or retrieve data on P2P network. The design of P2P pub/sub system is reference to the P2P pub/sub architecture in paper, A P2P Blog System with OpenID Integration [30]錯誤! 找不到參照來源。. The pub/sub system controls the functions of publish/subscribe. Users on the P2P network can obtain information via querying data, but pub/sub provides an immediate and convenient way to retrieve data. If we want to use pub/sub technologies on the P2P network, they usually need be supported by P2P protocol

implementation libraries directly. Besides, pub/sub system sends and receives messages, and the contents are different from P2P contents. Therefore, our application defines a pub/sub content format, and it is convenient to subscribe and publish messages.

3.1.2 Observer Pattern

Observer pattern is the most commonly used design pattern. It defines a one-to-many dependency between a subject object and any number of observer objects so that when the subject object changes state, all its observer objects are notified and updated automatically.

In the system, the P2P library we adopted designs use "continuations" to avoid that a system is blocked during doing lookup. "Continuations" allow us to continue processing while receiving results. These behaviors create new thread, and cause that the main system can't easily obtain results in the multilayer architecture. For example, class A implements observer and it has to implement update function. Whenever a observable class which add class A as an observer. When they get the result, they will notify all the observers which means the update function of class A will get the result which the observable sent.

A class can implements observer or extends observable. The observer class has to implement update function, so that when the observable class gets the query result it will notify all observers. The class extends observable, here we depict as subject, can call function build-in "addobserver" to add an observer class and when the class gets the result it calls build-in function "notifyall" to notify all its observer.

Our auction system can divided into six components which are describe in the next section, besides static data part and functionalities frames part which are used to handle initialization of P2P related thing and get user input. The relations of the rest four parts that use the concept of observer pattern are describing as follow. First of all, graphic user interface (GUI) implements observer to get all results from the observable class. Second, P2P data action functions and P2P pub/sub module extends observable so that when they get the result they will notify observers. Finally, the web server which is the one that receive OpenID provider's message depict a user is login or not. It extends observable so that when the message comes back it will notify the observer which is the GUI. In short, the relation is shown in Figure 3 - 1.
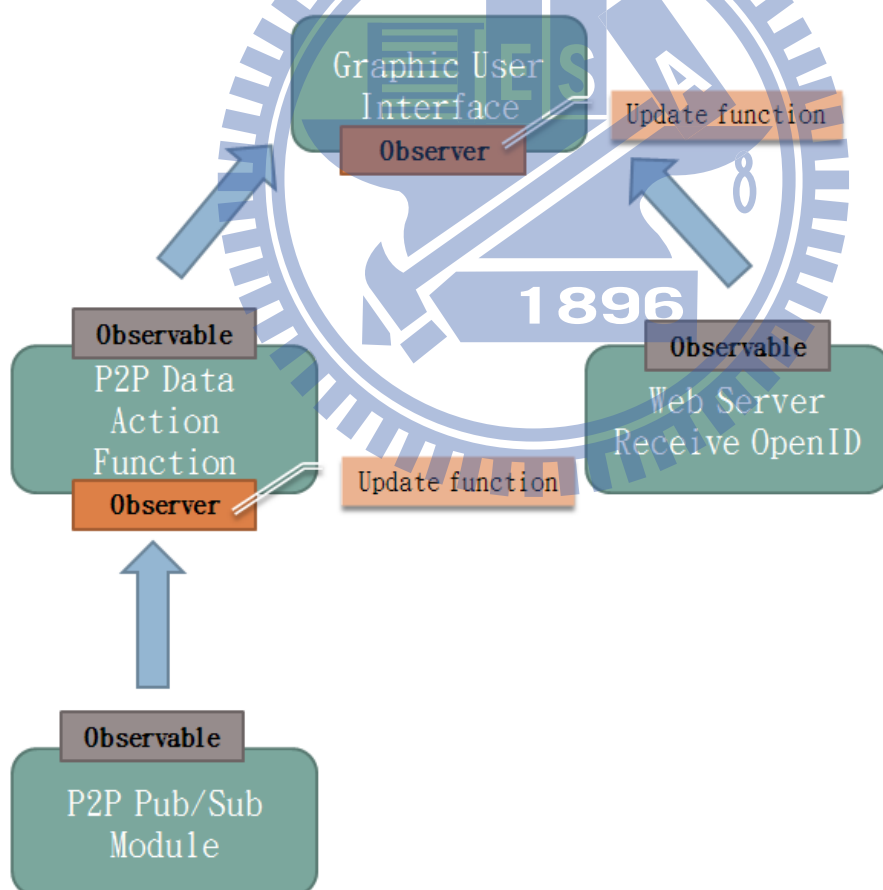

Figure 3 - 1   the observer pattern of auction system

3.1.3 Network Time Protocol Handler

On the Internet, the time of computer is adjust by the time zone that user has selected. And they are ways to change the computers built-in time to satisfy user's need. For example users can manually change their system time by click the system clock on the lower right corner of the operating system.

The auction system which built on top of client/server architecture has the consistent bidding time, because all users must send request to the server, and the time is determine by server. On the other hand, it is not easy to get the consistent time in the auction system which is based on the architecture of P2P. The time is determined by the system time of user's computer. As a result, we need a way to get consistent time on the Internet.

The network time handler solves the problem above. Implementing network time protocol, the handler sends a datagram packet to the time server and gets a response then translates it to network time protocol message which specified in RFC 2030[31]. Whenever call the network time handler, it will return the consistent time based on time servers. And this makes the P2P auction system no longer has the problem of letting user changing system time manually to affect the accuracy of time.
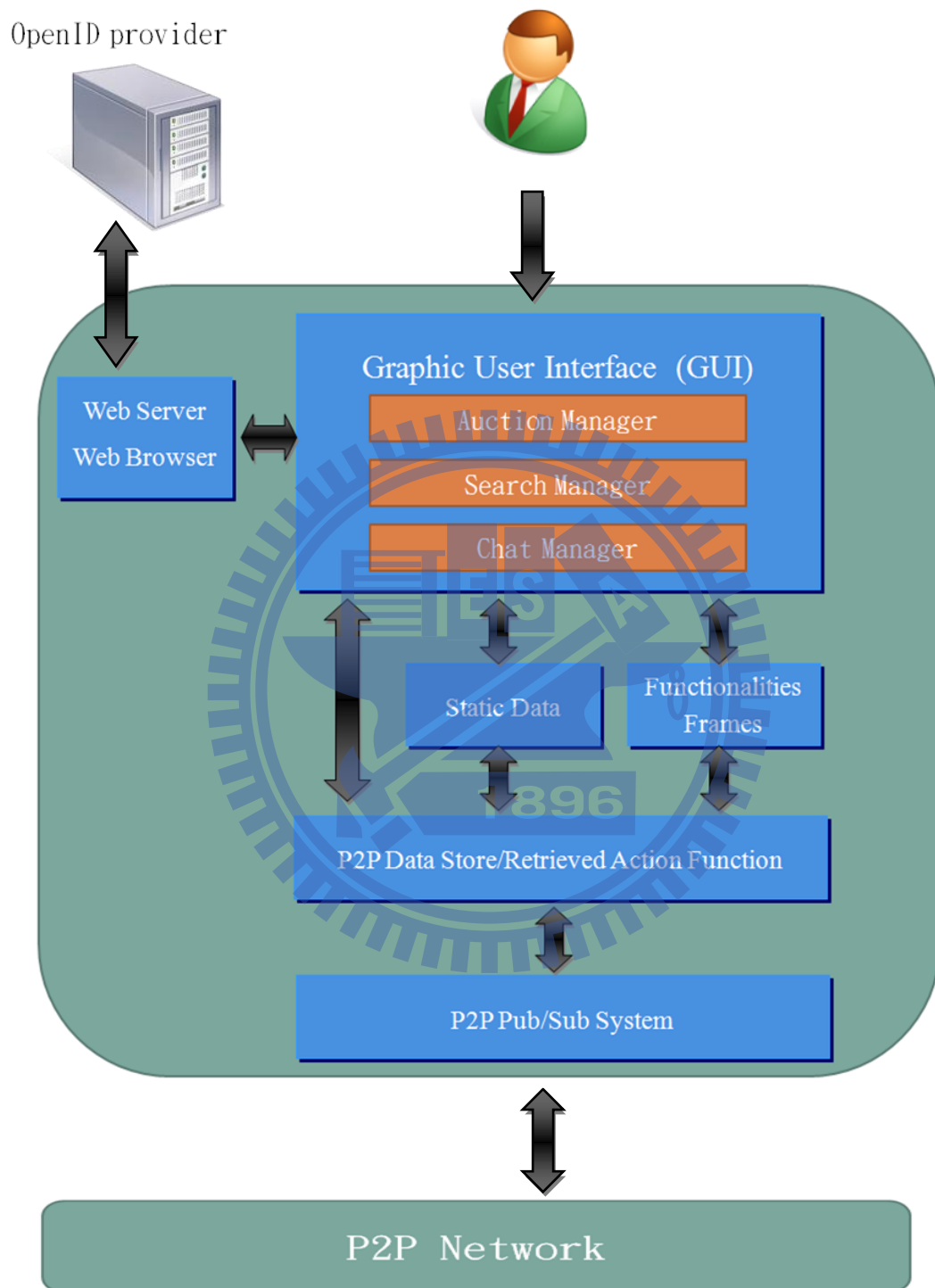
3.2　Auction System Overview

Figure 3 - 2　System Architecture

The system architecture is shown in Figure 3 - 2. The system can divide into six

components. There are graphic user interface (GUI), static data, functionalities frames,

P2P network data action function, web server and browser and P2P pub/sub system respectively. The details of the six components are described in the following section. And the implementation detail will describe in next chapter.

3.2.1 Graphic User Interface (GUI)

The graphic user interface of auction system allows user to interact with it. Graphic User Interface is the main part of the system and it consists of three mangers. That are auction manager, search manager and chat manager. The auction manager handle all requirements about sales such as post a product for selling, modify the content of selling product, delete a selling product or set a auction to end. The search manager handles all search requirements that user needs. There are three types of search a user can use. First, user can search for already known OpenID and get the entire selling product which the searched OpenID sells. Second, user can type an upper bound and get all products in the range. Finally, user can use keyword search to search for products user wants. When the transaction is concluded, buyer and seller can use chat system to determine how to pay for the product, for example, they can make an appointment at a place to exchange money and product. What user has to do is to click discuss button invoke chat manager to list all sellers who are online and click the OpenID, then they can start to talk.

3.2.2 Static Data

Static data stores information about user; it is a special class which all variables are static such as user identifier and P2P environment parameters. The common

feature of these variables is that the whole system needs just one copy of each; it is similar to the existence of global variables. There are several static functions in Static Data, most of them are invoke at the beginning of the system, the functionality of them are to set or to retrieve P2P related operation. For example, Static Data gets configuration file and retrieves default port value and beginning to binding port by socket testing. Then invoke the function in Static Data to join into a P2P network.

The configuration file, config.properties, records some modifiable parameters. For instance, it records web path of HTML page for user to enter OpenID or the web server's path which the system must call up to start web server. All these modifiable parameters are related to join into P2P network or to start the web server.

3.2.3 Functionalities Frames

Functionalities frames act as an interface between GUI and P2P network data action function. It contains all frames which auction system uses such as the chat frame, selling frame, buying frame and evaluating frame. For example, when user wants to sell a product, after clicking the button of sell product, auction system will pop up a frame to let user input all the information about the selling product. The three manager of GUI will not invoke P2P network data action function directly, only functionalities frames can invoke the P2P network data action function.

3.2.4 P2P Network Data Action Function

P2P auction system has to put or to retrieve different data, such as the selling product or user profile onto P2P network frequently so that others can see the newly

update product condition at once. P2P network data action function achieves their functionalities by using the functions in P2P pub/sub module. When GUI is triggered, for example, user wants to publish a new product to sell, the GUI calls the corresponding functionalities frame and after user has input all information about the selling product, functionalities frame will invoke the corresponding P2P network data action function to put data onto P2P network and publish to every node that has subscribe the topic. All classes of P2P network data action function play not only observer role but also observable role.

3.2.5 Web Server and Web Browser

A web server is a program that is responsible for handling HTTP protocol, such as Apache or IIS. It accepts HTTP requests from client and sends HTTP responses. Web browser is a program that displays documents in a web server, such as Internet Explorer or Mozilla Firefox. OpenID standard uses HTTP protocol to contact with each other. An OpenID provider offers service of registering OpenID URLs and providing OpenID authentication. A site in the authentication process is central website that user wants to login, but auction system can't build a central website to let users to login which will result in bottleneck at the website. The site also needs to send absolute address of it to OpenID provider so that when getting authentication from OpenID provider, it will also redirect the page to the site. Thus, we still need a web site that can accept messages from OpenID Provider.

Based on the situation, our solution is to attach a light web server to user's computer. That is, user plays the role of "site" and "user" both. User login into our web site via embedded web browser, after key in user's OpenID, web server will

direct user to the web page of openID provider; user has to input username and password to get authentication from OpenID provider. Then the OpenID provider will direct user back to web server in the auction system.

3.2.6 P2P Pub/Sub Module (FreePastry)

As describe in the previous section, our pub/sub system put the self-define pub/sub content into P2P network through the implementation of P2P protocol. The implementation of P2P protocol we use in auction system is FreePastry[32]. FreePastry is an open-source implementation of Pastry which describe in chapter 2.

The functionalities of P2P pub/sub module are initializing P2P environment, building node, joining P2P network and some basic operation on P2P network such as storing data, retrieving data, publish data.

In the auction system, static data retrieves form configuration file, config.properties which records some modifiable parameters for P2P pub/sub module to initiating P2P environment and joining into P2P network. To building a node and joining P2P network need some element. We describe the steps as follow. First, while building a node we need a port to handle all messages on P2P network, a port value is specify in the configuration file. After a node is established, it needs a bootstrap which is an existing node on P2P network to join into P2P network. If bootstraps do not exist, the node will form a P2P network by itself. P2P pub/sub module also consists of some basic P2P network operations such as store data, retrieve data, and subscribe topics. All of which are achieved by some the functions of open source library, FreePastry.

In short, the difference between P2P network data action and P2P pub/sub module is that P2P pub/sub module uses functions in FreePastry to build some basic P2P network operations and P2P network data actions use the function in P2P pub/sub module to build more complex operation, such as finding a selling product.

Chapter 4 Implement Details

4.1   System Functionalities

All of functionalities work under the condition that a user is login successfully. After user has login with their OpenID and the web server has get the authentication correctly, then all functionalities will ready to work. Figure 4 - 1 shows the functionalities of the system. And in the following sections, we describe the functionalities of the system in details.
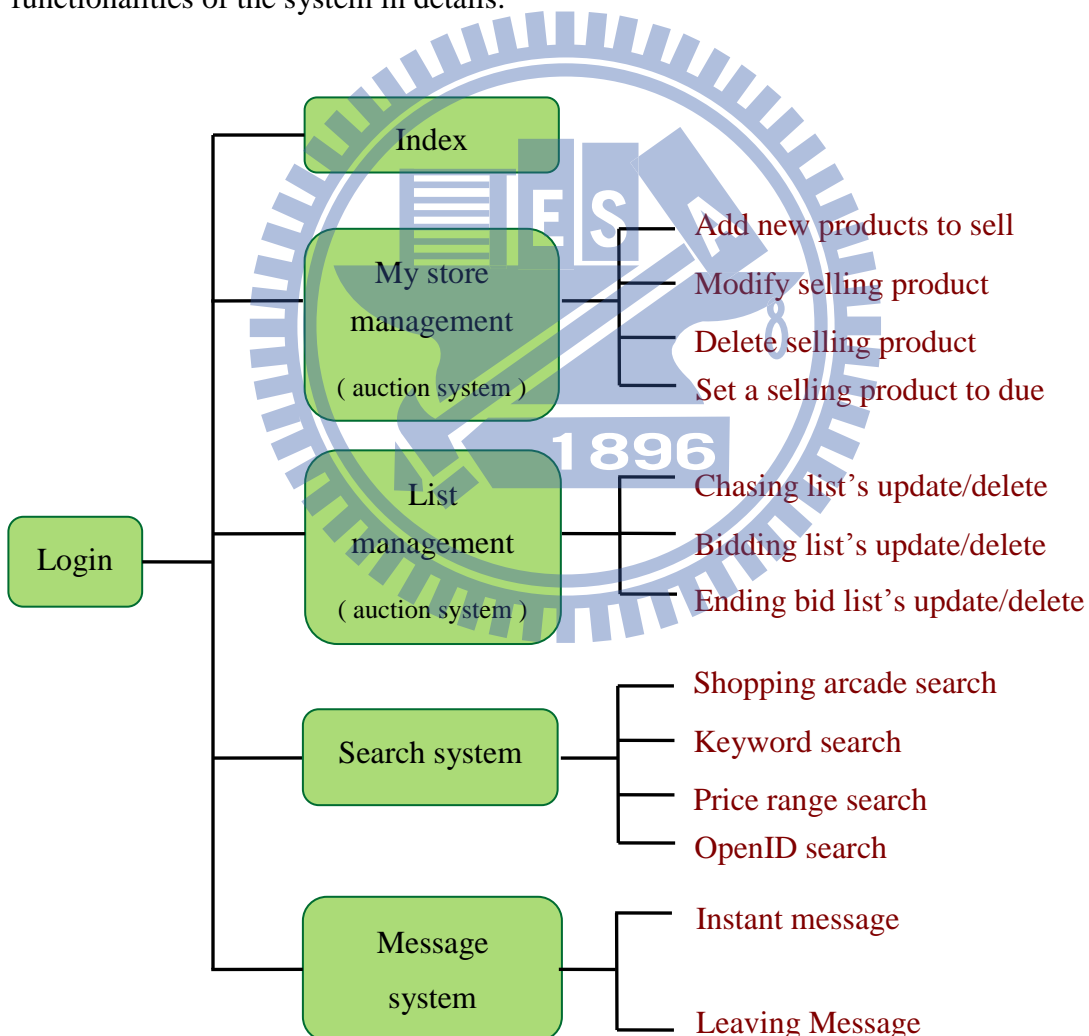

Figure 4 - 1   the functionalities of P2P auction system

4.1.1 Auction System

Auction system consists of three parts. First is some basic operations to manage a store. Second is three kind of lists to let user easy to memorize information about products. Third is the bidding part which handles all bidding for products.

There are four basic store operations to deal with selling product. First, adding a new selling product and put it on P2P network for other users to search. Second, modifying the content of products, this operation will store the modified data on P2P network. Third, user can delete a selling product. Finally setting a selling product due which means the selling procedure is ended. Moreover, there are three types of lists in the auction system which are chasing list, bidding list, and ending bid list. Chasing list let user add some products into the list that user wants to keep track of, this make user easy to memorize all products. Bidding list records all products that user has bid for, this make user keep stay in touch with the latest information of products. Ending bid list will refresh every time a new data is published, it will analysis products in the bidding list, if any product is due and the highest bidder matches user's OpenID, then the product is move to ending bid list.

4.1.2 Bid System

The bidding part is an important feature of auction system. User can bid for what user wants. Finally the highest bidder of products must complete the transaction.

The bid system in P2P architecture is just like the one in server based architecture. User bid for products and the one who own highest price will get the transaction. The only difference between server based and P2P based auction system

is where user sends request to. When someone has bid for a product, in server based architecture what we need to do is just modify the data on server. But in P2P based architecture, information of products is on P2P network, user needs to retrieve product information from P2P network and modify the data then put it back to P2P network. Finally publish the data to all subscribers and let the product owner retrieve the newly update product information and set to his profile.

4.1.3 Search System

Like server based auction system, searching is an important part for auction system. Users can find products by searching in the system. The difference between server based and P2P based auction system is that the way to store data. Server based auction system stores data in a centralize way, but P2P based auction system stores data in a distributed way.

The P2P auction system support two types of search, one is text based search which user need to key in terms to search for matching results and the other is shopping arcade. User doesn't need to input anything, just click the shopping arcade button in system and get the list of all the stores on P2P network. There are three kinds of text based search. The first is OpenID search; user can type OpenID of seller to search for seller's products. Second is keyword search; user can search for some specific keyword. Third is price range search; user can type an upper bound of affordable price and getting results back. The search system will not display products which are due, this will make user searching more easily.

4.1.4 Evaluation System

No matter what architecture the auction system is based on, users need to deal with a strange person. A successful transaction needs both seller and buyer trusts each other. As a result, evaluation system is very important, it build a fast and reliable way to inspect the one user transact with. The evaluation is given by other people. From the evaluation system, user can judge a transaction is safe or not.

The evaluating way in P2P auction system is special, unlike the server based auction system, user can decide to evaluate others or not. P2P auction system makes evaluation actively. Three days apart from product due date, the system will actively ask user about the transaction they made. User can give four kinds of evaluation, which are positive, negative, none and evaluate later. If user choose evaluate later, the evaluating frame will appear the next time when user login. By this way user is forced to give evaluation to every transaction. The work flow of evaluation system is shown in Figure 4 - 3, and the work flow of evaluating process is described in the next section.

The reason for three days is to leave enough time for seller and buyer to make a transaction deal. If user hasn't got the product three days after they made a transaction, user can choose evaluation later or gives a negative evaluation in the evaluating process. And if user chooses to evaluate later, every next time user login, P2P auction system will ask the user to complete the evaluating process. So our evaluation system takes a positive way to do evaluate and it always asking user to give a evaluation. This will decrease the rate of not giving evaluation after a transaction.

4.1.5 Message System

Most sever based auction systems don't support instant message; instead they support message leaving system. To implement instant message is nature P2P technology because it is born for peer to peer communication. The advantage of leaving a message is to save personal space for both seller and buyer. On the other hand the disadvantage is that transaction process becomes longer, user must wait for a reply. This will make bad feeling for user who is eager to buy something.

In P2P auction system we support both instant message and message leaving system. User can choose the way suitable for them to contact to each other. The message leaving system let user choose to leave message with OpenID or nickname. Using instant message user just clicks the OpenID user wants to talk to, and a talking window will pop out. When finish talking, no matter which side of user close the talking window, the other side of user will get a leaving message indicate the other is leaving.

4.2   Self-Define Pub/Sub content

According to P2P protocol, every file has an unique identifier. The identifier is produced by a hashing key. In other words, we can't find a file without a key. In P2P auction system there are two types of file that needed to store on P2P network. That is user profile and product information file. It is refer to the paper " A P2P Blog System with OpenID Integration"[30]. We use user's OpenID to be user identifier in P2P auction system. The key of a product information file is user's identifier attach with a

serial number, that is to store in the format of useridentifier#N, where N stands for serial number.

User profile stores all information about user, such as identifier, evaluation value, serial number, subscribe list, bidding list and ending bid list. It records all the personal data of user and whenever data is modified, the system will publish it out. For example, every time when a transaction is evaluated, the evaluation result will store in profile of user and publish to everybody. Product information file stores the information about selling product, including product name, product description, lowest bid price, due date of selling and picture of the product. The picture of product can't put onto P2P network directly, so we first reduce the size of picture which can avoid memory overflow problem, and translate picture into a java imageicon object via java I/O operation and finally put the product information onto P2P network with the other information. To see selling products, P2P data action function needs to get product information file on P2P network and transform java imageicon into the format of jpg picture file. The transformed picture is stored in directory named TEMP_TMG. And to avoid conflicts of picture name, we use seller's identifier attach with picture name. Every user's identifier is unique, so there will be no picture name conflict.

4.3　System Flow

In this section we describe not only a overall work flow but also all functionalities flows that use in the system.

4.3.1 Overall Work Flow

The overall work flow depict the process of a user from starting P2P auction system till the end of the system. The flow is shown in Figure 4 - 2. Starting the system and user login with OpenID successfully then according to user's OpenID, the system gets user profile on P2P network. If user profile doesn't exist, the system will produce a new profile and store it on P2P network. After getting the profile, system retrieves data and initializes variables in the system such as user identifier, subscribe list, bidding list and etc. And if the user had made any transaction three days ago, evaluating system will be triggered and pop out the evaluation frame to let user evaluating the other. Finishing the evaluation process, the system is already set still and user can start to operate on P2P auction system.
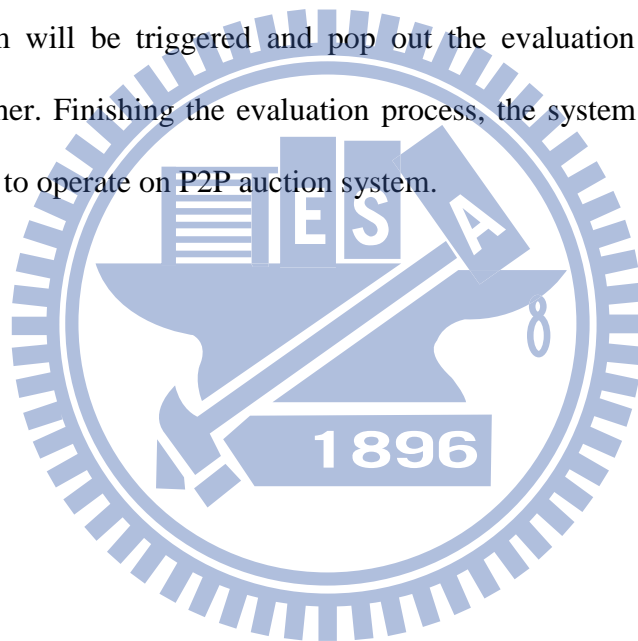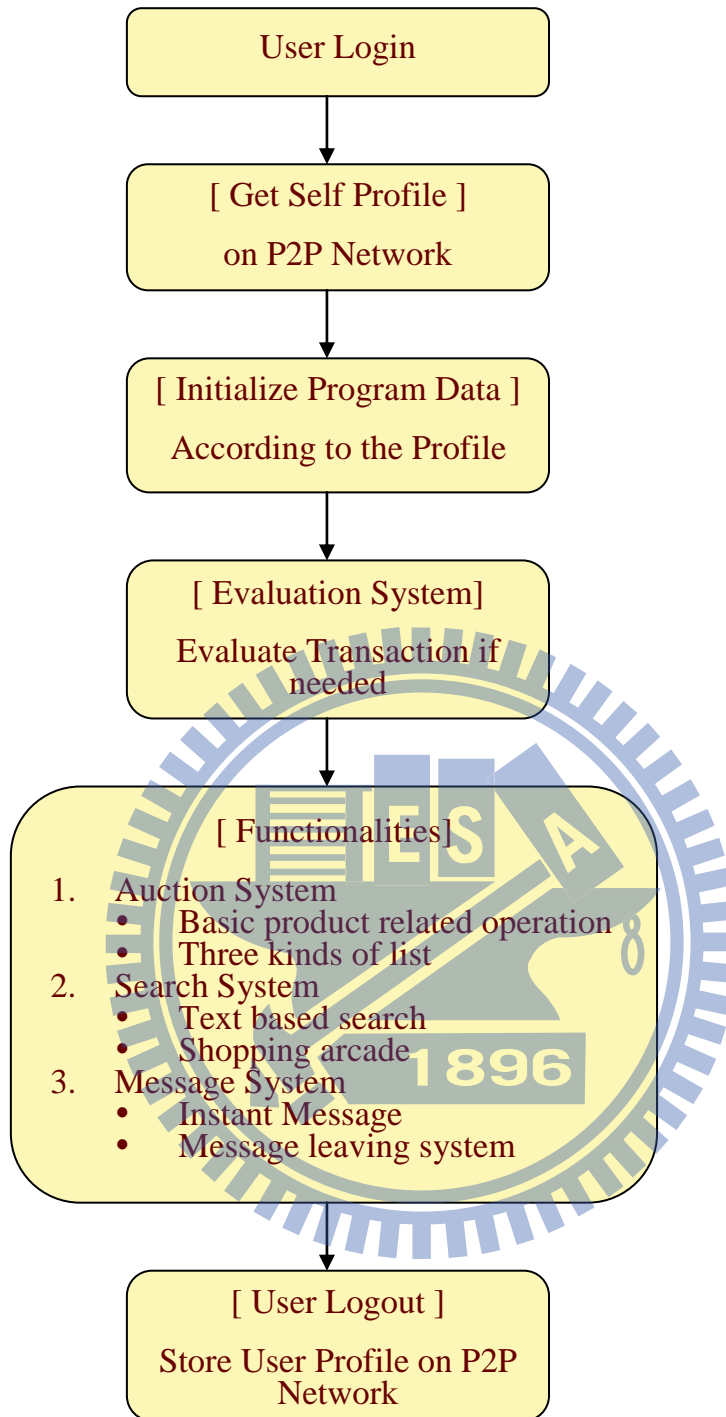
Figure 4 - 2   the overall work flow of P2P auction system

4.3.2 Evaluation System Work Flows

With evaluation system, user can view the evaluation value of others, just like the server based auction system. Figure 4 - 3 shows the work flow of evaluation

system. First is to check whether user is login or not. Then the system has to check whether user have made a transaction three days ago. If it is after three days, the system will retrieve the profile of the one user is transact with, then starting to evaluate by popping out an evaluating frame. After getting user's input, the system will put the result on P2P network and the one who is been evaluated has to retrieve the evaluation value and save to profile.
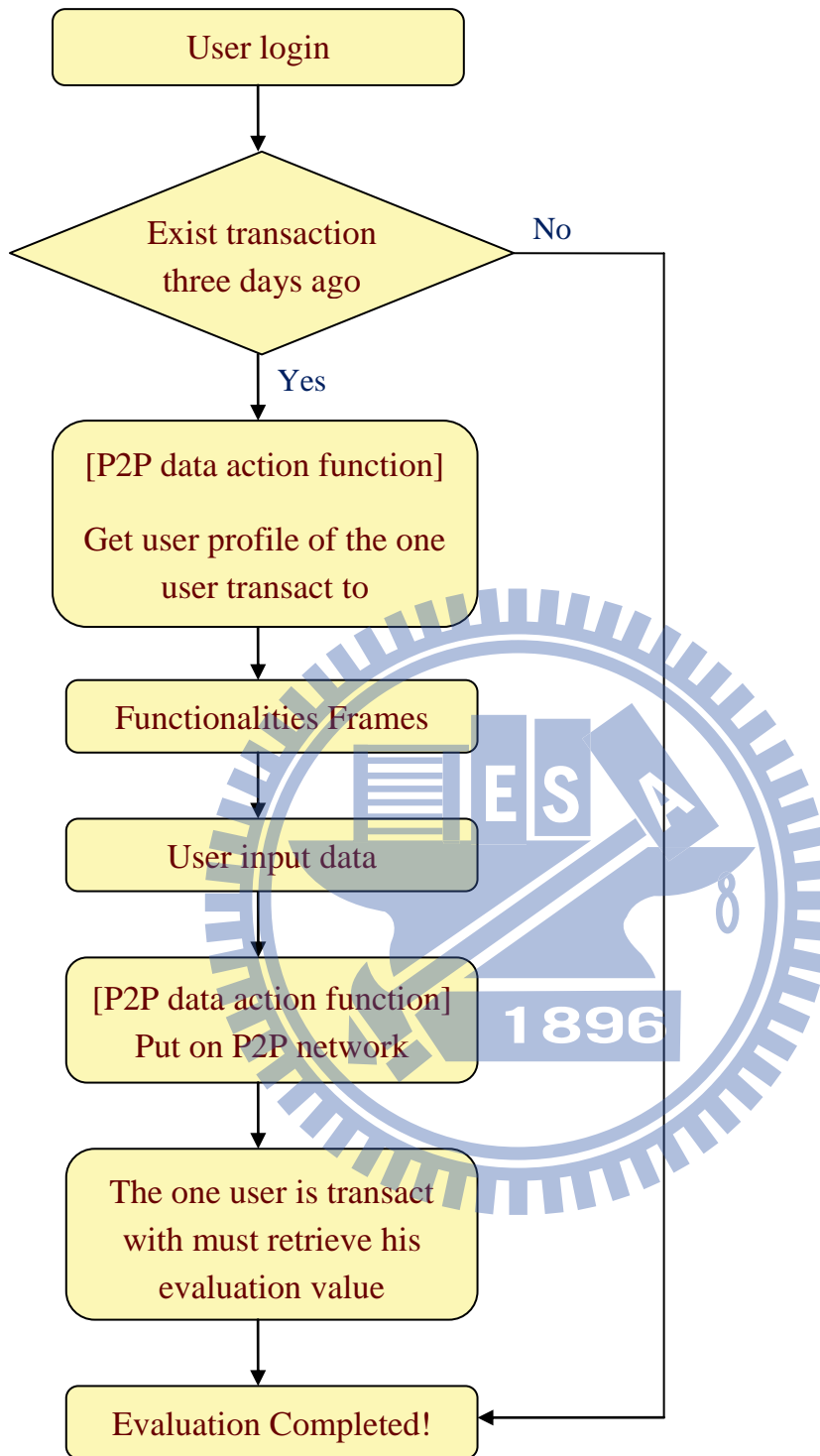
Figure 4 - 3   the work flow of evaluation process

4.3.3 Chat System Work Flows

   P2P auction system provides two ways of communications. One is leaving a message and waiting for reply. The other is using instant message. The figure below shows the work flow of using instant message. When user click "Discuss" button, P2P auction system will send a self-define "Ping" messages to all profiles which are retrieve form P2P network. By data records in a profile, P2P auction system can easily connect to the address of others and start to communicate. And the one get a "Ping" message, the system will sends a self-define "ACK" message automatically. As a result, the system can list all users who are online. And just click the one user wants to talk to, the system pops out a talking frame just like a chat room. And the work flow is shown in Figure 4 - 4.
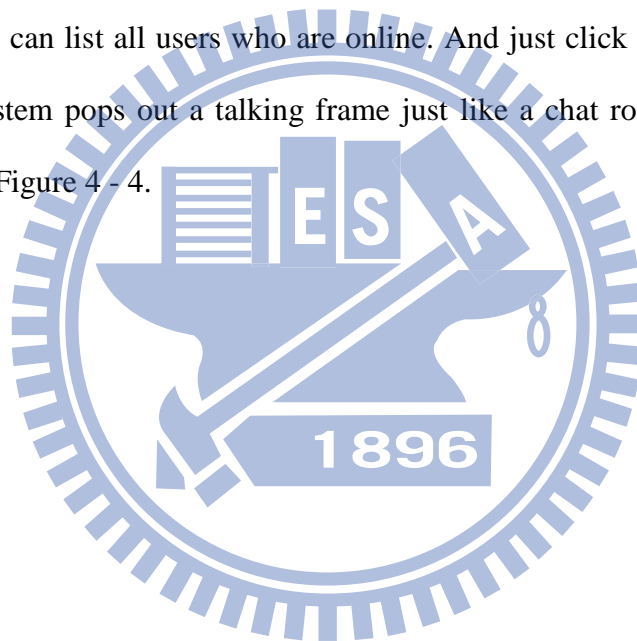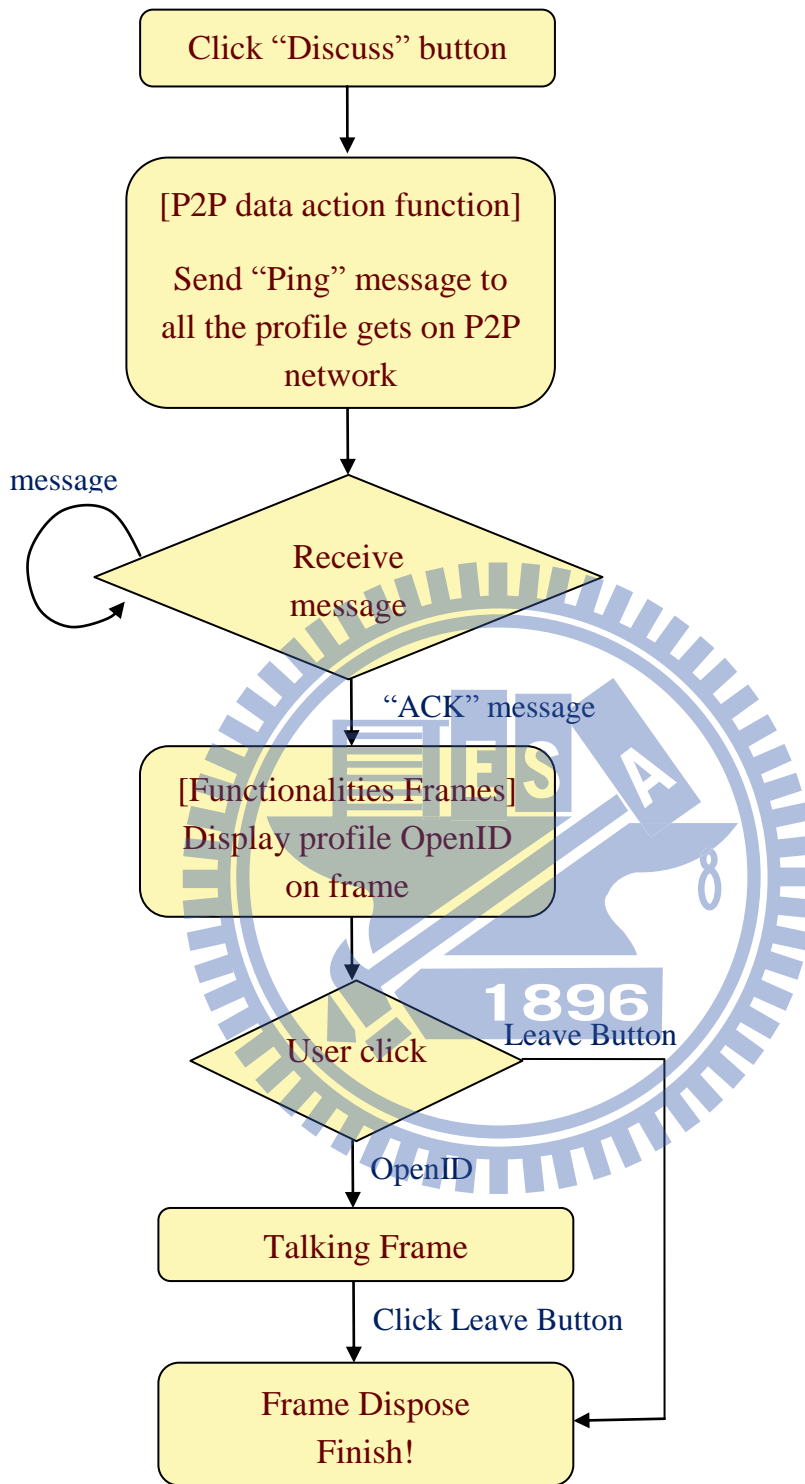
Figure 4 - 4   the work flow of instant message

Chapter 5 Application Demonstration

5.1 Main Frame of P2P auction system

The figure below is a overview of P2P auction system. The GUI part can divided into five areas to explain. We have indicate that the auction system consist of store management and list management which are area 1 and area 2 respectively. Area 3 is the login part, user click login button to invoke web server and web browser to login user. The search system is in area 4 which has shopping arcade, search with OpenID, keyword or price range. And finally to use instant message, user just have to click discuss button which is area 5 to do the talking part.
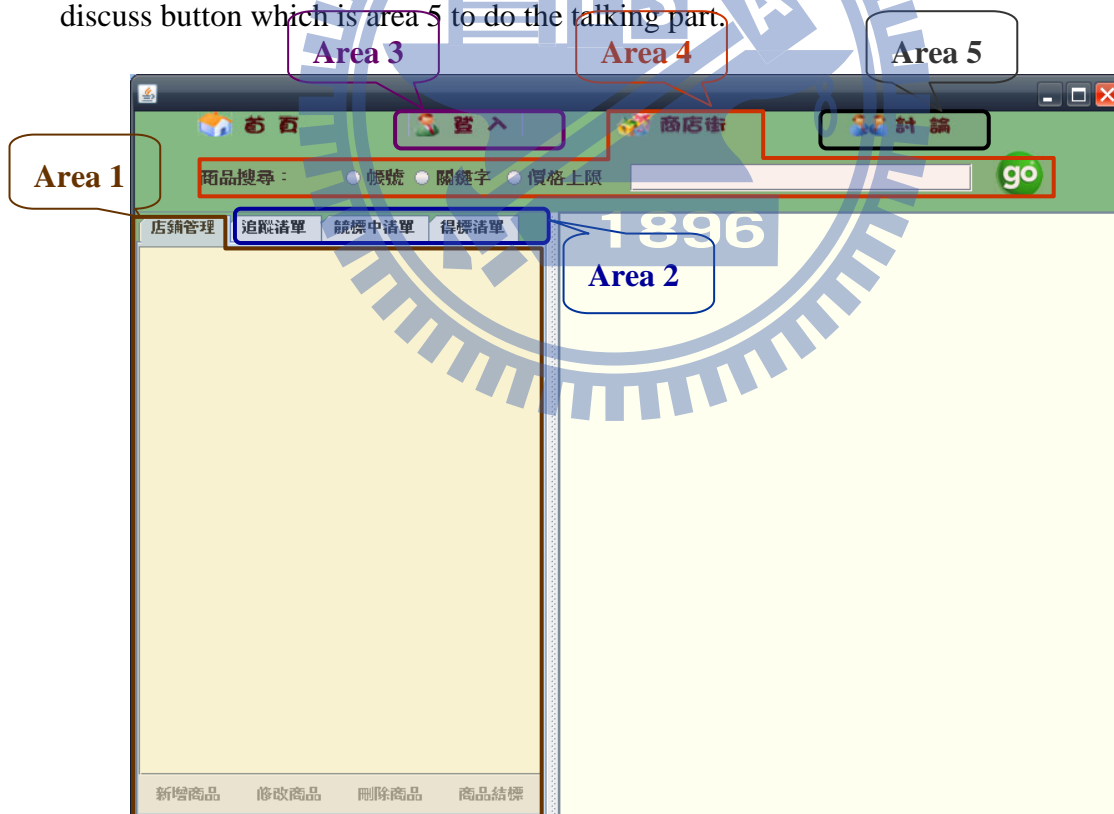

Figure 5 - 1   the overview GUI of P2P auction system

5.2 User Login

In Figure 5 - 2 shows that after user click login button, the system invokes web server and embedded web browser to let user key in his OpenID. And the system also supports user to login with Yahoo OpenID. Due to Yahoo online auction is one of the main auction system that used in Taiwan, supporting user login with Yahoo OpenID will make our P2P auction system more easily to use. And after the system has receives authentication from OpenID provider, web server and web browser will close automatically, and user is directed to the GUI part again.
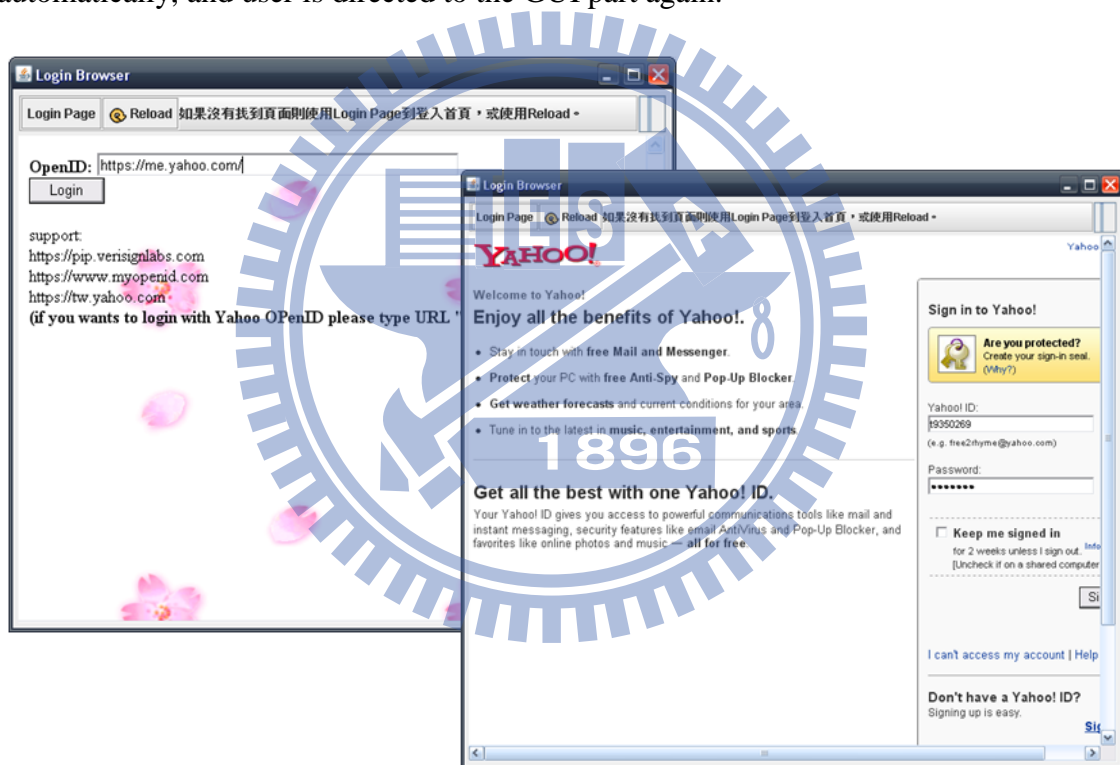

Figure 5 - 2   Login Page and OpenID Provider Website

5.3 Functionalities of P2P auction system.

5.3.1 Auction System

When adding a new product to sell, user needs to click new product button and to fill information about the product as shows in Figure 5 - 3. In the filling process, user clicks the text field of upload picture, a file upload dialogue will appear automatically to let user choose a proper picture to upload. To key in due date of product, there are two ways to fill in the text field. One is to key in date directly; the system will check type and rightness of what user types. The other is to click the button next to the text field and a calendar will appear to let the user choose the date.
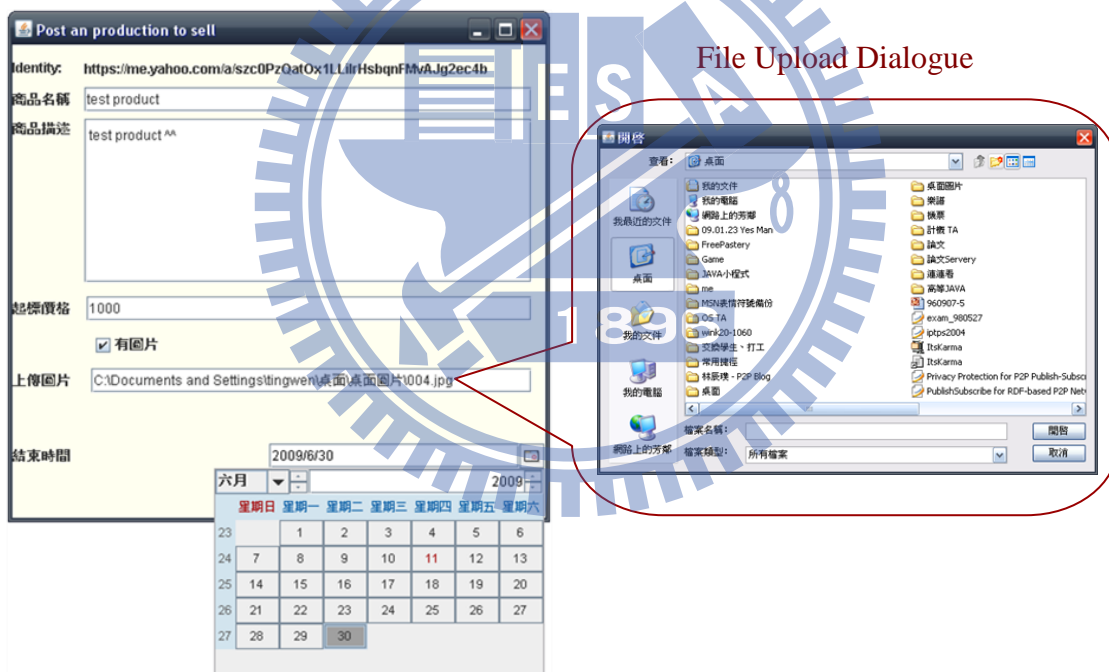

Figure 5 - 3   Add a new product to sell

5.3.2 Bid System

After adding a new product to sell, user can see the selling product showing at the right side of main frame as shown in Figure 5 - 4. To bid for a product, user just

click the bid link shows in the figure, after a announce frame pops put, user can type an affordable price to bid with others.

Figure 5 - 4   Bid for the selling product

5.3.3 Evaluation System

When a transaction is made three days ago, an evaluation frame will pop out to ask user giving an evaluation to each other. And if the user hasn't given an evaluation, the same frame will pop put the next time user logins. This way force user to evaluate each other when they have transaction, and by doing so make the evaluation of our system more reliable. The evaluation figure is shown below. After user has given an evaluation, the user can see the evaluation value attach to user's OpenID.
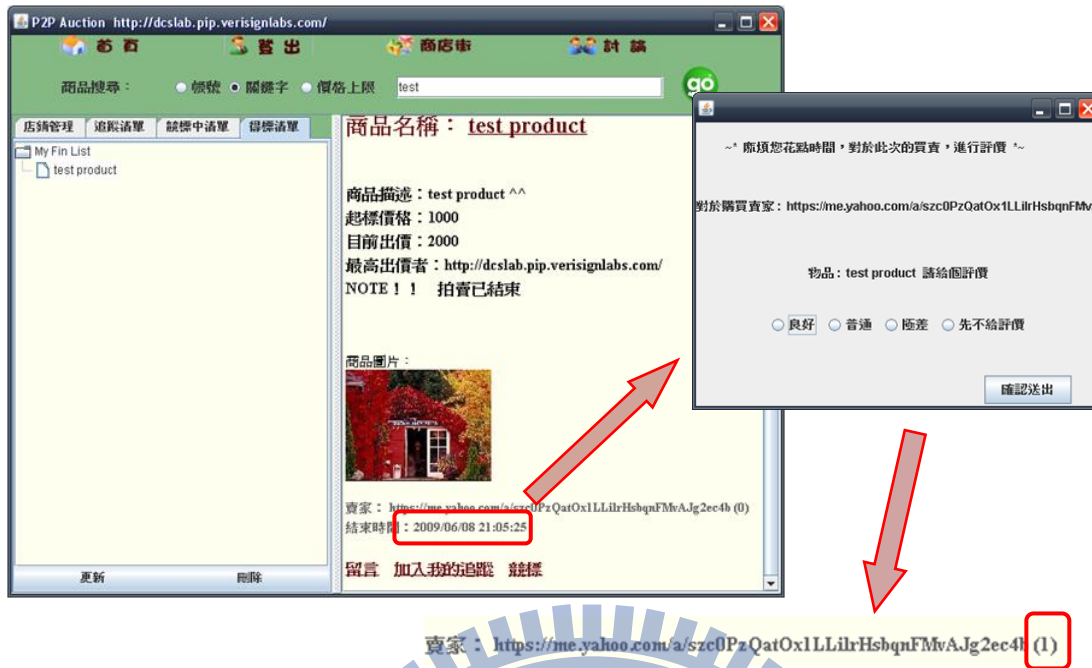
Figure 5 - 5   To evaluating others

5.3.4 Message System

There are two ways to communication to each other. One is leaving a message and the other is to use instant message. These two are shown in Figure 5 - 6 and Figure 5 - 7 respectively. To leave a message, user just clicks the comment link and type messages in the message box. Then others can see the message immediately. To using instant messages user can click the discuss button and choosing an OpenID to talk to. Then both side of user will pop out a talking frame automatically. When finishing talking, no matter which sides of user close the talking frame, the other side will get a message indicates the other side is leaving.

Figure 5 - 6   leaving a message

https://me.yahoo.com/

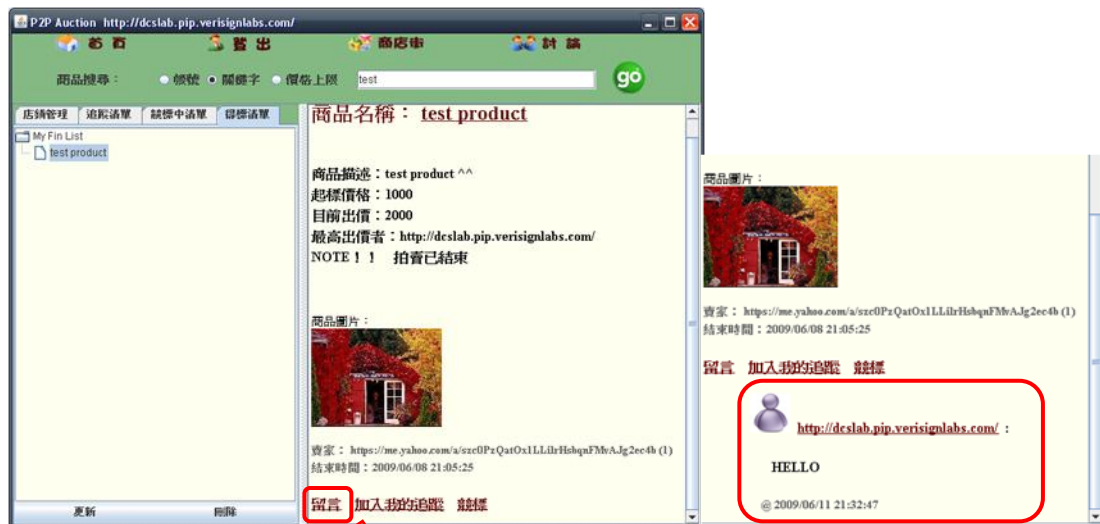**a/szc0PzQatOx1LLilrHsbqnFMvAJg2ec4b**
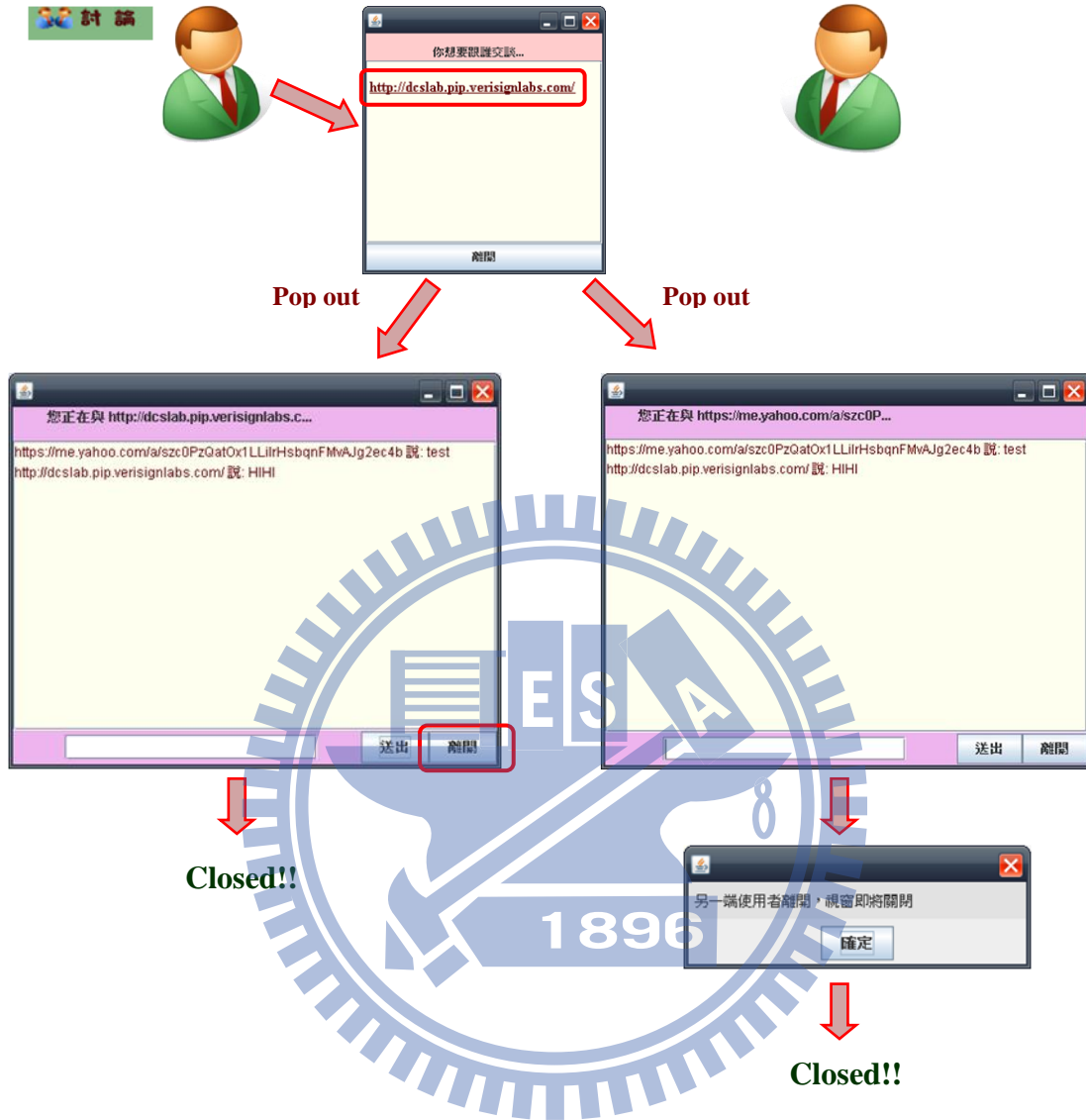
http://dcslab.pip.verisignlabs.com

Pop out

Pop out

Closed!!

Closed!!

Figure 5 - 7   Using instant messages

Chapter 6 Comparison

6.1   Comparison Between P2P Auction

	P2P auction system	ItsKarma	EzBas
Architecture	Distributed		
Registration	OpenID	Register on ItsKarma	Register on EzBas
Search for product	keyword, range	wanted, category	keyword
Discussion	Instant message, Message leaving	Instant message	Instant message
Evaluation system	Evaluation three days after	No evaluation	No evaluation
Additional software	Custom windows application		

Table 1 - Difference between P2P auctions

The table above lists the differences between P2P based auctions. Although ItsKarma and EzBas are not use now, we can still take advantage of them. The main difference between our P2P auction and others is that we have integrated OpenID login into our system, this make our system real distributed. Using ItsKarma or EzBas need to register an account and also need to verify username and password every time user logins. This result in the login part isn't base on P2P which causes same problem as server based auction, the bottleneck at server. And another difference part is that only our system implement evaluation process, this make the transaction more reliable, user can query for other's evaluation value in advance then user can decide to make a transaction or not.

The feature worth mention in ItsKarma is it's search part. ItsKarma support user to post an article which describes the product user wants. Then the sellers can search

for all want articles on P2P network to sell things to others. ItsKarma can also use category search. When adding a new product to sell, user must specify the category of products so that the system can do category search.

6.2 Comparison Between Server Based Auction

	P2P auction system	Yahoo	E-bay
Architecture	Distributed	Server/Client	Server/Client
Registration	OpenID	OpenID	On server
Additional software	Custom windows application	none	none
Cost	Free	Charge	Free
Subscription	Scribe	RSS	RSS

Table 2 - The difference between P2P auction and server based auction

The table above compare P2P based auction and server based auction. Their architecture is completely different. P2P based architecture is born to solve the problems of server based auction which are storage not enough and the bottleneck at server side. P2P auction system integrates OpenID to make our system completely distributed and the advantage of our P2P auction is that the process of selling product is totally free. Although E-bay is also free, this doesn't means it will never charge for fee. It is trend for server based auction system to charge fee. As a result, E-bay has high possibility to be the next server based auction system that charge user for fee. In short, our system provides another way to selling products.

6.3   Comparison Between P2P Blog

The architecture of P2P blog system[30] and P2P auction system is similar. They all implement with FreePastry and use OpenID to login. And in P2P auction system, we have implement all the future work in P2P blog system, that is keyword search, uploading picture, provides reference value to user (the evaluation value).The main difference between our P2P auction system and the P2P blog system is the functionalities, we not only adding new functionalities but also improve the originate functionalities. The table below shows the functionalities of P2P blog and P2P auction.

	P2P Auction System Functionalities	P2P Blog System Functionalities
Personal information	none	Self profile
Functionalities to Management Objects on P2P network	Product	Article
	Post	Post
	Modify	
	Delete	
	Set to End	
Way to Memorize Object	List	Bookmark
	Product List	Bookmark Article
	Bid List	
	Finish Bid List	
Subscribe	Subscribe Product	Subscribe Article
Communication	Leaving Message	Comment to Article
	Instant Message	

Chapter 7 Conclusion and Future Work

7.1　Conclusion

In this thesis, we provide another way to selling products. The system has overcome the problem of modern client /server based auction system. Based on P2P technology, the architecture of P2P auction system is distributed. Besides, building the system via P2P architecture is simpler than via client/server model because P2P technology already has some essential mechanisms like file-backup. Moreover, the system combine P2P network with OpenID authentication which makes the application totally distributed. By using OpenID login, user who has a Yahoo account can easily login with Yahoo OpenID. This makes the system easier to use because user needn't to apply for a new account. And it is a greatest attraction that the selling process is totally free; unlike the server based one needs to charge seller for fee.

7.2　Future Work

For further extension, we shall settle the following problem in the nearest future.

- First, in evaluation system we present is just seller part i.e. that we can only see seller's evaluation value. But seller is also under the risk of buyer reject the bid i.e. buyer may goes back on his/her word not buying product. The system has record both sellers and buyers evaluation value. So just consider representing both seller and buyer evaluation value with positive evaluation count and also negative evaluation count.

- Second, adding want articles which describe what user want and seller can contact with the user. Just like ItsKarma does.

- Third, the search system has to be improved. The system can search for ended selling product for buyers to refer to it. And adding category search or want article search like ItsKarma does. Moreover, we can add evaluation search, user can specify a threshold of positive evaluation of a seller so that to avoid bad transaction.

- Fourth, the system can add functionality of edit self profile including store name and personal information. So that users can see store name instead of user OpenID at shopping arcade.

- Fifth, the can have its plug-ins. And regard plug-ins as a notifier which notifies the user when others have bid for a product or a selling product is due.

- Sixth, transform the system to running on both windows to linux. The system can't run on linux just because the embedded browser can only run Internet Explore. As a result, we replace embedded browser to the one which can run firefox, for example, JxBrowser. By doing so, the system can run on both windows and linux.

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