

A Comparison Shopping Architecture over Multiple Malls : The Meta-Malls Architecture

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Abstract

As the number of electronic shopping malls increases astronomically, the difficulty of finding and comparing the specification and price of the desired items has resurrected even in the cyberspace. To help the process of visiting multiple sites collecting desired items in individual shopping bag that resides in the buyer's personal computer, the Meta-Malls Architecture is proposed. To help the process of seeking comparable items easily and effectively, a buyer is only required to find a sample item in a familiar shopping mall and click the "compare" button to invoke comparable items. The comparable items are supposed to be inputted by the sellers who want to claim the comparison because the sellers feel their items are more competitive. This comparison claim can be a new way of just-in-time advertisement. A Meta-Malls System is developed according to the Meta-Malls Architecture supporting the SET-based, one-stop payment service, and variations are deployed in the commercial sites. This architecture is particularly suitable for business-to-business electronic commerce.

1. Introduction

As electronic commerce becomes popular, the number of commercial shopping mall sites has already reached 250,000 and is expected to grow very rapidly. This is good news in the sense that customers can have more choices. However, this causes the new headache of searching and comparing the alternatives of product specifications and prices in the huge dimension of cyberspace. So, an aid for comparison shopping has become an essential facility to purchase effectively and efficiently over multiple shopping malls. In this research, we intend to provide buyers (both the individual customers and business acquisition departments; for simplicity, we will refer to them together as *buyers* if the context is not a matter of individual or business buyer) the power of selecting the most inexpensive item among the ones that can satisfy the buyer's requirement in the distributed cyberspace. To assist the comparison shopping procedure over the multiple cybershopping malls, we can think of several approaches.

1) The first type of aid is using the key word search and directory capabilities, which each shopping mall usually provides. Since most of the advanced cybershopping malls

are equipped with these capabilities, this aid is what is available at this point of time. This approach implies that the customer has to decide which malls to visit, The number of surfing malls will be limited by the buyers searching endeavour and *a priori* knowledge about the malls. Since the outcome of general search engines like Yahoo and Alta Vista as well as the ones dedicated to a shopping mall is no more than the URL's (Uniform Resource Locators) along with a short description, such search engines cannot pinpoint the items that buyers are looking for. Beside, the buyer has to even decide which search engine to visit because each search engine possesses different registered URL's.

2) The second type of aid that can overcome the limit of the first approach to some extent is the meta-key-word search and meta-directory service. To provide the meta-key-word search (refer to Figure 1), we need to construct a higher level coordinating agency that receives the key word requests from the buyers; sends out the key word to the associated search engines; receives the list of searched results from each mall; and constructs a merged list to display to the buyer [1,2]. The followings are typical meta-search engines that exist to date:

- ◆ All-in-One Search Page (<http://www.albany.net/allinone>)
- ◆ Starting Point (<http://www.stpt.com>)
- ◆ Fun City Web Search (<http://www.funcity.com/search.html>)
- ◆ HyperNews (<http://www.hypernews.org/HyperNews/get/www/searching.html>)
- ◆ Info Market (<http://www.infomkt.ibm.com>)
- ◆ DogPile (<http://www.dogpile.com>)
- ◆ Meta Crawler (<http://www.metacrawler.com>)
- ◆ Savvy Search (<http://guaraldi.cs.colostate.edu:2000/form>)
- ◆ ProFusion (<http://www.designlab.ukans.edu/profusion>)
- ◆ Inference Find (<http://infind.inference.com>)

The meta search engine can overcome the burden of visiting multiple search engines although the outcome is still no more than the list of URL's. To support the meta-directory service, the individual mall directories have to be merged into a larger meta-directory keeping the association relationships between them. If each directory is built independently, and has its own classification hierarchy

and terminologies, merging multiple directories into a unified one is not an easy task at all. So this kind of meta-directory does not exist yet.

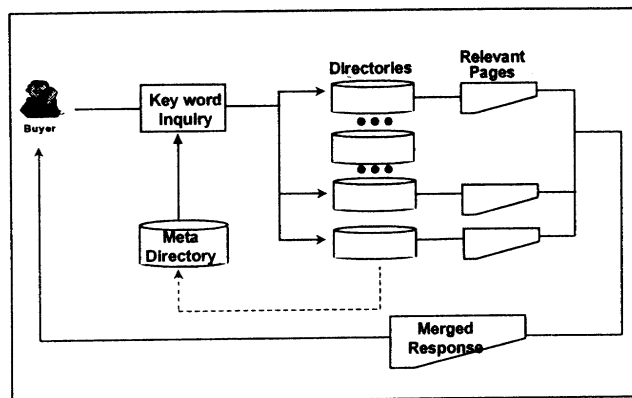


Figure 1. Meta-Keyword-Search and Meta-Directory

3) The third type of aid is the mobile agent, which searches with the given product specification over the HTML files, like Bargain Finder [3]. Simultaneous mobility of agents at multiple sites can save the buyer's search effort. However, the effectiveness of agents cannot but inherently be limited by the maturity of natural language understanding technology with which the mobile agent has to be equipped for the comprehension of HTML (Hyper-Text Markup Language) files. Since the full natural language understanding capability over the unstructured HTML files is not matured yet, propagation of this approach may have to wait until the natural language processing capability becomes more efficient and economical, which may take a long time. Because of this reason, agent based comparison shopping is still in the infant stage. Another limitation of current agent technology is that the price is overly emphasized as the criterion of comparison for a given requirement specification, although the tradeoff between specification and price is a crucial process in the purchasing decision-making process.

To overcome the demerits of current approaches, KAIST (Korea Advanced Institute of Science and Technology), ICEC (International Center for Electronic Commerce), MetaLand Inc. and Hyundai Information Technology have jointly developed *the Meta-Malls Architecture*, which can support the *one-stop product-level comparison shopping procedure over multiple independent cybershopping malls*. The sponsoring company MetaLand Inc. was founded as a consortium of twenty-six companies to provide such a comparison shopping service.

The remaining sections are organized as follows. Section 2 describes the Meta-Malls Architecture and the protocol between meta-malls coordinator and individual malls. Section 3 deals with the issue of expressing the buyer's requirement. Section 4 describes the individual buyer assistance in handling the shopping bag and wallet over multiple shopping malls. Section 5 proposes a way of supporting the one-stop payment for the items to be purchased from multiple cybershopping malls at a visit. For security, the SET (Secure Electronic Transaction) protocol is adopted to this scenario.

2. The Meta-Malls Architecture

To realize *product-level comparison shopping over the multiple independent cybershopping malls*, we have designed *The Meta-Malls Architecture* as depicted in Figure 2.

The *Meta-Malls Coordinator* (in short, Coordinator henceforth) keeps the database of summary information about the products prepared in each cybershopping mall and their relationship indices with the same/similar products in the same/other malls. The Coordinator also keeps the URL of each product for additional in-depth surfing to the originating malls. For this purpose, the Coordinator should be able to request and receive the summary information about the products from each cybershopping mall in a compatible manner.

Each *Mall Operator* is an independent entity *per se*, which means the buyer can enter the mall directly without passing the Meta-Malls Coordinator. However, the independent Mall Operator can be linked with the Meta-Malls Coordinator if the mall manager wants the buyers who have entered to the Coordinator to consider his/her mall as a candidate for comparison shopping. In theory, any commercial merchant system may be used for the development of a Mall Operator. However, to tightly couple the Mall Operator with the Meta-Malls Coordinator effectively, compatibility is a must. In this sense, adopting dedicated Mall Operator development tools that conform the standard named *Linkable Mall Developer* is recommendable. The standard defines the requirement that the mall operator has to follow to allow both the independent mall operation and the integrated service with the Meta-Malls Coordinator.

The Individual Buyer Assistant keeps the *individual shopping bag* and *wallet* in the personal computer. The certificate[8] may be stored in the wallet on the PC, but for the best security may be stored on the IC card. Key advantages of keeping the Individual Buyer Assistant in the buyer's PC instead of the Meta-Malls Coordinator's server are that the capability can be openly used for shopping on any compatible shopping malls; the individual statement can be stored in the buyer's site, which is a must for the business buyer to integrate with corporate information system; privacy can be highly secure; and the communication effort to input new items to the shopping bag in the server can be ameliorated. These features are a keen contrast to the current server-based cyber shopping mall architectures.

To realize the product level comparison shopping, the product data has to be stored in the structured database with the dynamic HTML file generation capability because the agent's comprehension over unstructured HTML files is not practically feasible. Since the product specification and price data can be suitably stored in a structured manner along with image file names, the Meta-Malls Coordinator can collect the summary information from the associated malls without any ambiguity. This feature is obviously

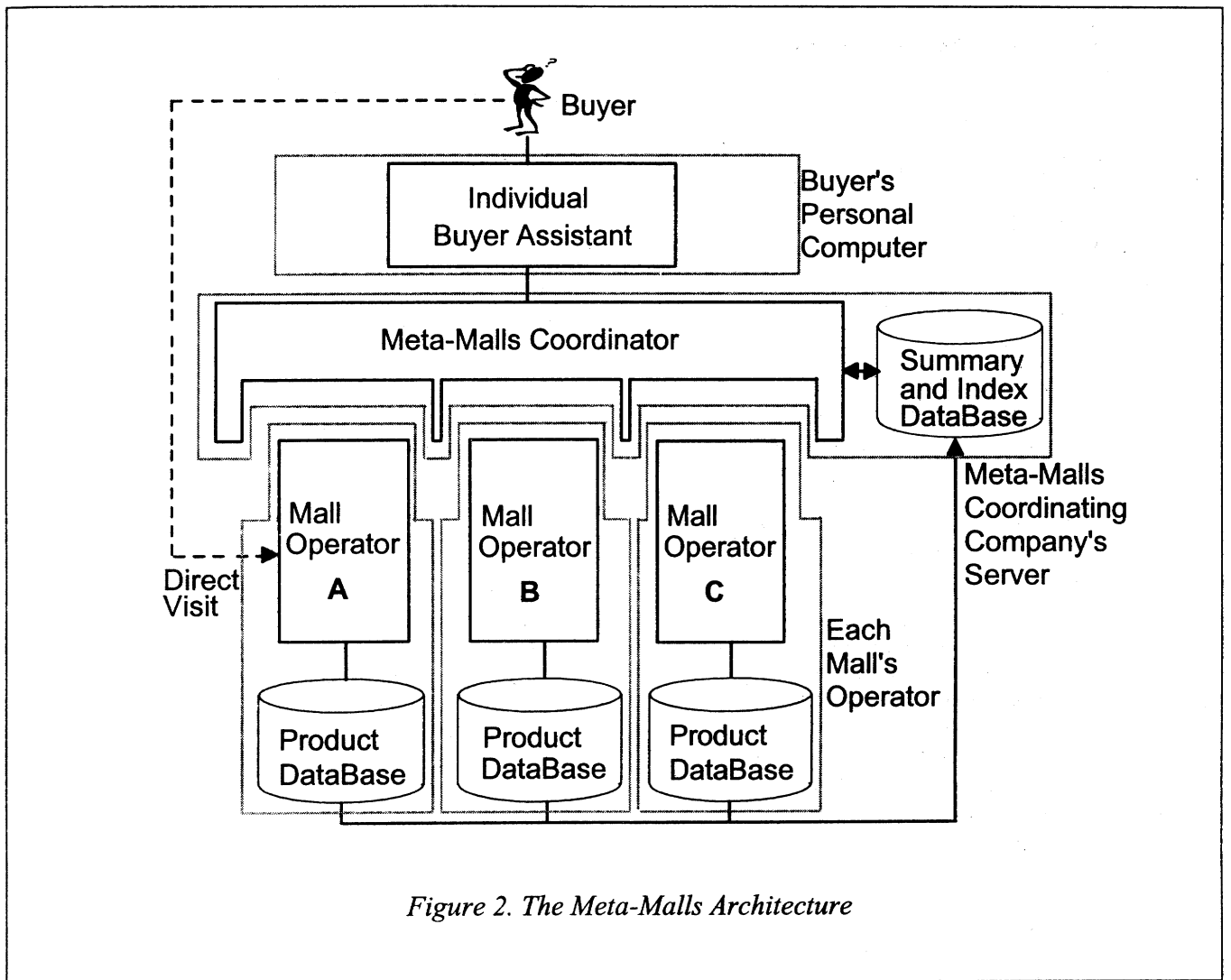


Figure 2. The Meta-Malls Architecture

desirable for buyer agent's comprehension. Moreover, the human buyer can see the display of each item in HTML file format because the file can be generated from the database at the time of request dynamically. In this manner, product-level comparison shopping can be supported.

3. Integration of Multiple Malls

There are three issues to be resolved to implement the Meta-Malls Architecture.

- 1) How to couple the Meta-Malls Coordinator with the Mall Operators developed in various commercial DBMSs?
- 2) How to couple the Meta-Malls Coordinator with the Mall Operators developed in HTML format?
- 3) How to integrate the data attribute names in each mall developed independently?

The first issue can be resolved by adopting the object wrapping technique in CORBA (Common Object Request Broker Architecture)[6], which can offer the compatible message exchange environment among the different DBMSs. The second issue can be resolved from the long-term and short-term perspectives. From the long-term

perspective, we expect that all cybershopping malls should be developed using a DBMS based tool following the standard of Linkable Mall Developer. As an interim method of coupling with the already existing HTML files, we suggest to append the product specification and price information in a standard structured format in the comment lines of the HTML files so that the agent can effectively retrieve them without any ambiguity, just like retrieving data from the object-oriented database.

Suppose a HTML file, which can be displayed as Figure 3, is structuredly coded as Figure 4. As mentioned earlier, this code should be included in the comment lines hidden from regular display.

The appended structured code may be manually prepared in the beginning stage with the aid of a template that specifies the designated products. For the semi-automatic generation of the structured codes with a human's final touch, a natural language processor has to be used for transformation from the hypertext. However, full automation has to wait until the natural language processing technology is refined.

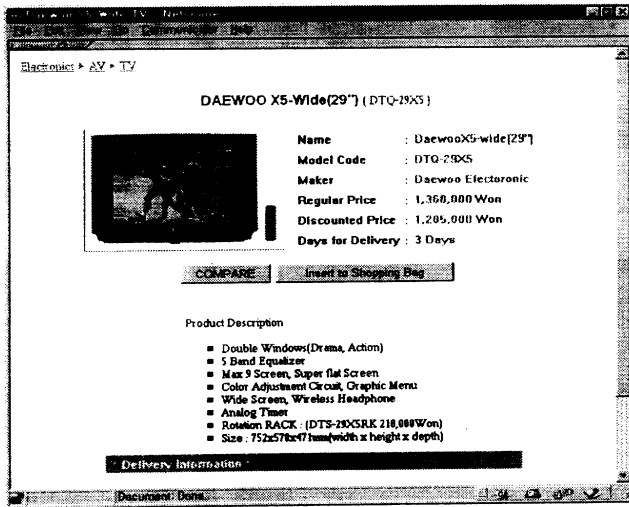


Figure 3. An Illustrative Product with the "COMPARE" Button.

To integrate the data attribute names from different malls, the coordinator should be able to comprehend the names. This may be realized by implementing the dictionary of attribute names along with the associations between the names. However, it is desirable to have agreement on the attribute names for international electronic commerce to conserve effort.

```

<! For Meta-Malls Agent ##### Product
Specification #####
  { {Daewoo_x_5-Wide(29")
    Is a : television
    Model Code : "DTQ - 29 x 5"
    Maker : "Daewoo Electronics"
    Regular Price : 1368000 Won
    Discounted Price : 1285000 Won
    Days for Delivery (in Korea) : 3 days
    Screen Size : 29(inch)
    Dimension : 752x578x471(mm)
    Remote Control : "Direct Access"
    Stereo : Yes
    Audio enhancement : "dolby surround sound"
    Audio volume equalizer : No
    Picture in Picture : Yes
    Caption : No
    On Screen Display : Yes
    Timer : "on/off", "sleep"
    Jack Panel : "1 S-video input", "1 rear a/v
input", "headphone"
    Lines of Resolution : 650
    Comb filter : No
    High Contrast Screen : Yes
    Warranty : "1 Year"
    Other Feature : "Shadow Mask", "Channel
scanning", "Super Flatness Screen"
  } }
  >

```

Figure 4. An illustrative HTML file

To keep consistency between the Mall Operator and Meta-Malls Coordinator, we need to set a commonly agreed updating protocol among the participants. Since the product specification and product portfolio does not change frequently, such change may be reported to the Meta-Malls coordinator by the Mall Operator upon its happening. However, some of the prices may be changed every day. So the price change may be reported every day. To enhance the updating efficiency, a standard EDI format may be adopted.

4. Buyer's Requirement Specification by Example

The next issue is how to aid the process of specifying the buyer's requirement. For some types of products, the specification may be simple to express and consistent between buyers and sellers. For example, the buyer may be able to identify an item by its brand name. However, in most cases, customers may specify their requirement in the customers' language. For example, a mother wants to present a computer to her daughter who is becoming a college freshman. In this case, the buyer may make request using the expression "what is an appropriate model for a college freshman?". Finding an appropriate model for such a request is exactly what sales engineers have to do. To automate this selection procedure, we need, namely, a Salesman Expert Systems [4]. Although it is not easy to build such an expert systems that can cope with the diverse customers' languages, the system should be useful for the certain categories of stereotyped inquires products. However, no such a commercial service exist yet.

To ameliorate the difficulty of expressing the buyer's desire, an approach that this project has adopted is the *Inquiry By Example*. In this approach, we let the buyer find one example item from a favorite cybershopping mall that might have been found by the traditional keyword and directory service that the cybershopping mall provides. The first step of this procedure may also be aided by the meta-key-word search engine to find the URL of the cybershopping mall that deals with the item.

Suppose the buyer has found a sample product - a television - as in Figure 3. Then the buyer can click a button "COMPARE" to initiate the comparison of same/similar products in the same/other cybershopping malls. Then, the summary of comparison (maker, model name, seller, price, etc.) can be displayed to the buyer as in Figure 5 so that the buyer can drill down to the interesting detail information in the associated cybershopping mall. In this manner, customers are allowed to search around the high level summary of comparisons and details in the associated but independent cybershopping malls. The buyer can insert the interesting items to the individual shopping bag during the search process. The items in the shopping bag can be carefully examined before the order considering the available budget and total sum. An interesting observation is that this kind of comparison display can be regarded as a new way of effective advertisement as far as the comparison information can be trusted, objective and

correct. Displaying the advertisement at the time of decision should be a very powerful media for promotion. So, some company information may be provided by the Coordinator for the customer's information, but the sellers may want to claim and pay for the comparative display. The comparison shopping scheme will benefit the buyers and competitive sellers, but may sound like a death penalty to the expensive sellers.

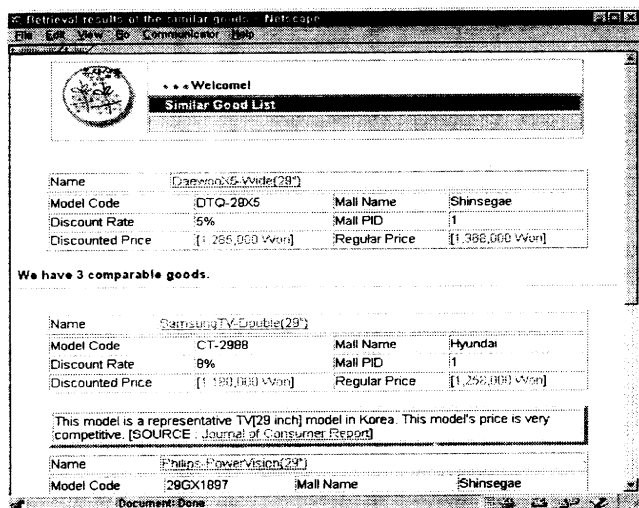


Figure 5. An Illustrative Screen for Product Level Comparison

5. Buyer's Individual Shopping Bag and Wallet

To assist shopping over multiple cybershopping malls, the *Buyer's Individual Shopping Bag* is necessary to keep the items picked from multiple shopping malls. To the buyers, tentative picking and ordering should be treated as separate steps. The buyer should be allowed to pick whatever is interesting without any risk, and to compare among the picked alternatives, considering the necessary budget. To assist this procedure, the Meta-Malls Architecture provides *The Individual Buyer Assistant*, which resides in the buyer's personal computer as mentioned in section 2.

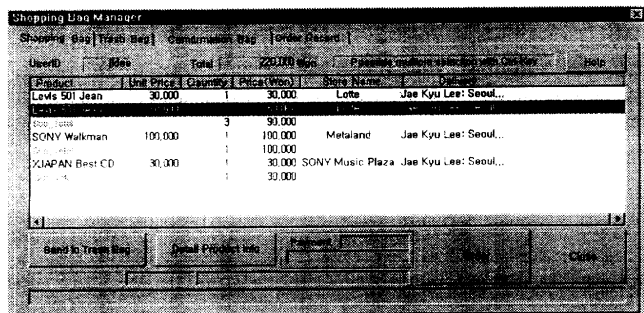


Figure 6. Buyer's Individual shopping bag and wallet

Refer to the illustrative screen in Figure 6. The picked items list in the "Shopping Bag" may be transferred to the

"Trash Bag" if the buyer does not want to order them. The buyer additionally needs to identify the mailing address and the payment account for each item one by one as in Figure 7. Push "Order" button is necessary for final ordering. The appropriately ordered items will be listed in the "Confirmation Bag" and will be saved in the "Order Record" bag for bookkeeping. We need to set a standard format of "Order Record" file so that the corporate information systems can interface with electronic order in a compatible manner.

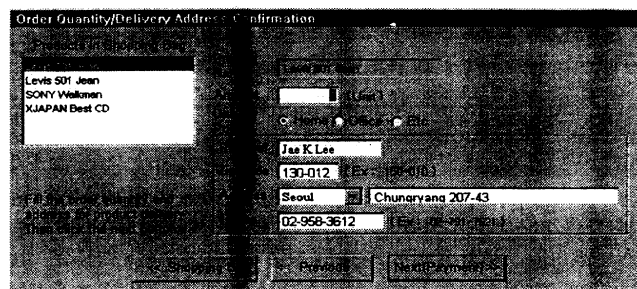


Figure 7. An Illustrative Screen for Address Selection.

This is an essential feature to allow the corporations multiple channels of purchase orders. To allow truly one-stop shopping, the items in the shopping bag (even though the items are picked from multiple malls) should be allowed to be ordered and paid at one time from the buyer's point of view. This means that the Meta-Malls Coordinator should generate the multiple orders - one for each relevant cybershopping mall based on the request from the Individual Buyer Assistant. To implement this kind of one-stop ordering along with the one-stop payment, an agreement between the company that runs the Meta-Malls Coordinator and the participating Mall Operators should be established in advance.

6. SET-Based One-Stop Payment

The SET (Secure Electronic Transaction) protocol [5] is becoming a *de facto* standard for the secure credit card payment procedure. So we need to incorporate the SET in the one-stop payment procedure of the Meta-Malls Architecture. One-stop payment means to get the credit card authorization only one time although the ordering items are picked from multiple cybershopping malls. Refer to the illustrative screen in Figure 8 that utilizes the certificate for encryption and digital signature adopted in SET. The certificate may be stored either in the personal computer or IC card. We have developed the Smart-SET which can store multiple certificates in the IC card at SET context.

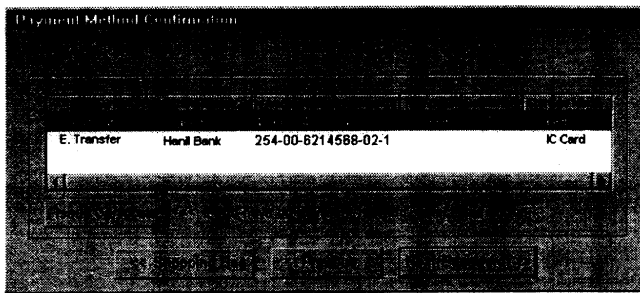


Figure 8. An Illustrative Screen for Certificate Selection.

To support the one-stop payment, the Meta-Malls Coordinator takes the authorization as the representative of the Mall Operators from the credit card company, and then notify the ordered information to each Mall Operator so that each merchant can deliver the ordered items to the buyer and settle the payment with the Coordinator. In this scheme, the Coordinator takes the role of "Merchant" in SET protocol, and the notification process between the Coordinator and the Mall Operators which is out of scope of SET protocol is a newly defined in the Meta-Malls Architecture. The notification messages are also encrypted to ensure security as SET protocol.

The one-stop payment scheme can reduce the authorization cost and simplify the payment procedure from the buyer's point of view. However, this implies that the Meta-Malls Coordinator should play the role of payment gate and clearing service among the Malls Operators.

7. Concluding Remarks

In this research, we have described a process to support a buyer's comparison shopping, and the required features of the Meta-Malls Coordinator, individual Mall Operators and Individual Buyer Assistant. We have also seen why we need and how to realize one-stop shopping and one-stop payment over the multiple independent cybershopping malls.

Currently, the Meta-Malls System version 1.2 is developed according to the spirit of Meta-Malls Architecture. The companies MetaLand Inc. and Hyundai Department Store have opened their services with a variation of this version respectively. The Meta-Malls System 1.2 performs all features of one-stop comparison shopping and one-stop payment with the SET protocol for secure payment. This approach may become one of the next generation cybershopping mall standards.

Acknowledgments

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