

# An Open Digital Library Ordering System

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**Abstract.** In this paper we briefly describe an open ordering manipulation system with a WWW interface. The orders concern articles of scientific journals. Customer users can search in data sources from a variety of suppliers for articles of journals and order specific pages of the articles. Their search can also include electronic journals in which case their orders can be fulfilled, charged and delivered electronically as an e-mail attachment without needing an operator. The various suppliers can view orders made to them and service them. A customer can direct his order to several suppliers declaring an order of preference. We also introduce the issues involved and present our open system solution that separates the search from the order procedures. Searching can use any external interface provided by the various data sources and intercepts queries and their answers to search requests.

## 1 Introduction

The National Documentation Center (NDC) is a governmental infrastructure for providing information on research and technology. We provide a journal article ordering service, allowing certain individuals or organizations to search through a set of diverse external data sources containing information about journals and their contents and order them from the corresponding supplier(s). A typical usage scenario of the ordering system is described below.

A customer user (customer) searches a collection containing information about journals and their suppliers. The journal collection can also contain electronic journals. The search is done using the search interface provided by each data source. The answer to his request is a set of journals that match the search criteria and it also contains the corresponding suppliers.

After the correct journal is selected, the customer has the opportunity to place one or more linked orders for the specified item. The first order is tried first. If it concerns an electronic journal, it is serviced immediately, otherwise it is sent to the appropriate supplier. The supplier must manually respond to the customer's request. In the meanwhile, the customer can keep track of the status of his pending orders or state that he received the ordered item.

From a supplier's point of view the system looks as follows. A supplier is able to view the orders waiting to be served by him and either accepts or rejects

them. He also has the possibility to view any completed orders for statistics or reporting. To prevent a supplier from withholding and not responding to orders, we include a timeout mechanism that makes the next linked order active after a specified time interval.

## 2 Description of the Ordering System

There are various issues involved in the above-described procedures. First of all, a major issue is the diversity of the available data sources containing information about the articles, journals and suppliers, or the electronic journals. Most of these sources already have their own search interfaces and provide different functionality, something we exploit. Unification of these sources in a single format is sometimes possible but in other cases is a difficult, if not impossible task. Furthermore, since multiple suppliers, customers and orders are involved, authentication and security mechanisms become a necessity. On the other hand, orders should be stored in a central place for the extraction of various kinds of statistical and financial reports. Last but not least, the system should have an easy-to-use intuitive interface as it is designated for use by librarians and other people not having any technical background in computers. In the following sections we describe the ordering system's functionality which addresses those issues and is also extensible, using many different external data sources.

The Figure 1 shows in general the system's functionality.

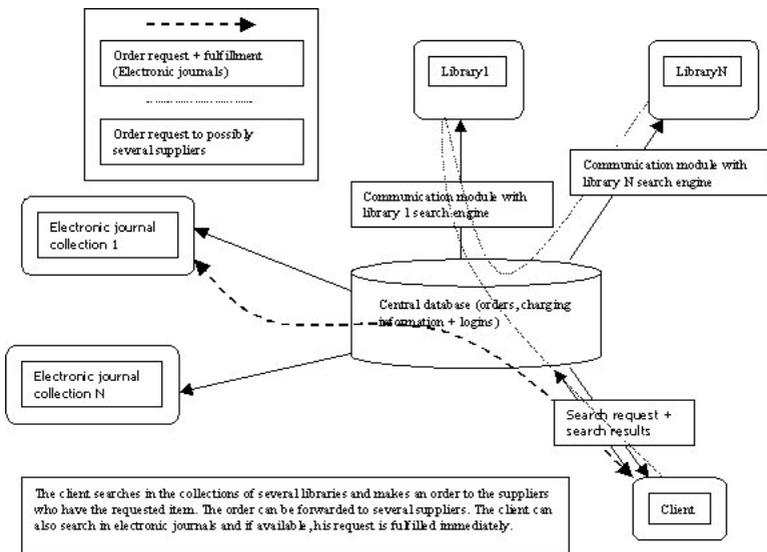


Fig. 1. General system architecture

## 2.1 Customer Search and Selection

The first thing a customer must do is search in the available data sources. In an open system, we do not store any information regarding the target material, journals or articles, in the central database. All such information is accessed from external sources and we use them by their search interfaces to obtain the results concerning a user's request. The system only needs to know the communication protocol with each specified external system. We can intercept calls to Z39.50 servers which give us access to collections of various libraries with the Z39.50 protocol, or to the HTTP protocol of the web interfaces and search engines of various electronic journals. We use proxying techniques to intercept the various queries and answers from the different systems and present them to the user. Thus, data are updated easily by their owners (suppliers) on their servers. We use read-only access.

The customer is prompted with the set of external sources available and is given the chance to choose one for his search. After that, he is presented the search screen of the selected source with various searchable fields. The customer can search for articles wherever available and find the journals that contain them as well as the suppliers that have them. In each case, the answer contains the specific item and the corresponding suppliers. The customer can then initiate the order procedure.

## 2.2 Ordering

After the search and selection of the requested journal the customer can create a linked order list to several possible suppliers. This step requires login and password authentication. In the case where the search included article information all the available data for the order are gathered, whereas in the case where article information is not available the customer is prompted to enter any missing fields, such as issue, article, start and end pages etc. The first order in the list is marked active and an agent hook executes. The agent hook executes each time an order in the list becomes current and the order is passed as a parameter. The actions of the hook depend on the type of the corresponding supplier. This way all order manipulation in the system is uniform.

**Robot Supplier.** In the case of electronic journals the completion of the order is made immediately and the requested pages are sent electronically as an e-mail attachment. In this case, the hook is responsible for fulfilling the order, that is locate, charge and electronically send the ordered article. It also marks the status of the order completed. We must note that in the case of electronic subscriptions the server computer is the only computer that needs access to the electronic journal data and handles and records their usage. Access to such data is often IP restricted and we record any usage of them according to the contract with each publisher. Other computers cannot directly search and retrieve any electronic journal data if any restriction is imposed by the publisher.

**Manual Supplier.** In the case of a manual supplier the hook just makes the corresponding order in the list active and a response from the supplier is expected manually. If the supplier rejects the request (e.g. in the case he can't serve the request) or does not answer for a specified period of time (timeout) the order is automatically forwarded to the next supplier making the next order in the list active and triggering the agent hook all over again.

The manual supplier is first logged into the system and browses the orders he must serve. Supplier logins can be IP restricted as an extra security feature. He is presented a list of pending orders and after viewing the details of each one he is able to reply. First of all, he declares whether he accepts or rejects the order and for each accepted order he also fills or corrects various fields such as number of pages, delivery method etc.

### 2.3 Statistics

Since all data regarding orders are stored in a central database, various statistics can easily be extracted. We can have per customer statistics where each customer can see total cost of completed orders, mean response time of the various suppliers or any other interesting data. We can also have per supplier reports that show for example the entire history of serviced orders. Several financial reports or valuable statistics regarding system usage can also be extracted for all users of the system.

## 3 Advantages - Future Extensions

Our system makes distributed operation and update possible because it avoids the unification of data in one form, something that in many cases is impossible, and it exploits the various search engines of the outside systems. No single entity is responsible for the gathering and update of the journal data but each data source is responsible for the data it provides. Moreover the system can easily be extended to support other data sources only by adding support for the protocol used to communicate with the source. The central database holding the orders themselves remains intact. We also use different algorithms for cost evaluation of orders. The charging of orders is a different customizable module in the system. Finally each customer can view the status of his pending orders.

As an alternative to frequent users, with login, we could have one-time users, where no logins are required if we provide for credit card charging. Of course this means that secure protocols must be employed for the exchange of such sensitive data. We could also provide certain private collections and allow each customer user to choose among them to restrict his search. For instance, we could have a collection of computer science journals and another of medicine journals.