Business-to-Business e-Commerce with Open Buying on the Internet

Zhong TIAN
tianz@cn.ibm.com
Leo Y LIU
lyliu@cn.ibm.com
Jing LI
lij@cn.ibm.com
IBM China Research Lab
4F/26th, 6th Shangdi Street
Haidian District, Beijing China 100085

Jen-Yao CHUNG
jychung@us.ibm.com
Vibby GUTTEMUKKALA
Vibby@watson.ibm.com

IBM T. J. Watson Research Center
30 Saw Mill River Road
Hawthorne, NY USA 10532

Abstract

Internet based e-Commerce is flourishing, but mostly in the Business-to-Consumer world. The lack of well-accepted standards is hindering the success in promoting Business-to-Business e-Commerce solutions. Open Buying on the Internet standard is one of the promising efforts in bringing business-to-business e-Commerce into corporate purchasing. Existing merchant servers can be augmented to endorse such standard like what we did with OBI-enablement for Net.Commerce.

1. Introduction

Internet based electronic commerce (e-Commerce) is flourishing, but mostly in the Business-to-Consumer (B2C) world like music, books selling etc. The lack of well-accepted standards is hindering the success in promoting Business-to-Business (B2B) electronic commerce solutions. VAN EDI based solutions are only accessible to large organizations due to the cost factor. Corporate buyers and suppliers, large and small, are looking for Internet based solutions to streamline the procurement procedures and to reduce the cost of establishing trading relationship and the trading transactions. Such demands put forward some fundamental challenge on issue like trust infrastructure on the Internet, standards and inter-operability etc. Open Buying on the Internet (OBI) is a promising emerging standard in meeting some of these challenges.

1.1. Open Buying on the Internet (OBI)

Open Buying on the Internet (OBI) is an e-Commerce standard that has been specified by the OBI Consortium. OBI is "an open, flexible framework for business-to-business Internet commerce solutions. It is intended for the high volume, low-dollar transactions that account for 80% of most organizations' purchasing activity"[1]. It is expected to streamline the non-mission critical procurement processes of organizations (e.g. MRO materials) by specifying a standard set of roles that OBI-compliant selling and buying parties must conform to. Furthermore, the standard is supposed to make it easier to achieve compliance by requiring usage of widely accepted, standards-based technologies such as HTTP, digital certificates (X509), secure sockets layer (SSL), and EDI. The usage of these technologies in the various components of an OBI server (OBI-enabled Net.Commerce server) is discussed later in this paper.
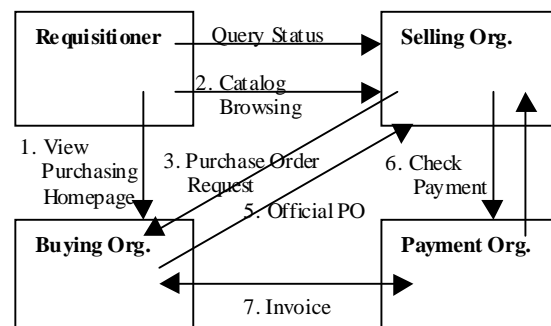
1.2. OBI Components

Figure 1 OBI information Flow

There are four essential entities involved in an OBI system. The ***Buying Organization*** procures items as part of its daily business operations. The ***Requisitioner***, a member of the buying organization, is interested in procuring certain items as part of the non-mission critical process of the organization within

his/her command. The *Selling Organization* supplies goods and services to other businesses. Finally, the *Payment Organization*, which may not exist in all OBI scenarios, as a clearing-house for all payment and settlement activities between the selling and buying organizations. All the aforementioned entities are assumed to have digital certificates that uniquely and securely establish their identities. Of course, these entities are all assumed to be connecting to the Internet.

1.3. Net.Commerce and OBI

Net.Commerce is one of IBM's leading merchant servers. It already provides powerful cataloging, user management, fulfillment and payment facilities to support Internet e-Commerce. What is needed is a new front end for handling digital certificates based user processing and an additional back-end engine for processing OBI-style transactions. This is very important because a large number of buying organizations would like a simple, standards-based way to interact with their many suppliers and are looking towards standards such as OBI and systems based on such standards to address this issue.

2. OBI-enablement for Net.Commerce

Lots of e-Commerce buying and selling solutions are running today, and lots of commercial merchant servers are available today. These systems already provide many of the basic functionality required by B2B e-Commerce, e.g. catalog, shopping cart and purchase order composition support. There is no reason to construct OBI-style solutions from scratch.

This paper describes an OBI extension to IBM's leading merchant server Net.Commerce so as to make it capable of serving as an OBI-enabled selling (merchant) server, as well as an OBI-enabled buying server. Our extension is designed as add-on components that can be installed after the base Net.Commerce system is up and running. Our effort should shed some light to how to make an existing e-Commerce solution OBI-ready. We focus on the OBI Selling Server (OBI/SELL) in the rest of the paper, and then a summary of the OBI Buying Server (OBI/BUY).

Net.Commerce, like many of the existing merchant servers, mainly serves the B2C paradigm. It already provides many of the services required for B2B e-Commerce. Such features include:

- Web server with basic security features
- User ID and password based user management
- A catalog facility for universally presenting all the goods and services a merchant is to offer
- Shopping cart support for purchase order composition

- A browsing and searching facility to assist users finding goods and services they want
- Purchase order fulfillment support for goods and services delivery
- Payment module integration for the actual billing

However, a number of new features need to be added and some of the ones above need to be enhanced to support B2B e-Commerce.

In our enhancement to Net.Commerce, the OBI/SELL provides the OBI functionality needed for a merchant to participate as a selling organization in OBI transactions, while the OBI/BUY provides the OBI functionality needed for an organization to participate as a buying organization in OBI transactions.

The OBI selling server, OBI/SELL, must support the following capabilities (in addition to those already provided by Net.Commerce):

- Digital certificate based requisitioner processing
- Web-based secure and reliable message exchange (both Purchase Order Request, POR, and Official Purchase Order, PO) with OBI/BUY
- Trading partner relationship management
- Net.Commerce shopping cart and OBI object (both PO's and POR's) conversion, which also include OBI/EDI message encoding and decoding

The OBI selling server, An OBI/BUY, must support the following capabilities (in addition to those already provided by Net.Commerce):

- Secure and reliable message exchange with OBI/SELL
- Trading partner relationship management
- Net.Commerce shopping cart and OBI objects (both POR's and PO's) conversion
- Plug-in into buying organization's approval and back-end processes

Although the capability list for both the OBI/SELL and OBI/BUY look very similar, they are functionally different, which requires slightly different design and implementation. This will be made clear through the rest of this document.

3. OBI/SELL: the OBI selling server

From component point of view, Net.Commerce, like many other existing merchant servers, is consisted of

- A secure web server for handling Internet connection
- A database engine for managing product, user, order, payment information
- A scripting engine for rendering presentation and customization
- A payment engine for checking payment status
- A shipping service engine for fulfillment support

OBI/SELL is designed as an add-on component to

Net.Commerce V3.1. Our design requires no major change to the current Net.Commerce code base, although minor changes are needed due to the different nature between B2B and B2C e-Commerce, e.g. more order status codes are needed for B2B e-Commerce to reflect business control status. Our OBI enhancement to Net.Commerce includes,

- **Digital certificate based user management:** Both server authentication and client authentication are extensively used in OBI/SELL to establish proper trust level. The web server is configured to require client authentication to extract digital certificate from a requisitioner's browser. Requisitioners no longer need to go through the explicit registration process to be recognized as legible users.

- **Trading partner relationship management:** Trading partner relationship is no longer hard coded into the merchant server. A supplier can easily maintaining its trading partner relationship with its all corporate buyers (e.g. adding new partners, removing old ones and changing parameters of exiting ones) by simply filling out a couple of forms.

- **Customizable catalog facility:** The catalog facility must be able to customize the mater catalog to reflect the price structure and other constraints based on the trading partner agreement. Such customized catalog will guarantee a requisitioner get the right price structure and the right kind of choice of goods and services within his command.

- **OBI style shopping experience:** There is no need for a requisitioner to fill out shipping and payment forms in an OBI style transaction. All he cares is to find the right goods and services he wants.

- **Net.Commerce shopping cart and OBI object (including both POR and PO) conversion:** OBI objects are basically ordering information defined in OBI specification. Net.Commerce shopping cart is actually a presentation of ordering information in a number of DB2 tables within Net.Commerce. New or changed items in Net.Commerce shopping cart for each requisitioner are periodically mapped into OBI objects and vice versa. The conversion process is also responsible for triggering the built-in payment and fulfillment processing for Net.Commerce.

- **OBI object exchange with OBI buying servers:** OBI/SELL is responsible for sending OBI Purchase Order Requests to their designated OBI buying servers, as well as for receiving OBI Official Purchase Orders from trading partners'

OBI buying servers. Such message exchange must be carried out in a secure and reliable way. OBI standards mandate HTTP as the data transportation protocol and SSL as the security protocol. Once again, both server and client authentication must be used for establishing identity trust.

In order to support the above enhancement, a number of new database tables must be added to current Net.Commerce database table set, e.g.

- **RequisitionersInfo**
Captures all the information of an OBI requisitioner as described in the OBI standard. It mainly contains information derived from the digital certificate presented by a requisitioner's browser and other OBI specific information in the HTTP POST message as described in the OBI standard.

- **TradingPartnerInfo**
Maintains information regarding all of the selling organization's OBI-enabled trading partners. This should include basic information of a trading partner, such as corporate contact information, shopper entry information, as well as security contract information.

- **TradingPartnerAggreement**
Maintains information regarding the specific agreement each trading partner has with this supplier. It mainly keeps the merchant reference information mainly for EDI coding purpose, including such information as preferred official name for the merchant (as used in creating this particular store), corporate code indicator (negotiated ID or DUN), and merchant reference number in Net.Commerce etc.

- **OBIOfficialPO**
Saves OBI orders received from trading partners into a permanent storage in its original form. Such orders are conceived as a purchasing contract. This table serves as one of the bases to resolve the non-repudiation issue, since it can be used as a data exchange log for OBI/SELL

The components for the OBI/SELL are all written in Java. The Java Servlet API is extensively used to integrate these components into the web server that supports the Net.Commerce server. The components also use JDBC to access the Net.Commerce server's database engine and also the OBI-specific tables. The servlet support is provided by the servlet engine in the IBM WebSphere. Furthermore, the components also use the Java crypt framework developed at the IBM Zurich Labs to manage certificates and also for SSL communication.

3.1. OBI Workflow

Figure 2 below shows the general workflow from a requisitioner's point of view. For more detailed information and description, please refer to the OBI Model description in the OBI technical specification[2]. The scenario here is Paul, an IBMer, trying to buy a logo'ed T-shirt for a business event from a selection of corporate designated suppliers. Paul first went to the corporate purchasing homepage. From there he got a selection of goods and services. Paul chose a specific seller SmartLogo Inc. from a list of Logo'ed merchandises supplier list. Buy following the link in the Intranet homepage, Paul was redirected SmartLogo's selling server on the Internet. Paul was requested to present his digital certificate to the selling server to identify himself. Upon receiving Paul's certificate, SmartLogo realized that this Paul was actually an IBMer and sent him an IBM-specific catalog. Paul made his selection according to the catalog and submitted his order with the order button.

Paul was done with the purchasing at this point and was ready to receive the T-shirt he had ordered. Later on, SmartLogo picked up the submitted items from Paul's shopping cart, packaged them as an OBI POR and then sent it back to IBM for IBM's internal processing.

Upon receiving new PORs', the OBI/BUY server in IBM kicked off the purchasing approval request by notifying Paul's manager. When Paul's manager approves the request, the OBI/BUY server kicked off account processing for this request to assure the accounting information in the order request form. When both of these procedures OK'ed, the OBI/BUY server in IBM transformed the original POR into official PO and sent it back to SmartLogo.

At this point, SmartLogo kicked off its own accounting processing to check on the payment instruction in the PO. If acceptable, it initiated the order fulfillment process, notified Paul his order was coming and exchange invoice/receipt with IBM for final payment settlement.
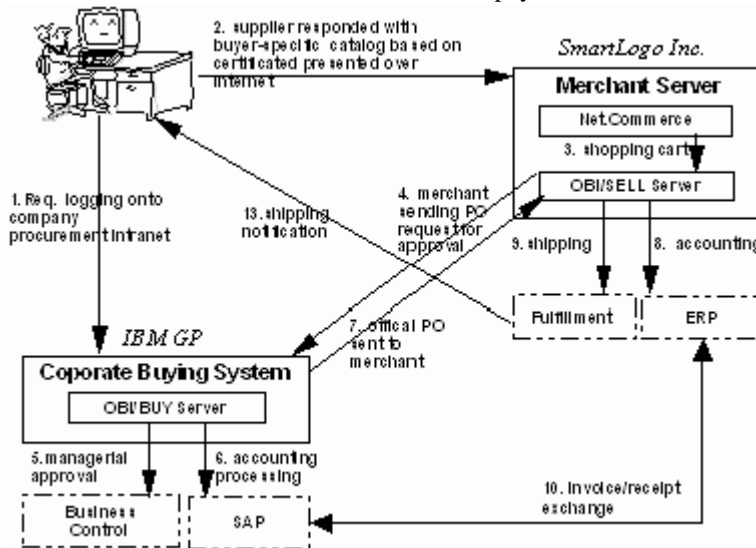

Figure 2 Business Purchasing with OBI-enabled Net.Commerce

3.2. OBI Component Design

In order to support the workflow described above the Net.Commerce server needs to be augmented with the OBI/SELL server augments with the features detailed in the following sections.

3.2.1. Digital certificate processing

The web server underlying the Net.Commerce server is enabled to handle HTTPS connections with client authentication. A requisitioner visiting the OBI/SELL Server uses an HTTPS URL (the URL refers to an OBI servlet called OBILogon) to connect to the server using a web browser. As a matter of fact, this URL is the universal entry point for all trading partners in the OBI-enabled selling solution. The web server requests for the requisitioner's digital certificate from the browser and passes it along any other information in the optional HTML POST FORM as specified in the OBI Standard to the OBILogon servlet. The presented digital certificate is verified for authenticity and validity against the issuing Certificate Authority and the information stored in the TradingPartnerInfo and TradingPartnerAggreement database table. And then the identification information in the certificate is used to retrieve information from the Net.Commerce shopper information tables and other OBI-specific database tables. The retrieved information is used to log in the requisitioner into the appropriate Net.Commerce mall or store and also

potentially present the user a catalog that is tailored
specifically to the user's organization or organizational
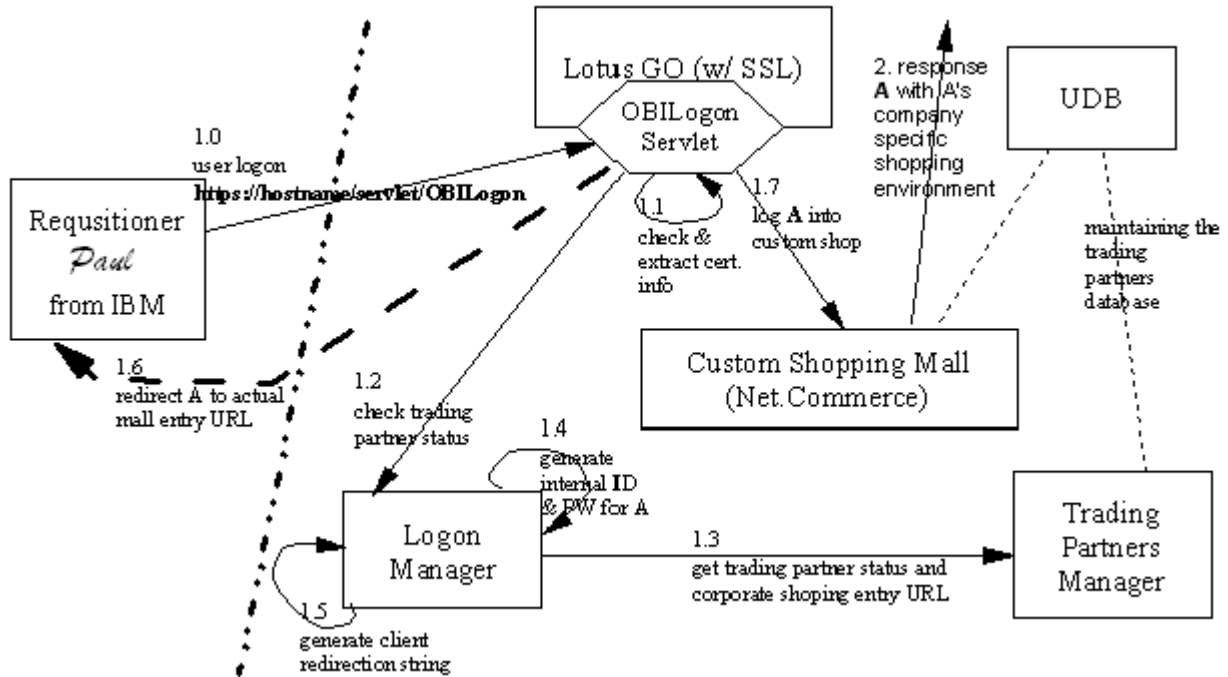
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Figure 3 Digital Certificate Based Requisitioner Processing

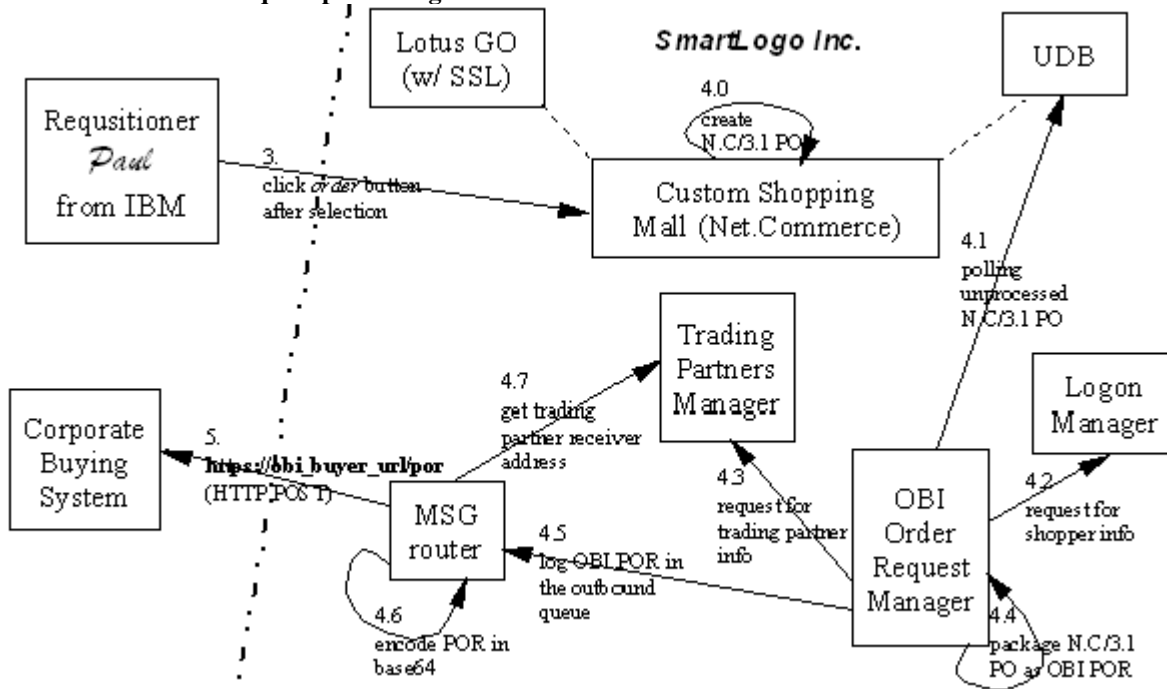### 3.2.2. Purchase Order Request processing

Figure 4 OBI/SELL Purchase Order Request Processing

This is actually one process with two steps that augment Net.Commerce order placement processing with OBI feature. First, newly submitted Net.Commerce purchase orders are periodically picked up by the OBI Purchase Order Request Daemon from the Net.Commerce shopping carts for all its shoppers. Each such order is packaged as an OBI Object (i.e. Purchase Order Request) and is

placed in a PurchaseOrderRequestQueue. The corresponding Net.Commerce order status is changed to a new state POR_OK to indicate that the order is successfully rendered as an OBI purchase order request. The message router would once again periodically pick up all these POR's from the PurchaseOrderRequestQueue and sends them to their originators' OBI/BUY servers with an HTTP POST message over an SSL link.

The message router here is primarily responsible for outbound message routing. The router follows a double-polling process in order to avoid OBI blockage of purchase order request processing in case of a network and/or database jam or breakdown. Furthermore, the router is both secure and reliable. The security is provided by the fact that router uses

SSL and client / server digital certificate authentication. It is also reliable in the sense that each message is guaranteed to be delivered to the opposite side until a HTTP 200 OK message is returned by the buying server or a maximum times of sending-retry is reached. The value of maximum retry can be configured during system installation. In the extreme case of delivery failure, an error message is logged together with the OBI object itself and the object is deleted from order request queue as required by the OBI specification. If sending successful, the corresponding Net.Commerce order status is changed to another new state (POR_SENT) to indicate that the order is received by the requisitioner's company, pending for approval.

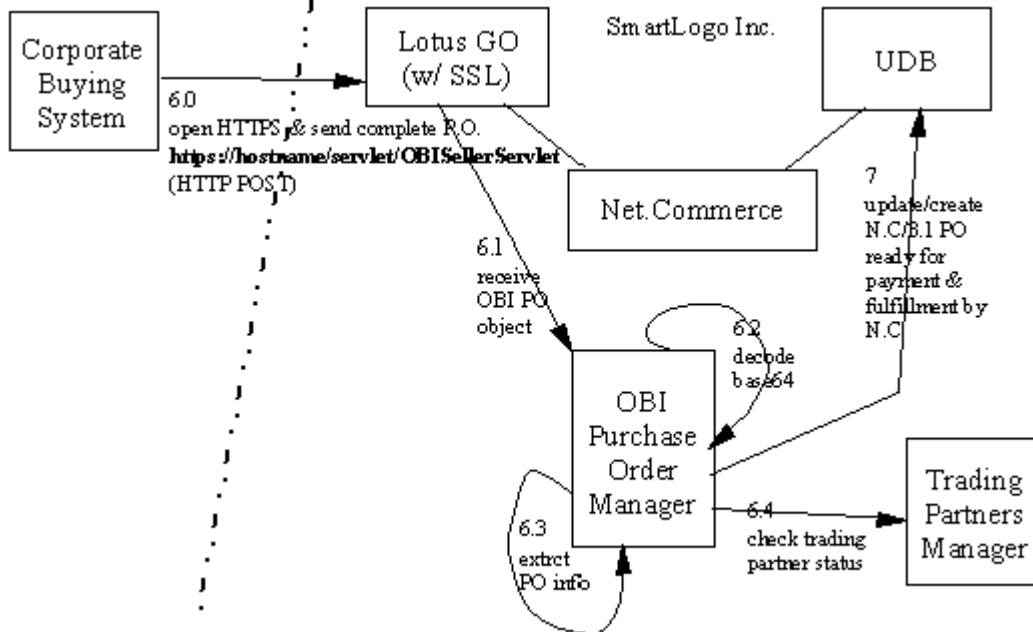### 3.2.3. OBI/SELL Purchase Order Processing

Figure 5 OBI/SELL Purchase Order Processing

This process is activated when the buying company successfully processed the previously generated Purchased Order Requests, and as a result, a matching official OBI Purchase Order arrives at the OBI/SELL server for actual notification and delivery of the goods and services ordered, and billing as well.

The OBI/BUY server sends the OBI object to the selling server as an HTTP POST message to a servlet (called OBISeller) on an SSL link. This URL also serves as the universal inbound OBI object receiver for this OBI/SELL solution for all trading partners enlisted. OBI/SELL server presents its own digital certificate to the connecting OBI/BUY server and requests digital certificate from the OBI/BUY server as well. The OBI/SELL server verifies the certificate

presented by the opposite server for identification and authentication before the OBI Purchase Order is accepted and logged in the selling server database. The OBI object is then mapped back into the Net.Commerce orders and its status is flagged as COMPLETED to indicate that OBI processing of the order has completed successfully. The Net.Commerce payment and fulfillment modules would pick up the completed order further processing

4. OBI/BUY: the OBI buying server

The OBI Buy Server requires much of the same messaging infrastructure that OBI/SELL Server has, namely, the ability to securely and reliably send and receive OBI objects. The primary distinction between

the sell server and the buy server is that the buying server must support some form of approval process and/or integration with the buying organization's back-end processes.

One of the approaches is to take advantage of the existing B2B support in Net.Commerce. Currently, Net.Commerce supports B2B shopping process by allowing orders placed by members of an organization to be approved by a designated authority (who is notified when orders are pending approval). However, this process is still entirely hosted on the seller's site. The Net.Commerce server installed on the buy side could be configured as a B2B store and when the OBI buy server receives a purchase order request it is mapped into the corresponding Net.Commerce order tables. This would trigger a notification to the approval authority (as a result of the B2B setup), who would approve or reject the order. Later, an OBI/BUY server monitoring the state of the orders would pickup approved orders and generate OBI purchase order objects. These OBI PO objects are then sent to the appropriate sell servers using HTTP POST messages on SSL links.

5. Conclusion

The OBI standard provides a general system architecture and message protocol to enable smooth business-to-business e-Commerce transactions to be conducted on the Internet. We designed and implemented our OBI/SELL server and OBI/BUY server as add-on components on top of an existing merchant server, namely Net.Commerce, to facilitate OBI transactions. Our OBI solution was successfully demonstrated at the OBI Action Showcase in the ICE EXPO'98 in Los Angles for both its functionality and inter-operability with all other participating vendors, including other major players like EPIC, Microsoft, and Netscape etc. A first OBI/SELL pilot was also successfully demonstrated with SciQuest Inc.

References

[1] OBI Consortium, "Open Buying on the Internet (OBI) Standard, release V1.0", May 1997
[2] OBI Consortium, "Open Buying on the Internet (OBI) Technical Specifications, release V1.1", June 1998