Open Buying on the Internet and Extensible Markup Language

Recommendations on Adoption by the Federal Government

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Prepared for the General Services Administration pursuant to GSA Contract GS-23F-9737H.

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Executive Summary

Today the federal government and, indeed, the world's businesses, stand on the brink of a technological revolution that could affect purchasing and financial activities for years to come.

What brings us to that point, in our opinion, is the confluence of three activities:

- The virtual explosion in the number of Internet users and Internet capabilities
- A worldwide move toward procurement over the Internet
- The development of extensible markup language (XML) as a useful tool for moving information over the Internet.

As keen observers of the foregoing activities, the federal Electronic Commerce Program Office asked the Logistics Management Institute to study open buying on the Internet (OBI), a specific architecture that some companies are embracing, and XML. We were asked to assess whether OBI and XML are appropriate for the federal government, and if so, where they might be used in the federal purchasing and finance operations. This report provides our answers.

Purchasing over the Internet, as a *concept,* portends, in our opinion, the wave of the future. Accordingly, we see an ever-increasing use of open buying techniques over the Internet. We note also, that recent changes in procurement regulations will facilitate the government's move to using the Internet more and, one would assume, to using OBI more.

However, when we examined the specific OBI model developed by the OBI Consortium, we found that its structured approach to the purchasing process limited its potential to a very narrow band of purchase transactions. That, we believe, is due to the vast majority of purchases that fall into the "micro" category for which the government already has simpler procedures in place. In addition, large federal procurements are often far too complex to be purchased using the OBI model.

Also, important is the fact that the OBI model is not directly compatible with federal purchasing procedures and would require reengineering to implement. Therefore, OBI is not recommended for the government to adopt because it is not applicable in a sufficient segment of federal purchasing and is not consistent with federal procurement processes.

We believe that XML technology will provide the government with another way of reaching trading partners with electronic information. The government can use XML as a single solution (technical specifications, business standards, and common protocol-based applications) to end-to-end data exchange requirements on a single architecture. We see XML as another tool in the government's electronic business toolkit. We do not see XML as competitive to the concept of electronic data interchange (EDI). We also see a continuing role for traditional EDI technology as embodied in existing public standards, when that technology is or could be used effectively and efficiently to move information between applications. However, we do see a trend toward, and the applicability of, using XML by trading partners who are transitioning to a Web-based end-to-end architecture, or who do not, should not, or will not adopt traditional EDI. The vast majority of small businesses resisted implementing traditional EDI, desiring something simple and less costly.

The most difficult issue addressed in the report is recommending the correct selection of XML technical specifications, competing business standards, and competing XML-based applications. If the government is looking for a "winning" XML technology, we must report that it is too early to predict which one or ones of the competing standards, products, and methodologies will emerge successfully from the myriad groups addressing the XML technology.

We believe that the best hope for standardizing XML globally lies in a recently announced United Nations (UN) initiative. That initiative joins together to focus on global XML standards issues, the UN, a group known as OASIS (Organization for the Advancement of Structured Information Standards), and, by invitation, all of the world's XML players. A "kick-off" meeting was held in November 1999. We encourage the federal government to support the UN/OASIS XML initiative by actively participating in it.

Clearly, the federal government could use XML in virtually all places, internal and external, where purchasing and financial information is exchanged electronically. However, committing to a specific "combination" of XML technical and content specifications is still premature. Rather, we recommend continuing and expanding pilot projects with the private sector through which the government will obtain information vital to deciding what aspects are ready for implementation. We also recommend that agencies feed the process and share experiences.

XML could apply to many areas of purchasing; however, no single standard exists today. The General Services Administration (GSA) represents the federal government in influencing the development of these XML standards by direct

membership and participation in the various industry consortia. GSA should increase its participation in several key industry associations, consortia, and standards organizations to represent federal requirements and to influence initiatives for developing standards. Among our recommendations on OBI and XML, and in addition to ones mentioned in this summary, we want to highlight the following as being particularly significant:

- Before using OBI or inserting XML technology, the current purchasing and financial business processes must be reengineered to maximize return on investment.

- Buying on the Internet, coupled with credit and debit card methods of payment, should be encouraged as much as possible until all qualifying federal purchases are processed that way.

- Buying on the Internet will be greatly facilitated by using electronic catalogs. Accordingly, we would like to see the government articulate a standard set of minimal information needed to use an electronic catalog as the basis of a valid procurement.

- Catalogs should be grouped together into electronic malls to facilitate comparison and the malls should be consolidated by commodity type to achieve economies of scale and to avoid duplicating efforts.

- XML is an important technology. The federal government should work toward coalescing the varied XML business standards groups into a single global effort focused on developing universally agreed upon XML standards.

The federal government, in partnership with industry, should seek ways of using XML to streamline business processes, particularly for trading electronically with small- and medium-size enterprises.

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Chapter 1
Introduction

On March 31, 1999, the Logistics Management Institute (LMI) received an order from the General Services Administration (GSA) to "*provide support in conducting research and analysis on open buying on the Internet (OBI) and extensible markup language (XML), including making recommendations on adoption by the Federal Government.*"[1]

FOCUS OF THE WORK

Over the past several years, federal government managers who oversee electronic commerce (EC) have observed the emergence of OBI purchasing and XML technology. It follows then, that those managers, sensitive to ways of doing business electronically, would want to know if OBI or XML would be more economical and efficient than the current ways the federal government purchases and finances those purchases.

If using OBI or XML could result in operational economies and efficiencies, then the federal government, through its Electronic Commerce Program Office (ECPO), should develop a vision and plan its implementation strategy. Concurrent with that implementation planning, two other significant steps will have to be taken in order to optimize the chance of a successful technology insertion:

- Plan to change the way the federal government does its purchasing and financing
- Obtain the funds necessary to support inserting the next generation of technology.

PURPOSE OF THE REPORT

Our report must address two fundamental questions:

- Should the federal government adopt OBI as a way of improving purchasing and financial operations?
- Should the federal government adopt XML as a way of improving purchasing and financial operations?

[1] General Services Administration order for supplies and services, number A00C99AM0064, dated March 31, 1999, with its accompanying statement of work; account number K84666198; signed by Donna C. Hughes, contracting officer.

To give a context to the questions, the ECPO developed a statement of work (SOW) that formed the basis of the order to LMI.

STATEMENT OF WORK

The SOW required that LMI apply its technical expertise to address four OBI and XML implementation issues:

1. How to meet the functional requirements in the procurement and finance areas through the use of OBI and XML.

2. Coordination of OBI and XML with other standards such as EDI, that have been sanctioned and/or adopted by the Federal Government.

3. How the Federal Electronic Commerce Standards Management Coordinating Committee (FESMCC) might add OBI and XML as part of its existing infrastructure.

4. Identification of procurement and finance policy issues that need to be addressed for the adoption of OBI and XML.

To address the issues, the SOW required LMI to take six actions:

1. Perform research and analysis on the Federal Government procurement and finance processes using GSA as the representative agency to determine how those functional areas should, if appropriate, adopt OBI and XML to realize the most benefit.

2. Determine and recommend how OBI and XML would work with other standards, such as EDI, within the Federal Government.

3. Identify policy issues in the procurement and finance areas that may need to be addressed for the adoption of OBI and XML.

4. Analyze the impact on the Federal Government of the World Wide Web Consortium, RosettaNet and CommerceNet strategies and standards with regard to OBI and XML.

5. If OBI and XML are adopted, provide an analysis and assessment of the vendor base, small businesses and specific industries that work with the Federal Government.

6. Recommend how the FESMCC might add OBI and XML to its infrastructure to support the member agencies and work groups.

The SOW concluded by requiring a report containing our research, analysis, findings, and recommendations.

ELECTRONIC COMMERCE PROGRAM OFFICE GUIDANCE

During the study, LMI personnel met several times with representatives of the ECPO. During the meetings, we determined that the report also had to address the following four issues:

1. Findings, conclusions, and recommendations on OBI and XML
2. Vision of how migration should take place
3. Use of the existing EC and EDI system architectures and how future EC and EDI technologies could be inserted into government purchasing and finance so it will be seamless and transparent to the user community
4. Barriers to implementation.

During the discussion with the ECPO personnel, we came to understand that they wanted to be able to use the report to drive the behavior of government departments and agencies. We believe this report accomplishes the required objectives.

REPORT ORGANIZATION

The report contains four chapters and six appendixes.

Chapter 1 introduces the objectives of the report.

Chapter 2 covers the subject of OBI. This chapter answers the question "What is OBI?" It also describes how OBI system architecture works, its operational benefits, and its drawbacks. The chapter continues with discussions on where OBI can be used in the federal government. Barriers to implementing OBI also are covered in the chapter. The chapter concludes with our findings, conclusions, and recommendations. The chapter references Appendix A, which discusses OBI technology in more detail.

Chapter 3 discusses XML. The chapter is structured much the same way as Chapter 2, but in this case, answers the question "What is XML?" It describes how XML system architecture works, its operational benefits, and its drawbacks. The chapter continues with a discussion of where we believe XML can be used in the federal government, including barriers to implementation. The chapter concludes with our findings, conclusions, and recommendations. This chapter works in conjunction with Appendix B.

Chapter 4 describes a "vision" of the future and a strategy for getting there.

Appendix A describes technical details about OBI.

Appendix B describes technical details about XML.

Appendix C summarizes the workshop hosted by LMI and the separate interviews conducted by LMI in conjunction with our study. In this appendix, we summarize the comments of the workshop participants and the people we interviewed.

Appendix D is a bibliography of selected references we used for developing this report.

Appendix E is the glossary.

Appendix F is a list of abbreviations.

CONDUCT OF THE STUDY

In preparing this report, LMI gathered information from a number of different sources and then formulated findings, conclusions, and recommendations. A detailed list of sources is in the bibliography. In conducting the study, we used the following approach.

- *Interviews.* We interviewed Ms. Teresa Sorrenti, GSA, about OBI, XML, and the role of the FESMCC; Mr. Charles Nethaway, the Department of Interior, about their EC program; Mr. Ken Stepka, National Aeronautics and Space Administration (NASA), about their EC program; and Mr. Kevin Shaver, Business Commerce Solutions, about the Department of Energy's OBI program. We also interviewed Mr. Bill Gormley, Ms. Carolyn Alston, and Ms. Teresa Sorrenti, GSA, about their EC program and goals.

- *Internet research.* Representatives of the ECPO encouraged us to research the Internet for RosettaNet, CommerceNet, the OBI Consortium, Electronic Processes Initiatives Committee, and the agency strategic EC plans. We researched a number of other Internet sites, which are referenced throughout the report and in the bibliography.

- *Policy research.* We researched several federal procurement and finance policies, which are referenced throughout the report. The policies are the National Performance Review (NPR) recommendations, Federal Acquisition Regulation, Presidential Executive Orders, and Federal Procurement Data System Report. Specific details on each of the sources are in the report.

- *Interview workshop.* Representatives of the ECPO invited various agencies to the OBI-XML workshop held at LMI in June. LMI developed a set of questions to test the hypotheses about OBI and XML and asked the attendees questions. (See Appendix C for details on the workshop and a

list of attendees.) We documented the results of the interview workshop, which are referenced throughout the report.

- *Formulation of conclusions and recommendations*. As we researched and conducted interviews, members of the OBI-XML team met a number of times to discuss findings. With the functional knowledge of federal procurement and finance and corresponding knowledge of federal policy and regulations, the team formulated conclusions and recommendations for the report, then determined a vision and strategy for the ECPO.

Chapter 2
Open Buying on the Internet

This chapter covers open buying on the Internet. In this chapter, we answer the question "What is OBI?" We discuss issues surrounding the OBI architecture by describing how OBI works. We examine OBI operational benefits and drawbacks. The chapter contains sections covering where we believe OBI might be used in federal government acquisition and what we see as the barriers to implementing OBI. The chapter concludes with a discussion of our findings, conclusions, and recommendations.

TERMINOLOGY

As used in this report, the terms "buying on the Internet" and "open buying on the Internet" are not synonymous. The term "buying on the Internet," as we use it, refers to generic, nonspecific ways that the Internet can be used to facilitate purchasing, and in some cases, finance activities. The term "open buying on the Internet," (abbreviated and hereinafter referred to as OBI) always refers to the specific architecture for buying over the Internet that was developed by the OBI Consortium, now managed by CommerceNet.

The substantial part of this chapter deals with the OBI Consortium-developed OBI standard that consists of both a transaction flow model and supporting architecture. Much of our work was based on the Consortium's version 1.1. Recently, the Consortium published version 2.0. Version 2.0 mainly improved known implementation shortfalls in version 1.1. Version 2.0 reorganized the structure to help eliminate duplication of content, correct inconsistencies, and improve flow. It changes the optional or mandatory status of some segments and data elements. The new version added some optional profile information needed by supply catalogs. It added a year 2000 (Y2K)-compliance statement. The main scope and operation of OBI remains the same. Before moving too far into the discussion of OBI, the reader must understand something about OBI. The following paragraphs are designed to help that understanding.

WHAT IS OBI?

Open buying on the Internet (OBI) is

- a standard used to purchase over the Internet;
- an architecture that may be used with a variety of software packages, other facilitating technologies, or adopted by third-party vendors; and
- not in-and-of-itself either software, a technology, or a vendor.

The concept of OBI is intended to accomplish two primary ends:

- Increase the number of vendors and the number of items available for purchase
- Simplify the procurement process.

OBI defines a capability for selling and buying organizations to directly interact using the Internet as the communications medium. OBI, as defined by the OBI Consortium, is one architecture for buying on the Internet.

The self-stated purpose of the OBI Consortium specification is to provide a standard framework for secure and interoperable business-to-business Internet commerce. The initial focus is on automating high-volume, low-dollar transactions between trading partners for the goods and services needed for maintenance, repair, and operations (MRO). MRO transactions account for an estimated 80 percent of most organizations' purchasing activities.[1]

The OBI Consortium defined an architecture that incorporates EDI on the basis of the transmission of an American National Standards Institute (ANSI), Accredited Standards Committee (ASC) X12 transaction set (TS) 850 Purchase Order, version 3040, over the Internet.

We now turn our attention to the foundation of OBI to examine briefly the content of that standard.

The Foundation of OBI

The foundation of OBI lies in developing standards by which businesses can conduct purchasing and payment transactions via the Internet. The primary goal of OBI is to develop open, publicly documented standards that organizations can use to conduct business. Furthermore, the OBI standard is meant to provide competition to all organizations (buyers, sellers, hardware providers, software providers, and payment processors) that subscribe to the OBI model by establishing the open architecture.

[1] http://www.openbuy.org/obi/library/white-paper.html.

The OBI standard purportedly solves issues of

- security,
- cataloging,
- user login,
- transaction type, and
- transaction format.

Next, we examine the issue of data location. This issue deals with the alternative methods of storing catalogue information upon which purchases will be made. It is relevant here because some federal uses of electronic catalogues differ from the OBI standard.

Location of Data

In the business-to-business world of electronic commerce, there has been substantial debate about where certain information resides.

For example, if a company needs to purchase a product from Vendor A (the selling organization) and the company is using the Internet, that company will need a unique login identification code (ID) for Vendor A, which often is maintained by the vendor.

If the same company needs to purchase over the Internet from other vendors, it will need a unique login ID for the other vendors, again, often maintained by those vendors.

The OBI standard calls for the IDs (or certificates) to be maintained by the buying organization rather than the selling organization so that one certificate can be used with multiple vendors. OBI policy also states that each selling organization is responsible for maintaining its own catalog.

Although seller-maintained catalogs is the emerging standard for Internet purchasing, it is not the model for some of today's purchasing systems, including the GSA *Advantage!*™ system. In those systems, catalogs are maintained by the buying organization and are often X12 EDI-enabled for commodities and prices.[2]

Let's now turn our attention to the OBI architecture by examining its four major component parts.

[2] Although seller's provide updated information to GSA for GSA *Advantage!* catalogs, GSA still maintains the database upon which those catalogs reside.

OBI ARCHITECTURE

The OBI architecture can be viewed as consisting of four entities (Figure 2-1):[3]

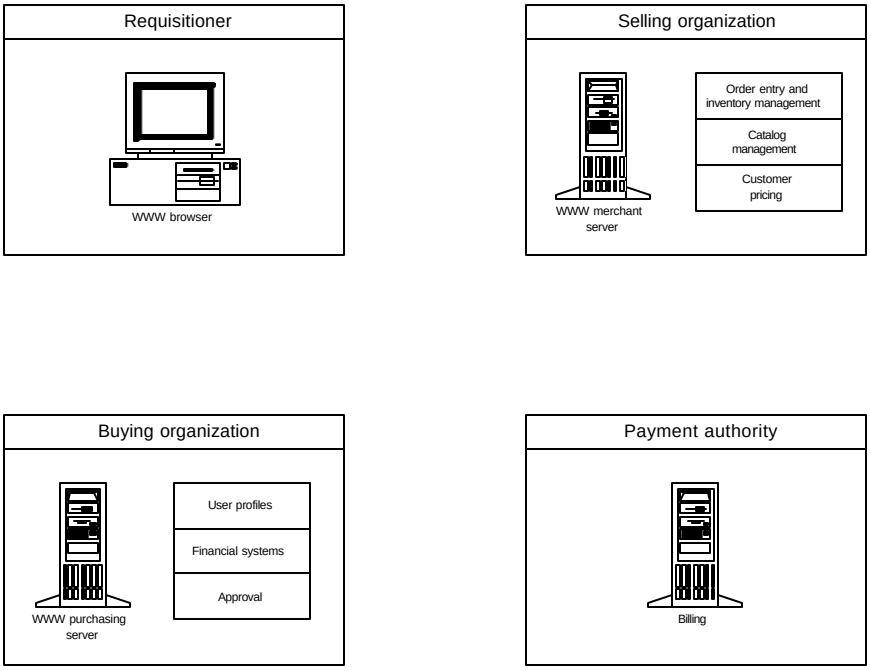
1. *Requisitioner*—The end-user of the system; the person who actually places the order. A requisitioner is affiliated with a buying organization.

2. *Buying organization*—Represents purchasing management and the information systems that support purchasing. The systems include an OBI server for receiving OBI order requests and returning OBI orders. The buying organization also negotiates and maintains contractual relationships with preferred selling organizations.

3. *Selling organization*—Maintains a dynamic electronic catalog that presents accurate product and price information. The catalog must be integrated effectively with inventory and order management systems and an OBI server for sending OBI order requests and receiving OBI orders.

4. *Payment authority*—Provides authorization for the payment vehicle presented by the requisitioner.

Figure 2-1. Four Entities in the OBI Architecture



In the current OBI architecture, a requisitioner uses a Web browser to interact with an electronic catalog at a selling organization. When the requisitioner places a preliminary order, the selling organization transmits an order request to the

[3] http://www.openbuy.org/obi/library/white-paper.html.

buying organization's purchasing server for approval and/or additional information. The buying organization may approve or reject the order. Since the order is received electronically, the buying organization can automatically feed the order through an internal workflow approval process if it so chooses. If approved, the completed order is returned by the buying organization to the selling organization.

Having mentioned several issues being resolved by the OBI architecture, it is now useful to look at how OBI can work in a notional federal government public procurement process.

THE OBI PROCESS

The steps listed below describe Internet purchasing using the OBI architecture:

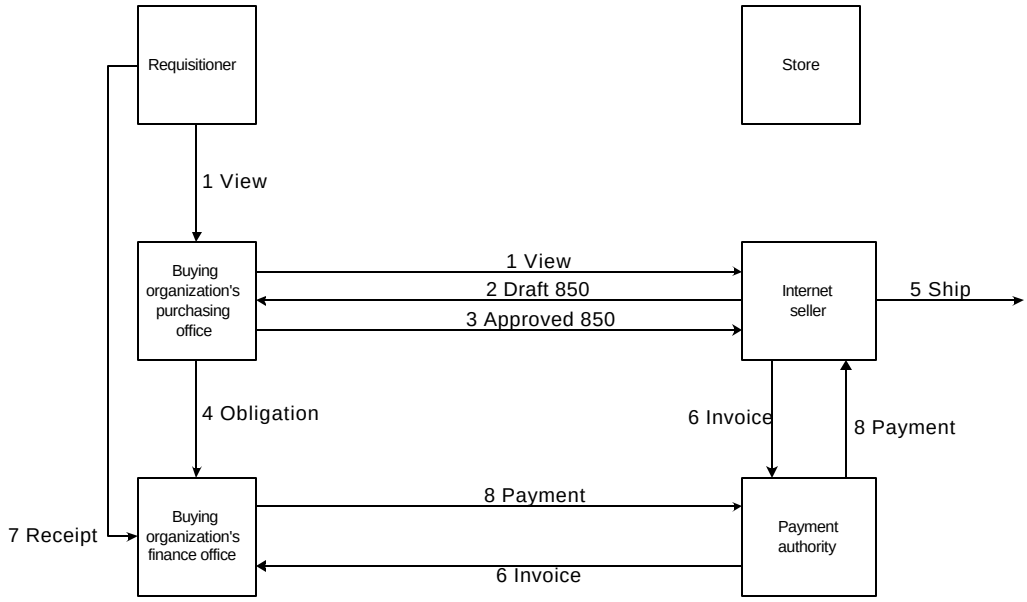
- Requisitioner logs on to company Intranet and goes to the "Purchasing Home Page" (Point 1 in Figure 2-2).
- The "Purchasing Home Page" validates the requisitioner's authority and uses a profile to determine where and what can be bought, and how much can be spent (Point 1 in Figure 2-2).
- The requisitioner, or in some cases a purchasing agent, then clicks an icon denoting a commodity type (for example, lab supplies) (Point 1 in Figure 2-2).
- The requisitioner is presented with a list of the preferred vendors (Point 1 in Figure 2-2).
- The requisitioner can then click on the vendor icon (for example, VWR Scientific) (Point 1 in Figure 2-2).
- The requisitioner views the VWR catalog, which is actually resident on the seller's site. The catalog may include information about buying organizations, discounted prices, and the like. The viewed catalog may only include items that are under contract (Point 1 in Figure 2-2).
- After the requisitioner selects all of the items needed, the requisitioner indicates that the session is completed. At that point, the seller sends an order request, using TS 850, to the requisitioner's manager for approval (Point 2 in Figure 2-2).
- The requisitioner's manager approves the order and electronically transmits a completed TS 850 purchase order to the seller (Point 3 in Figure 2-2).
- Billing data is transmitted from the buying organization to its supporting finance office (Point 4 in Figure 2-2).

- After fulfilling the order, (point 5 in Figure 2-2), the seller submits an invoice to the payment authority (Point 6 in Figure 2-2).

- The payment authority can be either the buying organization's finance office or, if a credit card is used to effect the purchase, a credit card company. If an invoice is submitted to the buying organization's finance office, the payment authority block would be eliminated on the diagram. The finance office can receive an invoice and make a payment to either a vendor or to a payment authority (e.g., a credit card company). A payment authority can receive a credit card purchase notice and make a payment to a vendor and also send an invoice to and receive a payment from a finance office (Points 6 and 8 in Figure 2-2).

- The organization's internal procedures of obligation, status reporting, receipt, and payment remain the same (Point 7 and 8 in Figure 2-2).

Figure 2-2. OBI Process



Now, with a clearer understanding of what OBI is, what it is not, and how it is designed to work, we can turn our attention to what we see as the benefits and drawbacks of using OBI in federal government purchasing and finance operations.

BENEFITS AND DRAWBACKS OF OBI

In this section of the report we draw heavily on comparisons between existing paper-based and electronic ways of performing procurement and finance activities. In addition, we factor in comments made by attendees at a workshop hosted by

LMI and one-on-one interviews with knowledgeable federal managers (covered in depth in Appendix C of this report).

We believe that OBI is an acceptable architecture for accomplishing the mission for which it was designed. However, we must determine if OBI assists the government in performing its purchasing and finance functions.

Put another way, we must determine if OBI, in its present or changed form, will afford the government an opportunity to achieve economies and efficiencies in its purchasing and finance operations when compared with current and projected ways those functions will be performed.

Benefits of OBI

- The OBI Consortium has developed an architecture that follows one of the many traditional, private-sector procurement procedures. The OBI model enables an organization to purchase items on the Internet and to electronically insert the transaction into the organization's procurement system. Inherently, this methodology introduces some degree of economy and efficiency into purchasing operations.

- Because the OBI order format specification is designed to support high-volume, low-dollar transactions for nonproduction goods and services that are based on existing trading partner relationships, the format is not burdened by excessive details that often add to the content of a traditional contract or order.

- Although the OBI model requires companies to implement EDI for transmitting order requests and orders, the exchanges contain only a minimal set of data. An OBI order is substantially reduced in size from that of the traditional EDI-based order.

- OBI specifies that data and processes be maintained and managed by their logical owner. Purchase authorizations and profiles are, therefore, managed by buying organizations while catalogs and order processing are managed by selling organizations. This configuration eliminates the need for unique purchaser login IDs for each seller, rather the seller authenticates the purchaser according to the profile maintained by the buying organization.

- Adopting OBI for organizations that do not currently follow its business model will compel changes in business processes and practices. The changes, to the extent that they are used to effect some purchases, will make those purchases more economical and efficient.

Drawbacks of OBI

- By design, OBI only supports part of the procurement process. OBI is only involved with the purchase request, approval process, and award procedures. OBI does not specifically address pre-purchase and post-purchase federal government business processes. It does not address issuance of request for quotes, receipt of quotes, financial actions, contract management, delivery status, or receipt.

- The current OBI model will require establishing new interfaces with the federal government purchasing process for small purchases. The process must be adjusted so the requisitioner's computer can be routed through the purchasing office computer to the vendors. The process must be adjusted to receive the draft 850 transaction from the vendor, which conflicts with the X12 standard. The process must be adjusted to approve the draft 850 (receipt of quote) for which the request for quote is not recorded. After the draft 850, which is different from the established TS 843 procedure, is approved, it must be changed into a normal 850 purchase order. Again, this is a change from the procedures established for the 843. Federal purchasing and information technology (IT) managers suggest that they are not keen on making, nor are they funded to make, dramatic changes to current operating methods or legacy systems. Clearly, adopting OBI will require some fundamental changes in business processes and practices.

- Trading partners must use EDI as the syntax of data exchange. Historically, process owners in the federal government have not fully embraced using EDI and, in our opinion, private-sector vendors who routinely sell, or try to sell, to the government have not been enthusiastic about adopting EDI. Not all federal trading partners are EDI-capable.

- The OBI model is based on a requisitioner first selecting a supplier (sole source) and then searching for a product. That scenario supports some federal government purchase levels and techniques, but not all. The model could be changed to allow for a robust method of competitive shopping by adding more search criteria, such as price, delivery data, and availability.

- The OBI model is limited. Operational support could be significantly improved by adding other functionality to the OBI architecture. The additions include the procedures for invoicing (X12 TS 810) and electronic funds transfer (perhaps using the TS 820) to automate the payment process. The lack of those systemic applications in the current OBI model may be a benefit to some organizations that do not want to change their pre- and post-business processes. It also makes the OBI process simpler and accordingly encourages greater participation from small- and medium-size businesses.

- The OBI model requires using an OBI-specific object. A better approach would be to use an secure (S)/multipurpose Internet mail extension (MIME) object. The S/MIME object offers the same functionality but is based on more universally accepted Internet standards.

- OBI does not follow the X12 EDI standards in its process flow. In the OBI model, the seller sends a draft X12 TS 850 to the buyer. EDI X12 standards identify the 850 as a purchase order from the buyer to the seller. This is the opposite directionality from that used by OBI. To the current EDI translation software, the seller appears to want to buy the item from the buyer. The buying office, which in a traditional X12 EDI standards process flow is the transmitter of an X12 850 EDI order, will have to change its application software to be capable of processing an inbound EDI 850 order. To resolve the problem of directionality, we recommend the OBI Consortium look at adopting other X12 transaction sets. For example, X12 TS 843, "Response to a Request for Quotation," seems more appropriate and is the accepted EDI transaction for this action.

- The OBI X12 850 transaction was designed intentionally for high-volume, low-dollar transactions. The OBI X12 TS 850 format does not support other types of federal government purchases. The format has explicitly not been designed to support the coding of traditional purchase orders, which include terms and conditions, significant line-item detail, complex delivery schedules, and detailed shipping instructions. The format also has not been designed to support complex, high-dollar transactions or the acquisition of production goods and services.

- The current OBI X12 TS 850 transaction set is developed in version 3040. This is an old version of EDI. The federal government standard base version is version 3050, a later version. However, many agencies use even later versions, such as 3070 and 4010.

Having listed some benefits and drawbacks of the current OBI model, we must now answer the question of whether or not there is a place for OBI in the federal government.

WHERE COULD OBI BE USED IN THE FEDERAL GOVERNMENT

In this section, we examine the procurement process in terms of its governing monetary thresholds to determine if and where OBI could be used.

Procurement

The format of OBI is not consistent with the federal government's current procedures for making either a small or large public purchase. The OBI model, in its

operational aspects and data flows, aligns itself closer to the traditional way the commercial companies process purchases. The main similarity is the use of the TS 850 to place purchase orders.

Having said that, OBI can provide the federal government with two services:

- It can facilitate the availability of electronic catalogs for buying on the Internet.
- It can automate the approval (if necessary), and award procedures for purchases.

But are those services needed in either today's or tomorrow's federal government purchasing environment?

To properly evaluate OBI and answer the question of where it could be used, we need to look at recent acquisition reforms and their impact on the future buying methods of the government.

Acquisition Reform

In the last few years, various executive and legislative acquisition reform initiatives have dramatically recast the federal procurement process. Of particular interest to the question of where to use OBI are those reforms dealing with simplified acquisition. Under the new simplified acquisition policies, thresholds (simplified acquisition thresholds [SATs]) have been established that use different procedures (simplified acquisition procedures [SAPs]). The established SATs are

- "micropurchases of under $2,500,"[4] and
- "simplified acquisition purchases up to $100,000 except…."[5]

Federal procurement now uses a more decentralized purchasing approach. Enactment of the Federal Acquisition Streamlining Act (FASA) of 1994 in response to NPR initiatives[6] moved purchasing authority for small-dollar-value items from central purchasing to the project offices, shops, and labs where most purchase requirements are generated. FASA empowered customers of the traditional procurement process to make their own buys when the purchase was valued at $2,500 or less. The preferred method of acquiring small-dollar-value items under decentralized purchasing is through an order from a Web-based electronic catalog using a government purchase card. This preference is stated in both the FAR [7] and

[4] Federal Acquisition Regulation (FAR) Part 2-101.

[5] FAR Part 2-101.

[6] NPR Recommendation PROC09, Lower Costs and Reduced Bureaucracy in Small Purchases Through the Use of Purchase Cards, Creating a Government That Works Better and Costs Less. The Report of the National Performance Review, Vice President Al Gore, September 7, 1993.

[7] FAR Part 13.003(e), 13.201(b).

an Office of Management and Budget memorandum.[8] The OBI procurement architecture relies on a traditional procurement model where the requisition or purchase request is routed to a central purchasing office for action. Any OBI application to federal purchasing will be limited to requirements greater than $2,500, which represents less than 15 percent of federal purchases.[9]

Those acquisition reforms alone suggest that there are simpler, more efficient ways than OBI for effecting conforming purchases. Why? Because the SAP has significantly changed procurement operations. The number of micropurchase transactions has grown to more than 85 percent of total purchases. Simplified acquisition is well over 90 percent of all transactions. These high percentages are caused by numerous factors:

- Agencies no longer need to maintain as many items in stock. They can get items quickly, without appreciable paperwork.
- Agencies are now ordering "just-in-time" supplies.
- Micropurchases are not subject to most restrictions of the Small Business Act and Buy American Act.[10] That results in more sellers being available.

OBI was designed, and *could* be used, in making micropurchases and small-dollar-value purchases. However, because a substantial number of small and micropurchases already can be made by using the simpler techniques, and because those account for all but a few percentage points of all federal purchases, we see little justification for overlaying the OBI architecture on those purchases. Additional advantages and barriers to using OBI for small and micropurchases are covered later in this chapter.

Current Federal Purchase Card Procedures

Two current functions are being performed with the federal purchase card. The first is simply a form of payment. The second is a procedure for using the purchase card for both procurement and payment.

The first function uses any traditional procurement process to pay for the purchases up to the limits of purchase cards. The purchase card is used solely as a means of payment. It can be used to fund purchase orders, contracts, Internet sales, etc. GSA *Advantage!* uses purchase cards as one of its payment methods. Under purchase card payment, the procurement and the necessary financial actions are already established.

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[8] Office of Management and Budget (OMB) Memorandum of March 14, 1997, Subject: "Electronic Catalog."

[9] *Federal Procurement Data System Federal Procurement Report Fiscal Year 1998 through Fourth Quarter*, dated October 1, 1997 through September 30, 1998.

[10] Public Law (PL) 103-355 Section 4301(b).

The second function combines both procurement and payment into one process by using just the purchase card. This is the micropurchases procedure that performs both procurement and payment. No procurement personnel or processes are involved in this operation.

Traditional contract procedures have proven expensive for federal micropurchases. Acquisition reform has allowed organizations to move away from the traditional procedures for micropurchases. The purchase card is the preferred method for purchasing and paying for micropurchases.[11] The federal strategic position (i.e., target) for purchase cards is that they will account for 90 percent of Internet and other high-volume, low-dollar purchasing and transparent end-to end back room purchasing by the year 2000.[12]

Most of the government agency EC plans we reviewed, and most of the EC managers we spoke with, indicate an expected increase in the use of the purchase card. Adopting "smart card" and "smart pay" processes are but some of the efforts being taken to expand this use. The government also is working with the purchase card companies to improve the amount and quality of invoice information to more tightly control the use of the cards and to reduce or eliminate the possibility of abuse.

We were not tasked to evaluate the advantages or disadvantages of the purchase card operation. Congress and the administration have directed that purchase cards be used. Purchase card procedures have been approved and are operating. Purchase cards are the government's desired method of procuring micropurchases. We believe using purchase cards is the correct path to take. Accordingly, following that path tends to be antithetical to the wholesale adoption of the current OBI model.

What are the advantages of using purchase cards?

- The micropurchases never enter the procurement system.
- The requisitioner and vendor are in direct contact either in person, by telephone, or over the Internet.
- Direct contact results in an offer and acceptance, which forms an implied contract.
- No formal contract, with all of its regulatory requirements, is needed.
- The process saves both time and effort.
- Approval to purchase is given by issuing the purchase card.

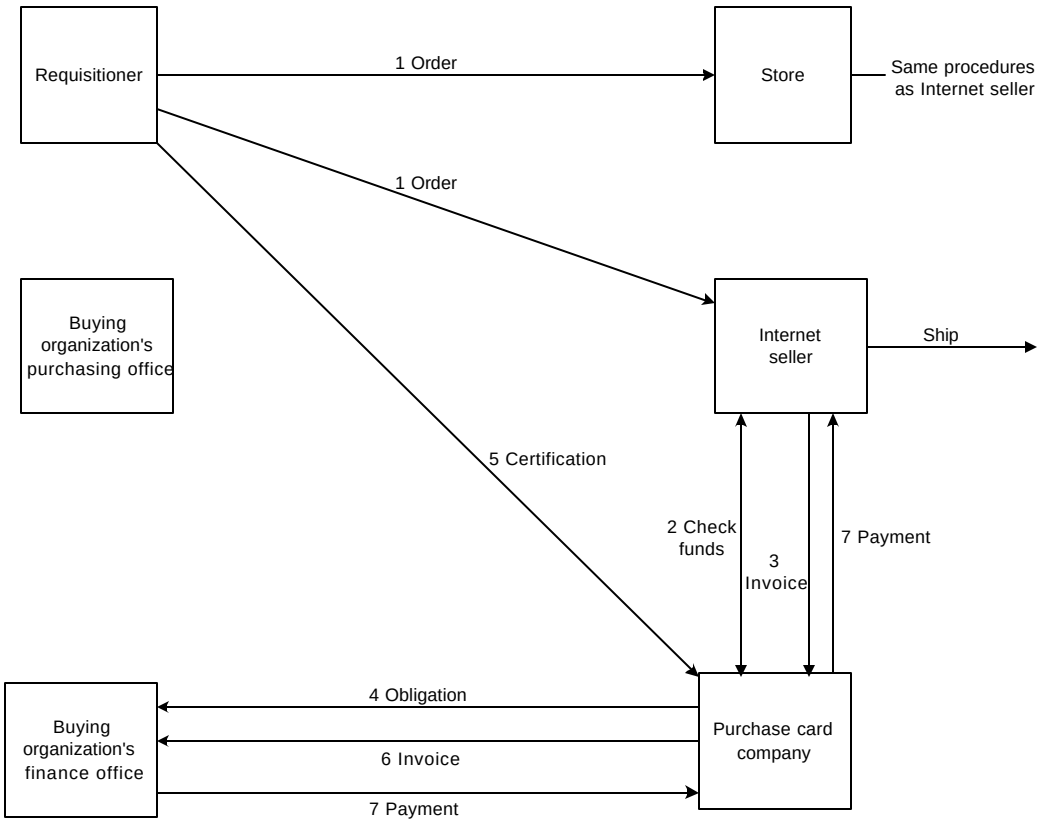
[11] FAR Part 13.201(b).

[12] OMB report, *Electronic Commerce For Buyers and Sellers: A Strategy Plan for Electronic Federal Purchasing and Payment* March 1998.

- Commitment and obligation are performed automatically; either as a pre-set amount at the beginning of the month or on an actual value basis at time of sale.
- The requisitioner (purchase card holder) administers the contract and verifies receipt of goods by keeping track of purchases.
- The requisitioner performs receipt notification by certifying the purchase card statement.
- The requisitioner takes whatever actions are necessary under the purchase card system, thus obviating the need for support by a procurement office.

The general process for purchase card operations is shown in Figure 2-3. The figure shows a comprehensive overview of a typical transaction.

Figure 2-3. Purchase Card Process



No single standard purchase card procedure exists in the federal government; rather each department has developed its own procedures. However, their procedures generally follow the same concept. Typically, each purchase card holder is given a monthly spending allocation, a per purchase limit, and accounting data. The purchase card holder then can purchase items from any approved source.

None of the actions in the process described below necessitates using the purchasing office.

- The purchase card holder may go to a local store or use the Internet to place an order (Step 1 in Figure 2-3).
- Once the purchase card holder makes a purchase, the seller checks with the purchase card company before shipping to ensure that funds are still available from the purchase card holder's allocation (Step 2 in Figure 2-3).
- If funds are available, the sale is made. No formal contract document must be processed through the buying organization's system. The seller sends an invoice to the purchase card company (Step 3 in Figure 2-3).
- In general, the obligation is established in one of two ways. First is a bulk obligation at the beginning of the billing period for the purchase card holder's entire spending limit (not shown in Figure 2-3). Second, an individual obligation can be made for each sale. For this method, the purchase card company will send a notification of obligation (normally an X12 TS 821) to the designated financial institution of the purchase card holder's agency, after it receives the sale transaction from the seller (Step 4 in Figure 2-3).
- At the end of the billing period, the purchase card holder verifies and certifies receipt of the items. The purchase card holder accomplishes this by either going to his account on the purchase card company's Web site or receiving his account statement through normal channels (Step 5 in Figure 2-3).
- After the purchase card holder certifies having received the goods, the purchase card company sends an invoice (normally a TS 810) to the agency (Step 6 in Figure 2-3). Some agencies receive the invoice first and then certify the transaction. Problems with the receipt of goods are negotiated between the purchase card holder and the vendor.
- The buying organization then pays the purchase card company (Step 7 in Figure 2-3). The purchase card company also pays the sellers.

In summary, we believe that opportunities for the OBI model's use in the federal government are limited and may not be cost effective.

Finance

OBI has left establishing procedures for buying on the Internet to the trading partners. Consequently, OBI in its present form cannot be used to transmit financial transactions. However, OBI can be used with either the purchase card or traditional method of invoicing.

We note that the use of an order (e.g., the X12 850), between buying and selling organizations, is the basis for starting the financial process. The OBI model purports that it automatically moves the results of a shopping session from the supplier's system into the buyer's purchasing system.[13] Therefore, any use of an X12 850 would allow the obligation to be automatically established based on the TS 850. That assumes that the X12 850 can carry the data required not only by the purchasing system, but the finance system as well.

We must therefore conclude that the current OBI model does not facilitate the flow of the other financial information needed to support the purchasing process. This shortcoming is not unlike the disparity between current government finance and purchasing applications. In that context, adopting OBI would not affect the government purchasing process any more than it does in today's environment.

What would be different is that EDI would be imposed on the purchasing process without a concurrent imposition of related and supporting EDI to complete the function (e.g., establishing commitments and obligations) or to effect payments as a result of either an invoice from a vendor or a credit card company. In our vision of the future, the vast majority of purchases, and attendant payment, will be made without needing the OBI.

To this point, we have indicated what we see as some of the advantages and disadvantages of OBI. To the extent they are applicable, the disadvantages could be repeated in the following section as they, by definition, qualify as barriers to implementation.

Rather than repeat the drawbacks, we elected to address the term "barriers" in a related light in order to factor in additional functional and technical matters. Additionally, there are practical and human issues that must be addressed in order to develop the full extent of support for recommendations made later in this chapter. To accommodate them, we draw on comments made during the workshop and one-on-one interviews we conducted.

BARRIERS TO IMPLEMENTING OBI IN THE FEDERAL GOVERNMENT

Internet purchasing is a logical architecture for micropurchases of $2,500 or less. It also could be used for some simplified acquisition small-dollar-value purchases ($2,500 to $100,000). Having said that, we believe that the current OBI model, as defined by the OBI Consortium, was designed more to support a private-sector purchase model.

Notwithstanding the foregoing, the effects of using OBI for each of the categories of federal purchasing are discussed below.

[13] *Open Buying on the Internet*, American Management Systems paper, undated.

Micropurchases

Any new approach, such as OBI, to small-dollar, high-volume procurement must be reconciled with the government's strong preference, in both public law and acquisition policy, for decentralized micro-purchasing by using a purchase card for acquiring small-dollar, high-volume items. These are the very items that OBI purchases through a central purchasing office.

There are significant differences between the current OBI model and the way the federal government procurement and financial operations are being accomplished for micropurchases, particularly when those purchases use the purchase card. We believe the better method of purchasing is via the purchase card, and not OBI. Some of the barriers to adopting OBI for micropurchases are the following:

- Under OBI, approval for each purchase must go to a level higher than the requisitioner. Under purchase card procedures, the purchase card holder is the purchase authority.

- Using the more formal OBI procedure will add time and cost to the purchases that otherwise could have been accomplished using more simplified methods and payment by purchase card.

- Under OBI, a contract or order is created using the X12 850 transaction set. If the government adopts the current OBI model for micropurchases, it will be reinstituting a purchasing method through the purchasing offices that was changed for the better by simplifying purchase methods and purchase card procedures. We have no objection to using the TS 850 with some trading partners if it is feasible and practical.

- Under the current OBI model, the contract or order is established using the X12 850 that was initially prepared by the seller and sent for validation to the buying agency. All sellers and all buying offices must be EDI capable in order to use the OBI architecture. That requirement will limit access of some vendors to the system. Under purchase card procedures, there is no formal contract and the obligation is established either in bulk or individually through the purchase card company. The seller and buyer do not need to be EDI capable.

- With OBI, purchases are recorded from the X12 850 transaction set. The current OBI model does not cover purchases made directly from a seller without EDI capability. When using the purchase card procedure, the process is essentially the same regardless of whether the buyer makes an Internet-enabled purchase or a purchase directly from the seller.

- Under OBI, the federal government traditional purchase order procedures require requisitioners to prepare a receipt so the purchase can be validated before payment is made. Under purchase card procedures, the purchases

are validated at one time at the end of the billing period during certification. Even if the OBI procedures are developed to enable reporting the receipt electronically, the development will take time and resources. The purchase card procedures are already established.

Table 2-1 highlights the difference between OBI and purchase card procedures.

Table 2-1. Open Buying on the Internet

Requirements	OBI	Purchase card
Method	Traditional contract	Purchase card
Approval authority	Higher authority	Purchase card holder
Contract	Formal	Implied
Basis for obligation	Normally transaction set 850	In bulk or individually
Financial process	TBD	Established
Receipt process	TBD	Established
Vendors EDI capable	Required	Unnecessary
Procedures for buying from store	Different	Same
Individual purchases involve purchasing office	Yes	No

Note: TBD = to be determined.

The transition from the formal method of purchasing to maximizing the use of purchase cards will take time. During the transition, we believe that the current OBI model may have a small niche in the government acquisition process. Without further analysis, we cannot determine if adopting OBI for that niche will be cost effective.

OBI Electronic Catalog for Micropurchases

The federal government is emphasizing making micropurchases through the use of electronic catalogs. The benefits of using electronic catalogs are widely recognized. Most federal department and agency plans for EC include a provision for using an electronic catalog.

We like that the OBI model gives access to multiple vendors. The model is designed so the sellers can maintain their catalog data and the buyer is responsible for their billing and receipt data. The responsibility of the sellers to maintain their own catalog data is very beneficial. The seller-maintained catalog will provide up-to-date prices, stock, and delivery dates. OBI's design satisfactorily allows access to multiple catalogs. The capability of tailoring individual searches to specific commodity sections is excellent and OBI does what is it designed to do and how it is designed to do it. However, the model does not meet some important needs of the federal government.

The major concern with using the OBI e-catalog is the selection criteria to find the purchase item. To compare items, the buyer must visit each vendor's site to find the best value, such as lowest price, delivery date, and product description, or to ensure that the item is in stock. Under OBI, the requisitioner is only provided with the names of the vendors that sell this item. The buyer then must select a vendor and access its e-catalog. Selecting items by vendor is not prohibited for federal micropurchases. The only requirements for selecting an item are that the price is reasonable[14] and the purchases are distributed equitably among qualified suppliers.[15] However, price, availability, and delivery dates are some of the federal requisitioner's major concerns, not which vendor is selected. The OBI model is not designed to first find the best value, by using criteria, such as lowest price or on-hand stock. To compare value, the buyer must go from vendor to vendor to find the lowest price or in-stock item.

We do, however, favor the OBI model's approach for location of data. We believe that all catalogs and price data should be resident on sellers' systems—and be readily accessible in a standard fashion to buying applications using the Internet. Once issues such as security, authentication, and special price lists are resolved, we see no continuing need for the government to maintain catalog or price information in government databases.

POSSIBILITY OF MODIFICATIONS

OBI is still being developed and can be modified. However, what is the advisability and likelihood of the model being modified? The developers of OBI used the traditional method because many private companies use that method. Although the OBI Consortium has indicated a willingness to consider changes to the model, the extent of acceptable change is uncertain.

Is the government willing to change its procedures for small-dollar-value purchases to accommodate OBI? We believe that the government is not for the following reasons:

- The federal government has been directed to use the purchase cards and the procedures to lower procurement costs and reduce the purchasing cycle time.
- The government has benefited extensively with its small-dollar-value purchases by using the purchase card.
- Documenting purchases, which historically has been the bane of the purchasing process, has been reduced, and in some cases, eliminated.

[14] PL103-355, Section 4301(d).

[15] FAR Part 13.202(1).

- Establishing commitments and obligations has been simplified.
- Purchase card companies perform the process at a lower cost.

Simplified Acquisition Procedures

PROCUREMENT

As the dollar value of a contract or order increases, most likely so does the technical complexity of the purchase. The OBI model's method of using a simplified X12 850 transaction set limits its functionality so it simply is not capable of handling other than basic purchases.

Federal procurement policy requires that agencies obtain supplies and services from preferred government sources before acquiring them from commercial suppliers. This policy is stated at FAR Part 8.001, *Priorities for Use of Government Supply Sources*. We believe that the following procedures are, and should be, the responsibility of the user in the agency.

> …agencies shall satisfy requirements for supplies and services from or through the sources and publications listed below in descending order of priority—
>
> (1) *Supplies*
>
> (i) Agency inventories
>
> (ii) Excess from other agencies
>
> (iii) Federal Prison Industries, Inc.
>
> (iv) Products available from the Committee for Purchase From People Who Are Blind or Severely Disabled
>
> (v) Wholesale supply sources, such as stock programs of the General Service Administration (GSA), the Defense Logistics Agency, the Department of Veterans Affairs, and military inventory control points
>
> (vi) Mandatory Federal Supply Schedules
>
> (vii) Optional use Federal Supply Schedules
>
> (viii) Commercial sources (including educational and nonprofit institutions). (Note: This step decides the OBI process.)

(2) *Services*

(i) Services available from the Committee for Purchase from People Who Are Blind or Severely Disabled

(ii) Mandatory Federal Supply Schedules

(iii) Optional use Federal Supply Schedules

(iv) Federal Prison Industries, Inc., or commercial sources (including educational and nonprofit institutions).[16]

The government's preference for ordering from certain government sources of supply before ordering from a commercial supplier must be considered when integrating OBI into federal procurement. The requisitioner cannot automatically enter a purchase until the preferred sources of supply are checked for availability. If the government implements OBI, the government must determine how FAR Part 8.002 requirements will be satisfied. More complex contracts would probably use the currently approved federal implementation convention and existing EDI architecture or the paper-based purchasing process to acquire the goods or services. However, OBI is capable of being used for some SAP small-dollar-value purchases of less than $100,000 if changes are made in the federal process.

The government uses both the traditional and purchase card[17] procedures for SAP small-dollar-value purchases. As more items become available in an e-catalog system, we believe that purchases will be made over the Internet in ever-increasing numbers.

However, the number of SAP transactions is substantially less than micropurchase transactions. For the SAP transactions, we believe that procurement offices will continue to use paper or electronic contract procedures, such as EDI.

Although SAPs at or below $25,000, except for micropurchases, are reserved exclusively for small business concerns,[18] larger companies can participate through blanket purchase agreements and indefinite delivery-indefinite quantity contracts. Because the limited opportunities for OBI in federal procurement are the simplified acquisitions reserved for small business, OBI technology must be accessible to small businesses. However, the OBI requirement that suppliers be able to generate and accept various X12 transactions limits the usefulness of OBI as an electronic commerce method for simplified acquisitions. Because OBI uses X12 EDI, small and medium enterprises (SMEs) must integrate and maintain EDI translation software as part of their software for accepting orders and quoting prices. The integration may prove a major burden for small firms given their limited technological means.

[16] FAR Part 8.001(a).

[17] Agency procedures should not limit the use of Government-wide commercial purchase cards to micropurchases. FAR Part 13.301(b).

[18] PL103-355, Section 4004.

We believe that for the "intermediate" dollar-value contracts and orders, OBI could be another electronic contracting process, particularly for doing business under SAP. Over time, the use of the purchase cards will increase. Other electronic processes, such as XML, will likely be introduced to facilitate the purchasing process. Thus, the extent to which procurement offices would use OBI instead of other competing processes and technologies must be determined. As more competing methods take up their share of the SAP transaction population, there may not be enough volume of individual purchases to justify implementing and using OBI.

FINANCE

We recognize that using the X12 850 transaction set in OBI could facilitate the exchange of data between government purchasing and finance systems. The exchange presupposes that government systems and the OBI model are compatible with their respective versions and releases of the X12 syntax. If the systems and the model are compatible, financial information (e.g., obligations) could move from a purchasing application database to a finance application database and vice-versa. Currently, concern exists that the OBI model uses an earlier version of the X12 syntax, and that the version is not capable of carrying data required by some contemporaneous finance systems.

We believe that OBI must be compatible with not only the procurement process, but also the financial process for it to be a more useful tool. Finally, as previously indicated in our discussion of micropurchases, the use of purchase cards would require some adjustments to OBI to ensure that obligations were recorded only once.

OBI ELECTRONIC CATALOG

The concerns about search criteria discussed under micropurchases are even more important under SAP. Multiple bids are required for SAP small-dollar-value purchases. [19] Better search, comparison, price, availability, and related criteria would enhance OBI's potential. For example, because SAP is designed for small businesses, buyers must have a way of identifying catalogs from small businesses.

PURCHASES GREATER THAN $100,000

As previously indicated, a fair relationship exists between the dollar value of a purchase and its complexity. Accordingly, although we know of examples where OBI might work for a large purchase (e.g., provisioning orders), we do not see a compelling need to use OBI for those types of purchases.

The complexity of large purchases, often technical, often unrelated to cataloged items, is a compelling reason for not further considering the OBI model for large purchases.

[19] FAR Part 13.104.

Additional Barriers

The workshop participants and interviewees generally were reluctant to make additional changes to the current system. The most compelling argument is that credit or purchase card-enabled micropurchases will obviate the need for much additional change in the EC purchasing/finance world of tomorrow. Additional barriers noted included the following:

- Competition for funds limits acquisition system investments to the highest payback areas
- Continued use of legacy systems
- Delay in fielding new systems
- Ever-decreasing technology cycle.

Other barriers may exist to be overcome if OBI was adopted as a major technology innovation. We believe that the most significant barriers have been highlighted here. In summary, the barriers make the prospects of using OBI bleak. To a large extent, the barriers determine the following findings and recommendations.

FINDINGS

- The federal government has been directed to simplify acquisition by using the purchase card and electronic purchasing as much as possible. The directive resulted from evidence that purchase card procurements reduce the cost of purchases.
- The purchase card procedures used by the government are established and working satisfactorily.
- Introduction and adoption of the smart card will increase the use of purchase cards.
- Approximately 85 percent of procurement transactions are micropurchases. Purchase cards are the preferred method for purchasing and paying for micropurchases.
- Approximately 98 percent of procurement transactions are less than $25,000.
- E-catalogs would facilitate making micropurchases and SAP purchases.
- OBI is still in the developmental stage. As OBI is enhanced, the observations cited here may change.

- OBI provides its users with the capabilities, advantages, and shortcomings of traditional commercial procurement procedures.
- The developers of OBI are meeting a definite requirement for organizations that use traditional contract procedures.
- The current OBI concept does not coincide with the current federal government purchase card procedures and SAP.
- OBI has linked the e-catalog capability and the X12 850 transaction set together for use in purchasing. The government requirement to purchase using that model has diminished because most Internet vendors will accept the government's purchase card in payment.
- The current search criterion of OBI does not meet the government's requirements for best value. OBI gives vendor information as a single data point. If a purchaser or requisitioner wants to compare vendors, the searches for goods and services might have to be repeated or aborted. The government needs to use its criteria for best value, such as product description, socioeconomic, price, availability, or delivery times, as their e-catalog search criteria. These criteria are not accommodated in the current OBI model.
- OBI does not follow the federal implementation convention for the TS 850 purchase orders.
- OBI does not specify electronic financial transactions for its procurements.
- Lack of enthusiasm and funds will dampen efforts to use OBI.
- OBI is not a part of the standard procurement system (SPS), which, at present, is using an X12 EDI component based on the more traditional flow of X12 transactions in version 3050.
- Federal processes for micropurchases are changing dramatically, which should be encouraged.
- The OBI Consortium has indicated a willingness to discuss changes to their architecture to accommodate federal requirements.[20]

[20] Tim Landry, OBI Consortium, at LMI workshop on OBI/XML, June 24, 1999.

CONCLUSIONS

- The current OBI model will have, at best, only a limited application in the government purchasing and finance operations.
- Buying on the Internet must be a desired goal of the federal government. However, the current OBI model will not be the long-term solution for attaining that goal.
- The federal government's purchase card methodology for micropurchases is working satisfactorily. Government efforts should be to directed at standardizing the process to the extent practical. The government should emphasize using purchase cards and electronic purchasing for simplified acquisitions.
- The current OBI model is not appropriate for use in the federal government micropurchases.
- OBI works for what it was developed to accomplish—simplify and better automate traditional procurement. OBI is meeting a legitimate industry need.
- Federal managers will resist efforts to use OBI technology in purchasing because it is suboptimal compared with the trend micro-purchasing, which makes up the bulk of individual purchases.

The final section in this chapter covers some recommendations, driven by our examination of the OBI model that might enhance federal purchasing operations.

RECOMMENDATIONS

The federal government's main emphasis in simplified acquisition should be placed where it can obtain the most benefit. Apparently, because of the limited application of OBI under SAT and the changes needed to both OBI and legacy systems to make OBI operational, OBI is not sufficiently more beneficial than existing capabilities. Consequently, the federal government should not plan to implement OBI at this time.

We recommend that the federal government continue and expand participation in all relevant associations, consortiums, and standards committees for e-catalogs and e-commerce to keep abreast of the latest technology and to influence emerging system designs.

We reached the following additional conclusions discovered as part of our OBI research, but not directly related to OBI.

- Continue to ensure the federal government follows commercial standards for electronic catalogs used in electronic malls over the Internet.
- Encourage expanding small-dollar-value items available to buyers over the Internet by increasing the number of vendors who can supply frequently demanded items in federal e-catalogs.
- Develop a method for vendors to make government pricing arrangements that are visible to only government-authorized buyers in vendor electronic catalogs.
- Ensure that the vendors maintain and provide their electronic catalog information.

At this point, we have covered the issue of OBI. In Chapter 3 we turn our attention to XML and its possibilities as a facilitator of federal government purchasing and finance operations.

Chapter 3
Extensible Markup Language

In this chapter we discuss the Extensible Markup Language in detail. We first identify what XML is and, equally important, what XML is not. We then discuss the XML technology—how it works, what its benefits are, and what its drawbacks are. We identify where XML can be used in the federal government and what the barriers are to its implementation. We then present a series of findings and conclusions and a high-level series of recommendations for adopting the technology. This chapter relates to the discussion in Appendix B.

HISTORICAL PERSPECTIVE

Before trying to answer the question "What is XML?" we believe it is necessary to look at the historical development of its antecedent standards.

Simultaneous to the advent of EDI for exchanging structured data between disparate databases, efforts were underway to find ways to structure information contained in documents as a means of capturing, exchanging, and reusing data primarily intended for human use. Those efforts took many paths, including the GenCode and Generalized Markup Language (GML) standards, with mixed results.

The Standard Generalized Markup Language (SGML) (International Organization for Standardization [ISO] standard 8879), a page mark-up language that is an outgrowth of GenCode and GML, is the most structured of these efforts. SGML was envisioned for use in both on- and off-line electronic exchanges.

However, the business community was slow in adopting SGML for a number of reasons—complexity, lack of widespread application beyond documents, and a general migration from document exchanges to data exchanges. The subsequent development of the World Wide Web using the HyperText Markup Language (HTML) as its interchange language backbone afforded greater opportunities for human-to-machine data exchanges. This was true despite the limitations inherent in HTML. From an application perspective the most significant of these limitations is the inability of HTML to interact with client-side databases without having to develop extensive proprietary code.

Recognizing the need to provide greater flexibility in data exchanges on the Web, the World Wide Web Consortium (W3C) decided to create a new Web-based technical specification. The W3C has developed this Web-based technical specification from a subset of SGML. The W3C, and an increasing percentage of the Web developer community, see this subset—XML—as the replacement for the

HTML technical specification for a significant portion of Web information exchanges.

Why? Because XML is much more robust than HTML in that it can be used to create a dynamic tagging structure to handle the content-rich environment of the Web in human-to-human and human-to-machine interaction. Furthermore, XML offers the ability to use human-readable semantics that enable humans to easily read, comprehend, and manipulate the XML document.

WHAT IS XML?

The Extensible Markup Language is a

- technical specification,
- series of developing business standards, and
- burgeoning technology base.

The technical specifications that are used to develop the business standards and enable the technology are comprised of a series of recommendations published by the World Wide Web Consortium. These technical specifications are just that—technical specifications. These specifications are not submitted to any recognized national or international standards body for ratification, nor does the W3C intend to do so.[1] Further, the technical specifications do not address a systematic way to use XML in specific business processes—either within an industry or sector, or across industries and sectors.

XML initially was developed as an alternative to HTML for exchanging data in human-to-single machine interfaces. The focus on exchanging data was necessary because HTML, the basic language of the Web, focused more on presentation than content. By the very nature of the XML genesis, the technical specifications were not business standards. As such, the XML technical specifications in-and-of-themselves were not readily adaptable to specific electronic commerce initiatives.

XML now is being viewed as a means of exchanging data over the Web in multiple-user-to-multiple-machine, machine-to-machine, and data-integration-to-application-interface environments. This expanded role of the basic XML technical specification is driving the development of a large set of companion technical specifications, business standards, and XML applications based on both the technical specifications and business standards. That expanded role—technical specifications, business standards, and applications focused on any-to-any exchanges—comprise what most people refer to when they use the phrase "*XML technology.*"

[1]Informal correspondence between Tim Berners-Lee, Director, W3C, and Mark Crawford, LMI, July 13, 1999.

XML TECHNOLOGY

In this section we discuss the XML technology, to include an overview of the technical specifications, business standards, and applications. A more detailed technical discussion is in Appendix B.

Technical Specifications

Extensible Markup Language technical specifications support a new syntax for exchanging information in a Web environment. The technical specifications are not a predefined set of tags—such as HTML tags—that can be used to mark up documents. Nor are they a standardized template for producing particular business documents. The XML core specification is a means for developing XML documents that contain these tags and templates.[2]

The W3C defines the core XML specification as a data set (set of low-level syntax rules) that provides "a very flexible text format based on SGML (ISO 8879)" to be used for Web-based structured document exchanges.[3] The W3C's position on the use of XML is that although it was originally "designed to meet the challenges of large-scale electronic publishing, XML will also play an increasingly important role in the exchange of a wide variety of data on the Web."[4]

For that to happen, a number of XML and XML-related specifications also needed to be developed. These additional specifications include the following:

- Document Object Model (DOM)
- Namespaces in XML
- XML Pointer Language
- Extensible Style Sheet Language (XSL)
- XML Schema
- XML Information Set
- Resource Definition Framework
- XML Linking Language.

See Appendix B for a detailed explanation of each of these specifications and their role in using XML. As an aside, we will later recommend that the federal

[2] http://www.w3.org/TR/1998/REC-xml-19980210.

[3] http://www.w3.org/XML/Activity of 20 May 1999.

[4] http:www.w3.org/XML/Activity of 20 May 1999.

government participate in the development of technical specifications to ensure its functional requirements are adequately articulated and taken into consideration.

How XML Works

The core XML technical specification consists of the syntax rules for creating dynamic document structures and data tags that when combined convey the contents and structure of a document. An XML document may be defined by a document type definition (DTD) and consists of a string of logical parts (elements) each of which is marked up (conveyed as discrete data) by start and end tags.[5]

The DTD conveys the construct of the XML document by defining object trees. The XML tags segregate discrete data elements within an XML document. The tags can consist of attributes that help to structure the functionality of the data. Each XML tag can be nested at any depth in an XML document. The dynamic nature of the tags allows them to be defined either at the moment of need, or as part of a predefined repository.

Predefined repositories of XML documents can be used for

- stand-alone document transfers;
- application-to-application exchanges; and
- trade group, industry, national, or international business standards.

When XML documents use defined DTDs and tags, and the DTD conforms to the receiver's expected implementation, XML documents can provide interaction with client-side databases without the need for additional proprietary codes. That adherence to pre-agreed-upon structure means XML documents also can be used for database-to-database exchanges and in XML-based applications.

The XML specification was designed to convey data. As such, an XML document does not convey how the data should be presented nor does it describe the behavior of the conveyed data elements. Those functions are left to the individual sender and/or receiver who can provide that functionality through association with either a companion XSL document or in conjunction with an HTML file.

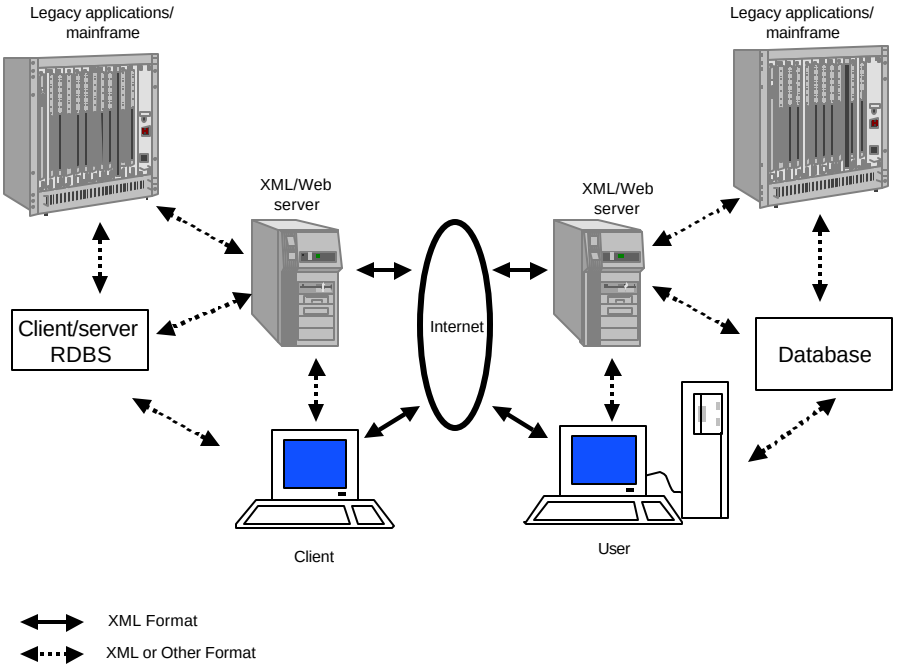
XML Architectures

An XML architecture is in reality an extension of the burgeoning Internet-Web architecture. The typical XML architecture is shown in Figure 3-1. In the context of this report, we define the Internet as essentially a universal, free-access

[5] A new XML technical specification—XML schema—is being developed. The specification creates a more complete and robust method for identifying document layouts without relying on SGML syntax rules. Instead, this new specification is instead based on the core XML specification. See Appendix B for a more detailed discussion on schemas.

data-communications pipe connecting computers the world over. The World Wide Web is the graphics user interface to every computer connected to the Internet.

Figure 3-1. Typical XML Architecture



Note: RDBS = relational database system.

Data exchange over the Internet is based on key protocols—transmission control protocol (TCP), Internet protocol (IP), file transfer protocol (FTP), and others—that provide a neutral medium for computers to connect. The Web is based on the HyperText transfer protocol (HTTP) for connectivity and HTML for data presentation. Web servers, using HTTP and HTML, act as intermediaries between users and systems. From our vantage point, Internet-Web protocols are quickly overtaking traditional local area network (LAN) and wide area network (WAN) client-server architectures. This shift in exchange methods is creating a single ubiquitous architecture environment that significantly reduces the complexities of today's plethora of competing and often incompatible IT architecture solutions.

Because HTML is focused on presentation, it is not designed for data exchanges between a user and a system. Complex scripts, screen scrape solutions, and other work arounds are necessary to exchange data between the Web server, back-end applications, and databases.

Although the Internet connects computers, and although the Internet transfer protocols standardize the method of exchanging data packets, this connectivity does not equate to real interoperability between those computers. Interoperability is not achieved because of the inherent differences of data definition and use between

the connected systems. In today's environment, only through extensive work arounds, including the application of EDI, can interoperability be achieved.

XML's multiplatform, multioperating system, and standard Internet-Web protocol support provides a mechanism to eliminate the need for those work arounds through development of a universally accepted method of Web protocol-based data definition and exchange.

XML Exchanges

XML documents are exchanged using the standard Web HTTP protocol. Those exchanges can occur in human-to-machine, machine-to-machine, and machine-to-human interactions. A typical XML architecture consists of the following components:

- Originator
  - *Database*. The sender's data can originate in an existing database.
  - *Application*. The sender's application will trigger creation of an XML document. An alternative is for the XML document to be created manually by using a browser-based form.
  - *XML Server*. The XML server can consist of the following:
    - *XML Parser*. XML parsers are being marketed as part of XML-enabled applications and databases. However, a number of parsers also are available free of charge. Those parsers import and extract data. Those parsers use import and extract routines that occur through the use of a predefined map identifying specific data elements to be pulled from a database, or to be taken from an application-generated flat file. In some respects, the parsers can be equated to the significantly more expensive EDI translators.
    - *XML Processor*. An XML processor reads every piece of an XML document and reports if it is well formed. An XML processor also identifies document-validity violations.
    - *Application Manager*. The application manager handles all requests relating to application data independent of the platform the application or data resides on.
    - *Metadata Manager*. The metadata manager handles requests for user-interface metadata.
- Web browser or Internet connectivity between trading partners

- Recipient
  - Browser
  - XML application server
  - Application
  - Database.

BUSINESS STANDARDS

With the expansion of XML to include interfaces for multiple users to multiple machines, machine to machine, and data integration to application interfaces, business process standardization is crucial to preclude an ever expanding and unmanageable proliferation of competing format, structure, and interface requirements.

Within an XML context, business process standards at a minimum should include a predefined set of XML document layouts—either schema's or DTDs—for specific business functions; an associated XML tag repository (to include syntactic and semantic harmonization); standards for communication exchanges (to include functional acknowledgement and nonrepudiation); and standards for security.

The foregoing sums up one of the most important areas in which federal government participation is essential because the government likely will use XML to support some of its purchasing and finance applications.

Business Standards Bodies

Because XML is such a new technical specification, and because the Web is very unstructured, no national or internationally recognized group has yet been formed to develop universally accepted XML business standards.[6] There are, however, several groups that have begun to develop agreed-upon XML business standards. The groups include

- CommerceNet,
- RosettaNet,
- XML/EDI Group,

[6]As we were writing this report, we learned that the United Nations, through its Center for the Facilitation of Procedures and Practices for Administration, Commerce, and Transport (CEFACT), will work with the Organization for the Advancement of Structured Information Standards (OASIS) and other interested parties to begin exploring an international (i.e., global) XML business standard. The work will be guided by a newly developed electronic business XML (ebXML) work group that will be chaired by a representative from CEFACT.

- European Committee for Standardization Information Society Standardization System (CEN/ISSS),
- BizTalk,
- OASIS,
- XML.ORG, and
- Financial Services Technology Consortium.

Regardless of which, if any, of them emerges as the lead XML business standards body, any federal government XML development work must be accomplished with the full coordination and cooperation of those various bodies, and opportunities to leverage their work must be explored.

COMMERCENET

CommerceNet is a global nonprofit membership organization with more than 500 corporate members doing electronic commerce. CommerceNet seeks to promote and advance interoperable electronic commerce to support emerging communities of commerce through its eCo framework. CommerceNet researches technology, applications, and business models and collaborates on research and development (R&D) projects. The CommerceNet eCo framework is focused on semantically integrating multiple database types with multiple data constructs and data libraries, trusted open registries, and agent-mediated buying. CommerceNet's government members include GSA, National Institute of Standards and Technology (NIST), Social Security Administration (SSA), National Security Agency (NSA), Defense Information Systems Agency (DISA), and Defense Logistics Agency (DLA). CommerceNet has already undertaken interoperable XML- and Web-based catalog prototypes for the federal government. To date those prototypes have been based on a combination of a variety of emerging industry and self-generated DTDs and tags and are not part of a larger standards effort. Notwithstanding, we believe that the studies should be continued because they hold great promise for proving concepts and can serve as a body of knowledge that the government can draw on as it moves to its next generation of electronic catalogue interaction.

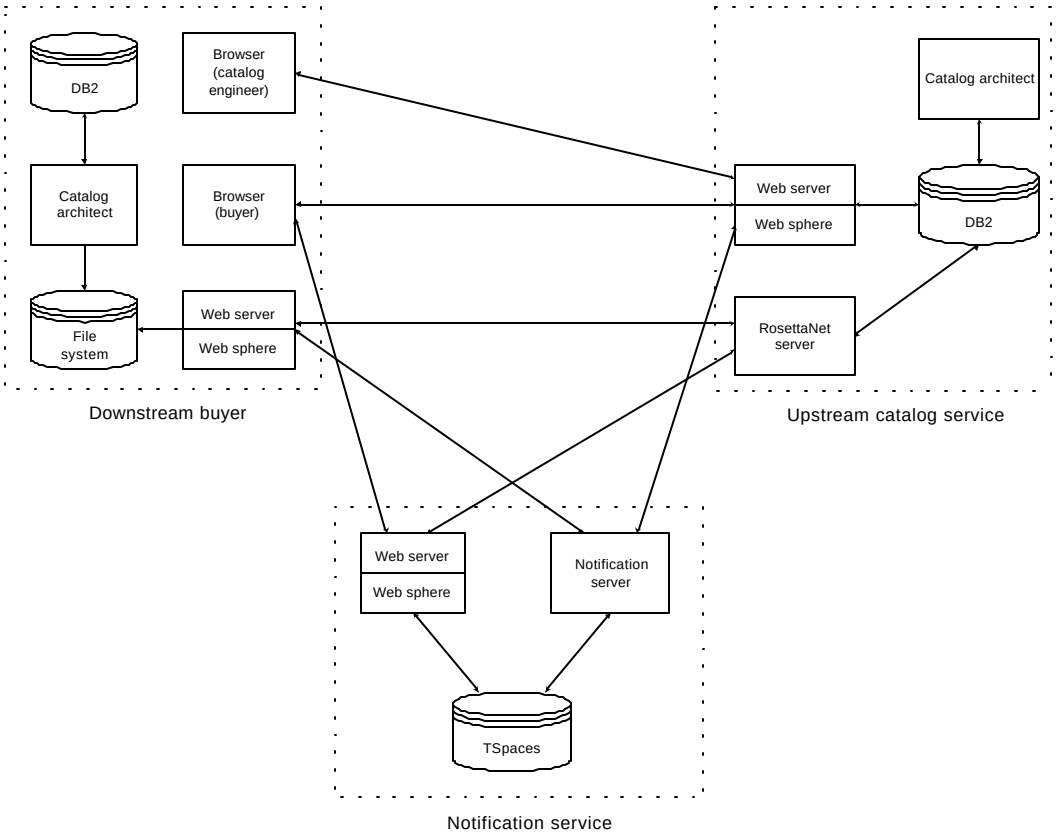
ROSETTANET

RosettaNet is an independent, nonprofit consortium of more than 60 of the largest IT and electronics product manufacturers, users, distributors, resellers, software publishers, and financial institutions that are working to define open and common business interfaces for use in the IT and electronics industry supply chains. Members include IBM, Microsoft, Toshiba, Federal Express, and GSA. RosettaNet is building protocol specifications based on XML. The RosettaNet protocols [partner interface processes (PIPs)] comprise a consistent and predictable collection of parsable objects with semantic meaning to any application programs that encounter them. The first 10 PIPs were released on 1 December 1999, and more than

75 percent of the IT members have committed to implementing at least one PIP by the 2 February 2000 deadline. RosettaNet also plans to expand beyond the IT supply chain into other business areas so that eventually its protocols will be the standard exchange language of all EC on the Internet, and has begun work with the electronics industry to achieve that goal.

The RosettaNet architecture is based in part on the OBI and eCo architecture. Figure 3-2 presents the RosettaNet architecture for purchasing.[7] The initial proof-of-concept RosettaNet DTDs are being developed using ANSI ASC X12 EDI transaction sets and associated implementation guidelines for the basic structure. RosettaNet initially developed tags by using the ASC X12 data segment and data element semantic identifiers as the baseline. However, RosettaNet has indicated it will take a different approach on its production development efforts, including using the developing schema specification and eliminating the ASC X12 standard as the baseline. RosettaNet has not chosen to seek publicly available specification (PAS) authority from ISO/International Electrotechnical Commission (IEC) for their PIPs; however, their coalition partners include recognized standards organizations.

Figure 3-2. RosettaNet Purchasing Architecture



Note: DB = database.

[7] http://www.rosettanet.org.

XML/EDI GROUP

The XML/EDI Group is working in conjunction with ANSI ASC X12 to develop XML guidelines for traditional EDI technical standards. The XML/EDI Group is creating focus teams centered on technology, industry, and standards bodies; has begun developing XML/EDI guidelines; is working with the CEN/ISSS XML project; and has issued various position papers on XML repository efforts. The XML/EDI Group has proposed creating BizCodes. The group envisions BizCodes as metadata tags that identify all subsidiary tags that have the same semantic meaning. The level of support from the industry groups for the BizCodes concept is unclear.

CEN/ISSS

The European Committee for Standardization operates an international association that manages cooperation between European National Standards Bodies (NSBs). CEN's objective is to adopt national and international standards that are relevant throughout Europe. ISSS, as a subgroup of CEN, encompasses all the relevant European Information Society standardization activities. CEN/ISSS is a "one-stop shop" for parties who have standardization requirements. CEN/ISSS fills the gap between formal and informal standardization through consensus-based CEN workshop agreements. CEN/ISSS has established an electronic commerce workshop whose efforts include an XML/EDI project for developing a demonstration system and support center predicated on applying XML to the UN/EDI for Administration, Commerce, and Transport (EDIFACT) standards. Given recent events with respect to creation of the UN/CEFACT and OASIS ebXML initiative, the CEN initiative may lose support and interest.

BIZTALK

Microsoft, considered by many to be the primary force in the W3C schema work, has submitted one of several XML schema proposals received by the W3C, and is a significant contributor to the developing schema draft specifications. Microsoft has begun developing usable schema's based on their schema proposal and is encouraging others to follow suit. Microsoft is posting both Microsoft and independently developed schemas on their BizTalk Web site. The BizTalk site is an outgrowth of Microsoft's work on defining an approach for flowing information between applications, regardless of platform, object technology, or enterprise information model. The BizTalk Framework™ is intended to be a set of XML-based tools and technologies to achieve this. The framework consists of a technical specification that defines a consistent way to use XML, a small number of mandatory and optional XML tags, and a Web portal. The technical specification is the equivalent of a traditional ANSI ASC X12 enveloping structure. The Web portal will be the repository for schema's, XSL, and business processes supported by BizTalk-based XML applications. Microsoft has publicly stated they are not interested in developing specific business process standards, only in providing a framework. However, their leadership in developing the BizTalk portal,

and their relative market strength in the computer industry, makes them a promising candidate for leadership in developing agreed-upon business standards.

OASIS

The Organization for the Advancement of Structured Information Standards is a nonprofit, international consortium dedicated to accelerating the adoption of product-independent formats that are based on public standards. The standards include SGML, XML, HTML, as well as others that are related to structured information processing.

Members of OASIS are providers, users, and specialists of the technologies that make the standards work. OASIS provides an open forum for its members to discuss market needs and directions and recommend guidelines for product interoperability. The consortium creates, receives, coordinates, and disseminates information describing methodologies, technologies, and implementations of the standards. The continued work of the consortium complements that of standards bodies, focusing on making the standards easy to adopt, and the products practical to use in real-world, open-system applications.

OASIS and NIST developed an XML conformance test suite that can be used to ensure an XML parser can properly handle XML documents created using the XML 1.0 specification. The conformance test suite was built by the OASIS technical committee as a tool for XML application developers to ensure developing applications will use the underlying XML technical specification properly. The suite is publicly available on the OASIS Web site. The OASIS technical committee has representatives from both the public and private sector, including NIST. OASIS also has created the XML.ORG industry portal.

XML.ORG

OASIS created XML.ORG as a repository for XML standards, including vocabularies, DTDs, schemas, namespaces, and stylesheets. XML.ORG is sponsored by companies that compete directly with Microsoft; chief among these are Sun Microsystems, International Business Machine, and Oracle. The XML.ORG Web site is intended as an alternative to the Microsoft BizTalk site. We cannot be sure which organization will emerge as supreme. UN/CEFACT's developing relationship with OASIS to develop a framework for XML business standards, and perhaps even inter- and intra-industry DTDs and tags that would be placed in the XML.ORG repository, may give XML.ORG an extra push over BizTalk. However, BizTalk has wide support, and the power of Microsoft to sustain it.

FINANCIAL SERVICES TECHNOLOGY CONSORTIUM

The Financial Services Technology Consortium (FSTC) "is a not-for-profit research and development organization comprising banks, industry partners, financial service providers, technology companies, academic institutions, and

government agencies."[8] The FSTC focuses on technology-based solutions for the financial services industry through a variety of project-oriented research and proof-of-concept activities. The projects relate to interbank issues and address interoperability requirements and standards. The FSTC Bank Internet Payment System (BIPS) project is developing a method for conducting Internet-based secure electronic transactions, including an open specification and a secure method for initiating spontaneous payment instructions over open public networks. BIPS transactions are based on XML and are being developed by creating BIPS DTDs and XML tags. In addition to the work of the FSTC, other financial industry XML-based standards efforts are underway. One is the joint Microsoft, CheckFree, and Intuit Open Financial Exchange (OFX) endeavor. This endeavor is working with financial services and technology companies to develop a unified XML-based specification for exchanging financial data over the Internet and to simplify and streamline connections to transactional Web sites, thin clients, and financial software.

As can be seen, many groups are focusing on the various aspects of XML development. In many respects, that is good news since we believe that the competition will likely drive the work forward faster. However, the competition among the groups signals that we can expect (and are seeing) a range of approaches and solutions to the same issue (e.g., the movement of data in electronic form).

We believe that prudent XML implementers will keep abreast of the XML developments and initiatives of the groups mentioned above. Further, those who want to ensure the viability of the products, such as incorporating internal business requirements that these groups are developing, will become involved in CommerceNet, RosettaNet, BizTalk, OASIS, XML.ORG, and the developing ebXML efforts. Such diversity of participation is necessary because no single XML solution exists for any organization. Further, participants will keep abreast of the innovative and interesting work these groups are doing.

XML Applications

Several XML applications and servers are beginning to appear on the market. XML-based servers will be platforms used for distributing and deploying XML applications. The servers will be a middle-tier link that integrates data from applications like SAP or Oracle with XML documents on the fly. The server also may extract data from XML documents and update the backend application. XML document management systems are also beginning to find their way into the marketplace. XML parsers that work on both XML and non-XML platforms are being developed. IBM has released an XML parser for use in a Java™ environment that can be used by Java and virtual Java platforms. In this subsection we highlight four technology companies that are developing and deploying XML-based IT solutions.

[8] Quoted from http://www.fstc.org/.

ORACLE

Oracle is incorporating XML in its product base. The core XML support being delivered in Oracle8i illustrates their commitment. Oracle is working toward including XML capabilities in future releases of Oracle Developer, Oracle WebDB, Oracle Jdeveloper, AppServer, tools, and packaged applications. The capabilities will enable developers to use XML and Oracle's Internet File System (iFS) XML file-type support for reading and writing application data as XML documents. The capability means that a single solution for applications, such as DoD's development of the Joint Ammunition Management Standard System (JAMSS) solution to replace multiple component applications that will rely on both transactional data exchanges and intensive client-server database for access and review, can be based on a standard XML solution. Oracle believes XML will allow for

- returning "richer" XML results from Structured Query Language (SQL) queries,
- querying the full XML document hierarchy,
- simplifying the development of applications that process XML,
- customizing reusable enterprise business logic, and
- managing and sharing tools and data warehouse metadata.

COMMERCEONE

CommerceOne has developed the Common Business Library (CBL), which they believe is a key element in wholesale migration to XML-based e-commerce solutions. The CBL will be an extensible public collection of XML data components created from reusable common semantic components of existing standards bodies. The CBL is being developed in collaboration with the W3C, ANSI ASC X12, UN/CEFACT, RosettaNet, CommerceNet, and BizTalk, among others. The latest version of CBL, version 2.0, contains support for the internationally accepted UN/EDIFACT EDI standard.

The developing XML business standards in the repository are the basis for CommerceOne's commercial MarketSite Open Marketplace Platform product. This product uses XML to enable the bi-directional exchange of buyer and supplier document exchanges via the Internet. We believe that the bond between the CommerceOne MarketSite product and the CBL is more problematic than the relationship between the Microsoft BizTalk server and repository. As such, the close relationship gives us some concern. However, our concern should not preclude the ECPO from working with CommerceOne.

WEBMETHODS

WebMethods has developed the business-to-business (B2B) Java-based integration server that runs on any Java-capable platform. The server hosts and publishes business models that are used for exchanging data over the Web. The models are encapsulated and accessed using XML for describing the procedure interface and the transaction format. The B2B integration server is capable of providing access to both Web-enabled applications and databases and non-Web-enabled legacy databases and applications. Version 2.0 of this server is based on a webMethods proprietary Web Interface Definition Language (WIDL). Although WIDL has been submitted to the W3C and subsequently published as a W3C Note, no further development of WIDL as a W3C specification has taken place. Further, webMethods has developed a replacement interface language called FLOW that will be used in version 3.0 of their product. FLOW is a process-oriented language that webMethods developed as a superset of WIDL. The webMethods server uses FLOW to enable visual linking between business systems.

SAP AG

SAP AG is a leader in enterprise resource planning (ERP) software. Competitors include PeopleSoft, Manugistics, and Oracle. ERP software integrates a company's business processes and applications. SAP ERP software uses proprietary business application programming interfaces (BAPIs) to do the integration. External integration across business boundaries can only occur if both organizations are using the same ERP package or a neutral interface such as traditional EDI. Programming interfaces between the SAP BAPIs and EDI translators is extremely complex. Realizing the ubiquitous nature of the Web, SAP is now incorporating XML functionality into all of its ERP interfaces. The functionality will enable both SAP and non-SAP trading partners to integrate Web-based business and further extend the pervasiveness of supply-chain management software.

We believe that each of the technologies and initiatives discussed above will play an important part in the development of the overall XML system architecture. However, we believe that the government does not at the present time have a clear picture of how, if at all, it intends to use XML in its purchasing and finance operations.

Elsewhere in this report, we discuss potential applications for XML but we believe that developing an overall federal strategy and implementation plan will be useful in determining which products will eventually afford the government the best return for its investment. Any organization developing a Web strategy and XML implementation plan should participate in product demonstrations to become familiar with the capabilities of this new technology. Of course, subsequent product selections should be based on extensive evaluations of technical aspects, XML specifications support, interoperability with the various business standards, and software user features.

Benefits of XML

XML benefits include

- use of Web architecture,
- distributed Web computing,
- expanding the concept of EDI, and
- Web searching.

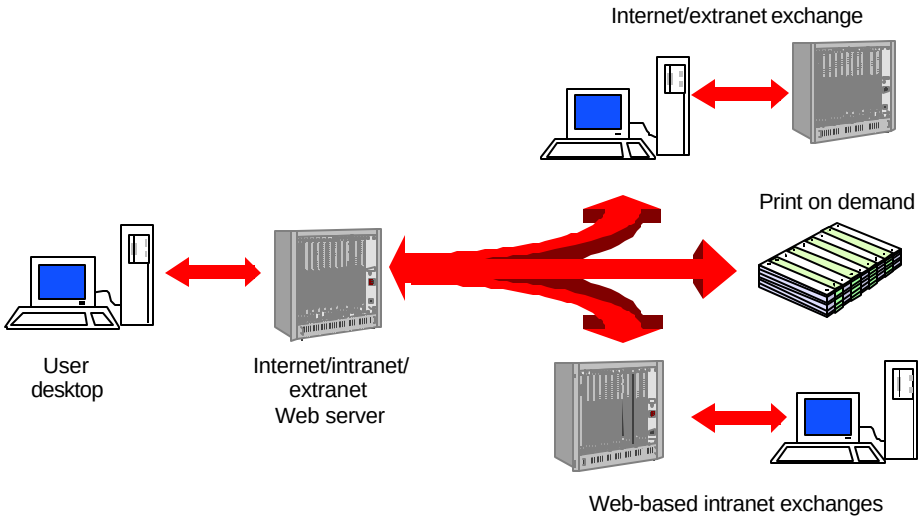
We discuss each of the benefits below.

WEB ARCHITECTURE

One of the significant benefits of XML is its ability to be transported across the Internet using HTTP. HTTP is a simple protocol used in all linking on the Web. HTTP is robust enough to handle the most complex XML documents.

Widespread adoption of the HTTP protocol has created a ubiquitous communication environment that enables data exchanged in an ever-expanding universe of business and industry groups. Heretofore, interfaces required using complex and often proprietary architectures that were as difficult to establish as they were costly to maintain. Because XML is designed to be exchanged using HTTP, businesses can now use their existing Internet-Web interfaces for machine-to-machine data exchanges. As a result, businesses can simplify their architectures to a single interface and architecture methodology for both human-to-machine and machine-to-machine data exchanges. Figure 3-3 illustrates possible internal and external data exchanges. In this model, XML is used to tag the data, and HTTP is used to transport the data. The entire enterprise architecture becomes Web based, thus reducing both investment and operating costs. For these reasons, we believe that XML will be an important technology in the government's future purchasing and finance operations. We also believe XML will enable greater integration between these areas and other government business functions as the government adopts XML.

Figure 3-3. XML Document Flows Using Internet Protocols



DISTRIBUTED WEB COMPUTING

XML was originally developed to mark up documents for Web exchange. However, the developers and early implementers of XML have realized that XML is much more. XML markups can be used to tag data. Tagged data can be used for distributed Web computing for both inter-and intra-company environments. In a distributed Web-computing environment, HTTP is used for the procedure calls and XML for the data. In a distributed Web environment, XML transforms the data into data islands that are treated as objects. The locations of the data islands then become the reference pointers used by applications to locate the specific data island being called by the application.

EXPANDING THE CONCEPT OF EDI

The extensibility of XML coupled with its support for Web-based data exchanges afford new opportunities for using EDI. Traditional EDI enables machine-to-machine transactional exchanges using an agreed-upon standard. Of course, implementing traditional EDI requires using an application and database environment for both the sender and receiver; purchasing and installing EDI translator software and hardware or using fee-for-service value-added networks (VANs); and creating interface routines between databases, applications, and translation services. Implementing traditional EDI requires a significant investment of time and money for developing and maintaining agreed-upon inter- and intra-industry standards and trading-partner-specific implementing conventions for those generic standards. Because of the programming complexity, automation requirements and resource requirements, only large companies and their direct suppliers have primarily used traditional EDI.

Some organizations, and even some EDI translator companies, have built proprietary Web-based extensions to their traditional EDI architectures. The extensions are seen as a way to avoid VAN costs, increase SME involvement in EDI,

and take advantage of the developing Web. That approach is desirable because accessibility to the Web is inexpensive. Accessibility only requires a bare-bones personal computer (available for less than $500), a dial-up modem (available for as little as $20), access to a telephone line, an account with an Internet service provider (typically $20 per month or less), and a Web browser (typically free).

Web-based EDI solutions either download an application that resides on the client computer, or operate using common gateway interface (CGI) scripts and form fills. In both cases, if the client is also operating internal applications, the client computer must operate the independent application with no opportunity for interfaces with its own database.

Using XML and form fills would facilitate internal database interfaces for the client computer without needing proprietary solutions. This approach minimizes the need for smaller entities to support multiple solutions for multiple trading partners and would enable larger entities to preserve their existing EDI solutions while expanding their trading partner base and migrating to a Web-based architecture. Further, the human readable nature of the XML DTD's, the burgeoning XML-enabled application and database environment, the ability to use low-cost Internet-Web-based architecture, and the widespread acceptance of XML as the Web standard all combine to offer a much greater opportunity for widespread acceptance of XML-based electronic data exchange between business partners. The ease of using XML and form fills coupled with the low cost in accessing the Web makes XML a very attractive alternative to traditional EDI for the SMEs that want to work with the federal government. Table 3-1 is a high-level decision matrix we have developed to assist the government in choosing between XML and traditional EDI for data exchange.

Table 3-1. EDI-XML Decision Matrix

Situation	Solution
Trading partners are EDI enabled.	EDI
High-volume batch processing is the norm.	EDI
XML standards and specifications do not support proposed process.	EDI
Trading partners do not have application or database.	XML
Trading partners want to use Web.	XML
Agency moving to Web architecture.	XML
Processing is done in real time.	XML
Data used for both user-to-machine and machine-to-machine exchanges.	XML

We do not want this section to be read as in any way diminishing the capability of traditional EDI. To the contrary, we believe that traditional EDI may still be the solution of choice for application-to-application exchanges of large numbers of routine business transactions—such as the receipt, processing, and validation of invoices that can then be passed to a bill-paying system resulting in the electronic transfer of funds.

We also recognize that the federal government's trading partner population has not rushed to adopt traditional EDI. For that reason, we believe that using XML will, in some cases, allow other trading partners, including SMEs, to begin exchanging information electronically. By adopting XML, the government will be able to take advantage of the economy and efficiency of exchanging data that way and thus expand the concept of EDI—computer-to-computer exchange of data without human intervention.

DATA SEARCHING

Another of the principal benefits of XML is its extensibility—ability to create data tags "on the fly". Extensibility is well suited for rapidly creating Web-based applications that use XML for exchanging data. Past work with autonomous agents and Internet searching has struggled with how to ensure the search agent can understand the semantics of the data.[9] Using XML as the semantics qualifier will help resolve the semantics problem. However, database administrators are recognizing XML also affords opportunities to greatly enhance Web-based searches by integrating XML tags with relational databases. In such an environment, the tag becomes part of a database element descriptor. If the database is connected to the Web, and if an agreed-upon XML tag repository exists, external agents will be able to conduct ubiquitous Web searches based on the agreed-upon tags. Because the tags can fully describe the attributes of the data, clarity of data across enterprise boundaries will be greatly enhanced.

The federal government could use this capability to allow searches of catalogues for purchasing goods. We envision a system using XML so a buyer or a requisitioner can search the Web and receive comparative information in a standard format without requiring expensive, proprietary software on the part of the information provider. The information then can be used to make informed purchasing choices according to such attributes as product capability, cost, availability, best value, and socioeconomic factors.

Drawbacks of XML

TECHNICAL SPECIFICATIONS

A number of technical specifications are not yet formalized. Because the set of technical specifications is incomplete, implementers are running the risk of developing XML-based solutions that may become obsolete before being fully implemented. Further, purchasing XML-related applications at this stage in the technical specification development process means the applications may not be capable of using the additional specifications once they stabilize. Although the technical specification issues do not preclude implementing XML, they certainly inhibit any XML solution's flexibility and should be carefully weighed before proceeding.

[9] Björn Hermans, *Intelligent Software Agents on the Internet: an inventory of currently offered functionality in the information society & a prediction of (near-) future developments*, Tilburg University, Tilburg, The Netherlands, July 9, 1996.

BUSINESS PROCESS STANDARDS

Developing business process standards is crucial to precluding an ever-expanding and unmanageable proliferation of competing format, structure, and interface requirements. The business process standards at a minimum should include a predefined set of DTDs for specific business functions and associated XML tag repository (to include syntactic and semantic harmonization); standards for communication exchanges (including functional acknowledgement and non-repudiation); and standards for security. A number of competing organizations are working to develop such standards. Until standards stabilize, implementers run the risk of choosing the wrong set of standards.

XML APPLICATIONS

The market and profit factors driving XML developers to bring their applications to market have implications that must be considered in developing an XML strategy and in timing XML deployments. Chief among the factors is that the products are being developed using technical specifications that are not yet finalized. As a result, early products may not interoperate well with subsequently marketed products that are developed using more mature or robust versions of the XML specifications. Further, these products may not support using developing business standards if the standards are based on later versions of the technical specifications.

XML AND EDI

EDI users, those that conduct computer-to-computer exchange of business information using agreed upon public standards, are taking a new approach to accomplishing EDI by wrapping their EDI transactions with XML tags. The transactions can be wrapped at either the data-element or transaction level. The purported advantage of the approach is that it is a method of moving an EDI transaction via the Web architecture thus avoiding VAN charges. The approach preserves the traditional back end EDI architecture that large companies have in place while purportedly enabling small- and medium-size enterprises to become more involved in EDI. However, such an approach is questionable because it only provides a different type of communication method without eliminating the requirement to do traditional EDI.

XML as a tagging mechanism adds an additional layer of structure when combined with X12. The additional layer increases flexibility but duplicates standardization requirements and adds to the bit count. For example, Federal Express has been experimenting with XML prototypes. File size in their manifest prototype has increased ten-fold compared to their traditional EDI transactions. To use XML as the new standard for Web-based EDI, a cross-industry set of standards—including interchange controls, syntactic and semantic rules, document schemas, and discernable discrete data element tags—must be created.

Any development work on cross-industry standards should take advantage of the work that has already been done building the existing EDI standards. The components of XML data interchange standards would most properly be maintained by a "standards body" similar to the ANSI ASC X12 or UN/EDIFACT bodies. As of this writing, we are beginning to see efforts in that area, but those efforts are only at the initial proposal stages.

In addition, we believe that a proper solution for XML-based EDI would include developing a comprehensive taxonomy scheme. However, developing such a scheme requires tremendous resources and is considered "too hard" by some XML-EDI proponents. As a substitute, the XML-EDI efforts have adopted a less robust solution by developing unique identifiers for each X12 element.[10]

Impact on Federal EDI

The existing federal EDI solution was developed to satisfy the following criteria:

- Automate manual processes
- Standardize approaches across departments
- Create a single face to industry.

These criteria were considered critical for ensuring that trading partners' costs (traditionally passed through to the government) are minimized and their efficiency maximized. EDI was selected because it was the best "national" approach available at the time.

With the development of XML, many have asked if XML replaces EDI. The answer is XML and EDI can co-exist in the federal government. The XML technical specification in and of itself is not a competitor to the concept of EDI, but the XML technology as embodied in the XML technical specifications, developing XML business standards, and Web-protocol-based XML applications are most assuredly competitors to the traditional batch-process ANSI ASC X12 and UN/EDIFACT standards. Rather than being viewed as a competitor to traditional EDI, XML is more properly seen as an extension of the EDI tool in the federal EC toolkit. The XML technology tool, like any other, should be used where business needs dictate.

Equally, traditional EDI should exist when the technology is the correct one to use for a specific business application. At this point we believe that XML should not be used in conjunction with traditional EDI standards because such a combination is of little value beyond perpetuating existing EDI architectures.

[10] ANSI ASC X12, X12 Subcommittee C, Task Group 3, EDI architecture task group, is responsible for developing an approach for using the X12 standards with XML. The task group has developed a technical proposal that has been accepted by X12. A copy of the technical report can be found at http://www.disa.org/x12/x12c/X12CTG3/PDF/xmltechreport.pdf.

However, we are aware of ongoing projects for which the issue is being looked at. A prudent XML implementor should monitor the progress and revisit later, the question of whether or not combining XML and the traditional EDI standards will make business operations economical and efficient.

WHERE XML CAN BE USED IN THE FEDERAL GOVERNMENT

The XML technical specification, XML-based business applications, and the developing business standards and practices seem more suited for application across a wide range of business processes used in the federal government. Put another way, XML can be used where OBI is used, and in places that OBI does not support.

The issue for the government is to resolve whether it wants to change the way it does business and, if so, will the new way be Web-enabled? If the answer is no, then adopting a modified OBI methodology for selected types of small purchases may be an appropriate strategy.

If, on the other hand, the answer is completely or partially yes, then wholesale adoption of XML used in conjunction with a complete Web-based method for making small- and some medium-size purchases appears more appropriate. Of course, to fully leverage the power of XML, implementers must use this technology tool to change existing business processes.

The overriding issue to resolve with respect to using XML is which "brand" of XML will the government adopt. There are many to choose from, both from a business standard and an application perspective. We did not analyze the various XML-enabled applications making their way to the marketplace. That analysis is more appropriate once an XML strategy is developed. However, the variety and nature of competing XML business standards must be understood to determine when and how to pursue XML.

RosettaNet, CommerceNet, BizTalk, XML.ORG, Financial Services Technology Consortium, CommerceOne, and the XML/EDI Group are but a few of the numerous organizations developing XML-based business standards. Unfortunately, the solutions being developed by these organizations are as varied as their number. Some are developing new transaction structures using conventional DTDs and others are using the developing schema specification that is yet to be approved by the W3C. Tag development also is varied. Tags are being created

- from scratch,
- using existing industry data-element dictionaries, and
- using approved standards.

In fact, several groups are using different approaches to develop tags that mimic existing UN/EDIFACT or ANSI ASC X12 transaction formats and segment and data-element properties. Others have reused the semantic content of approved standards but have eliminated unnecessary format and structure artifacts.

XML and Traditional EDI

A number of organizations are trying to link the XML specification with existing EDI standards. Their approaches are as numerous as their number. Although such a solution may benefit the specific organization, it may not be the right approach for the businesses that will implement them.

A better solution would be for an independent standards body to develop XML business standards (in conjunction with the various XML consortiums already in place). Either X12 at the national level or UN/CEFACT at the international level are perfect choices—they have already proven they have all the ingredients necessary to develop business standards. However, any effort at standardizing XML must be done using the same cross-industry, consensus-building approach used for standardizing EDI. The UN/CEFACT and OASIS joint ebXML initiative holds out the prospect of a more global solution to the aforementioned issues.

The X12 transaction sets, segments, data elements, and other components of the standards represent already developed inter- and intra-industry consensus and could be the basis for developing XML business standards. In fact that is exactly what RosettaNet and XML/EDI are doing. However, simply using existing standards does not reengineer the business processes to take full advantage of both a Web-based real-time interactive environment and the functionality of XML-enabled exchanges of business data.

Rather, the developing XML business standards should be based on the current business needs of its intended audience, take advantage of the opportunities human decipherable tags afford (even in machine-to-machine transactional exchanges), and should not be constructed simply to preserve an existing traditional EDI standard.

We believe that the federal government should support standardizing XML whenever the government can receive an operational advantage to do so. Having said that, it seems to us that the real answer lies in the globalization of a single XML solution.

If the government ties itself to a single solution, it will be unable to conveniently exchange data with the full range of its trading partners. The government will be unable to exchange data with trading partners because the trading partners

- will to a greater or lesser degree be XML-enabled,
- will not necessarily work with the same standards selected by the government, and

- could be working in an industry-specific environment while the government needs to exchange data across business sectors.

Accordingly, we believe a proper approach for developing XML specifications and standards is to work with organizations that represent a more global solution. We live in the age of the multinational company and although many of the government's trading partners are not multinational companies, the government should not have to support multiple standards.

When the government adopts an XML standard, the government will likely expect its trading partners to use the same standard. For that reason, we lean toward standards that will facilitate international trade. If those XML standards are supported, we believe that the government will benefit by aligning itself with a more "saleable" standard and one that is defensible because of its global appeal.

Using XML in the Federal Government

We believe that the relative infancy of XML is demonstrated by the proliferation of standards, descriptions, and tags. That proliferation might be practical for certain trade sectors and industries, but would not be optimal for the federal government, which must trade with all business sectors and with companies of different sizes and capabilities.

Although we believe that developing universally agreed-upon business standards is critical for wholesale development of XML applications, we also recognize significant opportunities exist for adopting XML despite its current infancy. For that reason, the federal government should adopt a Web-based system architecture that will work in conjunction with shared and distributed data. One cornerstone of that architecture would be a unified approach to customer access and the use of federal electronic malls being developed or used—such as GSA *Advantage!*, Department of Defense (DoD) E-Mall, NIBISH, and private-sector malls.

Beyond unifying customer access and use, creating XML-enabled electronic malls that unifies data searches and captures by using agreed-upon protocols and standards, all agencies would have access to standardized contract, catalog, and price information. GSA's traditional role of negotiating and maintaining federal supply schedules makes it well suited to lead in unifying federal electronic mall approaches and serving as a procurement information broker.

We also believe that as the government moves to an XML Web-based architecture, a procurement information broker, such as GSA, can ensure that all procurement-related applications have access to the same information. We further believe the RosettaNet, CommerceOne, and CommerceNet business models, and associated schema's and tags, offer opportunities for use as standard approaches for federal electronic shopping.

How Is XML Technology To Be Applied in the Government?

In general, XML can be used to transmit almost all of the government's current procurement and financial transactions. The government's traditional EDI implementation efforts have translated most of the current internal and external transaction requirements into an electronic format. Thus, the change from EDI to XML would be relatively simple.

Some of the more significant internal and external procurement and financial processes that have been converted to EDI are shown in Table 3-2.

Table 3-2. Government Purchasing and Finance Processes Converted to EDI

Quoting	Ordering	Issuing change orders
Invoicing	Paying	Transferring funds
Providing shipment notice	Providing contract notice of award	Acknowledging orders and changes
Vendor performance review	Providing pricing history	Providing contract clauses and provisions
Validating obligations	Recording material due in and received	Reporting contract completion status
Providing a contract payment management report	Providing debit or credit adjustments	Providing remittance advice
Controlling systems through application advice and functional acknowledgment	Providing price and sales catalog information	Obtaining profiles of trading partners
Reporting project costs	Reporting project schedules	Transmitting and receiving specifications and technical data
Reporting nonconformance	Transmitting a material safety data sheet	Reporting shipment discrepancies
Providing receiving and acceptance information	Reporting test results	Transmitting textual information
Inquiring about order status	Responding to an order status inquiry	

Converting existing forms to XML format would be simple in most cases. The use of the Internet is expanding rapidly and, accordingly, the federal government should take advantage of that emerging technology. All applications that can use the Internet should be candidates for converting to XML.

The important question is not "Where can XML be used?" XML can be used almost everywhere. The important question to answer is "How can the federal government and its trading partners begin exchanging information using the Internet with XML?"

The general answer to the question is to develop agreed-upon XML business standards, to allow transmission of XML-formatted data, and to start with

transactions that are of major importance to both the government and its trading partners (e.g., the order and the invoice). However, in order to answer the precise question, "Where can XML be used?" we must first articulate a position on "where XML can be used."

To address the question, we need to examine two separate domains:

- Internal applications
- External applications.

While examining the two domains, we kept in mind a vision of a relatively common government system architecture and the ability to share and distribute data. We examined the acquisition life cycle and highlighted a number of the most important business processes in the cycle for applying one or more of the new technologies.

INTERNAL APPLICATIONS

We started our review of the internal systems in the requirement definition stage. Typically, a requirement is raised that starts the process of acquiring a needed item of supply or a service. We believe the optimal model for moving this business functionality in the government lies in the DoD Defense Logistics Standard System (DLSS).

The DLSS provides a series of automated transactions designed to facilitate the entire supply process. Although the DLSS are automated as 80-column records, all business functionality has been migrated to a series of ASC X12 transaction sets for which government-approved implementation conventions (ICs) already exist. Conversion to X12 EDI had been mandated for all DoD logistics transaction exchanges and it is now only a matter of time before the 80-column records will be replaced by an EDI-based system of moving supply data through the acquisition process.

We believe an opportunity exists for government-wide adoption of a similar system. However, given the move to a Web architecture, we believe that Web technology using XML should be used so that the ever-expanding ubiquitous Internet can be leveraged to move the standard data to all required points in the business process.[11]

We have seen demonstrations of requisitions used as a funding request and validation document. Also, DoD will use a requisition to process requests into accounting systems and to commit funds. In most cases, this step will not be

[11] DoD has looked at transitioning to XML for its DLMS implementation effort but has determined going forward with traditional EDI provides the best method to put process improvements embodied by the Defense Logistics Management System (DLMS) in place in the near term. This approach will provide the stepping stone necessary for migrating to XML once the technical specifications, business standards, and applications reach an acceptable level of maturity to justify the sizeable investment that will be required in hardware, software, and further process changes.

necessary for credit card purchases, but it could be used in applications where purchases need to be authorized as opposed to having a spending limit act as a self-authorizing mechanism for a credit card purchase.

Electronic requisitions would continue to serve as the authority for issuing items from stock. If an item is not in stock, or is not stocked, the electronic requisition also could be the purchase request.

Although not yet demonstrated, we believe that an electronic requisition could be the basis for a request for procurement. If the supply, finance, and purchasing functions work in harmony, we expect that a requisition could be sent through a finance organization for application (i.e., commitment) of funds. The finance organization would forward the requisition to an appropriate purchasing office. While these functions are often collocated, there are countless examples across the federal government where an Internet-enabled system would be of great value.

If the internal business applications are harmonized, we also expect that the requisition could be the basis of a purchase or delivery order. At this point, the business process would move from the internal to the external systems.

We also investigated the contracting process. Here too, there has already been much work done in terms of data element definition, albeit in the context of traditional EDI. Notwithstanding, the entire process, from the time a purchase request is received until a contract is awarded, changed, administered, and closed, could benefit from exchanging information electronically by using XML.

Contract administration is another area that is on the verge of moving from 80-column records to using EDI. We believe, given the current state of the XML technical specifications and business standards, this effort should continue on the path of EDI implementation. However, we also believe once implemented this EDI solution, and the attendant business standardization efforts that are enabling it, could be used as the basis for a subsequent migration to an XML solution. And although not an optimal solution, until all parties are ready to migrate to a full end-to-end XML solution, the EDI solution, with little or no modification, could be treated as an object, wrapped in an XML envelope, and transmitted across the Internet to facilitate VAN-less communications.

Most business functions—such as revised delivery forecasting, shipment notices, contract payment notices, contract closeout status reports, and transportation authorization—are all good targets for the application of XML.

In addition, a wide range of post-contract completion activities might benefit from the electronic exchange of information. These activities include reconciling property accounts and de-obligating remaining funds.

We believe that once a Web architecture is developed and approved for the federal government, the impact on current legacy systems will be minimal to the extent they are already using electronic input for a whole range of functions. Naturally, to the extent that legacy systems and processes are still paper-based, it

will take more effort and the addition of hardware and software to convert the processes to Web-based applications. However, the conversion ought to be easier than moving from paper to full EDI.

EXTERNAL APPLICATIONS

Using the Web will facilitate communications to vendors, especially with small- and medium-size enterprises. Clearly, according to the historical records, those vendors simply did not embrace EDI as had been predicted. An XML-based order can be used easily if the government works with the appropriate standards-making bodies to ensure that required business functionality has been captured. We believe a global approach that takes into account both national and international standards to achieve the best result when adopting XML is the right long-term strategy. However, an international solution may not be available in the near term. Accordingly, we believe that adopting other XML standards on an interim basis, and only with a view of moving toward a more global solution, is an acceptable approach.

While we commend a "single face to industry" approach to the extent practical, we recognize that it should only be a goal. Developing Web solutions offer new opportunities to create and manage multiple approaches. We recognize that not all departments and agencies will use the Web in the same way, and, in fact, that diversity exemplifies the true power of the Web. The Web also gives the government new opportunities for accessing small and medium enterprises and enables new approaches for ensuring fairness and ease of access.

Web architectures will serve the federal government well as long as agreed-upon technical specifications such as XML are used; agreed-upon business standards are developed; and the underlying standard way of forming, documenting, and sharing the various business components of the process exists.

The cornerstone of the process should be a standard approach to federal electronic malls. We believe that the proliferation of electronic mall concepts and solutions should stop and a single solution developed.

Departments and agencies would benefit from a standard approach through more robust product information, price comparison, and ordering capability than is possible currently. To achieve that end, we believe that a procurement information broker and focal point for government electronic business requirements could take the lead in making this a reality.

As we indicate, ample opportunity exists for the vendor community to use the XML specification to communicate data to the federal government. Order confirmation, queries, shipment, proof of delivery, invoicing, and follow-ups are but a few of the significant opportunity areas.

By using the Internet backbone and Web protocols, a single solution can be developed where external trading partners can use the best business and technical solution that fits their needs (machine-to-machine, Internet, VAN,

human-to-machine, dial-up, Web) independent of the government solution. Among the areas fertile for infusing XML, the following offer significant promise:

- Cataloging
- Web-based procurement
- Web-based payment
- Web-based decision support (data searching and analysis)
- Supply chain management
- Reporting.

BARRIERS TO IMPLEMENTING XML IN THE FEDERAL GOVERNMENT

A combination of statutory, regulatory, policy, procedural, and technological barriers exist to rapid adoption of XML. We discuss several of these below. Federal Information Processing Standard (FIPS) number 161-2, *Electronic Data Interchange*, governs electronic data interchange standards. FIPS 161-2 defines EDI, requires the use of approved standards, and lays out the framework for managing the federal government's EDI efforts. Since this FIPS was released prior to the current rush of business information exchanges to the Web, it is silent on Web concepts, specifications, standards, and technologies. In identifying acceptable EDI standards, FIPS 161-2 only references traditional X12, UN/EDIFACT, and Health Level 7 (HL7) EDI. Finally, the responsibilities for the FESMCC are limited to developing processes and procedures for exchanges based on these standards.

To overcome these deficiencies, the FIPS must be changed to take into account the recent changes in the technologies for exchanging information. In keeping with the spirit and intent of the National Technology Transfer and Advancement Act of 1995, Public Law 104-113, the rewrite should be made more generic and less technology specific so that it will not have to be changed when successive technologies are developed and adopted. In our assessment, the contents of FIPS 161-2 do not conflict with Circular A-119, with respect to federal involvement in commercial standards bodies. [12] On the contrary, FIPS 161-2 provides a necessary supplement to Circular A-119 because its FESMCC provisions are a vehicle for coalescing federal business functional requirements for presentation to the commercial standards bodies.

[12] Office of Management and Budget, Circular No. A-119 (Revised), Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities, February 10, 1998.

Regulatory and Statutory Issues

With respect to regulatory issues, the FAR Subpart 4.5, *Electronic Commerce in Contracting,* recognizes electronic data interchange and defines it as

> …a technique for electronically transferring and storing formatted information between computers utilizing established and published formats and codes, as authorized by the applicable Federal Information Processing Standards.[13]

Although the definition may be broad enough to include XML, as discussed above, the FIPS does not mention XML. Before XML can meet the FAR's generic definition of EDI, an existing FIPS, such as 161-2, must be modified, or a new XML-only FIPS must be developed and approved.

Further, the Federal Procurement Policy Act (41 *United States Code* [U.S.C.] 426) requires that agencies meet certain requirements when conducting electronic commerce. One of the requirements contained in the FAR states that systems, technologies, procedures, and processes used by the agency to conduct electronic commerce must

> (5) Comply with nationally and internationally recognized standards that broaden interoperability and ease the electronic interchange of information, such as standards established by the National Institute of Standards and Technology.[14]

The current state of flux in both the XML technical specifications and business standards raises legitimate questions about XML's compliance with the regulatory requirements.

With respect to statutory issues, The FAR is of course based in statute (e.g., U.S.C. Title 10). To that extent, we have addressed the issue of the FAR in the preceding paragraph.

Policy and Procedure Issues

Much work has been done to align policies and procedures to cover the electronic exchange of information. Although some work will have to be done to expand the policies and procedures wherever they address a specific technology, we believe that the basic underlying documents adequately cover the currently contemplated addition of XML. Specifically, the FAR has been changed to allow for electronic contracting. The same provisions of the FAR should be read as equally applying to XML and for that matter, any similar enabling technology that might emerge in the future.

[13] FAR Part 4.501.

[14] FAR Part 4.502(b)(5).

Federal Acquisition Computer Network and Single Face Issues

Since the advent of federal EDI, the explosion of Web activity and the concept of electronic commerce has resulted in a private sector, and to some extent in selected government departments and agencies, shift in emphasis from EDI as the single method of electronic interface. Today, we see multiple EC tools being used with multiple technical and interface solutions. This proliferation of tools has reduced in practice the implementation of the "single-face" concept. However, this proliferation has not lessened the need for the single-face concept. The federal government must determine the continued validity of the single-face concept and determine a strategy for applying the concept to XML implementation.

Technical Specifications and Business Standards

Federal involvement in developing W3C technical specifications and in working with the various XML business standards bodies' efforts has been limited to minimal representation. We believe that the correct approach to adopting XML is to

- participate in standards development efforts, and
- develop a forum for
  - initiating business process reengineering actions, and
  - developing federal government business requirements for XML.

Until the government develops a cross-agency presence in the various XML-related specification and standards bodies, and until federal requirements are identified and incorporated in the developing specifications and standards, XML usability within the federal government will be limited.

The government is heavily reliant on legacy mainframe architectures. A significant number of agencies' core applications continue to run on those architectures. Although XML can interface with legacy applications through various pieces of developing XML middleware, the existing architectures inhibit taking full advantage of the technology. As systems migrate to client-server environments that use relational database systems, and as agencies begin to deploy Web-standards-based intra- and extranet solutions, the barrier will begin to disappear.

The SPS being developed by DoD contains an EDI capability. This system may be one in which adopting XML shows a significant return on investment.

FINDINGS

- XML technology is ideally suited to provide the next step in the expanding capability of the Internet.
- XML technology comprises developing technical specifications, diverse business standards, and burgeoning XML-based applications.
- XML technical specifications enable Web-based human-to-machine and machine-to-machine data exchanges.
- XML uses existing Internet-Web architectures.
- Wide ranges of Web software and database developers are using a combination of mature and immature XML technical specifications.
- The XML technical specifications are still developing. Although the basic XML 1.0 specification has been published for more than a year and the DOM Level I and namespace specifications are also approved, other critical pieces of the XML technical specifications are not yet complete.
- The XML schema specification, when approved, will replace DTDs in most XML applications. This will be particularly true in machine-to-machine exchanges of XML documents.
- XML technical specifications may include government requirements, but if they do, it is by happenstance rather then from direct government input to those specifications.
- Universal agreement to developing XML business standards does not yet exist, a national or international body for developing and storing business standards has not yet been identified, and development and global acceptance of all of the DTDs and XML tags necessary to support the full range of business needs will be a protracted process.
- Developing XML business standards may not include government business processes or security requirements. If the standards do, it is by happenstance rather than from direct government input.
- XML technical specifications and business standards do not yet meet federal government statutory and regulatory requirements for electronic commerce.
- The various efforts for developing business standards are fragmented enough to preclude identifying a “winner.”
- Some organizations developing XML business standards are developing commercial best practice solutions to electronic malls.

- Efforts are underway to develop XML wrappers for traditional EDI standards.
- The commercial XML applications being developed and marketed are using technical specifications having varying levels of maturity.
- SPS is being developed using traditional EDI.
- The federal government has no process in place to coalesce requirements for XML technical specifications or business standards like those that exist for EDI.
- FIPS 161-2 does not support using XML.
- OMB Circular A-119 does not prohibit issuing new FIPS or changing existing FIPS.
- Many critical decisions will be made about implementing XML during the next few years.

CONCLUSIONS

- XML is a new opportunity for integrating data across applications, systems, and organizational entities by using the developing Web infrastructure being established in both the private sector and the government.
- Migrating existing EC efforts that encompass more than a limited trading partner base to XML is premature. We base our conclusion on the lack of maturity of both the technical specifications and business standards.
- No central agreed-upon business standards body exists to control and direct the expansion of XML for Web-based EDI.
- A need exists for consolidating leadership in developing XML business standards.
- Successfully implementing XML in a large organization requires developing a comprehensive XML strategy to include participation in consortia developing XML technical specifications and business standards.
- Any large organization that wants product-neutral solutions must take a leading role and work in the framework established by the standards and technical specification development groups to push such solutions.
- CommerceNet, RosettaNet, BizTalk, OASIS, XML.ORG, CommerceOne, and ebXML offer the most promise for developing XML business standards.

- New XML machine-to-machine implementations should be based on commercial schema specifications or on government-developed schemas if commercial schemas do not meet the government business requirements.
- FIPS 161-2 should be changed, or a new FIPS developed, to support XML and the enhanced FESMCC role.
- The rush to market of XML applications is leading to incompatibility between products and the XML technical specifications and business standards.
- Various XML standards groups afford opportunities to provide a best-practice model for federal electronic malls.
- XML used simply as a wrapper for traditional EDI may not be a sound solution.
- The FESMCC is the best opportunity for coalescing technical and business standard requirements for federal XML efforts.
- Commercial XML business standards should be used in lieu of federally developed XML standards to the maximum extent practicable.

RECOMMENDATIONS

XML appears to be an appropriate technology for future data exchanges in a Web-protocol environment. To that end, the government must actively participate and influence the direction of XML's growth at all levels of technical specifications and business standards. The government should become extensively involved in the XML efforts of the leading standards-setting organizations.

A number of opportunities exist for leveraging XML for immediate improvements. However, because the technical specifications, business standards, and XML-related applications are still being developed, XML-based proposals for new EC initiatives should be carefully evaluated. The evaluation can determine if the effort of changing from DTDs and tags developed for the initiative to the subsequently developed multi-industry, national, or international standards based on the still-developing schema specifications would be cost-effective. The proposals also should be evaluated keeping in mind that the optimal use of XML would be made in conjunction with a reengineered business process. Further, the federal government should delay any extensive implementation of computer-to-computer XML-based exchanges until the schema specifications are satisfactorily mature.

The federal government should identify common requirements of the procurement and financial processes that may be used as a framework for participating in leading standards-setting organizations. Federal government requirements should be developed and proposed by interagency focus groups. The ECPO should serve

to collect the government's requirements in conjunction with a restructured FESMCC.

Independent of the decision to use XML for specific applications, the federal government must establish internal mechanisms to handle XML standardization issues, and must become involved in key external XML standards efforts. The FESMCC should coalesce federal agency requirements and work with external standards efforts to incorporate those requirements in the developing commercial standards. However, some functions that are unique to the federal government will not be addressed by the commercial standards bodies. In those instances, standard federal DTDs and tags should be developed through the FESMCC in compliance with the requirements of OMB Circular A-119 and a revamped FIPS 161-2.

The government also should push for creation of a single national or international standards body responsible for developing uniform XML DTDs and tags.

XML STRATEGY

For using XML, the ECPO strategy should be the basis for developing a federal XML strategy that includes the following steps:

- Participate in developing XML specifications through the W3C XML work groups.
- Participate in RosettaNet, CommerceNet, BizTalk, OASIS, and ebXML.
- Evaluate the developing XML business models for adoption in the federal catalog process.
- Monitor the progress of the CommerceOne, XML/EDI, and XML.ORG efforts.
- Use the FESMCC structure to coalesce federal XML-standards requirements.
- Use the FESMCC structure to develop XML schemas needed for supplementing commercial schemas for federal XML implementation.
- Post federally developed XML schemas in BizTalk, XML.ORG, and other commercial repositories.
- Change the FIPS to support XML and the revised role of the FESMCC structure.
- Ensure that mandatory requirements for federal acquisition, finance, and logistics are articulated and made a part of all XML standards.

- Identify industries that have the largest number of federal trading partners aggressively adopting XML.
- Identify departments and agencies that would want to participate in pilot projects with the trading partners.
- Open a dialog with the SPS program manager to discuss the possibility of incorporating XML in the SPS program.
- Obtain department, agency, and trading partner agreement on participating in pilot projects.
- Obtain funds for pilot projects.

Chapter 4
Vision and Strategy

In Chapters 2 and 3, we discussed how the federal government could use OBI and XML for procurement and finance. This chapter describes a vision of future government purchasing and a strategy the ECPO can adopt to turn the vision into reality.

VISION OF THE FUTURE OF GOVERNMENT PURCHASING

Our vision of the future of government purchasing borrows from the current state of on-line purchasing, including OBI. Government cannot make purchasing decisions as easily as an individual consumer can. Legislation mandates that the government adheres to specific buying guidelines that the consumer is not subject to. Therefore, the emerging consumer on-line buying model is insufficient for handling contracts that dictate the terms and conditions of doing business with the government for micropurchases. In the model below, at least 95 percent of the goods and services are procured at established low government prices by using the purchase card. Our vision also supports simplified acquisition by performing all transactions electronically using the simplest fastest procedures.

In our "ideal" visionary model with XML-enabled electronic malls that use a unified approach, all agencies would have access to standardized contract, catalog, and price information. In the model vendors interested in selling to the government will be obligated to provide dynamic "smart" catalogs that present items, terms, and conditions appropriate for the governmental buyer. These smart catalogs must work specifically with the identity and organization of a government buyer and tailor the view of the catalog to include only items specified in the appropriate contract. The smart catalogs also would be connected to inventory systems, allowing the buyer to see whether a particular item is in stock, along with delivery dates and contracted prices. The architecture of the ideal version is difficult to implement and not likely to come to fruition for some time.

In an ideal version of XML-enabled electronic malls, the government agency maintains profile and contract information regarding its staff. The information limits the number of login identities that must be maintained instead of users needing a different login identity for each vendor. Government buyers may go through a federal portal before connecting to a vendor's electronic catalog. In this way, the vendors know that connections coming through the portal are government buyers, thus streamlining the security procedures necessary to recognize federal buyers. The vendor must accept and recognize the agency-defined

identities, rather than depending on their own uniquely defined identities. The limited login identities will ease the burden on the individual buyer to memorize numbers.

To facilitate adding new vendors who use contracted government pricing to this model, a registry is required. The registry is the architectural element that puts buyers in contact with sellers who can provide the desired good or service. A vendor interested in selling to the government submits identifying information, including commodity type, to the registry.

Another architectural element is needed for the buyer to comparison shop. The consolidator architecture contains this element, querying the registry for candidate vendors, searching each vendor's catalog, and returning a consolidated list of options for the buyer to consider. Buyers would search on the basis of features, not brand name.

A version of XML-enabled electronic malls that uses a unified approach that all agencies could access for standardized contract, catalog, and price information would work like this. A government buyer connects to the electronic mall and specifies the first item he or she is interested in buying. The system searches the registry for vendors who have advertised similar items. The consolidator queries each vendor for the particular item, giving the buyer's organizational identity to ensure that the terms and conditions for selling are proper. The results of the query are displayed in a browser for the buyer to scan. The buyer can sort the results according to several factors, including price and delivery terms. The buyer selects the items from the vendor of his or her choice and adds it to the shopping cart. At this point, the buyer can search for another item or proceed to the checkout counter. At the checkout counter, the buyer can either enter a purchase card number to pay the bill or provide account information so the buyer's agency can run a tab and be invoiced. The contents of the shopping cart are ordered from the appropriate vendors. The obligation is established according to the form of payment entered by the buyer. The vendor's shipping system receives purchase information directly from the on-line purchase as does the buyer's accounting system. The purchase card payment follows the agency's established purchase card procedures. Accounts that are invoiced will receive the invoice at the account's billing address and will pay according to federal contractual procedures.

To reach the greatest number of potential trading partners, this model uses the standard HTTP data-transfer protocols and standards-based data formats. In our visionary model of XML-enabled electronic malls that use a unified approach, XML will be used to exchange all data between trading partners in the background, unseen by government users. Individual organizations can maintain their legacy data formats and structures by mapping to and from the standard XML formats.

Our vision of federal purchasing may be easily understood, but not as easily adopted and implemented. Below, we describe the ECPO strategy and what needs to happen to make this vision a reality.

ECPO STRATEGY

The ECPO is a facilitator and coordinator for working across the federal government to address government-wide issues, identifying opportunities for common solutions and approaches, supporting pilot projects that have government-wide applicability, testing new concepts and methods, and promoting information sharing about best practices in applying electronic commerce technologies.

The use of electronic catalogs introduces new technology, such as XML, which can have a major positive affect on government purchasing procedures.

Federal Electronic Commerce Policy

On the basis of the comments received from our interview workshop, we recommend that the ECPO articulate government policy for using Web architectures, OBI, XML, and other EC technologies, such as the electronic malls.

We see little advantage in trying to use XML (or any new technology) with existing electronic batch processes. The lesson that should have been learned from the EDI strategy is that technology is used optimally when processes change to take advantage of the economies and efficiencies of the new technology. However, BPR does not necessarily mean that only one way of doing business is possible. BPR can result in the adoption of a single standard that can be adapted to the specific requirements of each department or agency. However, processes should be changed to take advantage of the new way of doing business (e.g., real time, interactive human-to-machine, and machine-to-machine) that the Web makes possible.

After the ECPO recommends a Web architecture, the next step is to bring the agencies together and obtain their buy-in and participation. For this we recommend that the ECPO involve the highest levels of the government by working with government-wide executive councils and organizing interagency work groups to address government-wide electronic commerce issues. The government-wide executive councils and the interagency work groups will provide management structure and support needed for federal EC programs. At present, the EC Customer Advisory Board (CAB) is not active, however, we recommend that the ECPO try to reconstitute this group or another such group to address high-level issues.

The ECPO may contribute to the development of a government-wide EC plan and advise and make recommendations to agencies. At the request of OMB, the ECPO may support OMB in coordinating the development of annual strategic plans by

each agency. The ECPO should ensure that EC policies contain a model for agencies that want to adopt the technologies, but not mandate using the model.

EC Management and Support: Government-Wide Executive Councils and EC Work Groups

GOVERNMENT-WIDE EXECUTIVE COUNCILS

The ECPO, upon invitation, advises government-wide executive councils, such as the Electronic Processes Initiatives Committee, Procurement Executive Committee, Chief Finance Officer Council, and the Chief Information Officer Council. The ECPO should build a case for transiting to a Web-based architecture, especially because EDI is just reaching maturity in some parts of the government.

The government-wide executive councils would have the power to press for adopting EC in the federal government. The government-wide executive councils can do several important things:

- Bridge business functions
- Speak for all the departments and agencies
- Be the agent for change.

Representatives of government-wide executive councils are expected to know or become knowledgeable about the operations of their agency. They can speak with authority and make decisions on behalf of their department or agency. For this reason, once decisions are reached, action can be taken on EC initiatives and issues. Once the government-wide executive councils agree with the ECPO's Web strategy and new business processes, the ECPO would have the policies approved.

With regard to funding, we learned from our June workshop that although the participants both desire and prefer federal funding, departments and agencies will justify their own funding if they do not receive federal support. Thus, the individual agencies may already have funding for pilot projects.

EC WORK GROUPS

We recommend that ECPO organize interagency work groups to address government-wide issues (e.g., common business processes, XML standards) and brief government-wide executive councils. EC work groups, consisting of representative government members with expertise in specialized functional or technical areas, would be used to carry out various phases of the EC plan. For example, a work group would be assigned to examine the current federal policies so the plan that is developed follows regulations, or regulations that need to be created or changed are identified. We recommend that the ECPO use the existing federal

electronic commerce coordinators as a work group and also the FESMCC work groups. In this way, the ECPO can have resources for researching EC initiatives or issues and their effect on the government. With the EC management and support structure in place, the ECPO can effectively work with the agencies, and together, bring about the needed changes. The following are issues for the ECPO to discuss with government-wide executive councils and then address through the appropriate EC work groups:

- Examine current federal business practices.
- Identify and change applicable federal policies.
- Work with functional organizations to develop the "to be" business model.
- Participate with standards work groups in developing standards specifications. For example, participate in the W3C XML work groups.
- Identify departments and agencies that would want to participate in pilot projects with the trading partners.
- Obtain agreements from departments, agencies, and trading partners to participate in pilot projects.
- Obtain funds for pilot projects with industry.

Role of the FESMCC

The FESMCC supports developing, maintaining, and approving federal EDI ICs. The ICs contain the federal requirements for data that is needed when doing business with inter- and intra-EDI trading partners. The FESMCC is vital in supporting government EDI needs in procurement, finance, logistics, health care and communication, control, and security. Work groups representing each of these areas have the expertise of each department and agency wanting to do EDI. The ICs that these federal functional work groups develop then are approved by all the agencies participating in the FESMCC and embracing EDI. Because of the efforts of the FESMCC and the federal functional work groups, industry and federal trading partners can use federally approved ICs in doing business.

In EC, a natural evolution occurs when using technology. As the federal business through the Internet and electronic malls rises, the use of federal EDI could decline. Other EC technologies, such as XML, could be used. The FESMCC has proven the effectiveness of using work groups. With the introduction of XML and other new technology, we recommend keeping the management and work group structure in place and changing their charters to accommodate the new technologies so that they can better serve a Web-enabled federal government. For example, XML should be added to the FESMCC charter. The new charter will give FESMCC a new focus that is in line with the plans of the ECPO. The new charter

should address standardizing the use of EC technologies to include their underlying standards, and in the case of XML, DTDs and tags. The DTDs and tags are a superset of those already developed by industry, when both meet the federal business requirements and are on their way to be accepted across different industries planning to use XML. The superset would be the basis for all federal XML work and should be used if industry products are either unavailable or do not meet government business needs.

We envision that the FESMCC work groups also will be active in developing the XML requirements for XML-enabled electronic malls that use a unified approach for all agencies to have access to standardized contract, catalog, and price information. For example, the FESMCC chairperson should task the procurement, finance, and logistics work groups with developing a minimum set of federal requirements for each functional area to support using the electronic malls. Likewise, the chairperson should task the communication, control, and security work group with ensuring that the electronic malls meet federal requirements for their functional areas. The ECPO and government-wide executive councils would task the FESMCC work groups with defining the functional processes and data requirements.

Our discussions with the workshop participants indicate that the government needs to actively develop the new standards it wants to use and not let industry develop new standards without incorporating federal requirements. By having the FESMCC participate in defining the government's requirements for electronic malls and XML, the ECPO puts the federal government in a position to determine early what it requires (be able to work with industry to achieve its goals).

In redefining its role, the FESMCC will need to address the following. We recommend that the chairperson and the chairpersons of the work groups address these areas directly with work group members and facilitators.

- Adopt a new name that reflects EC and not just EDI.
- Enhance the FESMCC charter.
- Change FIPS 161-2 to reflect the new Web-based business processes and the federal adoption of other technologies and standards.
- Recruit additional agency participants who can work on parts of the EC plan and represent their functional areas, agencies, and departments.
- Develop a new comment and approval process that, in addition to ICs, includes DTDs and tags.
- Determine what Web site support is needed for the comment and approval process and post approved ICs, DTDs, and tags.

- Task the federal functional work groups with developing a minimum data set of federal requirements for procurement, finance, logistics, communication, control, and security for the electronic malls that use a unified approach for all agencies to have access to standardized contract, catalog, and price information.

- Determine procedural, regulatory, or legislative changes that may be required for business processes in the agencies to be reengineered.

We have discussed the EC plan and the support structure, consisting of the high-level government-wide executive councils and its work groups. Just as important to the success of the ECPO is a high-visibility outreach program.

Visibility and Outreach

As workshop participants pointed out, we can learn from our federal EDI program and do a better job of informing industry about working with the government. Through established industry associations, consortia, and other forums, the ECPO can strive to inform industry and cognizant EC officials in the agencies about federal EC initiatives and strategic plans. The ECPO's approach would constitute an unstructured and noninstitutionalized outreach program.

Appendix A
OBI Technical Details

This appendix discusses OBI and its related technology in detail. Persons who want to learn more about the technology of the OBI model should read this appendix in conjunction with Chapter 2.

Understanding the detailed technical requirements of the OBI model is important because, in some aspects of its operation, it may not meet the test of compatibility with the legacy procurement and finance systems or the federal government's internal architecture supporting those systems.

STANDARDS

The OBI architecture is built on existing standards to maximize interoperability and decrease implementation costs. Therefore, we believe that a brief discussion of the standards is a logical starting point for examining the OBI model. Accordingly, this appendix examines the standards used in the OBI architecture.

Table A-1 summarizes the standards we discuss.

Table A-1. Standards Used in the OBI Architecture

Purpose	Standard	Existing examples
Content display	Evolving standards for Web browsers (currently based on HTTP and HTML) as specified by the W3C	Netscape Navigator V3.0 or later; Microsoft Internet Explorer V3.0 or later
Order requests and OBI orders	X12 850 EDI standard	OBI version 2.0 order format specification (defined by the OBI Consortium)
Order transmission	HTTP 1.0 using SSL	HTTP servers available from many vendors, including Netscape, Microsoft, and Oracle
Secure Internet communication	SSL V3	SSL supported by many vendors, including Netscape, Microsoft, and Oracle
Cryptography	SSL V3 API	Netscape SSL API
	Public key cryptography standards (PKCS)	RSA Securities BSAFE™
		Microsoft CryptoAPI
Public key certificates and certificate authorities	X.509 V3 certificates	GTE CyberTrust, Verisign

Note: SSL = secure sockets layer; API = application program interface.

CONTENT DISPLAY

The OBI content display is what the user sees through the browser, currently using HTTP and HTML. Examples of browsers are Netscape Navigator version 4.0, and Microsoft Internet Explorer version 4.0.

ORDER REQUESTS AND OBI ORDERS

Formats

OBI version 2.0 specifies using a subset of the X12 TS 850 (version 3040) for two standard documents that use OBI-style electronic ordering: order requests and the OBI order. An order request is generated by a seller according to the content of a requisitioner's "shopping cart" and implies no approval. An OBI order is generated after a purchase is approved by the buying organization. In the future, the OBI Consortium may provide standard order formats based on EDIFACT or XML and may add other document types.

Order Transmission

HTTP is a proven and widely adopted Internet protocol. It is the core transport protocol used in the World Wide Web. OBI version 2.0 specifies using HTTP (using SSL) to transmit OBI order requests and OBI orders.

SECURITY

The OBI architecture supports a number of existing security standards, including Internet protocols for secure communications, public key cryptography (PKC), and digital certificates.

Secure Internet Communications

For generic secure communication between OBI entities, the OBI-specified protocol is SSL V3. This protocol covers the widest range of potential implementations of network software components.

Public Key Certificates and Certificate Authorities

PUBLIC KEY CERTIFICATES

The OBI architecture relies on digital certificates for identifying individuals, organizations, and machines. The certificates will be based on the X.509 V3 standard.

CRYPTOGRAPHY

OBI specifies using PKCS #7 for digital signatures. Currently, RSA offers the BSAFE™ and TIPEM™ tool kits, which support the PKCS #7 standard. Higher level tool kits also are available for developing secure applications. For example, Microsoft offers CryptoAPI, and Netscape and others offer commercial SSL implementation tool kits.

Summary

We are comfortable that the OBI architecture has addressed all of the known issues surrounding moving business data. We cannot say for a certainty that the current protocol choices conform to government guidelines and standards for similar aspects of security. However, on the basis of our knowledge of the subject, we believe that the protocol choices can be fully supported. Further work needs to be done to ensure that the OBI-selected security protocols are compatible with

- federal government laws, rules, and regulations;
- legacy purchasing and finance systems that will be used if OBI is adopted; and
- future purchasing and finance systems if OBI is adopted.

We now focus on the OBI model.

OBI Model

Below is a detailed discussion of the OBI model and architecture.

The OBI architecture is based on the following model of business-to-business commerce (the numbers correspond to the links in Figure A-1):

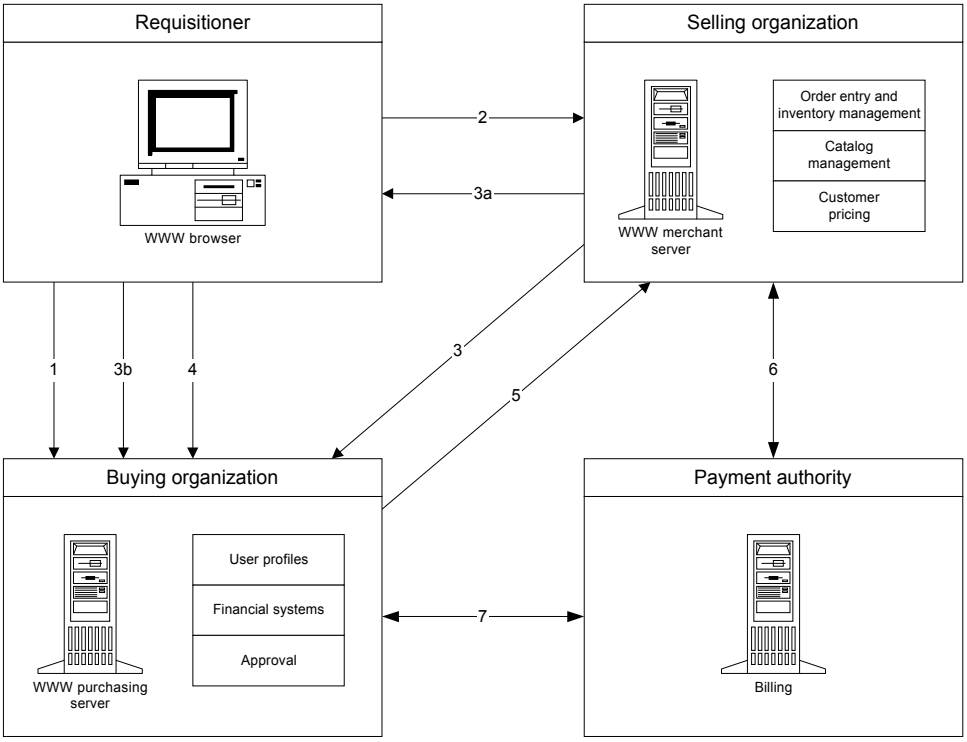
1. *A requisitioner*, using a Web browser, connects to a local purchasing server located at the *buying organization* and, via the Internet, selects a hyperlink to a *selling organization's* merchant server, which contains a selling organization's on-line catalog of goods and services maintained by the selling organization.

2. The selling organization's server authenticates the requisitioner's identity and organizational affiliation on the basis of the information presented in the requisitioner's *digital certificate*. Authentication information is used, in conjunction with profile information optionally presented by the requisitioner's browser, to identify the unique requisitioner and to construct a specialized catalog view. The requisitioner browses the catalog, selects one or more needed items, places them in a "shopping cart," and "checks out."

3. The content of the "shopping basket" and the requisitioner's identity are mapped into an "*order request*" (EDI-compatible). A digital signature is calculated (optional); the order request (and digital signature if used) is encapsulated in an *OBI object*, which is encoded and transmitted securely over the Internet using HTTP and SSL, to the buying organization. In OBI/2.0 two alternative methods are used for transmitting an encoded OBI object containing an order request over the Internet using HTTP.

   - The *server-to-server* method (step 3 in Figure A-1)
   - The *server-browser-server* method (step 3a-3b in Figure A-1).

Figure A-1. OBI Architecture



Note: The OBI/2.0 technical specifications focus primarily on steps 2, 3, 3a, 3b, and 5.

The buying organization's server receives the encoded OBI object, decodes it, extracts the order request, verifies the signature (if appropriate), and translates the order request into an internal format for processing.

1. Administrative information (e.g., the payment type) is added to the order request at the buying organization (either automatically from a profile database or manually). Depending on the buying organization's process, the requisitioner may participate at this step of the process. The order then is processed internally in either an automated or manual mode.

2. The completed and approved order is formatted as an *OBI order* (EDI-compatible) and a digital signature is calculated if desired. The order (and

digital signature, if appropriate) is encapsulated in an OBI object that is encoded for transport and transmitted securely from the buying organization server to the selling organization server via the Internet using HTTP over SSL. The selling organization receives the encoded OBI object, decodes it, extracts the order, verifies the signature (if appropriate), and translates the order into its internal format.

3. The selling organization obtains credit authorization, if necessary, and begins filling the order.

4. The payment authority issues an invoice to the selling organization and receives payment, if a credit card company. In another scenario, the selling organization could invoice the buying organization's payment authority and receive payment.

The OBI technical specification describes the following aspects of the OBI architecture:

- Requisitioner access to selling organization catalog
- Format for order requests and OBI orders
- Use of optional digital signatures
- Encapsulation of orders and order requests in OBI objects
- Secure transmission of OBI objects using standard Internet protocols
- Authentication of requisitioners and servers, including use of digital certificates.

Although some of the foregoing aspects are easily understood, we believe several are not. Accordingly, we discuss below those that we believe must be further explained.

Requisitioner Authentication Using Digital Certificates

Before allowing the requisitioner to access the catalog, the selling organization's server needs to establish (and store) the identities of the requisitioner and the company with which the requisitioner is affiliated. Both trading partners need to be able to trust that the identities have been reliably established before the catalog is accessed. The selling organization needs to be assured of the requisitioner's identity and the buying organization needs to trust that the selling organization established that identity before revealing sensitive pricing information or allowing the individual to request an order on behalf of the buying organization.

In the authentication step, X.509 version 3 digital certificates and the SSL version 3 protocol are used for mutually authenticating the requisitioner and the

catalog server. As part of the authentication, the selling organization's server verifies the requisitioner's certificate and obtains the authenticated common name (CN), organization name (O), and electronic mail (MAIL) address from the "Subject" field of the certificate as well as the organization name from the "Issuer" field of the certificate. The selling organization uses the information to determine the catalog information the requisitioner is authorized to see, populate any resulting order request with requisitioner's identification information, and identify the appropriate trading partner to whom the order request is to be sent.

By using the SSL V3 protocol and X.509 digital certificates, the selling organization has cryptographic assurance of the identity of the requisitioner, and the requisitioner has cryptographic assurance of the identity of the catalog server. SSL V3, in conjunction with digital certificates, is the standard, required authentication mechanism for accessing the OBI catalog.

The identity of the requisitioner is derived from the "Subject" and "Issuer" fields in the certificate. Specifically, the requisitioner is identified from a combination of the subject's CN; O; and MAIL address, if available; and the issuer's O. If additional information is needed to unambiguously identify the requisitioner, the buying organization can transmit a unique requisitioner ID as a name-value pair in a hidden field in an HTML form when the catalog is accessed. To our knowledge, the government has no policy about assigning unique personal identifiers. We believe that such a policy could be developed easily but that maintaining the identities would create some challenges to be overcome.

The identity of the company with whom the requisitioner is affiliated is derived from the organization name in the subject field of the certificate. The issuer organization name is used to verify that the certificate authority (CA) that signed the certificate is an authorized CA for this trading partner.

Authenticating the requisitioner to the catalog site includes the following steps:

- Selling organization preconfigures its catalog server to require a certificate for controlling access.
- Requisitioner requests connection to selling organization's catalog.
- Requisitioner's browser presents a certificate in response to server's request.
- Selling organization's server verifies that the certificate is valid and retrieves and stores information from the certificate, including the organization name from the issuer name and the common name, organization name, and electronic mail address (if available) from the subject name.
- Selling organization checks the subject's organization name and issuer's organization name with information stored in its databases to determine if the certificate is acceptable for catalog access.

- Optionally, the selling organization retrieves and stores requisitioner profile information from the HTTP post and uses data from the post to further customize the catalog view.

- Selling organization presents customized catalog view.

The process described above clearly does not exist across the wide range of legacy applications. Accordingly, if OBI is adopted, the applications will have to be adapted.

The OBI authentication specification requires that the

- browser and server support SSL V3 or later;

- browser and server have valid certificates installed that meets OBI requirements;

- catalog site be able to authenticate the requisitioner according to the requisitioner's certificate;

- requisitioner's browser be able to authenticate the requisitioner on the basis of a certificate; and

- information, including the subject's common name, organization name, and electronic mail address (if available), and the issuer's organization name, be retrieved from the requisitioner certificate and made available to server-side applications.

All of the foregoing technical requirements can be satisfied. However, they are not in place. If OBI is adopted, then creating the architecture necessary to store, retrieve, transmit, and receive the components for authentication will be necessary.

We believe that the FESMCC, working under a revised charter, could develop a draft authentication policy and the related system architecture issues.

Transmitting Optional Profile Information

Two situations can occur when the buying organizations, when accessing the catalog, may need to provide the selling organization with requisitioner profile information beyond the CN and O contained in the digital certificate. These two situations are as follows:

- More information is required to uniquely identify the requisitioner. This situation could occur if the CN and the MAIL address in the requisitioner's digital certificate do not uniquely identify the requisitioner in the buying organization.

- More information is required for establishing the boundaries for an appropriate catalog view for the specific requisitioner. This situation could occur if the selling organization requires additional information beyond the subject's organization name in the requisitioner certificate to establish the appropriate level of granularity for a specific catalog view. For example, if the selling organization requires an account code.

In these cases, two trading partners can agree to have the buying organization's server pass the additional profile information to the requisitioner's browser in OBI-defined name-value pairs in hidden fields in an HTML form when the requisitioner selects the selling organization's hyperlink. Using the HTTP *POST* or *GET* method, the requisitioner's browser will be directed to transmit the name-value pairs to the selling organization's application.

Clearly the ECPO should see that different selling parties will have different views about what needs to be done in both of the foregoing situations in order to grant appropriate access to potential buyers. Accordingly, we believe that this is another area in the authentication process where policy and standardization could be of importance. Accordingly, as before, if OBI is adopted, we recommend that the FESMCC develop a draft policy and standard work methods.

Catalog Access

In the initial steps of an OBI purchasing transaction, a requisitioner, using a Web browser, connects to a local purchasing server located at the buying organization and selects a hyperlink to a selling organization's merchant server, which contains an on-line catalog of goods and services. The selling organization's server authenticates the requisitioner's identity and organizational affiliation according to information presented in the requisitioner's digital certificate. If the requisitioner presents the appropriate credential, the selling organization server presents a specialized catalog view.

When the catalog is accessed, the selling organization determines the requisitioner's identity and the organization affiliation. In addition, some selling organizations may need more granular information, such as the specific trading contract and shipping destination for this requisitioner. The selling organization uses information obtained when the catalog is accessed to

- construct the appropriate specialized catalog views for requisitioners,
- give requisitioners access to their personal order status and order history,
- properly identify requisitioners on order requests that are sent to buying organizations, and
- transmit the resulting order request to the right place for processing.

The catalog access step (step 2 in Figure A-1) requires that the requisitioner be authenticated and optionally includes transmitting standard requisitioner profile information from the buying to selling organization. Catalog access relies on HTTP, SSL, HTML forms, and X.509 V3 digital certificates.

We believe that to optimize their use, catalogs that will be used in the government purchasing and finance processes need to contain a minimum set of data. Therefore, if OBI is adopted, the FESMCC could be tasked with developing that minimal set of data.

Equally important, the federal government must institutionalize its data requirements. For that reason, participating in the work of appropriate standards-making bodies is essential to ensure that resulting standards fully support the government's requirements.

Identification of the Requisitioner in the Order Request

The selling organization uses information obtained when the requisitioner accesses the catalog to identify the requisitioner on the OBI order request when it is sent to the buying organization. The following steps summarize the information flow:

- The selling organization retrieves and stores the subject common name, subject organization name, and subject electronic mail address from the requisitioner certificate when the requisitioner requests access to catalog.
- The selling organization retrieves and stores the OBI requisitioner identification (OBIREQID) from the optional name value pairs, if available, when the catalog is accessed, after the successful authentication by the requisitioner.
- When the selling organization constructs the order request, the requisitioner's identity information is included in the EDI transaction as follows:
  - If the OBIREQID is available, it is included in the order request in the N1 segment with N101=EY, N102=<Subject Common Name>, N103=92, and N104=<OBIREQID>.
  - Alternatively, if OBIREQID is not available but a subject electronic mail address is retrieved from the certificate, then it is included in an N1 segment with N101=EY, N102=< Subject Common Name>, N103=92, and N104= <Subject Electronic Mail address>.
  - If neither OBIREQID nor subject electronic mail address is available, then the common name is included in the N1 segment with N101=EY and N102=<Subject Common Name>.

The foregoing discussion on the several methods of identification raises another important issue. Current approved federal EDI implementation conventions specify a different naming convention. That convention may include a free-form text name; a code representing a name.[1] In that case, the receiving application may have to be adjusted to accept other forms of coding schemes. In addition, if the automated population of a receiving database is contemplated, additional logic might have to be added to ensure that other name varieties can be read and interpreted.

Digital Signatures

Digital signatures are optional in OBI. When used, digital signatures are based on the PKCS #7 cryptography standard and are detached signatures encoded separately from the data to which they apply. If a signature is used in an OBI object, it is a signature on the data contained in the OBI data field. The primary benefit of a detached signature is that implementations that do not support digital signatures will be able to process data that has been signed even though they are unable to verify the signature.

In OBI, signatures are associated with buying and selling organizations and not with individual requisitioners who initiate orders. A digital signature provides nonrepudiation of origin and content for transmitting the order or order request between trading partners. The recipient is assured that the particular order or order request was sent by someone with access to the signer's private key. This means an order cannot be forged or tampered with, and a signer cannot deny having sent a particular order.

The transport security protocol used to transmit OBI objects also provides the recipient with a high level of assurance of origin and content. The SSL authenticates the sender and protects the integrity of the data stream. If the result of the authentication is passed along to the application, then that action provides the recipient with information that can be used to ensure the authenticity of the received order.

Digital signatures have two additional advantages:

- First, they are evidence that can be stored for later retrieval if nonrepudiation is a business requirement.
- Second, they enable having multiple authorized signers in an organization.

However, the additional benefits of digital signatures must be compared to the cost of implementation. Initial OBI implementations involving low-dollar transactions and trading partner relationships may not use digital signatures.

[1] Examples of codes representing names include a DoDAAC (Department of Defense activity address code) or a CAGE (contractor and government entity) code.

We recommend that if OBI is adopted, transmitting digital signatures in the OBI model will be subjected to government legal review to determine if the method meets the federal standard for transmitting, receiving, and protecting digital signatures.

OBI and EDI Standards

The specification of the OBI order format is based on X12 EDI standards. EDI is a means of conducting structured electronic transactions between trading partners. Traditionally, EDI has referred to both the data structure of the transactions as well as the transport mechanism. However, although OBI/2.0 uses the EDI X12 850 version 3040 data standard for structuring order information for exchange between trading partners, the transaction set is transported by Internet standard transport protocols. The currently approved federal implementation convention for purchase orders (when issued from a buying activity) is the 3050 revision 1, using the X12 3050 standard as a baseline, and not the 3040 standard used in the OBI model.

If OBI is adopted, the capability of the OBI 3040 will have to be examined to determine what federal data requirements can be carried in that version or release. If a difference is noted, some decisions will have to be made:

- Are the missing data elements really required to make a government purchase using the OBI model?
- Will the managers of the OBI model be willing to change the model to accommodate required government business functionality?
- If the missing data elements are required, should they be mapped to the 3040 X12 standard or should the possibility of moving to a higher version or release be explored with the managers of the OBI model?

The specification of the OBI order format has been designed to support the data requirements of low-dollar transactions, generated by end-users, between trading partners. The specification enables using only a subset of the available 850 data segments, data elements, and codes in the standard and the interpretation of the segments, elements, and codes is well-defined. Implementation should not require using EDI translation software, although the specification is fully compliant with X12.

OBI/2.0 order format specifications requires the following:

- Buying organization’s systems must be able to create OBI orders in the format described and interpret order requests that are compliant with the specifications.

- Selling organization's systems must be able to create order requests in the format described and interpret OBI orders that are compliant with the specifications.

- Use of data segments, data elements, and codes must conform with the OBI specifications, i.e.,

  - ➤ segments and elements must be used as specified,

  - ➤ segments must appear in the sequence specified,

  - ➤ segments specified as mandatory must be present,

  - ➤ data elements specified as mandatory must be used if a given segment is used,

  - ➤ use of segments other than those explicitly listed as mandatory or optional is not allowed, and

  - ➤ use of standard X12 codes must conform with the specification (i.e., fields requiring standard codes must use those explicitly selected for OBI).

Using OBI-optional segments or elements is the option of the sending party but should be based on the mutual agreement of the trading partners. For this reason, the specific capabilities of the OBI model must be reviewed to determine the extent to which it can carry mandatory government purchasing data requirements.

We believe that necessary precursor steps for the federal government to take include

- determining if OBI will be adopted; and if so,

- determining the minimal data set needed to make a purchase that complies with law, rule, and regulation; and

- determining the extent to which the minimal data set can be carried in the OBI 3040 standard.

OBI in Relation to Other Standards

- *eCo Framework Project* is a CommerceNet initiative to develop a common framework for interoperability among XML-based eCommerce protocols from the ever-growing collection of specifications. The collection includes EDI, OBI, Open Trading Protocol (OTP), CBL, Internet Content Exchange (ICE), and XML. With the initiative, CommerceNet intends to define an architecture for how e-business is done in a distributed fashion based on the exchange of documents in XML. OBI is on a growing list of

ways that e-business is done. Some elements of the OBI architecture might be included in the eCo framework, while others will certainly not. We believe that eCo is a very important project and recommend that the government participate in it to ensure that interoperability is addressed.

- *RosettaNet Implementation Framework Project* intends to create PIP specifications for exchanging business information, which allows for rapid and efficient implementation using XML and the World Wide Web. The resulting framework is intended to accommodate other existing and future e-business protocols. OBI is one of the existing protocols that will be accommodated and borrowed from as appropriate. The RosettaNet consortium has recommended adopting the OBI model for encapsulating standard EDI transactions in Internet objects used to exchange business information between trading partners in the Information Technology supply chain. As with the eCo project, we believe that the government's participation in this project is equally important to ensure that government requirements are being addressed.

- *XML* has been identified by the OBI consortium as a potential replacement (or additional) data format for its order requests and orders. Currently, this data format is based on the X12 850.

- *EDI* is the chosen data format for the OBI objects. OBI chose to simplify using EDI by using the 850 for both the order request and the order. We note that the transmission of an X12 850 (e.g., an EDI) "order" to a buying office is an unusual use of that transaction set. Its traditional use, of course, is to go from a buying organization to a selling organization, not the other way around. Accordingly, if the government adopts the OBI model, it will have to either alter its receiving applications to recognize and accept the "order" (e.g., the X12 850 transaction set) or work to alter the OBI model.

- *XML/EDI* is an effort for developing XML guidelines for traditional EDI technical standards. The resulting guidelines might be adopted in the OBI data format. There might be three data formats to choose from, although the last two might be the same:

  - EDI

  - XML

  - XML/EDI.

- *OTP* is a specification developed by the Open Trading Protocol Consortium specifying an interoperable message protocol that encapsulates the payment, permits the offer or invoice to be presented, pays receipts to enable delivery, and achieves trading on the Internet. This is a more direct competitor of OBI, though it is broader, specifically covering distinct

offers and receipts. OTP is aimed at the more generic buyer-seller market sector in which the buyer could be a business and the seller could be another business or a consumer.

From the foregoing can be seen that competing standards are being developed. While we have written about OBI in the context of one model, clearly using OBI and related "languages," such as XML and EDI, is still evolving. The government will have difficulty as it works through the various issues if it decides to use OBI to determine which specific variety of OBI and "language" will appeal to its actual and potential trading partners.

Clearly the federal government, in making any choice to adopt a standard, must consider its trading partner base. The government buys from many hundreds of thousands of suppliers who represent virtually all trade sectors. Accordingly, adopting any purchasing model or standard must have the widest appeal to the private sector. The on-going competition for developing models and standards makes it extremely difficult to say with any degree of certainty that a preferred way of doing business exists.

Data Requirements

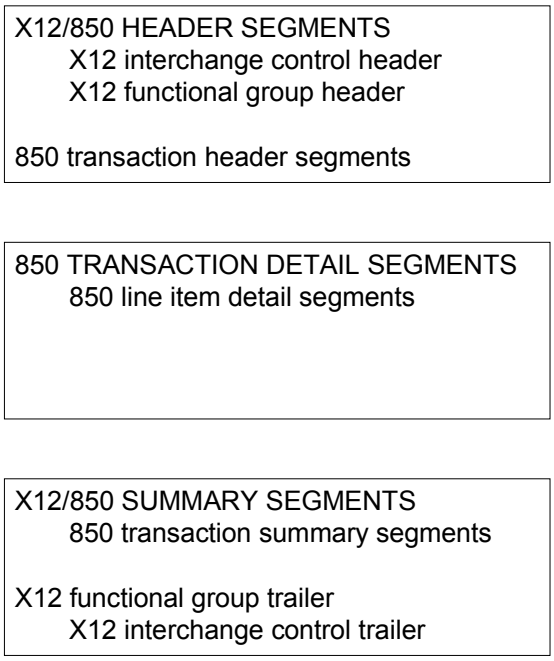
The OBI order format specification is designed to support high-volume, low-dollar transactions of nonproduction goods and services with existing trading partners. The transactions typically involve one or a few line items, next day delivery, predefined shipping, and terms and conditions that are based on existing agreements. The specification restricts using 850 data segments and data elements to those required for transactions that simplify implementation and ensure interoperability.

As a result, the OBI format will support many, but not all, types of purchasing transactions. In particular, OBI has explicitly not been designed to support the coding of traditional purchase orders that include terms and conditions, significant line item detail, complex delivery schedules, and detailed shipping instructions. It also has not been designed to support complex high-dollar transactions or the acquisition of production good and services. Having said that, save for the purchase credit card method of buying, OBI may be economic and efficient in other small but important categories of purchases.

Data Structure

All OBI 850 transactions include a header area, transaction detail, and a summary area. The header area is composed of an X12 interchange header segment, an X12 functional group header segment, and several 850 transaction header segments. The transaction detail area includes a number of data segments containing the details of the order's line items. The summary area includes 850 summary segments, an X12 functional group trailer segment, and an X12 interchange trailer segment. All OBI 850 transactions follow this structure as shown in Figure A-2.

Figure A-2. OBI 850 EDI Data Structure



In that structure, actual order data is carried in *data segments* that are made up of one or more *data elements*. Data elements contain actual data, identifiers (that characterize other data elements), or codes. Specific data segments have assigned locations in the header, detail, or summary areas. Some segments can be used at either a header or detail level. In these cases, where the segment is used determines whether it applies to the overall order or to a line item. For example, tax information can be included for either an overall order or for a line item.

X12 also includes sets of standard codes. The OBI order format specification describes the OBI required usage for data elements, data segments, and codes.

We commented earlier about the need to establish a government minimum data set and then to compare that data set to the capability of the 3040-based OBI model.

TECHNICAL COMPLIANCE

To promote interoperability, the concept of OBI technical compliance must be defined. OBI technical compliance specifies a *minimal* level of implementation that allows for the useful interoperability of systems and business processes. This section defines the requirements for such minimal technical compliance.

Technical compliance with the OBI/2.0 standard is outlined in two dimensions. First, all implementations must meet certain minimal requirements related to data, transport, and security to be considered OBI-compliant. Second, each of the

interested parties (i.e., selling organizations, buying organizations, requisitioners, third-party agents, and technology providers) must meet certain minimal requirements to be considered technically compliant.

Both receiving- and application-level edits will have to be examined to ensure that the OBI model, if it is adopted, will either support the current edits or to identify which edits or OBI structures will be candidates for recommended changes.

Compliance with Data-Related Specifications

Implementations that are compliant with OBI *data-related* specifications MUST be able to do the following:

- Create OBI orders or order requests formatted according to the OBI/2.0 order format specification.
- Package OBI orders or order requests as OBI objects before they are transmitted.
- Correctly interpret and process OBI orders or order requests formatted according to the OBI/2.0 order format specification.
- Interpret and process OBI objects without digital signatures or be able to interpret and process OBI objects that contain digital signatures even if signature verification is not supported. The capabilities of the legacy systems will have to be examined to determine how much they can support the OBI model or to determine what changes may be required.

Compliance with Transport-Related Specifications

Implementations compliant with OBI specifications for *server-to-server transport* MUST be able to

1. transmit base 64-encoded OBI objects directly to OBI-compliant servers using HTTP POST with SSL V3 as specified in OBI/2.0 technical specifications,
2. receive base 64-encoded OBI objects directly from OBI-compliant servers using HTTP POST with SSL V3 as specified in OBI/2.0 technical specifications,
3. recognize the content-transfer-encoding header field and decode all received data,

4. recognize and interpret the content-type "application/x-obi-order," and

5. designate a universal resource locator (URL) path where OBI objects can be received to provide information from the authentication to applications for verifying the order's origin.

We believe that the capabilities of the legacy systems will have to be examined to determine how much they can support the OBI model or to determine what changes may be required.

Implementations compliant with OBI transport-related specifications for *server-browser-server transport* MUST be able to

1. if sending, use HTTP POST method to transmit base 64-encoded OBI objects to a known URL path via a browser using a hidden-field-encoded OBI object ("EOBIO") in an HTML form as specified in OBI/2.0 technical specifications, or

2. if receiving, to receive base 64-encoded OBI objects at a designated URL path via an HTTP POST from a browser using an EOBIO in an HTML form, as specified in OBI/2.0 technical specifications.

We believe that the capabilities of the legacy systems will have to be examined to determine the extent to which they can support the OBI model or to determine what changes may be required.

Compliance with Security-Related Specifications

Implementations compliant with OBI *security-related* specifications MUST be able to

1. use SSL V3 protocol for secure Internet communications,

2. use the mutual authentication mode of SSL for authentication between clients and servers,

3. use (at minimum) 40-bit encryption for SSL sessions,

4. use certificates for authenticating clients and servers as specified by OBI/2.0 technical specifications,

5. use authentication information for access control, and

6. not provide or require using digital signatures that do not comply with OBI technical specifications.

Note: Minimal compliance with OBI/2.0 security-related specifications do not require that

- clients and servers support certificate revocation lists as part of authentication or
- clients and servers be able to include OBI-compliant digital signatures contained within an OBI object.

Technical Compliance for Selling Organizations

A selling organization that complies with OBI technical specifications MUST be able to do the following:

1. Provide a Web-based sourcing and pricing mechanism (e.g., catalog) and ordering capability containing private pricing and product selection that is accessible over the Internet to requisitioners who are affiliated with trading partners.
2. Authenticate requisitioners, before they access the catalog, by using digital certificates consistent with the OBI technical specifications.
3. Limit requisitioners' access to private catalogs and order history according to the information contained in digital certificates and, optionally, through profile information presented when the catalog is accessed.
4. Create OBI objects containing *order requests* consistent with OBI technical specifications.
5. Send OBI objects containing *order requests* via the Internet to trading partners' OBI-compliant servers by using server-to-server transport or server-browser-server transport.
6. Designate a URL at which the selling organization can receive OBI objects containing *OBI orders* from trading partners.
7. Receive OBI objects containing *OBI orders* via the Internet from trading partners' OBI-compliant servers that are consistent with OBI technical specifications.
8. Interpret and process *OBI orders* correctly.
9. Present a valid certificate consistent with OBI specifications for use in authentication during interactions with trading partners.
10. Authenticate trading partners' servers that present valid digital certificates.

11. Support secure Internet communications through SSL V3 Internet security protocol.

12. Comply with OBI/2.0 technical specifications.

We know from our research and general familiarity with federal operating systems that neither the legacy nor future purchasing systems can accommodate all of these required items. Accordingly, the government has to make some hard decisions, if OBI is adopted, about the need to modify legacy systems or to add required functionality to future systems, or both.

Technical Compliance for Buying Organizations

A buying organization that complies with OBI technical specifications MUST be able to do the following:

1. Provide requisitioners with Internet access to catalogs located at the selling organization's site.

2. Enable secure Internet communications by supporting use of SSL V3 Internet security protocol by requisitioners and servers across corporate firewalls.

3. Publish a URL at which the buying organization can receive *OBI order requests* from trading partners.

4. Receive *order requests* at the URL via the Internet from OBI-compliant trading partners' servers through either the server-to-server transport method or the server-browser-server method.

5. Interpret and process *order requests* correctly.

6. Create OBI objects containing *OBI orders* that are consistent with OBI technical specifications.

7. Send OBI objects containing *OBI orders* that are consistent with the OBI technical specifications to trading partners' servers via the Internet.

8. Present a valid certificate compliant with OBI specifications for use in authentication during interactions with trading partner servers.

9. Authenticate trading partners' servers that present valid digital certificates.

10. Comply with OBI/2.0 technical specifications.

As with the seller's requirements, we also know from our research and general familiarity with federal operating systems that neither the legacy nor future purchasing systems can accommodate all of the required items. Accordingly, the

government will have to make some hard decisions, if OBI is adopted, about the need to modify legacy systems or to add required functionality to future systems, or both.

Technical Compliance for Requisitioners

A requisitioner that complies with OBI technical specifications MUST be able to do the following:

1. Have a workstation with Internet connectivity.

2. Have a secure Web browser (Netscape Navigator 3.0, or later, or Microsoft Internet Explorer 3.0, or above) installed on workstation.

3. Have a valid certificate that complies with OBI technical specifications, securely installed in the browser for use in authenticating with selling organizations' catalog sites.

4. Use SSL version 3 for secure Internet communications.

Here too, some work will have to be done to ensure that all parties who have to participate in the process have the required functional capabilities. Ensuring that all parties have the functional capabilities will be no small task because the potential population can be in widely disparate locations across the entire government, both in the United States and abroad.

Appendix B
Extensible Markup Language Details

In this appendix, we provide more detailed information on the extensible markup language. We first identify the components of an XML document. We then provide background detail on the XML technical specification—including its origin, purpose, and controlling body. Finally, we identify the various components of the XML technical specification, discuss their role in exchanging XML documents, and identify the technical bodies responsible for their development and maintenance.

XML DOCUMENT COMPONENTS

XML documents consist of a series of entities (objects). Each entity contains one or more logical elements. Tim Bray, one of the principal authors of the XML technical specification, defines an XML object as

> …sometimes a file, sometimes a record in a relational database, sometimes an object delivered by an Object Request Broker, and sometimes a stream of bytes arriving at a network socket. These can all be described as *data objects*.[1]

These entities and their subordinate elements are delimited (separated) by the use of dynamic tags. Each element can have attributes (properties) appended to its tag that identifies how to process it. Normally all elements are properly tagged and are nested inside a root element. The root element name must match the document type name in the DTD. When all elements are properly identified and nested, the document is considered a fully tagged document instance.

An XML document can convey a formal syntax—DTD—describing the relationships between the components of the document. Each XML document begins with a processing instruction that identifies the XML version, describes how it was encoded, and explains whether it references other files. Both the beginning processing instruction and the DTD are optional. However, if the beginning processing instruction, DTD (or referenced location for the relevant DTD), and a fully tagged document instance are present, the document is considered valid.

Document Type Definition

A DTD provides a formal description of the full structure of an XML document with relevant sets of values. This description includes the ordering (looping), the

[1]Taken from http://www.xml.com/axml/testaxml.htm, July 8, 1999.

sequence, and the relationships of all tags (elements) contained in the document. A DTD is not mandatory. If it is not present, the XML system creates a default definition for all undefined tags. However, XML documents that do not contain or reference a DTD must adhere to stricter XML specifications and are limited with respect to processing capabilities. A DTD needs to be sent to a trading partner only once. Subsequent exchanges can refer to the original DTD. Conversely, the DTD can reside elsewhere, such as in a repository, and the location can be referred to in the header of the XML document. DTDs can be created for internal use, for use within a particular group of trading partners, for use within an industry or group of industries, or as a universal standard.

DTDs consist of a set of declarations, the format of which depends on the type of object being defined. Each declaration starts with one of four permitted keywords (Table B-1) identifying the type, and therefore format, of the declaration.

Table B-1. DTD Declaration Types

Declaration	Function
ELEMENT	Indicates that the declaration contains a model constraining the permitted contents of a particular element.
ATTLIST	Indicates that the declaration defines the names, permitted values/types, and default values of a list (set) of attributes that are to be associated with a named element.
ENTITY	Indicates that the declaration contains either the replacement text (or a pointer to a file containing the replacement text) to be used to replace a named entity reference within messages associated with the DTD.
NOTATION	Indicates that the declaration assigns a locally significant notation name to a process managed by a resource whose location is defined as part of the notation declaration.

Tags

Tags are used as the delimiters for individual XML elements. These tags are the equivalent to data dictionary descriptions. In a well-formed XML document, each XML element is enclosed by opening and closing tags. These extensible tags are based on a logical structure related to the data they are conveying, and they are intended to be comprehensible without interpretation. Just as with DTDs, XML tags can be created for internal use, for use within a particular group of trading partners, for use within an industry or group of industries, or as a universal standard. Table B-2 identifies the three types of XML tags.

Table B-2. XML Tags

Tag type	Description
<Start Tag>	Used to define the start of an individual XML element. Start tags are always required. A start tag is indicated by the character < followed by a descriptive name and a closing character >.

Table B-2. XML Tags (Continued)

Tag type	Description
</End Tag>	Used to define the end of an individual XML element. An end tag is identified by the characters < /followed by a descriptive name and a closing character >. End tags are optional, but they must be present to have a well-formed document.
<Empty Element Tag>	Empty element tags occur only at the beginning of an empty element. Empty elements are used for illustrations, figures, and other graphic data types.

Attributes

Attributes are additional information attached to an element. Attributes can describe characteristics of an element, including outside standards references.[2] Attributes occur in starts and in empty elements only.

Style

XML can be conveyed as a datastream with no style or can be combined with a stylesheet or as part of an HTML file for presentation at the receiver site.

TECHNICAL STANDARDS

In reality, XML is a compilation of several individual technical specifications designed to enable dynamic markup of Web-based documents. These technical specifications are the product of the W3C and its Web specification development and approval process. The W3C is an international association of organizations interested in the long-term evolution and stability of the Web. The W3C is not a recognized standards body, nor does it have a formal relationship with any recognized formal standards body.

W3C Specifications

W3C specifications are in reality recommendations of the W3C. They are not submitted to any recognized standards body for approval. The W3C as an association has a standards approval process based on the notion of consensus. Members working a specific issue must strive to address all participants' views and objections and strive to resolve them. Consensus is established when substantial agreement has been reached by the participants. Although unanimity is preferred, substantial agreement is achieved when the minority no longer wishes to articulate its objections. When disagreement is strong, the opinions of the minority are

[2] ANSI ASC X12 is responsible for the national EDI standards in use today. ASC X12 is developing a standard method for referencing X12 EDI data elements as attributes to user-defined semantic tags. This cross-reference will enable EDI activities to make a seamless transition between EDI and XML documents.

recorded in appropriate documents alongside those of the majority. Once consensus is reached, the W3C director makes a decision to approve or disapprove a specification. If the Director approves the specification, it is then classified as a W3C recommendation.

The W3C accomplishes its work through donations of time and money from its members. The W3C structure consists of a number of domains. Each domain consists of one or more coordination groups populated by a combination of XML employees. XML falls under the cognizance of the W3C Architecture Domain. The XML Coordination Group heads the Architecture Domain's XML effort.

XML COORDINATION GROUP

The XML Coordination Group consists of the chairs of the individual working groups. The XML working groups have been organized to manage and conduct XML design and development work. The XML Coordination Group is responsible for coordinating the efforts of the various working groups between the XML activity and other parts of the W3C and between the XML activity and other organizations.

XML SCHEMA WORKING GROUP

The XML Schema Working Group is developing an XML specification that, when complete, will be capable of defining the structure, content, and semantics of XML documents. One of the proposals this group is considering is centered on object-oriented technology.

XML LINKING WORKING GROUP

The XML Linking Working Group is working to design advanced, scalable, and maintainable hyperlinking and addressing for XML documents for both internal (location) and external documents (objects) and links. The group is basing its work on two W3C working drafts: XML Linking Language (Xlink) and XML Pointer Language (XPointer).

XML INFORMATION SET WORKING GROUP

The XML Information Set Working Group is developing a common reference set for XML documents that is based on abstract descriptions, such as document tree structures, elements, and attribute lists. The intent is to ensure interoperability among XML-based specifications and software tools.

XML FRAGMENT WORKING GROUP

As discussed above, XML documents are composed of several entities. The XML Fragment Working Group is working to define a specification for exchanging fragments (entity components) of XML documents without having to send the

entire document. This specification would define a method for providing appropriate fragment context information.

XML SYNTAX WORKING GROUP

The XML Syntax Working Group has varied responsibilities, including developing specifications for style sheet linking, canonizing XML, tracking international developments, and maintaining errata to the basic XML 1.0 specification. The group published the style sheet linking specification as a W3C recommendation on June 29, 1999. In canonizing XML, the group is focusing on developing Web-based approaches for using digital signature technology on XML documents and determining if a document has been tampered with. The international development effort is focused on ensuring that the XML specification is kept current when international standards such as the Universal Character Set (ISO/International Electrotechnical Commission [IEC] 10646) and Unicode are updated.

Current Technical Specifications

The W3C specifications are the work of the working groups discussed above. Member companies of the W3C initiate specification proposals. If deemed relevant, the submission is accepted by the consortium and posted as a *note.* Notes are the basis of the work of the various working groups that will develop the note into a *working draft*. The working drafts, when sufficiently developed, become *proposed recommendations* submitted by the working group to the full W3C. After considerable review by the W3C membership and approval by the W3C director, the W3C director issues the specification as a *W3C recommendation*.

APPROVED SPECIFICATIONS

The following XML and XML-related specifications have been approved by the W3C director and have been released as W3C recommendations:

- *Extensible Markup Language (XML) 1.0 Specification.* This is the basic specification that defines the method for developing and exchanging XML documents.

- *Document Object Model—Level 1.* The DOM is the Web equivalent of an API for manipulating documents and data using a programming language such as JAVA or C++. The DOM is a set of neutral language and platform interfaces that an application program invokes to access and modify the content and structure of XML and HTML document objects by creating an interoperable set of classes and methods. The DOM provides a standard set of objects for representing documents, a standard model of how these objects can be combined, and a standard interface for accessing and manipulating them. When invoked, the DOM creates a tree-based object model.

- *Namespaces in XML*. "XML namespaces provide a simple method for qualifying element and attribute names used in XML documents by associating them with namespaces identified by Uniform Resource Identifier (Web address) references."[3] These references can include specific repository links for cross-referencing an element name to an alternative standard such as the ASC X12 EDI standards.

- *Associating Style Sheets with XML Documents.* This specification allows a style sheet to be associated with an XML document. This association is accomplished through processing instructions placed in the document's prolog.

- *XSL Transformations (XSLT) Version 1.0.* XSLT provides the syntax and semantics for changing one XML document into another using source and destination document object trees. XSLT is designed to work in conjunction with XSL but can also work independently.[4]

- *XML Path Language (XPath) Version 1.0*. The XPath specification proposes a common syntax and semantics for "functionality shared between XSL Transformations and XPointer." XPath addresses parts of an XML document and provides basic string, number, and Boolean manipulation capabilities.[5]

PROPOSED RECOMMENDATIONS

The W3C director has forwarded the following XML and XML-related specifications to the Advisory Committee for review:

- *Resource Definition Framework (RDF) Schemas.* Although not an XML specification, the RDF is crucial for the viability of XML with respect to data exchanges and searches. The RDF is an XML application that provides a data modeling language using XML syntax. The RDF is the equivalent of a master library catalog index card for data on the Web.

- *XHTML™ 1.0: The Extensible HyperText Markup Language—A Reformulation of HTML 4.0 in XML 1.0.* The W3C has recognized the Web protocols are being used ever increasingly. This expansion is moving Web protocols beyond typical browser interfaces into new browser environments. These new environments include cell phones, televisions, cars, wallet-sized wireless communicators, kiosks, and desktops. The XHTML 1.0 specification integrates XML capabilities into HTML to create standards that support these nontraditional Web browser platforms.

[3] Available at http://www.w3.org/TR/1999/REC-xml-names-19990114.

[4] As this report was going to press, the director of the W3C has approved the XSLT technical specification as a W3C recommendation.

[5] As this report was going to press, the director of the W3C has approved the XPath technical specification as a W3C recommendation.

WORKING DRAFTS

The following working drafts are in various states of development by their respective work groups:

- *XML Schema*. The XML schema specification is being created to develop a more powerful XML-based DTD. Within the context of EC, schemas will provide rules for validating business transactions and can be used to define those transactions within specific trading partner groups.
  - *Part 1—Structures.* Part 1 of the XML schema specification will provide methods for describing the structure and constraining the content of an XML document.
  - *Part 2—Data types.* Part 2 of the XML schema specification will provide a framework for associating data types with XML element types and attributes. This association will enable XML software to manage dates, numbers, and other special forms of data more efficiently.
- *XML Information Set (Infoset).* The Infoset specification will describe a method for creating an abstract data set that will contain a description of the information available in a well-formed XML document. An Infoset can contain the following items:
  - A document information item (required)
  - Element information items (required)
  - Attribute information items (required)
  - Processing instruction information items (required)
  - Character information items (required)
  - Reference to unknown entity information items (required)
  - Comment information items (optional)
  - A document type declaration information item (optional)
  - Entity information items (required for unparsed entities, optional for others)
  - Notation information items (required)
  - Attribute declaration information items (optional).
- *Document Object Model—Level 2.* The DOM Level 2 specification will expand on the content of Level 1 to include an event model, richer queries,

and—most important—manipulation of the cascading style sheet styles attached to an XML document.

- *XML Signature Requirements.* The working group is designing this specification to detail XML digital signature design principles, scope, and requirements specification. "It includes requirements as they relate to the signature syntax, data model, format, cryptographic processing, and external requirements and coordination."[6]

- *XML Pointer Language (XPointer) and XML Linking Language (XLink).* XPointer and XLink define a standard way to represent links between resources. In addition to simple links, like HTML's <A> tag, XML has mechanisms for links between multiple resources and links between read-only resources. XPointer describes how to address a resource, and XLink describes how to associate two or more resources.

- *Extensible Style Sheets (XSL).* The XSL specification provides a means of identifying how the transaction's originator wants it to be displayed by the receiver. An XSL processor can evaluate, rearrange, and reassemble the XML document. Thus, recipients can add to, modify, or reorder the document to suit their internal processing requirements.

NOTES

Notes are documents prepared and submitted to the W3C or prepared by working groups in the W3C. A W3C note is not endorsed by the W3C but is provided for discussion only. Notes may be considered for subsequent action by the W3C, but there is no requirement to do so. Implementers use the contents of notes with the full understanding they do not constitute a formal recommendation. The W3C has published a number of XML-related notes in the last several years. These can be found on the W3C Web site. Recent notes that have not yet resulted in working group efforts but may affect future XML include

- schema for object-oriented XML 2.0,

- accessibility features of cascading style sheets, and

- XML canonizing requirements.

[6] Available at http://www.w3.org/TR/xmldsig-requirements.

Appendix C
OBI-XML Workshop and Interview Results

General Services Administration (GSA) tasked Logistics Management Institute (LMI) to determine what steps the federal government needs to take with regard to the new technologies, open buying on the Internet (OBI), and extensible mark-up language (XML) in procurement and finance. To meet the requirements of a task, LMI's approach in conducting a study is to first form a hypothesis and then prove or disprove the hypothesis. LMI then formulates questions that will generate information that supports or negates the hypothesis.

LMI's hypothesis was: *The federal government will derive benefits in the procurement and finance areas from the adoption of OBI and/or XML technology*.

LMI then developed 13 key questions (see below) and hosted an OBI-XML workshop, which representatives of many federal government attended.[1] The workshop was used in lieu of individual interviews to obtain the views of knowledgeable government persons about using EDI, OBI, and XML. This appendix summarizes the answers to the questions and follows the order in which they were addressed at the workshop.

KEY QUESTIONS

The following are key questions that were asked of the agencies at the OBI-XML workshop:

1. What operational changes do you foresee now and in the next 5 years?
2. What are your plans for your legacy systems?
3. What are your current EC plans and milestones?
4. What policy or procedural changes do you envision for implementing your EC plan?
5. What are your trading partners' EC plans?
6. What adjustments in policy and technology are you making to accommodate your small- and medium-size businesses?
7. What benefits, such as cost-reduction, people resources, or timesavings, have you incurred by implementing your current EC?

[1] Table C-1 on page C-27 lists attending agencies and organizations.

8. What is the Financial Management Service (FMS)/Treasury investment strategy for adopting new technologies? (What return on investment strategy is desired before FMS/Treasury will adopt a new technology?)

9. What restrictions or problems have you encountered implementing EC?

10. Do you have metrics for measuring your current operation before and after EC was implemented?

11. Have you participated in activities of the W3C, RosettaNet, or CommerceNet? If so, please explain.

12. What federal government support does your agency require when adopting new technology? Example: FESMCC supports all federal agencies on EDI issues.

13. If OBI or XML prove beneficial for the federal government, are funding resources in the budget sufficient to accommodate adopting OBI or XML in the next year or next 5 years?

EC AND CURRENT OPERATIONS

Some participants expressed their view that a number of impediments existed to successfully inserting EDI technology into current operational systems. They indicated that similar impediments would exist to adopting OBI or XML. The impediments included the following.

The Perceived Impediments

- Some attendees sensed that people simply do not want to change the way they are doing business and, although this is a recognized challenge, the stimuli used are insufficient to cause an appreciable amount of change.

- The cost of implementing EDI is too high.

- The appropriate information technology skills will be lacking at the outset.

- No penalties are imposed on departments and agencies that do not implement EDI either at all, or timely and effectively.

- The number of different versions and releases of implementation guidelines signal a lack of consistency and readiness on the part of the government.

- The problem, when considering that the government trades on a one-to-many basis, across business sectors, and with businesses of all sizes, is enormous.

- Using value-added network and value-added service providers drive up the cost of communicating business information.
- EDI, even though it is a good technology, is insufficient alone to overcome inherent system problems.
- The departments and agencies only see problems from their own perspective and have little interest in helping to resolve the problems of others.
- The legacy systems cannot work with EDI without developing some interface software.
- The underlying business practices of the government are not those of the private sector.
- The cost to participate is often prohibitive.
- The architecture is neither secure nor easy to use.
- Little or no business process reengineering was done before EDI was inserted into the current way of doing business.

The Perceived Fixes

The participants also expressed their views on ways of ensuring that lessons are learned from the past, and the same mistakes are not repeated. In addition to working on the impediments listed above, the following points were made:

- OBI and XML use the Internet, which is
  - more easily understood today than was EDI and its system architecture when that technology was being implemented, and
  - an easier and less costly method of establishing telecommunications interconnectivity.
  - the technology of choice for an ever-increasing number of government suppliers.
- Legacy systems will work over the Internet when using OBI or XML technology.
- Internet technology is inexpensive to implement and does not require a sophisticated system architecture to use.

- Employees throughout the federal government will have to be knowledgeable about the new technologies because they need to be understood as a fundamental step to success.

- The way both the government and its supplier base do business needs to be harmonized.

Following the discussion on the first issue, attention turned to the issue of change.

PLANNING FOR NEW WAYS OF ACQUISITION

The purpose of this discussion was to determine what changes were being made in the ways the departments and agencies discharged purchasing and finance responsibilities. In the exchange of views, we learned that some changes had already been made and others were in progress.

What Is Happening?

From our discussions, clearly change was being brought about as a result of exposure to better ways of doing business rather than as a result of studies of business process reengineering. It was encouraging nevertheless, to see some changes under way, most of which involve using the credit card. The changes discussed included

- using credit cards in systems where a payment authority pays the credit card bill, coupled with credit card company and bank innovations that facilitate the interfacing of systems and modern ways of doing business;

- using smarter ways of buying, such as through the GSA *Advantage!* system, electronic malls (e-mall), and electronic catalogs;

- a concerted effort in one department to eliminate the material inspection and receiving report;

- the concept of evaluated receipt settlement to pay vendors rather than the formal shipment notice-receiving report-invoice-payment method of today; and

- a system to use the credit card method of payment with the OBI model of purchasing.

Lingering Concerns

New methods, while improving processes, are not immune from real or perceived impediments. For example some attendees expressed views that

- there is little or no control over what is being purchased using credit cards;
- accounting methods have to change to accommodate credit card purchases;
- departments and agencies have not settled on a common way of receiving credit card bills and of reconciling those bills as a precursor to authorizing payment;
- credit card bill reconciliation is labor intensive;
- departments and agencies continue to meet their own needs without conceding to the needs of other applications;
- legacy and new systems continue to be built as stovepipes;
- credit card purchases create control and security issues;
- credit card purchasing methods do not lend themselves to larger procurement actions and the government should not discount the small percentage of large purchases because they represent a substantially large percentage of the procurement dollars being expended;
- technology has to fit methodology, not the other way around;
- government specifications should reside on the Web;
- although the OBI model fits a category of purchases but not the precise current government business model, it should be adapted to enable using a credit card; and
- THE BUSINESS PROCESS HAS TO CHANGE!

Following this discussion, which highlighted some of the initiatives and concerns expressed by the group, the discussion turned to EC plans and milestones.

EC Plans and Milestones

LMI had ready a number of department and agency EC plans, which all seemed to indicate that EC technologies were considered valuable tools to be exploited in the near future. However, during the workshop, we found that often some disparity existed between planning at the strategic and implementation level and the ability to execute a plan.

For example:

- At least one department indicated that it was putting its EC plan on hold until after the first of the year 2000. That same department indicated that no specific funding was earmarked for EC activities in the department's year 2000 budget.

- A view was expressed that the reality at the department level is that budgets do not always align with EC plans. In fact, identifying and justifying EC funds from already existing budgets rather than to have specific funding for projects identified in an approved budget often is necessary. The reality is that departments are doing what they can with the resources they have.

- In one department, the organizational structure is such that subordinate elements are fairly autonomous. In that regard, even though the EC strategic plan was developed at the department level, each subordinate element is responsible for its own budget execution. Accordingly, the approach to implementing EC projects can be uneven, despite having an overarching EC plan.

- No unanimity across the federal government exists about the funding, timing, and types of deliverables or measures of success.

We next explored winning strategies for obtaining the funds necessary to execute EC projects.

Obtaining Funds

Many attendees who spoke about obtaining funds to support EC projects indicated that it was a difficult task. The view was expressed that asking for funds, even for high-visibility projects, is no guarantee that the funds will be provided. Winning strategies focussed on several different methods.

- Funding for pilot projects tends to be more successful than projects for inserting a new EC technology over a legacy system. Some concern was raised that unless the pilot projects are carefully crafted and executed, they do little to prove the efficacy of a potential operating system.

- The ever-reducing technology cycle has made justifying funding year after year in support of an ever-increasing variety of technologies difficult. Finding funds has been successful when a single technology has been selected and demonstrated.

- Establishing cross-department and agency projects has allowed for wider testing and the sharing of costs.

- Do not limit projects to simple piloting; combine piloting and prototyping.

- Set a goal of rolling out prototype applications in small doses.
- Mandate projects that are centrally funded coupled with a "buy-in" from all levels of management that will become involved in the technology insertion.
- Back up plans with studies that show the potential return on investment. Then measure the results of the project to determine if the return is being achieved. An opposing point of view is held by some that the government is not motivated by the same stimuli as managers in the private sector.
- History has shown that mandated programs were not successful. Departments and agencies of the government are fairly autonomous. As such, success has been achieved when the individual department or agency decided on its own to improve business processes.

A discussion about motivation and how to achieve it across the federal government followed. Some attendees were of the opinion that since the government does not operate like the private sector, other methods had to be used. It was suggested that notwithstanding current planning activities, more needed to be done.

The discussion then turned to the issue of changes and the perceptions of people about what changes they saw happening in the operational EC environment during the next 5 years.

Operational Changes During the Next 5 Years

Some attendees were quite candid in admitting that notwithstanding their EC strategic plans, they saw both static and dynamic operations. In other words, although some changes are planned for, other operations will remain static. In summary, here is what we learned about the various department and agency plans:

- Some did not project out 5 years, but did project out to the year 2001.
- Plans called for adopting Web-based solutions wherever it made sense.
- Plans indicate that changes to the business process should be the driver and not the technology. Yet, when we asked in the workshop about ongoing business process reengineering initiatives, the attendees were hard-pressed to offer many examples of where it was taking place in the government.
- There is a clear sentiment that EC will happen in time across the federal government.
- A good way to plan is to take the department or agency mission at its highest level and then to decide how emerging technology can support that

mission. Once issues are viewed from that perspective, writing EC plans becomes easier.

- Policy does not keep pace with technology. The example of the FAR was cited. Eliminating receiving reports or invoices and post-payment auditing are areas that could be changed in the FAR to support current technology capabilities.

- No consensus exists about how electronic catalogs and malls should be constructed and used. There is a need to build that consensus across the federal government.

Although many EC plans exist, they have no common direction. Goals were not clearly established across the departments and agencies of the government. However, many plans exist and although they did not all drive to a paperless solution, each appeared to have some EC goals and a clear understanding of the value of technology.

That situation provided a segue to the next issue, which dealt with plans for legacy systems.

Legacy Systems

History has shown that the prospect of success, while possible, is often tempered by the need to overlay new technology onto legacy systems. One issue that the ECPO wanted addressed was how an application and system architecture could be built so successive generations of technology could be overlaid transparently and seamlessly.

Such an architecture could be built relatively easily if the applications used to drive similar and complimentary business processes across the government were standardized. Unfortunately, such is not the case. The departments and agencies are likely to work with stovepipe systems for some years to come. Agencies that will migrate to new applications may find that the applications are unifunctional and that they will not work with complimentary applications.

Here are some examples of what we mean:

- One department indicated that it was going to use an off-the-shelf financial management system. We question whether or not that system will work in harmony with its complementary systems (e.g., requirements, purchasing, credit card reconciliation, shipment, and receiving).

- Another department indicated that its new purchasing system would have an EDI module. We question whether or not that EDI component will work in concert with the OBI buying model or migrate to the use of XML technology.

- Some workshop attendees expressed the view that departments and agencies did not intend to replace all systems but rather only to take advantage of selected technologies (e.g., use electronic catalogs over the Internet). In other words, migration to EC will be done in pieces.

- It is difficult to achieve uniformity in applications that perform the same function. As an example, why doesn't the government use a single procurement system? Achieving harmony across complimentary applications is equally difficult. As an example, can all procurement systems communicate with all financial systems? Complimentary systems inserting the same technologies in the same time frame was another issued raised in the workshop.

- Decisions have to be made about whether legacy systems can be Web-enabled. If they cannot, then the trend should be to move away from them. If they can, then an initiative should be undertaken soon to enable them.

- The optimal system would be one that is commercial off-the-shelf (COTS) that can be interfaced with a legacy system that allows for Web-enabled plug-and-play applications, which would integrate complimentary applications into a single package.

- There appears to be a bias toward purchasing off-the-shelf applications rather than building ones from scratch.

We are not sure that merely acquiring a COTS package will solve the larger problem. To the contrary, we see other initiatives that must be a part of the overall process of changing the way people do business. For example:

- One key step will be to look at examples of vertical industries that have to make their complimentary applications work together. The RosettaNet is an example of a success story in that regard.

- Get all of the key players into the same room at the same time to create consistent, uniform policies and practices.

- Stop trying to be all things to all people. Decide if the government should address the issues involved in the largest number of actions (e.g., small purchases being paid for with a credit card) or the small number of actions that account for the largest expenditures—or both.

- Level the playing field between the government and its supply base. Get vendors involved in government efforts to reinvent government.

- The key will be to get the small- and medium-size enterprises involved. This will be necessary because they represent the largest number of individual purchase actions and it is there that the bulk of the government-buying work force is devoting its time.

We then shifted focus and began addressing matters that affected implementing EC.

Restrictions and Problems Encountered in Implementing EC

The group offered up a number of reasons why EDI did not achieve a predicted level of success.

- Small- and medium-size enterprises did not understand the technology or issues involved in implementing EDI.
- Newer buying methodologies, such as OBI, are more easily understood.
- The government did not optimize its vendor outreach program.
- EDI tools and applications were difficult to insert over existing business processes. Compare that situation with the ease of Web-enabled methods of doing business.
- Part of the issue was the enabling software, or the lack of it, and its cost.
- The system architecture for EDI was more complex than using the Internet. Companies were forced to use value-added network providers, which added to the cost of doing business. Other companies that did not choose to become EDI literate had to hire value-added service providers to facilitate their use of EDI. That function also was a cost of doing business.

The discussion then turned to matters of policy. The group was asked about policy and procedural changes that might be necessary for facilitating the migration to EC-based business.

Policies and Procedures

For this issue we were attempting to see what recommendations could be made that would facilitate the migration to EC. The following concerns were expressed:

- The government needs to have a better system in place that can quickly take advantage of changing technology.
- The government has too many places where similar policy is recorded, often not in harmony. Examples offered included the FAR, FASA, Foreign Agents Registration Act (FARA), and Government Performance and Results Act (GPRA).

- Clear policies on electronic signatures, encryption, and other EC-related issues need to be implemented across the government.

- Forming a group whose purpose is to identify required changes to laws, rules, regulations, policies, and procedures might be advantageous.

The group then looked at the issue of making adjusting technology to accommodate small- and medium-size enterprises.

Working with Small- and Medium-Size Enterprises in an EC Environment

The discussion revolved around the issue of using commercial practices as the best way of reaching out to SMEs.

- The participants suggested that the government needs to reach down to all tiers of its vendor base as a way of determining what is achievable.

- The government could develop the value proposition and carry it to its vendor base. If the vendors buy in to the proposition, the government could provide its vendor base with some tools that would facilitate the routine exchange of business data.

This discussion then led again to the subject of funding the project, the availability of investment capital, and issues related to return on investment.

Investment in New Technologies

We asked and received answers to a number of questions about how departments and agencies obtained funds to work on new projects and to insert new technologies.

- At least one department indicated that no new money for the type of technology insertion being discussed is available. However, the department's representative opinion is that because the technology showed promise, some level of implementation was likely, but that it would be accomplished without new money.

- Another opinion was expressed about the proliferation of projects. An opinion was rendered that as the size of the work force decreases, decisions have to be made about what activities to stop, slow down, or reprioritize as other, more promising projects come along. An opinion also was expressed that there would be no new funding for projects.

- The private-sector approach was discussed. Some attendees were of the opinion that a study of return on investment (ROI) would not be beneficial because
  - new technology should replace old ways of doing business but because the cost of the old way was undeterminable, no meaningful comparison was possible;
  - there are no funds to study ROI;
  - government managers are not allowed to keep or reinvest savings;
  - resulting efficiency is the only way to demonstrate success; and
  - we need a clear migration strategy and path to show how we can get from one method of operation to another.
- Other attendees suggested that proper budgeting and justification would result in seed money for pilot projects. However, budgeting is not done at the federal level but rather at the individual departments and agencies.
- It was suggested that the departments and agencies do not lose people when new technology is inserted. That point was disputed by others who provided the DoD experience where civilian end-strength was cut and part of the resulting savings was used as EDI seed money.
- Another opinion expressed had to do with how money has been spent. Funds are seemingly allocated for projects but little was done under those projects to reach out to SMEs. Accordingly, although the government was searching for better technologies and better ways of doing business, little attention was being paid to the typical trading partner.
- It was clear to many attendees that the single greatest change in the way the government was doing business was tied to credit card payments. If purchasing statistics are analyzed, it can be seen that well over 90 percent of all federal purchases are small purchases and that an ever-increasing number of those are made over the Internet using the credit card as the method of payment. If the Internet credit card becomes the purchase method of choice, what types of procurements are left for applying new technologies?
- Any resulting system has to be established at little or no cost to SMEs. In the EDI model, for an SME to participate was simply too expensive and difficult. We should take full advantage of the Internet as we approach SMEs, which constitute the largest population of parties doing business with the federal government.

The foregoing discussion then led to the next question about initiatives for reaching out to trading partners.

EC Planning for Trading Partners

We are well aware that new technologies cannot be inserted unilaterally. Business is a bi- (or multi-) lateral activity. As such, one party to a business exchange cannot adopt a technology without the other party agreeing to use the same technology. We asked what the departments and agencies knew of trading partners' EC plans and what those trading partners were doing to improve EC.

- A lack of Internet service providers in some parts of the country is a serious impediment. For some SMEs using a long-distance carrier to communicate with the federal government is a burden.
- The Web will make SMEs world-wide providers and we see them flocking to use the Internet.
- It is worth an investment to put valued trading partners on the Web. Savings will come when we work with them. The issue is how to get them trained and how to help them obtain a presence on the Web.
- Solutions will only be universal when the government reaches out to SMEs and makes them a part of any planning. The SMEs have to have input so they will have a stake in the outcome.
- Another approach is to reach out on a sector basis and form one or more groups of business associations.
- The government finance community has led the way in bringing SMEs into the EC environment. That was accomplished by requiring electronic transfer of funds as the way of doing business with the federal government. That requirement, coupled with a vigorous education program, has helped move SMEs into the electronic business environment.
- One overriding consideration is the ease of setting up a Web site and becoming a business presence on the Internet versus the need in the government for interoperability. Companies could gravitate to a wide range of solutions that will make doing business with them all in a standard way difficult for the government. The challenge for the government is to decide if it wishes to accommodate a multiplicity of business methods, or if it wants to settle on one or two methods and facilitate trading partners' use of those methods.
- A concerted federal outreach program would be helpful. We don't do as good a job when left on our own. A consolidated, concerted, and funded

effort at the highest levels of the government would help move the next technology insertion forward.

The discussion then turned to economy and efficiency. Clearly, the present government leadership is looking toward reinvention. Therefore, if EC has been implemented, what claims of success are being made by the departments and agencies and do those claims translate into savings?

Benefits Derived by Implementing EC

The insertion of EDI technology took place across the government several years ago. Accordingly, some empirical evidence should exist that suggests that technology proved to be beneficial.

We cannot equate the EDI experience in its entirety to the potential value of OBI or XML, but we can make some inferences from the lessons learned to date. On this subject we heard from attendees who had not previously spoken on issues of funding or ROI.

- We learned that some departments and agencies must analyze cost-benefits and justify ROI for new projects. Accompanying those analyses are statements of the impact of the new programs. Capital planning is constantly being assessed and revised to meet current demands.

- Programming, planning, and budgeting themselves can be an impediment. Getting a project studied, justified, funded, piloted, and put into production takes so long that going directly to the piloting stage and hoping for the best often is simpler.

- Technology is improving so fast today, and because it holds out a promise of a better way of doing business, there is no time to step back and determine if the current way of doing business is good enough for the time being.

- The Internet holds out great hope for reducing transaction costs. If the costs can be reduced, the substantial number of purchases and payments made during a year should compel change.

- There is a negative impact when adopting new technology. We are unaware of any work being done to assess the cost of migrating to a new technology. The cost of and time for retraining the work force was singled out as a barrier to change.

- Some evidence in studies undertaken by the grocery industry exists that savings can be realized when moving to a new technology, but movement on that basis still remains a hard sell for the government. One could argue that some activities in the government are within the grocery sector.

As such, they could prove to be good test beds for inserting new technology and changing to more commercial methods of purchasing and making payments.

- In some departments and agencies apparently little or no costs are saved and some tasks are taking longer to perform. The answer of course is better automation, but only when coupled with changes in practices and processes. For example, little effort is being taken at the highest levels of the government to address issues such as telecommuting to work.

- If the departments and agencies are going to have to reduce the size of their work forces, we would like to see a part of the anticipated savings returned as the seed money to explore new technologies and business processes.

Accordingly, we asked if anyone had metrics to back up claimed economies or efficiencies.

EC Implementation Metrics

The attendees did not offer any evidence that they had metrics to support claims about past and current EC implementation.

- At least one department indicated that it had done some benchmarking studies during the last 10 years.

- Another opinion held that while there was little in the way of government metrics, some private-sector metrics indicated success. In that regard, the inference could be drawn that to the extent the government performs similar functions to those of the private sector, then the private-sector metrics might apply equally.

The discussion then shifted to current technologies, use of XML and OBI, or participation in the groups sponsoring them.

Participation in OBI and XML Development Organizations

We wanted to learn the extent to which the departments and agencies of the government were participating in ongoing initiatives under the auspices of various organizations:

- W3C

- RosettaNet

- CommerceNet

- Others.

We found that at present, participation was minimal.

- Two agencies indicated that they were participating in W3C.
- Several others knew of the efforts of the organizations but to this point had not participated directly in their work.
- Still another organization was participating in both a leadership role as well as a pilot project partner.

We noted a lot of silence around the room when we raised this question. Apparently, whatever the level of government participation, it was minimal.

Participants pointed out that in spite of little participation, the organizations were progressing with their work. For example, RosettaNet is a member of the EC coalition and is developing data tags for anyone who might want to use them. Clearly, the lack of government participation in that effort would lead to a situation in which

- government data requirements might not be covered,
- public-sector business practices might not be accommodated, and
- the government would have to change business practices to take advantage of available data tags.

In the finance community, the leader of the Internet initiative is the NATCHA Internet council and Smart Card Forum. Accordingly, government involvement is with that organization rather than with any of the other specific organizations indicated above.

At this point in the workshop there was a slight digression in the discussion. Attendees spoke briefly about the differences between changes in business processes and changes in the nature and types of data required to complete a business action. For example, even though a buyer can use the Internet to search for sources of supply, the buyer might not be able to place a valid order or create a valid contract that conforms to current government requirements. So although the purchasing process was altered and is more private-sector-like, impediments in law, rule, and regulation could stymie the optimal use of technology. It then follows that the processes and mandates must be brought into harmony before optimal results can be achieved.

LMI raised the issue of complimentary applications and how they could be brought together when current work seems to focus on component parts of the business process. For example, it is good to develop a standard for purchasing, however, because suppliers want to get paid, any standard developed for invoicing or payment should draw on data elements of the purchase order. When the

tagging is complimentary, vertical systems can be built for large parts, if not all, of the acquisition process.

In summary, many attendees said that there was an immediate need for the government to select the technologies, methodologies, and organizations with which it wished to work—then to actively participate in the ongoing work of those organizations.

Another question was raised about the cost to join and participate in the leading OBI- and XML-developing organizations. While each organization has similar forms of membership fees, the fees differ among the organizations. In addition, because the standards-developing parts of the larger organizations meet regularly, the cost in attending meetings and consolidating government requirements would be additional.

The discussion led to the final workshop question, which had to do with the role of the ECPO and FESMCC.

SUMMARY AND CONCLUSIONS

A number of issues must be addressed when any new technology is contemplated for insertion and use with existing legacy systems. The departments and agencies are likely to work with stovepipe systems for some time in the future. Agencies that migrate to new applications may find that the applications are unifunctional and that they will not work with complimentary applications. We recognize in one context, the value of buying an off-the-shelf system. However, we are not sure that systems can work in harmony. If they cannot, we believe that the savings in acquiring an existing application will be lost because of the inefficiencies created when systems that cannot communicate with each other start to come on line. We would much rather see a larger centralized application coupled with the concept of shared and distributed data that is readily accessible by all parties.

We concluded from the workshop that many departments and agencies remain leery of a new technology coming so closely after the insertion of EDI. Most seemed to recognize that using OBI and XML would provide benefits that were simply not possible when EDI is used. The workshop group indicated that the insertion of new technology should come about through a methodical, funded, and carefully studied approach that includes outreach programs for small- and medium-size trading partners.

Although many EC plans exist, they lack a common direction. Goals were not clearly established across the departments and agencies of the government. However, there are many plans and while they did not all end in a paperless solution, each appeared to have some EC goals and a clear understanding of the value of technology. Attendees also indicated a dichotomy between approved EC plans and approved budgets at the department and agency level.

Departments and agencies already are making some changes in the way they conduct business. Some would welcome additional changes that would help them achieve additional economies and efficiencies in their business processes. However, most signaled a cautionary note, suggesting that there were many historical lessons to be learned from the insertion of EDI technology. OBI and XML technology hold a prospect of improving business practices and some departments and agencies welcome their insertion.

The question about what departments and agencies are doing to accommodate SMEs in an electronic environment was asked, however, there was little discussion. We believe that there was little discussion because little is being done in this area.

The group agreed that government policy and procedures need to change and not be a barrier to adopting good EC procedures. We recommend that policies be identified and addressed so that future EC technology can be adopted and the policies do not need to be changed with each new technology the government wishes to adopt.

From the workshop discussions we could see that there was little empirical evidence to suggest the savings being realized through either inserting EDI technology or adopting new business practices. That does not suggest that they do not exist; to the contrary, it is likely that there have been savings and other indirect benefits. The benefits are just hard to identify and quantify. Similarly, the attendees did not offer any evidence that they had metrics to support claims made about past and current EC operations.

Many agreed that business processes should change and become more closely aligned to the direction being taken by the private sector. Other attendees believe that because the government does not operate like the private sector, other methods have to be used. It was suggested that notwithstanding current planning activities, more needs to be done. There were discussions that all plans need to be set at the highest level of the government and should have stated attainable goals, expressed in measurable terms with budgeted support. Then, as projects are funded, managers are on notice that they will be responsible for meeting specific goals. Department and agency managers then have to measure results and take actions to ensure success.

Role of Federal Electronic Commerce Program Office and Federal EDI Standards Management Coordinating Committee

In the discussion about the FESMCC, clearly the attendees felt that there had to be an organization at the federal level to coordinate matters related to EC. No questions were raised about the Federal EC Program Office.

The ECPO should serve as a liaison to other groups and as a facilitator on EC matters in the federal government. The departments and agencies will look to the ECPO to advise them of participation opportunities.

With respect to the continuing or future role of the FESMCC, the following comments were made:

- There is a need for the FESMCC, or a group similar to it, to continue. However, its charter will likely change as will the composition of participants.

- Do not miss the point, business processes and practices need to change to take advantage of emerging technology. It should not be the other way around as with EDI. Consequently, the first group that needs to meet is one with cross-government representation, empowered to make recommended changes in policies, practices, and procedures. Once that group has done its work and changes are approved, another group can evolve to oversee the insertion of new technologies that can facilitate the new way of doing business. Some overlap and concurrent work can exist between the business process and the standards development groups.

- Any committee or group has to be dynamic and empowered to get things done. Meetings held without resulting action are useless. If we are going to be responsive to an ever-diminishing technology cycle then we have to be empowered to make decisions and take actions. What is needed is a new committee with broad representation and the ability to "jump start" actions for inserting new technology.

- We have to have more diverse department and agency involvement than at present. Every department and agency of the government, at some level, has to be at the table for a group to obtain all business requirements and to migrate those requirements into the standards environment. Little will be accomplished if the work is done piecemeal.

- If the current FESMCC is going to evolve, it needs to be revitalized. Department and agency representatives are not holding many meetings and are not voting on standards issues. In all fairness, when most standards have been developed, the work of the FESMCC is bound to have tapered off. The real question is whether or not it should be revitalized instead of being reconstituted.

- We have not discussed the need to do business modeling. For several attendees this is seen as a first step. The government acquisition cycle should be modeled as a way of analyzing business data and resulting business requirements.

- Several attendees expressed the view that given the extent of legacy system use, there will be no way to attain a "single face to industry."

However, with the appropriate system architecture and interfaces, there is every reason to expect that the government will achieve a "virtual" single face.

- There are two levels of groups needed. One should be at the high level to articulate the new way of doing business, and the second at a lower level to ensure the proper interfaces with the standards-development community.

- The way to sort out responsibility is to work on business process issues government-wide. Then, leave implementation matters to the departments and agencies.

Role of the FESMCC in Support of XML

The Chairperson of FESMCC was interviewed to determine if and what role the FESMCC could play in inserting XML into the federal government.

The ECPO needs to make a number of decisions about the government's adoption of XML. The following are the four options:

1. Send EDI transaction sets with an XML wrapper

2. Convert EDI into XML

3. Send XML data and convert it to EDI

4. Use pure XML.

One or all of the above options may be adopted at some point. Regardless of the decision, once the government adopts XML, federal agencies will need support and guidance in developing and using XML DTDs, tags, and implementation efforts. Such support already exists for EDI implementation conventions in the FESMCC. With this support infrastructure already in place, we recommend taking advantage of it and not creating a new, separate organization.

If the ECPO adopts the first option above, the current role of the FESMCC would change little. The government would continue to use EDI, and an XML wrapper would be used to merely send the EDI data over the Internet. Then, the FESMCC would continue supporting the development of EDI ICs.

However, if the ECPO chooses options 2, 3, or 4, then the role of the FESMCC would change. We recommend that at this point the FESMCC retain its functional work groups, i.e., procurement, finance, logistics, health care, communications, control, and security. Regardless of the technology used, the FESMCC members need to represent these functional areas for their departments or agencies to convey how XML can support functional business processes. Option 2, convert EDI into XML, and option 3, send XML data and convert it to EDI, require

agency members who are knowledgeable in the EDI ANSI standard and also members who are knowledgeable in XML, DTDs, and tags.

Option 4 requires the FESMCC role to change completely away from EDI and have new members focus entirely on XML. This option would require FESMCC members to have the functional business-processing knowledge coupled with that of XML.

Options 2, 3, or 4 would directly affect changing the FESMCC:

- Name
- Charter
- FIPS 161-2
- Agency member participants
- Approval process for ICs, DTDs, or tags
- Web-site support of above approval process and posting of approved ICs, DTDs, or tags.

Once the ECPO decides on adopting XML and the short- and long-term strategy of implementation, the FESMCC chairperson will need to decide how to best support these efforts and make the appropriate changes so that agencies can participate accordingly.

The FESMCC must have more diverse department and agency involvement than at present. This is crucial, whether the FESMCC be revitalized for EDI or reconstituted for XML.

EC at the National Aeronautics and Space Administration

During the interview with NASA, Mr. Ken Stepka discussed the extremely proactive role of NASA in implementing EC. NASA has developed a number of EC projects focused on buying and selling activities—including Internet payment. These projects are identified in detail in their Office of Management and Budget-mandated *Electronic Commerce FY 98 Assessment and FY 99/00 Implementation Plan*.[2] The implementation plan lays out how NASA intends to move forward in implementing EC concepts and technologies throughout the department. From an internal perspective, the agency is moving forward on buying a suite of products for all business functions. This suite is focused on using Web-enabled tools and may ultimately include an Intranet orientation.

[2] National Aeronautical and Space Administration, *Electronic Commerce FY 98 Assessment and FY 99/00 Implementation Plan,* January 1999.

With respect to OBI and XML, neither technology appears to have much play in NASA's long-term strategies. NASA participates in a number of multiagency projects, including the catalog interoperability project that is using XML. However, neither technology appears in the FY99/00 implementation plan, and our interview with Mr. Stepka of the NASA procurement office was unsuccessful in identifying OBI or XML plans. Regardless, given the significant investment in Web technology for both internal and external interfaces, we believe XML will play an increasingly important role in NASA's future EC endeavors.

EC at the Department of Interior

Charles Nethaway, Deputy Director of the Reston Office of the National Business Center (NBC) at the Department of Interior, described his organization's efforts to develop systems that would eliminate the need for paper invoices and receipt documents. The Electronic Commerce for the 21st Century initiative has led to the development of Internet-based EC modules that connect to legacy federal procurement, finance, property, and analysis systems. [3] The modules include requests for quotes, quotes, awards, ordering, receipt, acceptance, invoicing, payment, and analysis and inquiry functions.

Mr. Nethaway described a recent visit to Giant Food to examine their use of EDI to minimize paper documents and improve information flow. Giant Food is using EDI to exchange information with direct store delivery vendors. Giant Food has found that different commodities require different accounting and payment methods. For example, seasonal items are treated as consignment items with payment to the supplier occurring only after the item has been scanned during a consumer purchase. Snack foods are not requisitioned directly; rather the supplier inventories the shelf and fills in the empty spaces.

Mr. Nethaway sees this approach as a useful example for federal purchasing, which involves purchases of items in various commodity categories.

Mr. Nethaway also shared NBC's strategic decisions for the 21st century, which included the following:

- Take advantage of best practices and EC initiatives by developing strategic alliances in the federal community.
- Eliminate unnecessary procedural complications and take full advantage of innovations and technologies.
- Industry EC standards and COTS solutions will be used as much as possible.
- Develop flexible interoperable solutions that will be implemented to enable SMEs, as well as large businesses, to interface.

[3] http://wasc.usgs.gov/ec21/.

- Improve current business processes and interfaces with legacy systems.
- Develop a modular EC solution that as a whole provides a complete financial management solution.

Mr. Nethaway indicated that one of the major problems with the current use of credit cards for purchasing is reconciling purchases against funding sources. The credit card bills alone do not provide enough detail to enable the buyer to allocate purchases to funding sources. A solution to this problem is to use multiple credit cards, each dedicated to a single funding source. This would enable the buyer to allocate each purchase to the desired funding source by selecting the appropriate credit card.

The lack of information present in credit card bills also exists in electronic fund transfers (EFT). Mr. Nethaway described the intent to provide remittance advice to the vendor as part of the EFT.

BPR at the Department of Energy

Kevin Shaver is the President of Business Commerce Solutions (BCS), the Department of Energy (DOE) contractor responsible for automating the procurement and finance operations. Mr. Shaver frankly discussed DOE's program in the following interview.

The goal of DOE is total automation workflow, nationwide, of the procurement and finance areas for small purchases, simplified acquisitions of less than $100,000. This means that operations of both functional areas must work together seamlessly in a paperless environment. A combination of technologies is being used that includes HTML, HTTP, and EDI.

The program is being implemented in phases and benefits are now being realized. BCS is developing an interactive catalog that supports the OBI framework. This is not the exact model as described by the OBI consortium. DOE chose to implement only parts of the model that will work for DOE and DOE vendors. For example, the OBI model calls for the agency to receive an EDI 850 transaction set. DOE has no application to receive the 850 and, therefore, has not implemented this part of OBI. Mr. Shaver indicated that other parts of the model were also not followed, but did not go into detail.

The key to the success of the program lies not with OBI, but with business process reengineering (BPR). DOE revamped and streamlined both the procurement and finance processes to accommodate automation. Without the BPR, the program would not have succeeded.

DOE had difficulty obtaining buy-in from the vendors. Therefore, DOE does not have the traditional hub and spoke relationship, where the hub dominates and dictates all the rules. DOE's current philosophy is to do what it takes to realize the

goal of total workflow automation. Therefore, DOE is willing to accommodate vendor EDI facsimile, traditional EDI, or EDI over the Web. DOE is using the DoD-approved 850 (purchase order) version 3010. DOE plans to migrate to a federally approved 850 according to vendor acceptance. If none of the vendors are using the later versions of the 850, for example the 4010, DOE will not plan to adopt it. "There would be no point, because no vendor could receive it." Therefore, DOE will also not dictate using XML. XML may have some advantages, but only if the players are willing to adopt it.

DOE's electronic catalog program is nationwide and has four vendors offering their products, with previously contracted discounts built into the system. Plans are to add other vendors, however, Mr. Shaver indicated that only the large vendors are targeted. The reason is that smaller companies may not have the means to meet DOE requirements. In the future, DOE will have a "template" where all requirements in selling to DOE are "standardized" and all vendors will need to comply. Once the template is complete, any vendor that is able to meet the requirement may provide their catalog information and offer their products and services to DOE. In this way, the SMEs will not be precluded from doing business. The SME will need to decide whether the up-front investment is worth securing DOE business.

The other difficult part of the program was developing the new electronic streamlined procurement and finance processes. "There were many different factions within procurement and finance that carried out their functions their own way. It was a challenge pulling it all together and convincing these functional managers that the new automated processes would make their jobs easier. Many were skeptical until the benefits were realized."

Consistent and better prices were obtained from the vendors. Turnaround times were quicker, reducing 3 weeks to 2 to 3 days. Fewer errors were made because there was no re-keying. The obligation of funds now is automated. Cycle times for both procurement and finance were greatly reduced. The procurement department will reduce the number of people by 75 percent during the next 5 years. Mr. Shaver is still obtaining metrics to further measure benefits.

The program is not yet complete. The pilot is in phases. The deployment of the internal applications is a production system, however, the interactive catalog is in a pilot phase and needs to be "tweaked" to be more effective.

Mr. Shaver cautioned anyone undertaking BPR in procurement and finance not to act on assumptions. "The vendors, tools, and technology were not available to do all this. Even private industry was not ready." His advice is to keep pushing forward and make it happen. "Don't stop and don't give up, or nothing will ever be accomplished."

EC within General Services Administration's Federal Supply Service

We interviewed Mr. Bill Gormley, Assistant Commissioner, Office of Acquisition; Ms. Carolyn Alston, Deputy Assistant Commissioner; and Ms. Teresa Sorrenti, Director, Acquisition Operations and Electronic Commerce Center, all representatives of GSA Federal Supply Service (FSS), to discuss their EC strategy and requirements for OBI and XML.

Mr. Gormley described GSA's EC vision of a totally automated procurement process in the federal government. A number of steps have already been taken to achieve this vision.

- GSA has moved toward becoming a broker of commercial products and services.
- GSA recognizes that the legacy logistics system will be around for some time and has an ultimate goal to upgrade, change, or integrate the system into a more complete business environment and migrate the system to COTS.
- GSA is increasing the number of procurements involving the Internet and credit card users.
- The number of GSA contractors and customers has grown dramatically. From 1995 to 1999 the work force has not increased, yet the sales and leverage under GSA/FSS programs has increased from $12 billion to $23 billion. The additional workload this represents could not have been accomplished without the use of technology and electronic commerce. Today 45 percent of the orders go out via EDI and 55 percent go out via facsimile.
- GSA expects the number of procurements, users and services to continue to increase and is evaluating the impact of implementing XML to facilitate its services.
- GSA plans to require that a contractor be on GSA *Advantage!*™ prior to the effective date of the contract. This will require a change in contract clauses.
- GSA's goal is to be an employer of choice, attracting and maintaining an e-business attuned work force.
- GSA is employing sound business practices as the ways and methods of conducting business change.

As an individual agency, GSA is working toward total EC. GSA uses a number of methods to measure performance. GSA takes the results of the annual business review along with sales, costs, revenues, and customer inputs to develop priorities; then assesses the time and investment dollars required for those priorities. These results determine the resources and requirements of GSA's IT department. From this, GSA then creates its IT plan. Once IT requirements are determined, GSA then analyzes how the IT changes will impact the customer. If the requirements are beneficial to GSA customers and streamlines GSA processes, then the IT department plans are implemented. Resources may be a problem when implementing XML. Several pilot projects are being considered.

GSA is holding conferences for small- and medium-size enterprises to help educate them on the use of electronic commerce. GSA seeks EC solutions where "one process fits all" and there will be no unfair advantages for the large or small vendors. GSA has as a goal, the establishment of a single business database—populated with trading partner data—from all enterprises wishing to do business with GSA, where all the solicitations and orders will feed off of this one database. Consideration is being given to developing the operational software and providing it to all trading partners as a way of facilitating electronic commerce and encouraging participation of the largest number of SMEs. Ms. Alston indicated that GSA accommodates SMEs today by providing a diskette for those commercial partners who do not want to invest resources in EDI. Firms are also able to search and view solicitations via the Electronic Posting System.[4]

Some impetus is coming from GSA trading partners who are asking the GSA to move forward to simpler, less costly, more easily understood ways of doing electronic business. They are also asking when all federal government agencies will have the same requirements—"or single face to industry." In this way they will know what changes to make in order to work more effectively with all of government.

Mr. Gormley indicated that problems or restrictions in implementing EC are both external with trading partners and internal within the government. With EC changes, expectations rise and once implemented, EC/IT changes must quickly meet those expectations to achieve credibility. Externally the trading partners do not want any additional changes to burden the way they do business today.

GSA cannot allow itself to be in a position where its methods actually hinder trading partners. Consequently, GSA has to lead or at least keep pace with shifts in usable business technology. Changes in operating technology should be considered so long as they do not cost more than current methods or take longer (e.g., induce time into the acquisition process) than the current way of doing business.

[4] www.gsa.gov/eps.

GSA has both a good vision of the future and a sense of direction. Accordingly it is doing a good job of getting the word out to its work force and trading partners. Equally, GSA understands the need to leave business decisions to business people and not allow itself to be driven by technology alone. Success is achieved when technology can be used to move business processes forward rather than to change business processes solely to take advantage of new technology. Managers will always have the difficult task of balancing new, competing requirements against support for existing systems.

Table C-1. Workshop Attendees

Name	Organization
Christo Andonyadis	LMI
Mark Crawford	LMI
Delia Davis	Office of Acquisition Policy, MVE, GSA
Charles Demers	GSA-TCR
Marv Goldstein	NIST MEP
Paul D. Grant	DoD (OASD [C10]), OSD
John Hart	Federal EC Program Office, GSA
Joan Kimmel-Frantz	National Business Center, Department of Interior
Carol Koontz	FTS/ITI/TFBB, GSA
Tim Landy	AMS
CeCe Lichtenstein	Financial Management Service, Department of the Treasury
Stephen Luster	LMI
Al Matera	Office of Acquisition Policy, GSA
Dan McGrath	FITEC
Mary Mitchell	Office of EC, OGP, GSA
Bill Morgan	GSA
Charles Nethaway	National Business Center, Department of Interior
Genie Pack	GSA/FSS/FC
Christina Palko	GSA/FSS/FI
Bob Parker	LMI
Doug Reimel	NIST MEP
Louis Schlosburg	PBS-CIO, GSA
Dennis Schroff	CFO-BCD, GSA
Howard Stern	One Health Bank, Government Partnerships
Robert J. Sturm	Federal EC Coalition, Electric Press, Inc.
Ronald Taylor	FITEC
Stephanie Taylor	Department of Interior
John Thomas	Federal EC Program Office, GSA
Earl Warrington	PBS-CIO, GSA
Theresa Yee	LMI
Janet Zucker	JECPO

Appendix D
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Appendix E
Glossary and Definitions

This appendix is a glossary of some technical terms and "terms of art" that may be unfamiliar to the general reader.

843 Transaction Set. This is the name given to the EDI Response to a Request For Quotation.

850 Transaction Set. This is the name given to the EDI Purchase Order.

ANSI X12. The American National Standards Institute is the national body that sanctions American standards. X12 represents the EDI standards.

CommerceNet. CommerceNet is a global nonprofit membership organization with more than 500 corporate members doing electronic commerce. CommerceNet seeks to promote and advance interoperable electronic commerce to support emerging communities of commerce through its eCo framework.

DOM. Document Object Model is a means of addressing elements and attributes in a document from a processing application or script. The W3C has a DOM working group that is developing a standard model for HTML and XML documents.[1]

DTD. Document type definition is a set of rules for document construction that lies at the heart of all SGML development and all valid XML document construction. Processing applications and authoring tools rely on DTDs to inform them of the parts required by a particular document type. A document with a DTD may be validated against the definition.[2]

E-Catalog. The electronic catalog is an on-line catalog available via the Internet.

EDI. Electronic data interchange is the exchange of data in a standard format from computer to computer, without the need for human intervention.

FESMCC. The Federal EDI Standards Management Coordinating Committee is a federal government organization empowered to raise and approve EDI implementation conventions.

GSA Advantage!™ The on-line ordering system for government purchasing offered by GSA.

[1] St. Laurent, Simon, *XML: A Primer*, IDG Books Worldwide, 1998.

[2] Ibid.

HTTP. HyperText Transfer Protocol is the protocol governing communications between clients and servers on the World Wide Web. HTTP enables clients to send requests to servers, which reply with an appropriate document or an error message.

HTML. HyperText Markup Language is the most popular markup language in use today. It is one of the foundations of Web development, providing formatting and basic structures to documents for presentation via browsers.[3]

Implementation Convention. The documentation of a cross-reference between the data required to perform a business function (e.g., a purchase order) and the location where that data will be carried in EDI format in a transaction set.

ISO. The International Organization for Standardization (the acronym is derived from its French name), which sets industrial standards relating to everything from character sets to quality processes to SGML.[4]

OBI. Open buying on the Internet is the specific architecture for buying over the Internet developed by an organization called the OBI Consortium, now managed by CommerceNet.

Parser. An application that converts a serial stream of markup (an XML file, for example) into an output structure accessible by a program. Parsers may validate or check on how well formed the markups are as they process the output.[5]

RosettaNet. RosettaNet is an independent nonprofit consortium of more than 40 IT product manufacturers, users, distributors, resellers, software publishers, and financial institutions working to define open and common business interfaces for use in the IT supply chain.

SGML. Standard Generalized Markup Language is a complex set of rules for defining document structures and is the parent language of HTML and XML.[6]

W3C. The World Wide Web Consortium was founded in October 1994 to lead the World Wide Web to its full potential by developing common protocols that will promote its evolution and ensure its interoperability. The W3C is an international industry consortium jointly hosted by the Massachusetts Institute of Technology Laboratory for Computer Science in the United States; the Institut National de Recherche en Informatique et en Automatique in Europe; and the Keio University Shonan Fujisawa Campus in Japan. The XML technical specifications used to develop the business standards and enable the technology are the result of a series of recommendations published by the World Wide Web Consortium.

[3] Ibid.

[4] Ibid.

[5] Ibid.

[6] Ibid.

XML. Extensible Markup Language is a technical specification under development by the W3C, a series of developing business standards, and burgeoning technology base used for Web information exchanges.

Appendix F
Abbreviations

ANSI	American National Standards Institute
API	application program interface
ASC	Accredited Standards Committee
B2B	business-to-business
BAPI	business application programming interface
BCS	Business Commerce Solutions
BIPS	Bank Internet Payment System
BPR	business process reengineering
CA	certificate authority
CAB	Customer Advisory Board
CAGE	contractor and government entity
CBL	Common Business Library
CEFACT	United Nations Center for the Facilitation of Procedures and Practices for Administration, Commerce, and Transport
CEN	European Committee for Standardization
CFO	chief financial officer
CGI	common gateway interface
CN	common name
COTS	commercial off-the-shelf
DB	database
DISA	Defense Information Systems Agency
DLA	Defense Logistics Agency

DLMS	Defense Logistics Management System
DLSS	Defense Logistics Standard System
DoD	Department of Defense
DoDAAC	DoD activity address code
DOE	Department of Energy
DOM	Document Object Model
DTD	document type definition
ebXML	electronic business XML
EC	electronic commerce
ECPO	Electronic Commerce Program Office
ECRC	Electronic Commerce Resource Center
EDI	electronic data interchange
EDIFACT	EDI for Administration, Commerce, and Transport
EFT	electronic funds transfer
EOBIO	encoded OBI object
EPIC	Electronic Processes Initiatives Committee
ERP	Enterprise Resource Planning
FACNET	Federal Acquisition Computer Network
FAR	Federal Acquisition Regulation
FARA	Foreign Agents Registration Act
FASA	Federal Acquisition Streamlining Act
FESMCC	Federal Electronic Commerce Standards Management Coordinating Committee
FIPS	Federal Information Processing Standard
FITEC	Financial Implementation Team for Electronic Commerce

FMS	Financial Management Service
FSS	Federal Supply Service
FSTC	Financial Services Technology Consortium
FTP	file transfer protocol
GML	Generalized Markup Language
GPRA	Government Performance Results Act
GSA	General Services Administration
HL7	Health Level 7
HTML	Hyper Text Markup Language
HTTP	hyper text transfer protocol
IAIC	Interagency Acquisition Internet Council
IC	implementation convention
ICE	Internet Content Exchange
ID	identification code
IEC	International Electrotechnical Commission
iFS	Internet file system
Infoset	XML Information Set
IP	Internet protocol
ISO	International Organization for Standardization
ISSS	Information Society Standardization System
IT	information technology
JAMSS	Joint Ammunition Management Standard System
LAN	local area network
LMI	Logistics Management Institute
MIME	multipurpose Internet mail extension

MRO	maintenance, repair, and operations
NASA	National Aeronautics and Space Administration
NBC	National Business Center
NIST	National Institute for Standards and Technology
NPR	National Performance Review
NSA	National Security Agency
NSB	National Standards Body
O	organization
OASIS	Organization for the Advancement of Structured Information Standards
OBI	open buying on the Internet
OBIREQID	OBI requisitioner identification
OMB	Office of Management and Budget
OFX	Open Financial Exchange
ORG	organization
OTP	Open Trading Protocol
PAS	Publicly Available Specification
PC	purchase card
PIP	partner interface process
PKC	public key cryptography
PKCS	Public Key Cryptography Standards
PL	Public Law
PMO	Program Management Office
R&D	research and development
RDBS	relational data base system

RDF	Resource Definition Framework
RFQ	request for quotation
ROI	return on investment
SAP	simplified acquisition procedure
SAT	simplified acquisition threshold
SGML	Standardized Generalized Markup Language
SME	small- and medium-size enterprise
SOW	statement of work
SPS	standard procurement system
SQL	Structured Query Language
SQL	Structured Query Language
SSA	Social Services Administration
SSL	secure sockets layer
TBD	to be determined
TCP	transmission control protocol
TS	transaction set
TS	transaction set
UN	United Nations
URL	universal resource locator
USC	United States Code
VAN	value-added network
W3C	World Wide Web Consortium
WAN	wide area network
WIDL	Web Interface Definition Language
WWW	World Wide Web

XLink	XML Linking Language
XML	extensible markup language
XPath	LML Path Language
XPointer	XML Pointer Language
XSL	Extensible Style Sheet Language
XSLT	XSL Transformation
Y2K	year 2000