Document Exchange Model for Augmenting Added Value of B2B Collaboration

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ABSTRACT

In this paper we present a B2B integration project, which aims to augment the added value of services instead of improving efficiency by automating processes. This paper introduces the VAlue Layered docUment Exchange (VALUE) model, which is a novel collaboration model adopted for this project. The key feature of the VALUE model is that partners exchange XML documents that are updated by adding elements for process information, such as the acceptance or rejection of a proposal, to received documents. Exploiting the extensible characteristics of XML, this model enables real business collaboration without complex process flow control. The project has demonstrated the advantages of a collaborative protocol based on this model in the Japanese retail industry. This protocol adopted ebXML MS (Messaging Service) for messaging over the Internet, and was the first case that applied ebXML to real business collaboration in Japan.

Keywords

B2B, ebXML, supply chain management.

1. INTRODUCTION

The global spread of the Internet has promoted the innovation of commercial transactions called B2B. Typified by RosettaNet [7], B2B (Business-to-Business) commerce covers inter-company business communication that uses XML-based protocol, while B2C (Business-to-Customer) commerce refers to Internet shopping in a Web browser. Although it had once gotten intensive media attention, B2B has not spread as fast as expected, except in some sectors, such as the IT industry. Many industries are still looking for a convincing business benefit in return for a new IT investment to replace existing EDI [5].

The typical purpose of B2B collaboration is optimization of supply chain management (SCM) that includes external partners. In general, the delivery of services to final consumers requires the coordinated efforts of multiple companies. To respond to demands from consumers quickly, companies involved in a chain have to exchange information about orders, inventory, and delivery. B2B integration provides a means for exchanging such information among companies. Therefore, each company has to estimate the tradeoff between the following business benefits and investment costs before participating in B2B collaboration.

(1) Business benefits from collaboration

To motivate companies to join B2B collaboration, a business benefit should be evident to each player. Since EDI systems have already spread throughout many Japanese industries, the advantages should exceed the benefits from the existing EDI. Although B2B communications enable the optimization of total performance of the supply chain for providing services to final consumers, it does not always guarantee the best solution for each participant.

(2) Cost of system introduction

To exchange information, each company has to conform to the standard defined for B2B collaboration. Since a supply chain involves companies with various roles, participants are on various levels of IT infrastructure. Some companies use telephone and fax based communication, while other companies use workflows to coordinate operations among departments. Therefore, the cost for introducing systems that conform to B2B protocols should be low even for a company that does not have an advanced IT infrastructure.

As for business benefits, so far, B2B collaboration has focused on the cost reduction achieved by automating intercorporate processes. As represented by e-procurement, B2B supply chains are the means to simplify inter/intra corporate transactions, to exclude intermediaries and to introduce automated laborsaving processes. This approach has caused the imbalance of advantages between buyers and suppliers. For final consumers, the benefits from efficient supply chains are obvious, i.e. lower price and faster delivery. On the other hand, the advantages for suppliers, which are at the other end of the chain, are unclear.

Moreover, if information infrastructure is not developed enough, a company will have to deploy new staff for processing data from/to a B2B system. In some companies, for example, an employee must print a hardcopy of messages received from the B2B system, and then type the messages into a host computer.

To reduce the cost of developing a B2B system, an effective approach is the adoption of an XML-based standard like RosettaNet or ebXML [3]. Since these standards use common Internet technologies, such as HTTP and XML, a company can introduce a B2B system that has flexible and sophisticated functions at relatively lower cost than conventional EDI. However,

these standards have been designed to develop highly automated intercorporate processes, which include public flow defined by RosetaNet PIPs (Partner Interface Process) or ebXML BPSS (Business Process Specification Schema). After all, to make effective use of these standards, a company needs a highly developed intracorporate system that can cooperate with outside processes.

This paper presents an example of a B2B integration project in the Japanese food retail industry, called the Kasumi B2B Integration Project. The unique concept of this project is that it aims to augment the added value of services instead of improving efficiency by automating processes. To achieve this goal we introduced the VAlue Layered docUment Exchange (VALUE) model, which is a novel collaboration model for exchanging self-contained XML documents that include process information.

In this model, the partners exchange XML documents that are updated by adding elements for process information, such as the acceptance or rejection of a proposal, to received documents. The XML documents are designed to exchange richer information that can provide business advantages for both retailers and suppliers. Exploiting the extensible characteristics of XML, it enables real business collaboration including human interaction without advanced process flow control. Further, the adoption of Internet B2B standards including ebXML reduces the costs of developing the infrastructure necessary for B2B collaboration.

2. RELATED WORK

This section gives a brief explanation of major activities related to our research.

2.1 RosettaNet and ebXML

As Internet-based B2B collaboration protocols, RosettaNet and ebXML are the cutting-edge standards. While RosettaNet provides specifications for the IT industry, ebXML is a generic solution unconfined to specific industries. For example, GCI (Global Commerce Initiative), the major international retail standardization body, has expressed support for ebXML. These standards have layered architecture covering transport layers to business collaboration layers. Their most competitive feature is definitions of public flows, which specify interface processes between partners. RosettaNet specifies more than 100 PIPs (Partner Interface Process) for business communications for IT industries. ebXML takes a more generic approach that specifies a language called BPSS (Business Process Specification Schema) to describe processes like PIPs.

However, advanced IT infrastructures are necessary for making effective use of these public flows. Currently, only large-scale corporations have introduced an expensive system called B2Bi (B2B integration) or EAI (Enterprise Application Integration) framework to support such functions. Our project adopted only the ebXML MS (Messaging Service), which specifies messaging layers and is the most widely used part of the standard.

2.2 JCA and JEDICOS

In the Japanese distribution industry, EDI (Electronic Data Interchange) is wide-spread. The most-used communication standard is the JCA protocol over VAN (Value Added Network), which is a domestic protocol in Japan developed 20 years ago. As a message format, only a format for ordering is commonly used. In 1997, JEDICOS message formats were developed by the Distribution System Research Institute (DSRI), the Japanese standardization body of the distribution sector [2]. JEDICOS is based on EDIFACT, an international standard, and defines various message types necessary for the distribution industry. JEDICOS had raised expectations for replacing JCA and engaging industry innovation. However, use of JEDICOS has not become wide spread yet, since many companies are still looking for a convincing business benefit in return for a new IT investment to replace existing EDI.

Now, many standardization bodies are newly developing XML-based EDI standards. We defined original XML business documents using existing standards wherever possible. For example, we adopted GLN (Global Location Number), GTIN (Global Trading Identification Number), and some codes used in JEDICOS. Further, our activity has fed back to DSRI's activity to build an XML-EDI standard called JEDICOS-XML.

2.3 CPFR and Collaborative Commerce

As a business model innovation associated with advanced SCM, an activity called CPFR (Collaborative Planning Forecasting and Replenishment) has become a hot topic in the retail industry [1]. Although the cases of CPFR exhibit a lot of variety, the key concept is the use of future information. CPFR makes buyers and suppliers share information about production planning and sales forecasting, while conventional SCMs are confined to using real-time, but present, information about orders, inventory, and distribution. Since the target collaborations of our projects include order forecasts, sales results, and promotion plans, our activity can be regarded as another form of CPFR. However, the goal of CPFR is not changed. It is the improvement of supply chain performance. The unique value of our project is introducing collaboration that will increase the value of service using the rich information structure of XML.

Although a lot of B2B standards have been developed based on XML, few of them have succeeded to show convincing reasons for XML. Lee [6] discussed the values of B2B commerce and concluded that B2B collaboration is more beneficial than basic B2B data exchanges. The essential benefits come from collaborative business models like CRP (Continuous Replenishment Process) rather than technical advances like Internet-based EDI. Holzmüller [4] analyzed the reasons for failure of the initial trials of B2B marketplaces and conducted a Delphi study regarding future possibilities. They presented numerous suggestions for the future B2B marketplace. However, they attached little importance to the use of structured message like XML. In this paper, we show that the characteristics of XML itself can drive business model innovation.

3. COLLABORATION FOR AUGMENTING BUSINESS VALUE

In this paper we present concepts and techniques which help companies pass the thresholds of participating in B2B collaboration. As an example, we discuss the Japanese food retail industry with the focus on a supermarket where supply chain automation is neither possible nor desirable.

3.1 Japanese Food Retail Industry

A supermarket is a chain store that mainly provides foods for consumers. It provides more than 10,000 goods, which come from more than 1,000 suppliers. Products cover a wide variety from

processed foods to fresh foods. Suppliers include international food processing companies, national food manufacturers, wholesalers, and family-type operations. Although low price and steady supply are important factors for selecting suppliers, the trust in quality and safety established during a long business association is indispensable. In addition, various regulations and business practices make the business model complicated.

Although EDI has been already spread in this industry, only limited numbers of companies, such as national manufacturers, have integrated merchandising systems that can manage product data, inventory, and sales results. Moreover, the information literacy of the employees is relatively low compared with the IT industry. Therefore, it is not easy to convince companies to make another IT investment for automating B2B processes.

On the other hand, the retail industry is facing the limits of mass marketing. As the market becomes saturated, retailers are required to respond to diversified consumer preferences. Between suppliers and consumers, a supermarket can play a role in explaining or recommending products to consumers.

Without a sufficient description of products, consumers cannot choose the products that they really want. When consumers choose items, they refer to various types of information about the product and judge whether the prices are fair. For example, the expiration date and ingredients label are standard properties. Indications that a product is nongenetically-modified and BSE-free are now seen on product labels. Such information is invisible from the external appearance of the product. By presenting information adequately, the added value of the products can increase, thus augment the advantages for both retailers and suppliers.

Further, recommending products directly affects sales results. The bargain sale is a usual practice for increasing sales. The ingredients for Christmas dinners should be displayed specially at the end of the year. If a manufacturer starts TV commercials for new products or if a famous cookery program recommends recipes for healthy foods, the associated products should be displayed without delay. By synchronizing such activities, both retailer and suppliers gain advantages. Since the retailer can send order forecasts for these promotion plans, suppliers obtain further advantages with respect to inventory management.

In order to design a sales floor that can give recommendations to consumers, information should be shared by a retailer who senses real customer trends, and suppliers who have detailed product information. Controlling information about products in response to the diversity of consumers is the common approach with CRM (Customer Relationship Management), which is widely regarded as a promising development. Applying B2B technology to sharing information is the key for increased customer satisfaction by augmenting the added value of services, instead of reducing costs of operation.

3.2 Kasumi B2B Integration Project

The Kasumi Project is an initiative that develops communication protocols for real B2B collaborations in the Japanese retail industry. The project consists of Kasumi, which runs a supermarket chain, food manufacturers, a wholesaler, and B2B system integrators. The project aims to increase the added value of services by exchanging highly structured information among partners instead of reducing cost by automation.

The supply chain associated with the project consists of four types of players: supplier employees, buyers from headquarters, floor clerks, and consumers. Product information goes along the chain in this order, and sales results in the reverse order. Note that physical distribution uses another chain which includes the delivery center instead of the headquarters.

The Kasumi Project chose four types of collaboration as targets, that is, product registration, promotion plan, sales results, and planogram proposal. The rate of progress was such that we completed demonstrations of the first two types by the year 2002. Our model was applied to the following collaborations.

(1) Product registration

A buyer from headquarters receives a request for registering a product with associated information from a supplier. The buyer examines the request and registers the item into the merchandise database if the request is acceptable, and sends back the result. Operations for deleting, updating, and replacing are processed in a similar way. A merchandise database maintains information about all the items handled by the retailer. A floor manager refers to the registered information to decide what items should be selected and how to display them.

(2) Promotion plan

A buyer from headquarters receives proposals of the promotion plan. There are various types of promotion, for example, seasonal sales like Christmas, campaigns of new products, and coordination with TV commercials or programs. The buyer examines the request and registers the plan into the merchandise system if the plan is acceptable, and sends back the result. The response includes order forecasts that can support the supplier's inventory management.

Both collaborations include human negotiation and are currently done by FAX and telephone. B2B collaboration is expected to fill the present information gap between the headquarters and stores, and to affect the activities on the sales floors. Although the remaining two types of collaboration would result in different business benefits, the unique value of the project is demonstrated by the above two transactions.

4. COMMUNICATION PROTOCOLS AND THE COLLABORATION MODEL

4.1 Communication Protocols

In this project we adopted ebXML MS as a communication protocol. MS is a messaging service protocol defined by adding extensions for business transactions to SOAP (Simple Object Access Protocol). A message based on MS consists of a header container, including envelope information, and a payload container, including business documents. We used HTTP as a transport protocol and adopted two-way authentication using SSL to insure security. The standard procedures for sending and receiving messages are shown in Fig. 1.

First, the receiver process is started by receiving a request from a supplier as an ebXML message. It then validates the header container, sends back an Ack message, and proceeds to the next step. The transmission of the Ack message indicates that the requested message has been received. If a validation error occurs, the process adds the associated error messages to the Ack message, and completes the procedure.

Next, the process extracts a business document from the payload container, validates it with associated XML Schema, checks consistency with a merchandise database, and sends a Reply message. The transmission of the Reply message indicates that the requested message has been processed. If a validation error occurs, the process includes the associated error messages in the Reply message, and completes the procedure. If no error occurs, it proceeds to the main procedure that processes the extracted business document.

To enable the two-way communications necessary for "ProductRegistration" and "PromotionPlan", the same procedure follows in the opposite direction, i.e. from retailer to supplier.

4.2 VALUE Model

The VALUE model is a collaboration model based on the exchange of a self-contained XML document. The key feature of this model is that the same structure is used for the request message and corresponding response message. Collaboration proceeds by updating specified elements of the received massage and sending back the document.

This model is defined as an additional description to the definition of a business document structure. It consists of *messaging information* and *constraint information*. Messaging information consists of the message ID, sender information, receiver information, and related message information. This information is represented as a part of the XML structure. To make the document self-contained, sender and receiver information must be included in the business document, even though this information is also included in the ebXML header container. The related message ID indicates the precedent message, e.g. request message corresponding to the response message. Using this information, related messages form a thread of communication. Constraint information describes what part of the document should be changed and at which receiving or responding time the values should be set. These descriptions are defined outside the XML structure. The messaging information and constraint information can express the collaboration context in the message. It enables the collaboration to proceed without depending on the processes defined by each partner.

4.3 Collaboration for Increasing Added Value

For the two types of collaboration, we defined the following XML business documents to be exchanged between companies.

"ProductRegistration" is an XML document for the exchange of product information. ("" represents the name of an XML document.) A supplier sends this document to a retailer when requesting product registration. Each of the documents includes information of one or more products. The received document is processed for display on a Web page for a buyer. The buyer decides how to treat the product, and inputs data on the Web browser to add result information to the received document. The buyer negotiates with the supplier by phone or e-mail, if necessary. The accepted products are registered into the merchandise database with received information. The result is sent back as an updated XML document as shown in Fig.2.

"PromotionPlan" is an XML document for the exchange of promotion information. A supplier sends a "PromotionPlan" to a retailer when proposing a promotion plan. Each of the documents includes information of one or more products and a description of plans for promoting them, e.g. promotion types, sales terms, and trade conditions. In the same way as "ProductRegistration", this document is updated and sent back to the supplier. When inputting the result, the buyer inputs forecasts of orders. To specify a promotion associated with TV programs, we also defined a "TVPromotion" format. This document is not sent back to the supplier.

4.4 Example of a Business Document

Here, we explain a document structure based on the VALUE model by using "ProductRegistration" as an example. This document structure includes 162 elements, and the levels of hierarchy are eight at maximum. Fig.3 shows an overview of "ProductRegistration". In the figure, '< > ' represents the name of an element, '-' represents the level of the hierarchy, and 1,.0..1, 1..n represents the constraint of appearance.

(1) The highest level structure <ProductRegistration> consists of <MessageInfo>, <Title>, <ProposalComments>, <BuyerComments>, and <ProductList>. <MessageInfo> is a structure corresponding to messaging information defined by the VALUE model. <ProposalComment> is set when a supplier sends, and <BuyerComment> is set when a buyer responds. <ProductList> holds information of one or more products.

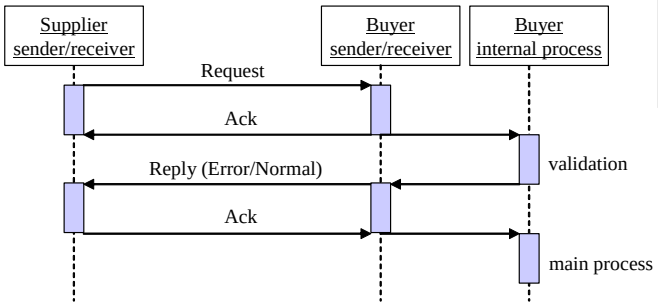

Figure 1. Communication protocol

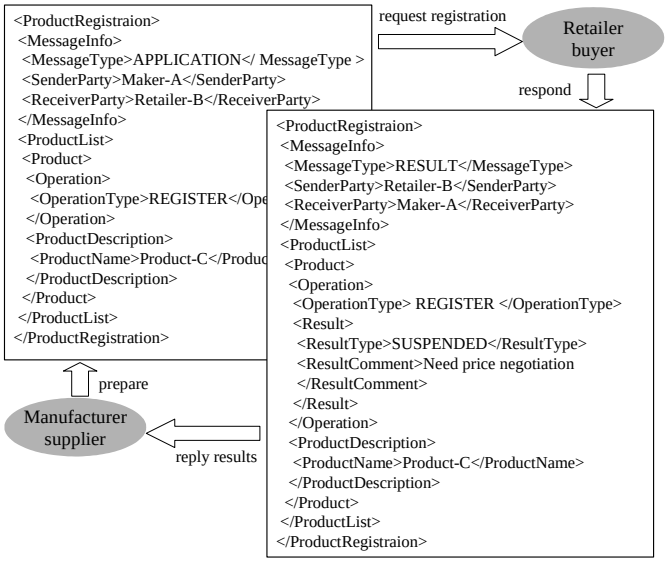

Figure 2. Business document exchange

(2) <MessageInfo> consists of <MessageID>, <MessageType>, <RelatedMesage>, <CreationDate>, <SenderParty> and <ReceiverParty>. <MessageType> indicates whether the message is a request or a response. <CreationDate> is the date of message creation. When the document is sent back as a response, the value is updated. <SenderParty> and <ReceiverParty> are the structures that identify the sender party and receiver party. Each includes the party ID and party name. The sender and receiver information are reversed when responding.

(3) To enable a "ProductRegistration" to have more than one product, <ProductList> has one or more <Product> elements. As a description of each product, <Product> includes <Operation>, <ProductDescription>, <SalesInfo>, and <PurchaseInfo>. <Operation> specifies the requested operation and result. <ProductDescription> describes intrinsic property information of the product, such as product ID, product name, manufacturer, and net contents. <FeatureList> is an element for adding miscellaneous properties of the product that cannot be prepared beforehand. <SalesInfo> describes information associated with sales, such as release date and list price. <PurchaseInfo> describes information associated with purchasing, such as order condition and unit cost. These elements, except for operation and product ID, are specified when a supplier sends the message.

(4) <Operation> consists of <OperationType> and <Result>. <OperationType> is indicated as REGISTER, UPDATE, DELETE, or REPLACE for each product. <Result> is an element to be input by the buyer. It further consists of <ResultType> and <ResultComment>. <ResultType> is indicated as ACCEPTED, REJECTED, or SUSPENDED and <ResultComment> holds the reason of the result.

(5) <ProductID> represents a structure that identifies the product. It consists of <GTINCode>, <AlternateIDList>, and <ProductName>. <GTINCode> is the global standard code of the product. <AlternateIDList> is a structure which accommodates one or more other identifiers. When a supplier initially registers a product, the sending message includes the GTIN code and the code of the sender company. When the message returns from the retailer, the code of the receiver company is added. After registration, a supplier can request updating operations with the codes of the retailer.

```
1   <ProductRegistration>      (1)
1    |--<MessageInfo>          (2)   ;messaging information
1    | |--<MessageID>                 ;message identifier
1    | |--<MessageType>
0..1 | |--<RelatedMessage>            ;related message identifier
1    | |--<CreationDate>
1    | |--<SenderParty>               ;sender party information
1    | |--<ReceiverParty>             ;receiver party information
0..1 |--<Title>
0..1 |--<ProposalComment>             ;sender comments for proposal
0..1 |--<BuyerComment>                ;buyer comments for proposal
1    |--<ProductList>           (3)   ;list of product information
1..n | |--<Product>                   ;information of each product
1    | | |--<Operation>         (4)   ;operation to request
1    | | | |--<OperationType>
0..1 | | | |--<Result>                ;results for operation
1    | | | | |--<ResultType>
0..1 | | | | |--<ResultComment>
1    | | |--<ProductDescription>      ;product intrinsic information
1    | | | |--<ProductID>       (5)   ;product identifiers
0..1 | | | | |--<GTINCode>
1    | | | | |--<AlternateIDList>
1    | | | | |--<ProductName>
1    | | | |--<MakerID>
0..1 | | | |--<NetContents>
       ...   ...
0..1 | | |--<FeatureList>             ;miscellaneous property
1..n | | | |--<Feature>
1    | | |--<SalesInfo>               ;sales related information
1    | | | |--<ListPrice>
0..1 | | | |--<ReleaseDate>
0..1 | | |--<PurchaseInfo>            ;purchase related information
1    | | | |--<OrderCondition>
1    | | | |--<CostPrice>
```

Figure 3. Structure of "ProductRegistration"

5. EMPIRICAL RESULTS

5.1 B2B Server Architecture

We developed a B2B server as a part of the Kasumi merchandise system, which consists of a headquarters server and more than 100 store servers. The B2B server is positioned at the end of the headquarters server and is in charge of communication with partner companies. As shown in Fig.4, the main component of the B2B server is the Business Process Manager (BPM), which coordinates modules, such as ebXML sender/receiver, UI, validation, and data access, in accordance with process flows.

We here explain the process flow for product registration as an example. The BPM starts a process flow when the ebXML receiver module receives a message including a "ProductRegistration". The receiver extracts "ProductRegistraton" and stores it into the XML data server. The flow invokes a validation module to check the document. If no error is detected, it then invokes the UI module to send a task for prompting an employee to input data. The input results are added to the <Result> tag of the stored document. Accepted products are registered into the merchandise database of the headquarters server using a data access module. The <ProductID> issued by the data access module is then added to the message. Finally, the result message is sent to the server of the supplier by an ebXML sender module.

5.2 Demonstration Scenario

We carried out demonstrations of "ProductRegistration", "PromotionProposal" and "TVPromotion" through the following steps.

(Step 1) A supplier prepares a business document and sends it to the retailer server as an ebXML message.

(Step 2) When the retailer server receives an ebXML message from a supplier, it checks its header container and sends an Ack message with the results.

(Step 3) The retailer server extracts a business document from the

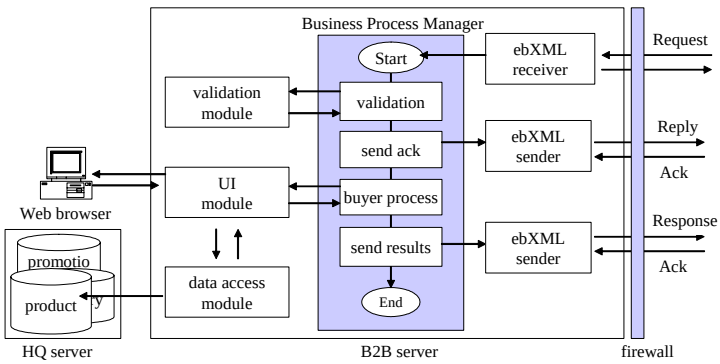

Figure 4. B2B server architecture

payload container and validates it with the associated XML Schema. If errors are detected, it sends a Reply message with the document including error messages and completes the process.

(Step 4) If the business document is accepted, the task list of a buyer shows a new task associated with the document on a Web page. Clicking the task item displays messages as an input form page. The input form for "ProductRegistration" displays information of one or more products, text fields for buyer comments, accept/reject buttons, and a submit button. The input form for "PromotionPlan" further displays fields for inputting selling prices and the prospects of order quantities. A buyer completes the forms by inputting the data and pressing the submit button.

(Step 5) The product data that a buyer has accepted is stored in the retailer's merchandise system. The data from buyers and product IDs issued by the merchandise system are added to the stored business document. The retailer server reverses the messaging information and sends it back to the supplier server as an ebXML message.

(Step 6) Finally, the supplier server receives the business document as the result message and sends an Ack message and Reply message.

5.3 Achievements

Next, let us examine whether raised issues have been solved through the demonstrations.

(1) Business benefits for participants

We aimed to provide business benefits to suppliers as well as retailers by exchanging rich information based on the VALUE model.

In Step 2 for "ProductRegistration", we received various documents that were generated from the merchandise system of each supplier. Some manufacturers have relevant information about the purpose of development and the target consumer. Such information is quite useful for designing the sales floor and providing appropriate product descriptions. Since the information is specific to each manufacturer, it is difficult to define common tags. Instead, <FeatureList> elements are used for representing miscellaneous information. In this way, by participating in the B2B collaboration, the suppliers have a means for getting out the information, which is confined to the supplier database, to the sales floors. This promotes the competitive values of the product that can justify higher prices.

In Step 1 for "ProductRegistration", a supplier used an automatic mechanism that sends a message at the time of product information updating in the supplier merchandise database. This automatic mechanism, however, has difficulty in processing rejection responses from retailers. For this case, which was not expected, we adopted the exceptional rule that the supplier should negotiate acceptance of the product before sending a request. Although such exceptional rules are critical disadvantages from the viewpoint of laborsaving, we made the increase in participant companies who can provide rich product information a higher priority. Since the VALUE model does not specify strict procedures, collaboration can proceed independently from the participant's internal process. This implies that a competitive procedure of each participant can be easily combined with B2B collaboration.

(2) Cost of system development

We aimed to reduce the cost of developing B2B systems by adopting Internet standards including ebXML and introducing the VALUE model.

In Steps 1 and 4, both senders and receivers use a Web browser as a client. Each participant developed the B2B server differently. The commonly used techniques, e.g. multipart MIME, SSL with two-way authentication, and Servlets are developed with standard Java libraries. This enabled lower cost and shorter terms for development than conventional infrastructures. This time, the participants newly developed ebXML receiving/sending modules from scratch. We think this cost will be reduced as the use of ebXML becomes more widespread.

In Step 3 we used XML Schema for validation. This mechanism reduced the cost of developing a program for data validation. In Step 4 we provided GUI, as an input form in a Web browser, by applying XSLT to the received XML. This reduced the cost of GUI development. In Step 5 we used data-binding technology to make a Java object from an XML document. This reduced the cost of building a conversion program. In this way, XML related standards are useful in reducing the cost of B2B system development.

In Step 4, operations executed in a Web browser are conceptually identical to the operations done by FAX. What a buyer has to do is input data on an XML document and send it back to the supplier. This does not require a high level of information literacy. In Step 6, the responded XML document is self-contained, that is, it embodies all the necessary information. Therefore, the receiver program may process only the responded document independently of the information that was used as the request. The simplest way to handle the responded document is to view it in a Web browser by applying XSLT for visual checking.

5.4 Remaining Issues

In this section, we discuss the issues which arose during the demonstration.

5.4.1 Redundant Information Exchange

The VALUE model, which we have presented in this paper, increases the size of exchanged data due to redundant data. From its self-descriptive nature, XML is a redundant message format, i.e. text format that includes tag names in all instances. Actually, the "ProductRegistration" message used in the demonstration takes 4KB for the common area and 4KB for each product, thus totally 4 x (N+1) KB for N products. Since major product replacement occurs a few times a year, it is not heavy for the present Internet infrastructure. However, retailers, which become a hub of communication, have to prepare sufficient capacity.

5.4.2 Meta-schema

B2B standards like ebXML and RosettaNet provide a means for describing processes for exchanging messages. However, they do not have the ability to describe the relationship between the document structures to be exchanged. In the VALUE model, we defined the document structure that includes all the information that is finally specified. To define collaborations, we further determine what elements should be set at sending and responding times. These steps of developing B2B protocols are simpler than defining the sender process, receiver process, sending messages, and receiving messages. Moreover, maintenance of the document

format is easy because the required information necessary is concentrated in the document. This feature that can shorten the process of reaching an agreement is quite important since such B2B transaction agreements take too much time and often form a bottleneck.

In our project we described the constraints on receiver and response documents in a natural language. To expand the range of use, a language for the constraint description should be developed. Since the language describes the relationship between schemas that describe XML messages, it would be a meta-schema which needs to be elaborated further to make such a language more useful for practical cooperation.

6. CONCLUSION

Today, B2B, a form of e-Commerce between companies, gets strong attention from many industries. So far, the focus of B2B interest has been cost reduction resulting from automation using sophisticated B2B protocols. However, in many industries, undeveloped infrastructure and uncertain business benefits for participants slow the development of B2B collaborations.

In this paper we presented the VALUE model, which is a collaboration model that takes advantage of XML characteristics to fill the gap between IT infrastructures and increase the added value of supply chains. The key feature of this model is the addition of result tags to the received XML message and its being sent back. So far, many B2B standardization activities, including ebXML and RosettaNet, have promoted XML-based collaboration protocols. However, most of the activities use XML as just a data format to describe data and do not use distinguishing XML characteristics.

Our model describes process-related information in the message structure by using the characteristics of XML, i.e. rich structure, flexibility, and self-description. Through the exchange of self-contained documents, this model is applicable to undeveloped infrastructures, and at the same time, does not limit the coordination of advanced infrastructure, such as that developed in a global enterprise.

In our project we adopted ebXML to develop a B2B system based on the VALUE model and demonstrated it with real business collaborations. Through this demonstration, we confirmed that the model enables B2B collaboration without demanding a highly developed infrastructure. By improving the quality of information exchange, it has provided business benefits to suppliers as well as retailers.

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