Harmonization of Exchange in a B2B Platform based on Java Web Service Technology

Youcef Aklouf⁽¹⁾ and Habiba Drias⁽²⁾

⁽¹⁾ Laboratory of applied Computer Science (LISI) National Engineering School for Mechanics and Aerotechnics(ENSMA), Poitiers 86960 FUTUROSCOPE Cedex - FRANCE aklouf@ensma.fr

> ⁽²⁾ National Institute of Computer Science-INI-BP 68M Oued Smar El Harrache, Algeria h_drias@ini.dz

Abstract

Web services (WS) and Services Oriented Architecture (SOA) are actually in exponential evolution. They allow systems to communicate with each other using standard Internet technologies. Systems that have to communicate with other systems use communication protocols and the data formats that both systems understand. Such Web Services interest has coincided with the proliferation of XML, Java technology and Business-to-Business (B2B) commerce.

The key attraction of Web Services comes from the business drivers of cost reduction and B2B integration. The B2B standards try to formalise the Business Collaboration (BC) based on documents exchange between partners. This collaboration is defined in some standards in a machine-readable format and in some others it is not. ebXML and RosettaNet specify such a collaboration. This paper compares business processes based on ebXML and RosettaNet with Web service technology. Then, it shows how these standards can be integrated in the same B2B developed architecture.

1. Introduction

The collaboration in Business-to-Business (B2B) exchange is defined as a process named Business Process (BP). A BP gathers two kinds of managed information. First, it represents a set of business documents containing several business and products information used in such an exchange. Second, it defines a choreography, which means the dialogue

order or a scenario between the partners involved in the B2B relationship. A number of standards try to describe specifications and formalisms that define this collaboration. For example, the most importants standards are ebXML with its Business Process Specification Schemas (BPSS), and RosettaNet with the Partner Interface Processes (PIPs). The third technology that tries to implement such a collaboration is Web Service technology.

The actual tendency in setting enterprises/ relationships is to provide a framework in which the exchange could be completed in an automatic manner. Several standards work in this direction and try to promote their software and their models to be capable to interact with other standards and technologies without taking in account their backend system technologies nor their internal data representation. For that, most companies try to implement their exchange using the Web services technology which gives some additional added values to realize this goal. But, the use of the Web services alone will not be enough to resolve the interoperability and the semantics problems that could be occur during an exchange. This is caused by the limits of the current Web Service model when describing the choreography and the dynamic aspects of a collaboration. In another way, several recent standards such as ebXML and RosettaNet try to define a Business Process (BP) in a machine readable format.

The most important key issue with the BP is the definition of the collaboration. On the one hand, RosettaNet which is a vertical standard defines a set of Partner Interface Processes (PIPs) as a binary collaboration between two involved partners. Each PIP

deals with a limited part of the whole exchange model. For example : Purchase Order, Notification of shipment, etc. On the other hand, ebXML which is a horizontal standard, defines a unique and a generic BP based on an XML schema model. Each particular BP is viewed as an instance of this generic BP model. The originality of the ebXML business Process is that the collaboration is defined in a formal manner and in a machine interpretable format (XML and UML) which is not the case for the RosettaNet PIPs collaborations.

The PIPs are only defined as a UML diagrams and tables. In spite of these limits of PIPs, they remain operational and are used by several computer science industries in the real life with some additional development efforts. The limit of such standards is that the collaboration is not directly implemented. Moreover, the mapping between BPs definition and implementation is cost effective.

To overcome these problems and to outline our contribution, an automatic collaboration platform based on an integrated collaboration model defined with ebXML BPSS (Business Process Specification Schema [1]) and RosettaNet Partner Interface Process [2] is proposed and described. Then, this model will be implemented using the Web service technology. Our contribution is based on the work published in a previous paper [6]. The orthogonality principle allows us to use the best-in-solution for each part of the B2B architecture. In our case, a combination of a PIP and a BPSS is given to model the business process collaboration, and to allow an easy implementation of such a collaboration. The web service technology is used as an implementation framework in order to ensure interoperability and a reliable exchange. The web services have proven to be currently the best used technology for the application exchanges over Internet.

This paper starts by a short description of the three ebXML BPSS, RosettaNet PIPs and Web services standards. Section 2 provides a comparison of these three standards based on three defined criteria. Then, section 3 describes our architecture by giving more details on its different parts. The implementation as a Web service with the several developed modules is outlined in section 4. Finally a conclusion and some future works are presented in the last section of this contribution.

2- Business Collaboration Modeling

This section gives a short presentation of the three standards listed previously. A description of the ebXML BP model with some XML examples of its business collaboration formalism is given. Then, a RosettaNet PIPs is described basically with DTD and UML diagrams. This section ends by introducing some key-points of the web services technology.

2.1 ebXML Business Process Specification Schema

ebXML allows arbitrary business collaboration to be defined completely in XML-schema based model. A UML representation is also given. This model is presented as a standard language for BP specification [1]. It specifies the structure and the semantics of machine processable BCs definitions. At a high level, business collaboration consists of a set of roles collaborating through a set of choreographed business transactions by exchanging business documents. These basic semantics of business collaboration are illustrated on figure 1. Two or more business partners participate in the business collaboration through roles. The roles always exchange messages in the context of business transaction. Each transaction consists of one or two predefined business documents flows.



Figure 1: The ebXML Business Collaboration

The main distinction between ebXML BP language and other standards is in fact, that ebXML gives a formal mechanism to describe the choreography. This last describes the collaboration between the partners involved in the exchange. Notice that the exchange is defined by different states of collaboration and transitions between them. This modeling mechanism can be viewed as a machine readable presentation of a finite state automaton.

As outlined above, the BP is defined in an XML schema document definition, which will be taken as a basis model or language for each instance of a particular BP. Figure 2 gives is an excerpt from an ebXML BP collaboration document with a simple choreography.



Figure 2: XML Business collaboration Document

The business collaboration presented above is a binary collaboration between two roles: a buyer and a seller, this collaboration is defined by a business transaction activity named Place Order, and some states which are the start, the success and the failure states. The execution of such a collaboration allows moving between the defined collaboration states according to the data given during exchange.

2.2 The RosettaNet Partner Interface Process

A Partner Interface Process [2] is the RosettaNet model of a business process. The content of a PIP is a set of transactions that are sent back and forth between two organisations. These transactions occur between two computers of the companies that support data transfer required for specific tasks occurring within the companies. Thus, a PIP consists of two standard subprocesses. The first sub-process is performed by one partner company and the second sub-process is performed by the other one. The scope of a PIP is defined systematically. The RosettaNet development strategy begins by partitioning distribution processes into categories called clusters. These clusters are partitioned into finer grained categories named segments. Analyses of the business processes in a segment yield a number of RosettaNet opportunities areas whose definitions provide the scope of a PIP. For example, PIP3C4 is the forth BP defined in the cluster 3 segment C.

A PIP for a business collaboration defines exactly two *roles* for the trading partners that participate in the business process. For example, PIP3A4 [2], Request Purchase Order (PO), defines the roles *buyer* and *seller*. The business process is divided into one or more business activities. In the PIP3A4 (Request Purchase Order), the business activities are Request PO and Confirm PO. The messages (business documents) exchanged between the roles during the business activities are called *action* messages. The Request PO business activity sends a PO Request from the buyer to the seller. The seller activates the Confirm PO business activity and sends a PO Confirmation to the buyer, who acknowledges, at the line level, if the purchase order is accepted, rejected, or pending. The PIP specifications for a business process define the:

- structure of the action messages in a DTD syntax format ;
- sequence in which the messages are sent between roles in a UML diagram ;
- quality of service attributes for the message exchanges in HTML or text.

2.3 The Web Services Technology

Web services are modular, self-describing applications that can be published and located anywhere on the web or on any local network. The provider and the consumer of the XML web service do not have to worry about the operating system, the language environment, or the component model used to create or to access the XML Web service, as they are based on ubiquitous and open Internet standards, such as XML, HTTP or SMTP. An initiative from Microsoft and IBM to describe the messages between client and the web server, WSDL (Web Service Description Language [3,4]), describes and defines web services. It helps the user to set up a system using a service ranging from connection details to message specification. A WSDL document defines services as a set of network endpoints (ports), that is associated with a specific binding. This binding maps a specific protocol to a port-type composed of one or more operations. In turn, these operations are composed of a set of abstract messages, representing the data. The pieces of data in a message are defined by types.

3-Comparison between BPSS, PIP and Web services

Actually, these three standards are not at the same level. However, they can be used in the same platform and can be compared since they have some similar roles. Three evaluation criteria are chosen to achieve the comparison. These criteria are : the collaboration expression, the choreography expression and the implementation possibility.

3.1 Collaboration expression

In the ebXML standard, business collaboration can be driven by specifying a set of attributes, parameters and signals for controlling the exchange. For example, acceptance acknowledgement, acceptance exception, guarantee delivery, etc. This set of attributes is used in a transaction and particularly in the messages exchanged to guarantee reliable and secure relationship between partners. These attributes are specified in both UML and XML schema defining the BP. For the RosettaNet standard, a limited set of attributes and parameters is defined as tables and text format. It needs human intervention to interpret each attribute and to implement its signification in the real exchange. Currently, some work is proposed by the RosettaNet developers to integrate the specification of messages attributes from the ebXML BPSS.

For the web services technology, the concept of collaboration, as required in B2B areas, is not yet completely formalized. In the web services, collaboration is defined just as an exchange of messages between a client of a service and a provider of this last. These messages contain only the information about the used methods and their parameters. This information will be enveloped in a SOAP message, and the control will be done by the SOAP at the messaging level, not at the collaboration level.

3.2 Choreography expression

The choreography is an ordering of business activities within business collaboration. The purpose of the choreography is to specify which transaction would happen at any point of time. As a result, the specification of choreography in the business collaboration defines unambiguously which message (business document) is expected by any of the part at any time. As explained previously this choreography is described in both RosettaNet and ebXML standards, but in the first standard the choreography is presented as UML diagrams and tables. In addition to the UML representation, ebXML provides an XML based format representation. Moreover, ebXML describes both the choreography and the business collaboration in the same document, when RosettaNet uses several separate presentation formats with DTD, HTML and MS Word. The last technology, Web services, doesn't describe the choreography. It uses a simple query/response mechanism defined as operations in a WSDL document. Recently, a number of technologies have emerged and try to give a layer above the description one of the Web service (WSDL document). This last defines the choreography and the dynamic aspects of the Web service. The most known protocol is BPEL4WS (Business Process Execution Language For Web service)[7] and a new W3C workgroup called a Web Service Choreography Group has been created for this goal.

3.3 Implementation possibility

The most important part of each defined system or architecture is the implementation step. This part must take into account the specifities of each partner involved in the exchange, and how the mapping must be done between the information exchanged and the partners backend system. This translation is cost effective and enforces the partner to do several modifications and to develop a mapping module to recognize in a suited format the received information. This is the problem of the current standards that define the BP model. They don't give sufficient information on how the users of these BP models must implement them. ebXML gives a set of specifications defining its architecture without giving more details about the implementation.

RosettaNet has the same philosophy and, the details of development are left to the partners. The Web services come to gives a solution for these problems with a set of tools. J2EE technology from Sun Microsystems and Dot Net from Microsoft are the most concurrent implementation technologies for WS. A Web service exchange requires partners to know just the definitions of the operations, the messages and the parameters defined in a WSDL document and the URL of the service invocation. The implementation details are not visible for the requester. It defines only a client that calls the Web service functions with the correct types and a number of parameters, and receives the information in the XML format using SOAP which is currently the most important technology used in the inter-application exchange. To recapitulate this point, a web service is used in our architecture as an implementation of the BP model.

This section end by a comparative table between the three standards defined above with a short conclusion

	Business Collaboration	Choreography	Implementation
ebXML	 Very global and general. Defined in both UML and XML schema based format. 	-Very global and complete -Defined in both UML and XML schema based format	Proprietary Implementation Partners competence.
RosettaNet	-atomic and Operational -UML diagrams and text	-Limited. - UML diagrams and text	Proprietary Implementation Partners competence.
Web services (WSDL)	Simple query/response mechanism	Not defined in the actual version of WSDL.	Several tools are available and for developing Web service

	(Sun Microsystems's
	and Microsoft .Net)

As a result of this comparison, these three standards are complementary and could be used in the same unified architecture. So, to ensure a reliable exploitation of the BP model from the definition step to the development one, it is well accepted to use currently 1) the BPSS model for defining business collaboration messages attributes and choreography, 2) RosettaNet PIPs to define the atomic binary collaboration between partners and 3) the Web service technology to implement the BPs.

4- The proposed Architecture

Our work proposes a definition of a B2B architecture followed by an implementation of this platform based on the three standards or technologies shown in the previous sections. Next step uses these standards conjointly to provide a secure, a reliable and an interoperable architecture. Each partner providing a service must affect a URL to its BP. This URL is stored in a registry (UDDI or ebXML registry). In our case an ebXML registry is developed for this purpose. The BP will be discovered and retrieved as a set or a unique Web service. The activities that may be undertaken during this step are :

- 1- use of a RosettaNet BP. (in our example, the PIP2A9 is a BP for product technical information query);
- 2- integration of PIP2A9 in the ebXML BP model;
- 3- development of a Web service based on the resulting BP.

4.1- RosettaNet PIP2A9

The PIP studied in this paper is the PIP2A9 (Query Technical Product Information) [5]. Technical product information is the category of information that describes the behavioural, electrical, physical, and other characteristics of products. There are numerous classes of customers within the supply chain that need to be able to access product technical information. These include distributors, information providers (such as web portal companies, other commercial information aggregators, and end-customer information system owners). engineering, design engineering. manufacturing and test engineering. The exchanged messages of the PIP2A9 are defined in a DTD document.

To be able to integrate a PIP in the ebXML BP model and after in the web service architecture, a transformation of DTDs to XML Schema document is needed. This task is performed by XMLspy 2004 tool. During this transformation some problems occur due to the fact that the DTD appears to be stand-alone and not a part of a bigger model, and therefore elements are duplicated or re-defined in different DTDs. To resolve this problem, the schemas coming from these DTDs must be combined in the same document. The result is an XML schema defining a PIP2A9.

4.2 Integration of PIP2A9 in the ebXML BPSS model.

The next task will be the integration of the resulting PIP2A9 in the ebXML BP. This task will be achieved without any error if the mapping between RosettaNet PIP and the corresponding part of the ebXML BP is given correctly. A PIP corresponds to a Binary collaboration or exactly to a business transaction in the BPSS specification. A business transaction in ebXML is defined by a business transaction activity with document flows exchange based in general on a request and a response documents. So, each PIP in the RosettaNet model will be integrated in the BPSS model as a business transaction activity. Figure 3 defines an excerpt of a BPSS with a PIP example document.





4.3 Developing a Web service based on the resulting BP.

Once the BP is defined, next step actually develops the Web service. A WSDL must be either created or generated using a tool. In our case, a WSDL is created to define exactly the BP defined previously with the most important functions described in the PIP2A9: the specific product information and the list of products requests.

Our WSDL is created using XMLspy2004. The following is an excerpt from the PIP2A9 WSDL:



Figure 4: A PIP2A9 WSDL document.

Based on this WSDL document a Web service will be designed. The development environment used is the Jbuilder2005 Enterprise version with the Axis Box Tool for the Web service [3]. Axis uses WSDL2Java tool which generates a set of skeleton classes and interfaces. These lasts are used as containers for the developed Java code of our specific Web service.

Once, the classes are increased with a PIP2A9 specific code, a set of Java Server Pages (JSPs) are developed to test the service. The general schema of the developed platform is shown in figure 5.



Figure 5: Web service Platform.

A client could connect to the web service using either the JSPs defined as a web interface (1) or retrieve a WSDL document describing this service and implements its own Java client (2). As explained above, these JSPs can be viewed in a Client Browser and the client can access the supplier database through the web service functions to retrieve data stored in another machine and accessed by RPC/RMI methods. The data defined in the database and the messages exchanged between the client and the service provider conform to the BP developed in section 4.2

Conclusion

e-business consortia are developing BP standards and specifications to allow partners involved in the exchange relationship to interact in a reliable and an interoperable manner. These initiatives aim to provide a shared machine-readable view of BP, allowing information sharing for heterogeneous systems. The web service technology allows developers to explicitly define BPs and interact with partners in a web environment.

In this paper, a quick presentation and a comparison of three standard technologies was presented and a proposal on how to integrate them in the same B2B model was described. Moreover, B2B architecture was conceived with the basic role of developing BP based on the integration of RosettaNet PIPs and ebXML BPSS model. Finally, we overviewed the operational details used in the implementation of our platform as a Web service. In the future, we plan first, to scale up the proposed architecture and approach by addressing the study of the other Business protocols from both RosettaNet and ebXML and then, to extend the developed platform to be generic and accept each type of BPs being either a simple or a multiple web service

References

- [1] ebXML Business Process Specification Schema v2.0. February 2005. *http://www.oasis-open.org/bp/docs*
- [2] Geref, Arthur, "Partner Interafce Process Technical Architecture", RosettaNet 2001
- [3] S. Brydon, G. Murray, V. Ramachandran, I. Singh, B. Streans, and T.Violleau, 'Designing Web Services with the J2EE[™] 1.4 Platform: JAX-RPC, SOAP, and XML Technologies'. Sun Mictosystems, January 2004
- [4] G.Kappel, and G.Kramler, 'Comparing WSDL-Based and ebXML based Approaches for B2B Protocol Specification'. Martin Bernauer, Business Informatics Group. Vienna University of Technology, Austria, 2003
- [5] RosettaNet Specification: "PIP Specification Cluster 2: Product Information, Segment A: Preparation for Distribution, PIP2A9: Query Technical Product Information", November 2001
- [6] Y.Aklouf, G.Pierra, Y.Ait Ameur, and H.Drias. "PLIB Ontology For B2B Electronic Commerce". 10th ISPE International Conference on concurent engineering: Island – Portugal, 26 - 30 JULY 2003
- [7] F.Curbera (IBM) and all:"Business Process

The 2006 International Arab Conference on Information Technology (ACIT'2006)

Execution Language for Web Services" V.1.1, BPEL4WS. May 2003