An web service based B2B integration approach for managed public and private process

Cixing LV1, Yunlong Zhu1
1 Shenyang Institute of Automation, Chinese Academy of Sciences, Shenyang, China;
E-mail: smale@sia.cn, ylzu@sia.cn

Abstract

The growth of requirements for e-business application brings more challenges, and the advent of the web services enable companies to collaborate closely with their business partners and gain access to needed information and business logic. By analyzing challenges of B2B and features of new technologies (web services), a flexible, standardized B2B integration approach based on web service for public and private process was presented.

Key words: B2B, Web service, B2B integration, process automation

1. Introduction

B2B integration refers to the provision of a uniform view of the e-commerce system to the interacting entities involved. B2B integration is also concerned with connecting front-end systems to back-end systems. These systems possibly include legacy data sources and applications or outside partners systems [1]. Companies have been using various technologies and products in an attempt to support B2B integration and collaboration. These solutions vary from basic point-to-point connection approach such as EDI to complex B2B integration.

Due to the complexity of the global value chain and heterogeneous partners and goals, B2B integration is an increasingly complex task, facing the challenges outlined below.

A high degree of integration and interoperation [2]. E-business systems are supporting radically new or emerging businesses that require integration of business processes within and across enterprises. Furthermore, business integration requires distributed components that use disparate technologies that need to interoperate.

(2) Common framework for heterogeneous transaction exchange protocol. Company collaborates with heterogeneous partners in the complex value chain for business goal. A B2B relationship involving n enterprises would involve n(n – 1) specific protocols. Without industry-defined content, trading partners are left with the expense of defining their own proprietary bilateral implementations. With a common framework in place, it handles all transactions.

(3) Consistence management for public and private process. A flexible, standardized architecture is required to better manage the connection of various applications within and across company at lower costs and easier adjustment to changing market conditions. A further enhancement to Internet based integration is required to deal with the need for selected B2B processes to be an end-to-end choreography of transactions. Furthermore, links individual public (such as RosettaNet PIPs or ebXML transactions) and private processes, management of end-to-end process across multiple internal applications is needed.

In recent years a B2B integration paradigm shift from document centric file-based interchange of business information to process-centric and service-based information exchange can be observed.

To meet the aforementioned information system and B2B e-commerce needs, and with the aim of providing a cost-effective and feasible B2B integration approach using Web Services was purposed and incorporated in a managed public and private process manner in this paper.

The rest of this paper is organized as follows. Section 2 discusses some related B2B integration works from the research world and industry. Section 3 discusses both the basic concept of Web Services and its application in B2B integration. Section 4 presents the concept and solution framework of B2B integration.
for public and private process. Section 5 makes concluding remarks.

2 B2B integration concepts and architectures

Companies everywhere are implementing B2B initiatives, aimed at automating trading relationships and making them more efficient. This calls for a method of integrating disparate applications between enterprises into a unified set of business processes. Different solutions exist in the market for B2B application frameworks, including EDI, RosettaNet, ebXML etc.

2.1 Related standards and technologies

(1) EDI
A seminal event in B2B evolution was the development of electronic data interchange (EDI), whereby trading partners established standard formats for the exchange of electronic documents to facilitate electronic transactions [4]. Trading partnerships between two firms using EDI are well defined and generally stable. This stability means that EDI is used for automated replenishment and efficient supply chains [5].

The strength of EDI stems from its well-defined data and transaction standards. With these standards, EDI software has been able to provide transaction services that make it possible to execute viable commercial transactions between two firms. However, EDI has been limited because it is most often used by larger companies [6] and does not scale easily to include new participants. It is also not designed to operate in dynamic electronic markets.

(2) RosettaNet
The RosettaNet consortium develops XML-based business standards for supply chain management in the information technology and electronic component industries. The consortium develops interoperable ecommerce standards for high-technology companies such as computer hardware and software manufacturers. It defines the business processes and provides the technical specifications for data interchange. RosettaNet standards comprise Dictionary, RNIF (RosettaNet Implementation Framework) and PIP (Partner Interface Process) [7].

(3) ebXML
The electronic business XML (ebXML) framework has been proposed by the United Nations Centre for Trade Facilitation and Electronic Commerce (UN/CEFACT) and the Advancement of Structured Information Standards (OASIS) organizations in 2001. EbXML provides a complete framework for setting up B2B collaborations [8]. It is a set of documents, with several prototype completed, enabling businesses of any size to do business electronically with anyone else.


Above all, RosettaNet predefines specific public processes by PIPs whereby ebXML allows to define arbitrary public processes through CPA. This means that in case of RosettaNet two enterprises can interoperate by virtue of being RosettaNet compliant. In the case of ebXML two enterprises have to agree on a definition of their public processes first. Standards like EDI are neither defining public processes nor providing a mechanism to define public processes. In this case enterprises need to borrow the mechanism from e. g. ebXML to define public processes. None of the standards addresses the interplay between public and private processes.

2.2 B2B integration architectures

Different solutions exist in the market for B2B application frameworks. They fall under one or several of the following approaches [9,10]:

(1) Document exchange solutions
Traditional approaches in B2B e-commerce had a strong document-centric focus. Business partners were required to agree on exchanged business documents in order to conduct electronic businesses. Syntactic and semantic differences resulted in the need for bilateral agreements on data and protocols between each pair of business partners. While this approach provides some decoupling of applications, increasingly this approach is seen as expensive to implement and inflexible to change.

(2) Application interface-oriented solutions
The solutions leverage the interfaces made available by in-house or commercial applications in order to access both business processes and data information. By using these interfaces, developers are able to bundle applications, allowing them to share business logic and information. While this approach can provide a very rich and functional integration between two parties, the direct integration of applications in this manner makes it very susceptible to changes in the applications of one party or another.

(3) Exposed business services
The exposed business service approach is being widely promoted under web services. This approach provides additional flexibility over direct API integration by presenting simplified and abstracted versions of APIs via small discrete units of code that handle specific limited functionality. Also the differences in technology between trading partners is dealt with by using an application neutral implementation of XML messaging over the Internet http protocol in the form of a mechanism known as SOAP (Simple Object Access Protocol).

While this approach is likely to achieve great benefits for B2B integration there are still issues to be dealt with in using such technology widely. One of the principal issues is the vertical standards for content and business process enacted for particular industry segments. Consequently, stricter definition of industry standard services would still be required.

(4) Process integration-oriented solutions

Process centric approaches capture the flow of business information between business partners, which is communicated to reach a certain business goal. Business process models allow smaller companies to participate in established business processes by aligning their internal process to the collaborative process. Such business activities conform to a set of standard patterns and involve not just the exchange of business documents but also standard signals to indicate the successful (or otherwise) execution of a transaction to assure a reliable and secure exchange.

The existing approaches offer a set of standard technologies and protocols for B2B application solutions. However, in order to link individual public processes (such as RosettaNet PIPs or ebXML transactions) and manage the end-to-end process across multiple internal applications, it requires a further enhancement to Internet based integration and deals with the need for selected B2B processes to be an end-to-end choreography of transactions.

3 Web services in B2B integration

3.1 Web service technology

Web service technologies provide a language-neutral and platform-independent programming model that can accelerate application integration inside and outside the enterprise. It is convenient to construct flexible and loosely coupled business systems by application integration under web service framework. With the acceleration of web service adoption, the pool of services will grow, fostering development of more dynamic models of B2B integration[11].

Web services comprise components as following:
(1) Business Process Execution Language (BPEL). The business process execution language is an XML-based language designed to enable task-sharing for a distributed computing – even across multiple organizations – using a combination of Web services. BPEL specifies the business process logic that defines choreography of interactions between a numbers of Web Services[12].

(2) Simple Object Access Protocol (SOAP). The simple object access protocol is a communication protocol and a message layout specification that defines a uniform way of passing XML-encoded data between two interacting software entities[13].

(3) Web Services description language (WSDL). The Web service description language is a contract language used to declare Web service interfaces and access methods using specific description templates[14].

(4) Universal description, discovery, and integration registry system (UDDI). The UDDI registry provides a central location for registering and finding services within the web services architecture[15].

3.2 Web services in B2B integration

There are plenty of publications in the area of using web services to support B2B integration. In general, there are two basic approaches, which have studied by researchers[16].

Some researchers set their focus on using Web Services to support XML message-based B2B collaboration. XML-based standards, such as Electronic Business XML (ebXML) and RosettaNet, define common ontology, syntax for the message exchange, and interactions across organizations boundaries[17]. Jing Wang and Yeong-Tea Song [18] proposed an architecture supporting RosettaNet by using Web Services.

Some researchers discussed the possible solutions of using web Services to support process-based B2B integration from different points of view. Sayal et al. [17] purposes a framework to extent workflow technology to support B2B interactions and to link them with the internal workflows. Nathan et al. [19] developed a Web Services-compliant eXFlow solution to streamline in-house and B2B process and to facilitate rapid process prototyping and enterprise application integration.

These publications discussed the concepts and applicability of B2Bi collaborations using Web Services from different point view. However, the insight view of putting them to work seems still
Lacking. And they rarely cover process-based approaches to B2B process integration in consideration of web services technology, and public and private process management.

4 B2B integration framework for managed public and private process

4.1 Concept of B2B integration for managed public and private process

Over time, organizations deployed more and more back end applications that on one hand side have to exchange data between each other and on the other hand side have to be part of the B2B integration infrastructure. At the same time the number of B2B integration standards increased rapidly[20]. Consequently, in order to manage of connection of various applications within and across company would achieved at lower costs and easier adjustment to changing market conditions, a flexible, standardized architecture is required. Furthermore, in order to link individual public and private processes and manage the end-to-end process across multiple internal applications, it requires a further enhancement to Internet based integration and deals with the need for selected B2B processes to be an end-to-end choreography of transactions. A conceptual scenario of public and private process in B2B is shown in fig. 2.

The managed public and private process form of integration allows one to define a second layer of process that links individual public processes and decouples the message exchange protocol and business logic. This layer can also be used to manage the end-to-end process across multiple internal and external applications. Such a process is typically implemented using enterprise workflow applications with integration into applications.

4.2 Web service based B2B integration framework for managed public and private process

A web service based B2B framework is proposed to deal with the problems of integrating B2B interaction standards with the internal processes and human operations seamlessly, enabling fast, template-driven generation of processes and services that can interact according to such standards, and automating and managing the broad, complex procedures that span company boundaries and application boundaries.

The proposed solution includes the following components (see also in fig. 2):

   This modeling concept supports the definition of B2B protocol behavior in terms of sequencing as well as business document types that define the payload of business events exchanged with trading partners. It also defines time-outs, retry logic as well as error handling. This modeling concept allows to implement any B2B protocol that a trading partner has to support. [21]. B2B Process templates repository store process skeletons that implement the conversational logic according to a given B2B standard.

2. B2B Service library
   B2B service library stores predefined sets of B2B activity definitions in web service manner, made available to the process designer, which can be reused in a BPEL process to send and receive B2B messages, and transfer data between those messages and workflow variables. B2B activities are the activities in which an interaction with a trade partner takes place.

3. Public process manager
   A public process defines an organization-external message exchange sequence. A public process is a set of process steps that are connected by control flow in order to define the step execution sequence. Public process steps either send or receive messages from and to trading partners, or send or receive messages from and to bindings (binding connect public processes to private processes, see below).

The public process manager is the resource that executes all B2B activities, by interacting with partner organizations according to the specified standard. The public process manager includes all components related to business agreements such as trading procedures, transactions requirements, message transport protocols, security aspects and the reliability aspects. Basically, a business process can receive a business event from a B2B protocol and it defines the processing of this business event. In the simplest case the business event is passed to an application protocol.
in a one step business process. In a more complex case the business process adds processing steps like an authorization before a business event is passed on to one or several back end application protocols.

(4) Process engine
Process engine plays different roles in process designing stage and process running stage. It takes charge of process routing, process life cycle management, work item delivery and work item management.

(5) Human Interface
Human Interface provides tools to help manual interactive activities of participants such as electronic approval or decision-making. In particular, B2B integration requires manual handling tools for potential exception or transaction recovery that may have occurred in automated business collaborations.

(6) Binding component for public process and private process
Public processes describe the message exchange behavior between enterprises whereas private processes describe the message exchange behavior within enterprises. B2B integration is not completed by building newly peculiar components for e-business, but rather by binding a public process to a private process. This allows transformation of message, document between public process and private process, and implements domain specific business rules.

Transformation of messages between public to private processes and vice versa. The particular use of transformation within bindings makes sure that the business process can operate on a common view. Basically messages are transformed to a normalized format. This transformation into a normalized format provides a homogeneous environment for both public and private process in message view.

Transformations of document format. A transformation either transforms a public process specific format in the normalized format as required by the private process or transforms the normalized format from the private processes in the specific one of the public process.

Implement domain specific business rules. Through conditional expressions a specific context can be established. Depending on this context different branches in the private process are executed to specialize behavior for the specific context. For example, the purchase order is larger than a specific amount then an approval has to take place.

The concept of the binding of public and private processes allows abstracting from behavior as well as documenting format. Evaluating business rules outside the workflows themselves assures that workflows are trading partner independent. The important aspects are that the private process is independent of the particular public process behavior and the particular document format of the B2B protocol. Furthermore, business rules are encoded outside the private process so that it does not depend on specific trading partner rules any more.

The advanced approach with public and private processes provides clear abstractions on different levels.
The public behavior (public process) is clearly separated from the private behavior (private process). Bindings tie both together and bridge the different abstractions. At the same time the public document formats are clearly abstracted from the private document formats whereby the binding provides the necessary transformations.

6 Conclusion

The growth of requirements for e-business application brings more challenges, and the advent of the associated new technologies gives the development of B2B transaction more chances. The study focus on B2B integration for the goal of managed public and private process, by introducing new technologies (web services). The proposed solution can be used to speed up both the development of new business processes that support B2B interaction standards and the enhancement of the existing business processes by the addition of B2B interaction capability.

References