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B2B 에서의 Collaborative 워크플로우 아키텍처 모델링

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Collaborative workflow architecture modeling in B2B

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Abstract

Collaborative system is an essential idea in the global and e-business environments. Workflow plays a key role implementing collaborative system. Workflow is an emerging technology for business process automation, monitoring, integrity enforcement, and recovery. A process model describes the structure of business process in the real world. The process model can be transformed into a workflow model utilizing a computer. This paper proposes a web-based workflow process design in the B2B environment. Considering a global environment where the partners interchange their processes beyond the company boundaries, a web-based infrastructure is the most preferred platform. Considering this, workflow processes and e-Business structures were combined together on the web environment.

Keywords: collaborative, workflow modeling, B2B, Web-based system, WPDL, PIP, XML, ebXML

1. Introduction

Companies increasingly started supporting external electronic commerce transactions with traditional partners in their value chain. The newly developed enterprise resource planning includes extended functions of electronic commerce, customer relationship management, and supply chain management. To meet this challenges, a collaborative framework is widely adopted which operates based on the interactions between businesses operating within a single global electronic marketplace where enterprises of any size and in any place can meet and conduct business with each other.

The globalization of world markets and business environments, brought by information technology, network and Internet in particular requires business people to adapt to new business logic and change. To keep up and remain competitive, companies should assess the efficiency of their workflows, workflow processes, customer relationship and service. Workflow is an emerging technology for business process automation, monitoring, integrity enforcement, and recovery. The process model describes the structure of business process in the real world. It defines all possible paths through the business process, including the rules that define which paths should be taken and all actions that need to be performed. A business process consists

of structured series of activities and exchanges of business information among business partners to achieve a particular goal. Business processes consist of areas that are performed by a computer and areas that are achieved by human. The areas that are run based on computers are called workflow model. Thus, a process model in the real world can be transformed into a workflow model in the computer environment.

An e-business application is an application that is intended to automate some or all of the tasks in the exchange of a business process. Three items to solve the e-business applications are a modeling language, a standard process and schema languages.

Business processes or workflows are composed of three independent dimensions, the process logic, organization, and information technology infrastructure. The process logic describes what activities are to be performed and in which sequence they need to be performed. The organizational dimension specifies the person to perform each activity. The infrastructure describes the computer program for the activity. According to their value to the business and their repetition, workflows are categorized into four groups; Ad hoc, administrative, collaborative and production workflow. The business value defines the importance of a workflow to the company's business. The higher part of business value corresponds to the core competency area. The repetition is a measure to check how often a particular process is performed in the same method. Ad hoc workflows are characterized by low categories in business value and repetition, where there is no predefined structure or procedures. Administrative workflows show low business value with high repetition. Collaborative workflows are characterized as high business value with low repetition. Production workflows correspond to the cases with high values in two factors. The real problems tackled in most cases correspond to collaborative and production cases.

The workflow processes are implemented through a business model, which is composed of views, diagrams, and objects and processes. A business model is illustrated with a number of different views, each of which captures information about one or more specific aspects of the business. Each view consists of a number of diagrams, each of which shows a specific part of the business structure or a specific business situation. Concepts in the diagrams are related through the use of different objects and processes. The objects are the "things" in the business which are physical or abstract. Processes are the functions in the business that consume, refine, or use objects to affect or produce other objects.

Previous research includes workflow and Internet [Dayal et. al., 2001], agents and workflow for the B2B [Chen et. al., 2000], and utilization of the workflow services of database system [Puustjarvi and Laine, 2000]. Rykowski and Wieczerzycki [2000] proposed three tier web-based framework for computer system supporting cooperative work. It is composed of an interpreter of a query language as main interface of the server, specialized object-oriented database of information resources as an engine, and an XML (Extensible Markup Language) wrapper as a gateway for data repositories.

The objective of this paper is to design web-based workflow process in the collaborative B2B environment. Chapter 2 describes the workflow model and web-based architecture. Chapter 3 proposes web-based workflow process design to be implemented in the e-Business environment. Conclusions follow in the final chapter.

2. Web-based workflow architecture

When a business process is modeled, all executable forms are described by the process model. Each running process corresponds to an instance of the process model. The constructs and

associated language used to formulate a data model as well as the precise prescription of the properties and behavior of instances of an associated data model are referred to as a metamodel. It is made up of constructs that are available to users to model organizational structure, the process, and the topology of the workflow management system (WFMS).

The activities of workflow are grouped as manual or automatic. Regardless of how the activity is carried out, it is performed on behalf of a user. This requires to specify the name of users corresponding to the specific activity. Instead of specifying the name of a person, it is desired to express the assignment of people in organizational terms, such as roles, departments or positions. When an activity is carried out, the WFMS assigns the work to the selected person. The process model is composed of a set of activities, control connectors, transition conditions, input containers, output containers, and data connectors. A process or activity can return data. The data that is passed to the process or activity is called the input container; the data that is returned by a process or activity is called the output container. Each container is associated with a data structure.

Workflow reference model is defined by WfMC [2001]. It is composed of five interfaces. Interface 4 defines interoperability between subprocess of workflows. A subprocess can be carried out by the WFMS that controls the process from which the subprocess is spawned. This subprocess is called a local subprocess. When a subprocess is processed by another WFMS, it is called a remote subprocess. Four models are defined explaining the interoperability between subprocesses and a parent process. They are chained service model, nested subprocess model, connected indiscreted model, and parallel synchronized model. The metamodel structure for collaborative business processes based on workflow process definition language (WPDL) is shown in Figure 1.

The interface mechanism in the import/export layer normalizes the final format of a work process description. This definition led to a common interchange format, WPDL, which supports the transfer of workflow process definitions between participating parties. The WPDL proposes a set of extensibility mechanisms to support vendor specific requirements. This is based on the definition of a workflow metamodel. The metamodel identifies a basic set of entities for the exchange of process definitions: process definition, process activity, participant definition, transition information, application definition, and process relevant data. These entities contain attributes which support a common description mechanism for processes.

The basic architecture for web-based systems includes a connecting network, a web server, and a client browser. TCP/IP, HTTP, and HTML correspond to each of three components respectively. After the requirements are analyzed using use case model, the next step is to develop a system architecture that is capable of meeting the requirements and realizing the use cases. The great extension between Web sites and Web applications lies in the use of business logic. The business logic is a rule, or process, that affects the business state of the system. A Web application extends a Web site by enabling its user to invoke business logic and subsequently to change the state of the business on the server. Three significant architectural components to a Web application are the client browser, the Web server, and the application server. Also, the Web application uses database server. There are several Web application architectural patterns. An architectural pattern expresses a fundamental structural organization schema for software systems. The most common patters are [Buschmann et. al., 1994]:

• Thin Web client: The client requires only a standard, form-capable Web browser. All of the business logic is executed on the server.

• Thick Web client: An architecturally significant amount of business logic is executed on the client machine. Typically the client uses dynamic HTML, Java applets, or ActiveX controls to execute business logic. Communication with the server is via HTTP.
• Web delivery: On top of using HTTP for client and server communication, other protocols, such as IIOP (Internet Inter-ORB Protocol) and DCOM (Distributed Component Object Model) are used to communicate between distributed object systems. The Web browser functions as a delivery and container device for a distributed object system.

For practical problems, a combination of different patterns can be adopted. For example, an Internet-based e-commerce system may use the Tin Web client pattern for its consumer sales use cases but use the Tick Web client or the Web Delivery pattern for the back-office maintenance use cases. Figure 2 depicts the Thick Web client architecture pattern. The Thick Web client architectural pattern extends the Thin Web client pattern with the use of client-side scripting and custom objects, such as ActiveX controls and Java applets. The client can execute some of the business logic of the system and hence becomes more than just a generalized user interface container.

3. Collaborative workflow protocol in B2B environments

The web and Internet provide opportunities for enhancing workflow systems and vastly increasing their implementation in critical business processes. The business process within a company can be implemented using simple workflow process. While the exchange of business process among different enterprises can be implemented using collaborative workflow model. The situations in the B2B environment corresponds to the latter case. The workflow frameworks applied to the B2B environments are eCo framework, RosettaNet, Biztalk and ebXML [2001]. Each one is explained in the following.

(1) eCo framework was initiated by CommerceNet consortium supported by leading IT companies. The main purpose was to create global e-Business environments. XML has been adopted as a base technology rather than CORBA (Common Object Request Broker Architecture).

(2) In the electronics industries, the RosettaNet [2002] consortium was founded to define standard interfaces between business process integration. RosettaNet Partner Interface Processes (PIPs) define business processes between trading partners. The PIPs define the processes and data elements necessary for a broad set of supply chain scenarios. The PIPs only define the interface tasks that supply chain partners commonly participate in the inter-organizational processes used by another partner. It is the responsibility of each partner to identify how its internal processes and systems align to the PIPs. The concept of PIPs is shown in Figure 3.

(3) BizTalk is a B2B solution based on XML from Microsoft. BizTalk is composed of Framework, BizTalk.org and server. The schema is specialized using XML schema which specifies document content and structure.

(4) ebXML (electronic business XML) is an international standard framework supported by UN/CEFACT (United Nations Center for the Facilitation of Procedures and Practices for Administration, Commerce and Transport) and OASIS (Organization for the Advancement of Structured Information Standards). As this is initiated by UN, this standard is well suited for the international e-Business environments compared to other standards. In addition to the partner's XML message, ebXML specifies business process model, core data component, and distributed repository.

When multiple parties belonging to different enterprise are involved in a business process, a

centralized process management is not appropriate because there are barriers such as a firewall or security checking. The collaborative model is desired which enables the partners to interface and interchange the shared process. The proposed metamodel can be implemented in the collaborative business processes. Coordination, cooperation and competition might arise among different enterprise. Within the same organization, cooperation can happen in the form of centralized or distributed state. Coordination is required between a parent process and subprocesses. Competition arises among sourcing companies. The idea of collaborative business processes is shown in Figure 4. The specification of a collaborative processes is represented in XML format. When compiled, it is first transformed into a document object model, then into a Java class for cooperative process definition.

Starting from static web page, the web browser technology has been improved into dynamic structure with CGI (Common Gateway Interface) scripts and servlets. The browser requests from the web server the invocation of a particular program that returns a web page as result. Recently, a browser with Java program can load applets that perform local functions such as the verification of user input. An applet can use the object bus of an object request broker (ORB) to access server objects. The web browser or the ORB acts as a control flow service determining which CGI script, servlet, server object to invoke. In the Internet environment, browsers are ubiquitous, whose property enables any user to access all data and processes. For an enterprise to provide appropriate functions accessible from the web, servlets or ORB server objects can be used from web server pages.

The implementation of all the server-side components – business objects, persistence layer, transaction components - is done exactly the same way as in any client/server system. The only difference is in the construction of the Web-specific components. Web pages are architecturally significant components. They exist in the model and in the executable system. There is a direct mapping from Web page model element to the actual web page code. Web pages in the Web application can be implemented with scripted Web page files such as ASP (Active Server Page), JSP (Java Server Page), or with compiled components such as CGI, Java servlet, ISAPI (Internet Server Application Programming Interface), NSAPI (Netscape Server API). Implementing the client pages in the model is the same, regardless of which server-enabling technologies is adopted. In the server page, there are scripted pages and compiled pages. While compiled components often perform the role of multiple server pages, scripted pages create one component per server page.

4. Conclusions

This paper proposed collaborative workflow design for the B2B environment. Most processes in the B2B need cooperation among outside companies. The scheme of PIPs is adopted to combine inter organizational activities and processes. The system is implemented using Web-based architecture. Client-side and server-side program were adopted to implement the business logic. The proposed system can be applied for a flexible and dynamic information interchange among intra- and inter-organization for cooperative processes.

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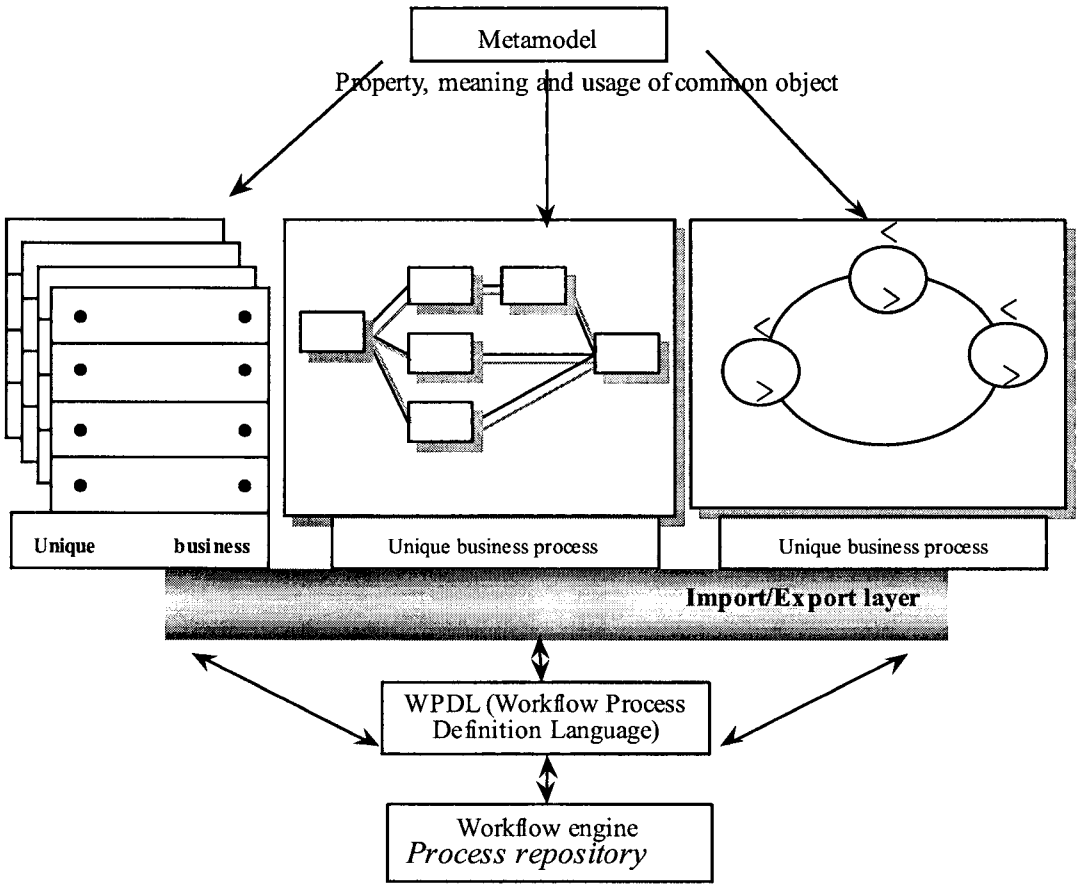

Figure 1. Metamodel structure for collaborative business process based on WPDL

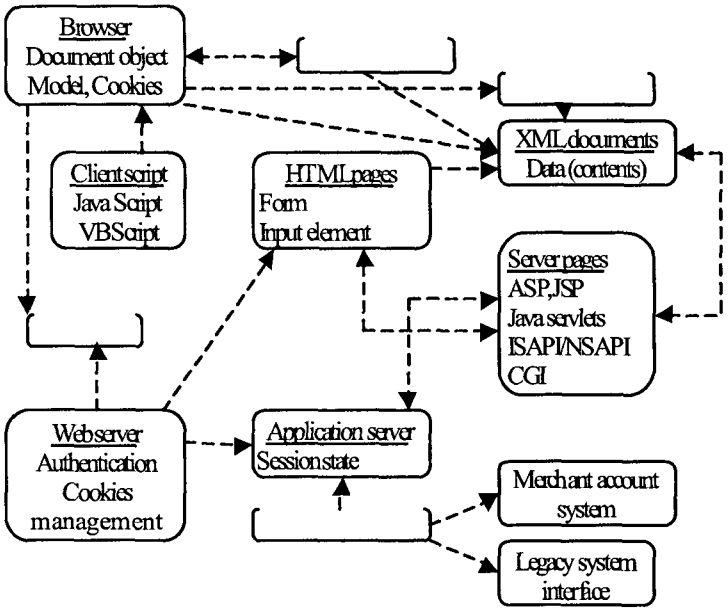

Figure 2. Web-based structure for workflow implementation

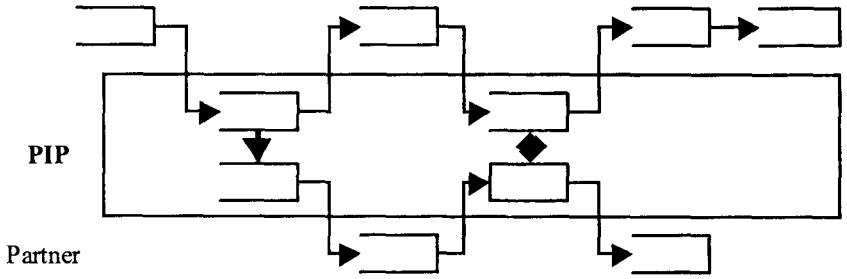

Figure 3. PIPs (Partner Interface Processes) representing interface between partners

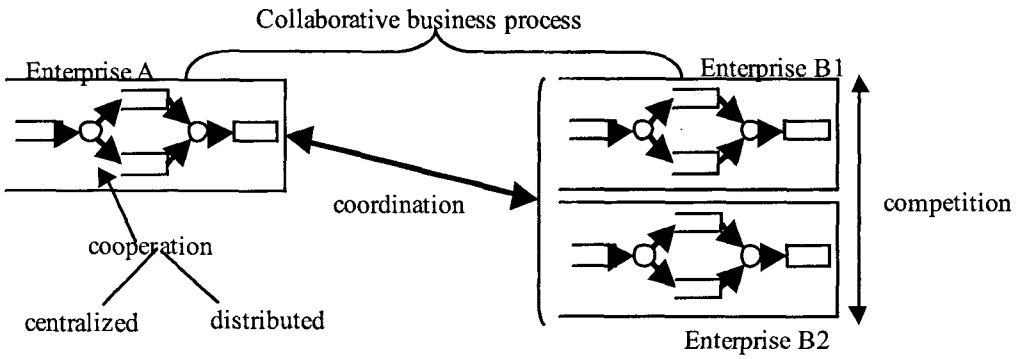

Figure 4. Collaborative business process