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비즈니스 프로세스 표준의
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**State-of-the-art of Standards in
Business Process Modeling and Execution**

State-of-the-art of Standards in Business Process Modeling and Execution

by

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ABSTRACT

In today's world with enterprise operating in a global business environment, Business-to-Business (B2B) collaboration becomes a critical success factor for enterprises. Trading parties are attempting to collaborate between their heterogeneous business processes and to automate exchange of their information. However, business process collaboration across enterprise boundaries is a complex task. Consequently, cross-organizational business processes need to apply the standards in business process modeling and execution.

Over the past decade, there has been a lot of research to develop standards for collaborating and automating enterprise business processes. Today, with the growth in e-commerce and the blurring of enterprise boundaries, there is renewed interest in the business process collaboration and automation. Many standards in business process modeling and execution for collaboration have emerged and are continuously being enriched with new proposals from different vendors and initiatives. However, few efforts have been dedicated to systematically evaluate the history and the relationship of these standards.

From the historical perspective, this paper provides an overview of the state of the art in the past, present and future of standards in business process modeling and

execution. First, the past standards are analyzed with three research axes – the initiatives, the viewpoints about message exchange, and the phase of business process development lifecycle. Second, as the present business process standard trends, efforts to cooperate between diverse standards are focused. Last, the possible future standards that include not only the logical information of business process but also the physical information are envisioned. The illustrative example is presented to show the viability of the future direction of standards.

KEYWORDS: Business Process Standard, Business Process Modeling, Business Process Execution, B2B Collaboration

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1. Introduction

A business process is a set of one or more linked procedures or activities executed following a predefined order which collectively realize a business objective or policy goal, normally within the context of an organizational structure defining functional roles and relationships. A business process is typically associated with operational objectives and business relationships (i.e. insurance claims process, engineering development process). A process can be wholly contained within a single organizational unit as well as can span several different organizations, such as in a customer-supplier relationship [1].

Many companies have automated their business processes and have shared their information in distributed information systems. Business process automation and information sharing help to improve productivity and interoperability [2]. As business process automation becomes a critical factor of organizational success, the standards in business process modeling and execution have noticeably emerged to express the business process as human and machine understandable notations or languages. Hence, each business process standard defines notations or languages for specifying business process behavior and business interaction protocols.

As Business to Business (B2B) e-commerce is emerging, collaboration across heterogeneous organizations becomes another key issue for organizational success. The concepts for process automation within a single organization need to be extended to support cooperation with partners across enterprise boundaries. However, business process collaboration across enterprise boundaries is a complex task [3]. Obstacles to heterogeneity arise from the fact that partners do not share the same semantics for the terminology of their business process models and use various standards in business process modeling and execution.

Through these roles, each business process standard aims at promoting a

standard for the automation and collaboration between business organizations. Based on different origins and purposes, there are many business process standards such as XML Process Definition Language (XPDL), Business Process Modeling Language (BPML), ebXML Business Process Specification Schema (BPSS) and Web Services Business Process Execution Language (WS-BPEL). Furthermore, with the constant emergence and change of standards, business process domain is flooded. By various standards, it is too hard to find a proper standard for a specific business objective or policy goal.

Over the past decade, there have been a few surveys in analyzing the relationship between such standards. However, they just focused on the comparison of a few standards, and had specific perspectives. In substance, they could not help to recognize the business process as a whole. Hence, clearing the history of standards is needed.

The objectives of this paper are to provide the history of standards in business process modeling and execution and to envision a possible future direction of business process. The detailed objectives are 1) to provide a genealogy of business process standards, 2) to consider the current status of standards, and 3) to illustrate an example which applies the suggestion. The suggestion should contribute to the stabilization of standards and the proper selection of standards considering enterprise situation.

The scope of this research is limited considering only to the business process content, business process modeling, and business process specification. Specifically, we first consider the business process content, such as RosettaNet Partner Interface Processes (PIPs). Second, we analyze the business process modeling, such as Business Process Modeling Notation (BPMN) and the Unified Modeling Language (UML). Third, for business process specification, we aim at XML Language (XLANG), Web Services Flow Language (WSFL), BPSS, WS-BPEL, BPML, XPDL, Workflow XML (Wf-XML), Web Service Choreography Interface (WSCI), Web Services Conversation Language (WSCL), Web Services Choreography Description Language (WS-CDL), etc.

The remainder of the paper is organized as follows: Section 2 defines three research axes used to analyze the relationship of standards in business process modeling and execution. The previous works of business process standards are presented in Section 3. Recent challenges of standard organizations are detailed in Sections 4, respectively. Section 5 addresses the possible future direction with a case study. Finally, Section 6 closes this paper with discussion and concluding remarks.

2. Research Axes

This research work is centered on the standard in business process modeling and execution field. It is based on three axes to classify these standards in an effective manner. The three research axes are the initiatives, the viewpoints about message exchange, and the phase of business process development lifecycle. The first axis is about initiatives: the publishing organizations. The second axis concerns the viewpoints about message exchanges: two different ways of describing business processes that support orchestration and choreography. The third axis is based on the phase of business process development lifecycle: process notation, process definition, and interaction definition.

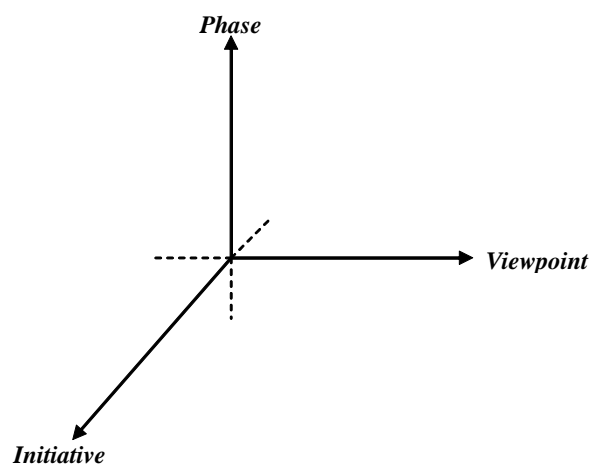


Figure 1. Research axes.

2.1. Initiatives

The first axis is initiatives, the publishing organizations. Major solution vendors and e-business consortiums have made various business process modeling notations and specifications for a more rapid spread of B2B automation and collaboration. These vendors also presented their solutions conformant to the standards, which in turn provide greater adaptability and feasibility for B2B automation and collaboration.

There are many initiatives such as Organization for the Advancement of Structured Information Standards (OASIS), the World Wide Web Consortium (W3C), the Business Process Management Initiative (BPMI), Workflow Management Coalition (WfMC), and RosettaNet. Each initiative publishes one or more specifications. For example, OASIS published BPSS and WS-BPEL. Also, W3C published three specifications such as WSCI, WSCL, and WS-CDL, and BPMI published two specifications such as BPMN and WS-BPEL. Because each initiative has its own viewpoint, standards in business process modeling and execution can be categorized by different initiatives.

By different origin, each initiative can be classified into four categories: workflow management, traditional B2B vendor, Business Process Management (BPM) vendor, and e-business vendor as shown in Table 1. First, standards related to workflow management include various purposes of standards proposed by WfMC. Wf-XML is the interoperability specification for heterogeneous workflow engines [4], and XPDL is the specification for workflow process definition interchange. These two standards offer useful functions to be requisite for the cooperation of two or more workflow systems [5]. Second, several standards are presented for traditional B2B transaction proposed by W3C and OASIS. Third, BPMI is related to business process management. BPMI.org is a non-profit organization that empowers companies of all sizes, across all industries, to develop and operate business processes that span multiple applications and business partners, behind the firewall and over the Internet. BPMI.org is supported by several organizations, including Intalio, SAP, Sun, and Versata. The Initiative's mission is to promote and develop the use of BPM through the establishment of standards for process design, deployment, execution, maintenance, and optimization. BPMI.org develops open specifications, such as the Business Process Modeling Language (BPML) and the Business Process Modeling Notation (BPMN), and supports businesses for using Business Process Management technologies. Finally, e-business standards, such as ebXML and RosettaNet, focus primarily on the exchange of data and message rather than on the control-flow among enterprises.

Table 1. Major standards in business process modeling and execution by initiatives.

Initiatives	Origin	Standards
<i>OASIS</i>	Traditional B2B vendors	BPSS, WS-BPEL
<i>W3C</i>	e-business standards	WSCL, WSCI, WS-CDL
<i>BPMI</i>	BPM vendors	BPMN, BPML
<i>WfMC</i>	Workflow management	XPDL, Wf-XML
<i>RosettaNet</i>	e-business standards	PIP
<i>Others</i>		OAGIS, WS-I, WSFL, XLANG

2.2. Viewpoints about Message Exchange

The second axis is the viewpoints about message exchange. It is classified by two different ways of describing business processes that support orchestration and choreography.

The terms orchestration and choreography describe two aspects of emerging standards for creating business processes. The two terms overlap somewhat, however orchestration refers to an executable business process that can interact with both internal

and external services. Orchestration always represents control from one party's perspective. A typical example of orchestration is WS-BPEL. This is distinguished from choreography, which is more collaborative and allows each involved party to describe its part in the interaction. Choreography defines the observable message exchanges, rules of interaction and agreements between two or more business process partners. A typical example of choreography is WS-CDL [6].

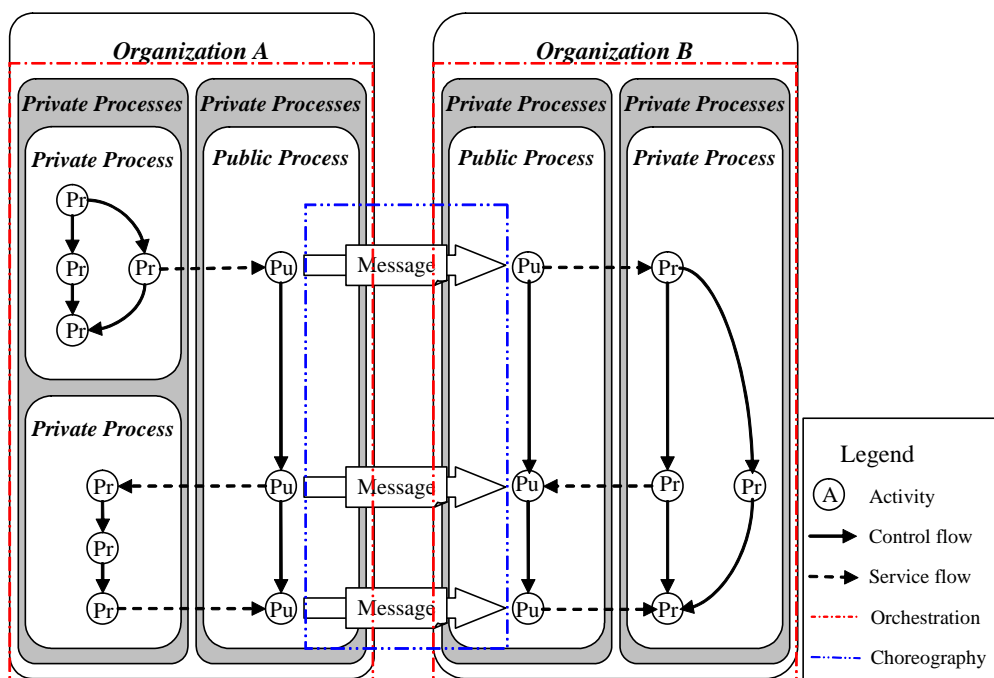


Figure 2. Orchestration and choreography.

2.3. Phase of Business Process Development Lifecycle

The third axis is the phase of business process development lifecycle. The business process development lifecycle is the overall process of developing business process engine through a multi-step process from planning through analysis and design, realization, deployment, and execution as shown in Figure 3a [7]. The standards in business process modeling and execution are used in the analysis and design phase and

the realization phase. Phase 2 and Phase 3 are segmented into three distinct phases, process notation, process definition, and interaction definition. This lifecycle is depicted in Figure 3b.

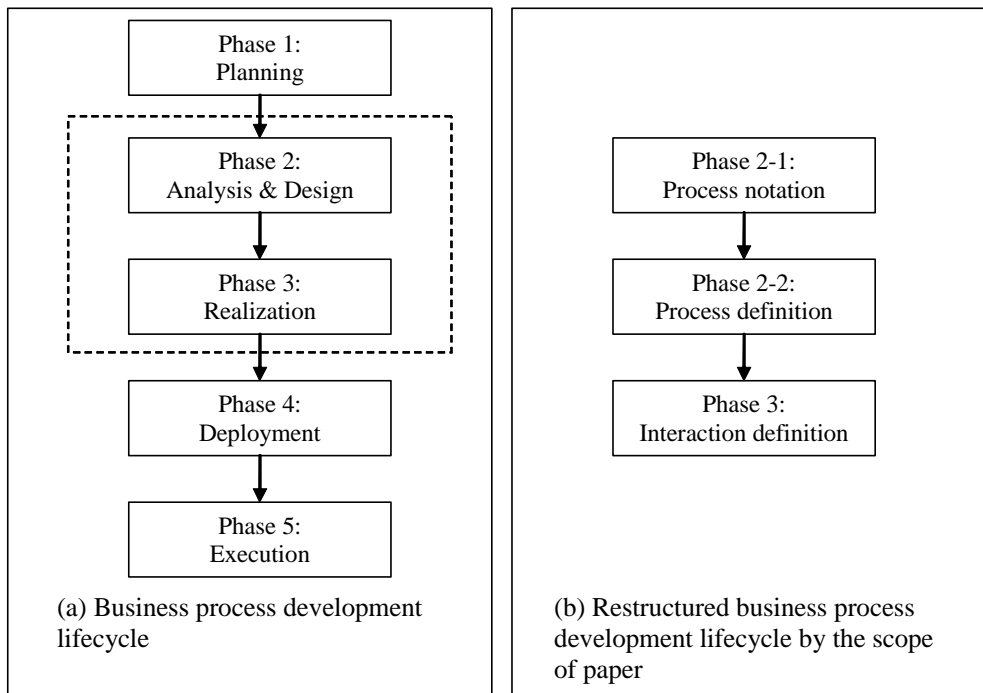


Figure 3. Business process development lifecycle.

First, the process notation phase provides businesses with the capability of understanding their internal business procedures in a graphical notation and gives enterprises the ability to communicate these procedures in a standard manner to facilitate the understanding of the performance collaborations and business transactions between the enterprises. Second, the process definition phase provides a means to formally specify business processes. It consists of a network of activities and their relationships, criteria to indicate the start and termination of the process, and information about the individual activities, such as participants, associated IT applications and data, etc [1]. Third, the interaction definition phase describes peer-to-peer collaborations of participants by

defining, from a global viewpoint, their common and complementary observable behavior, where ordered message exchanges result in accomplishing a common business goal.

3. Previous Works

3.1. Genealogy of Standards in Business Process Modeling and Execution

Since the early 2000s, many standards in business process modeling and execution for collaboration have emerged and are continuously being enriched with new proposals from different vendors and initiatives. Each business process standard relates to others. Some standards have a direct effect on others, and some standards have an indirect effect on others. The relationship of various standards is shown in Figure 4 and each standard is categorized by initiatives.

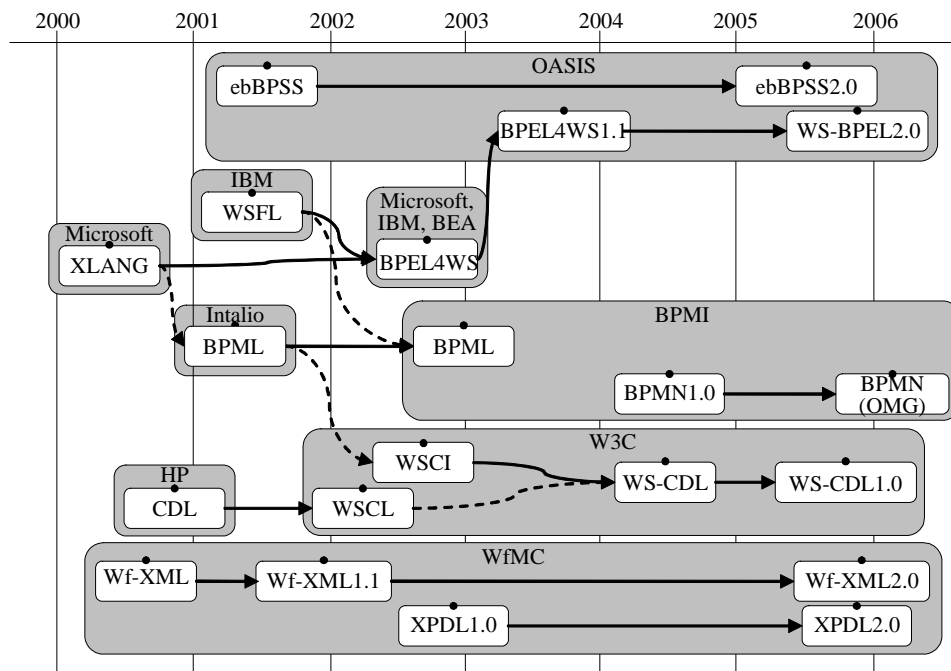


Figure 4. A genealogy of standards in business process modeling and execution.

In this figure, dot means emerging point of standard. Also, dashed arrow denotes indirect effect and straight arrow denotes direct effect.

The chronic analysis was performed using the criteria as three remarkable

events. After the remarkable events occur, standards in business process modeling and execution are changing. Chronic analysis is used to explain the change of standards. The remarkable events happened in the history of standards are following.

1) Emerging business process standards

Early work to design a business process by combining Web services included Microsoft's XLANG, IBM's WSFL, and Hewlett-Packard's Conversion Definition Language (CDL).

In May 2000, Microsoft initially developed XLANG to support sequential, parallel, and conditional process control flows for its BizTalk Server. Against Microsoft's XLANG, IBM developed WSFL to describe both public and private process flows in May 2001 and the WSFL is available to implement through alphaWorks called Web Services Process Management Toolkit. Hewlett-Packard also developed the CDL as defined in the HP Service Framework Specification (SFS) in November 2000. The service framework specification is a layered specification that enables interoperability through the use of XML and formal definitions of interactions amongst services. The CDL provides a standard way to model the public processes of a service, thus enabling network services to participate in rich interactions. In May 2001, CDL was submitted to W3C by the members at Hewlett-Packard Company and W3C Published WSCL version 1.0 in March 2002. The BPML version 1.0 was published by the BPMI, which was founded by Intalio in August 2000.

Outside the web services domain there have been other initiatives to standardize the specification of executable business processes. Most notable is the initiative of the WfMC. Since 1993, the WfMC has been active to standardize both a workflow process definition language and the interfaces between various workflow components. In August 2002 the WfMC released XPDL version 1.0 beta to support the exchange of workflow specifications between different workflow products.

2) Explosion of standards in business process modeling and execution

For conventional understanding, the history of standards in business process modeling and execution is categorized by publishing organizations.

The OASIS is a non-profit, international consortium that creates interoperable industry specifications based on public standards such as XML. OASIS defines open specifications such as the BPSS and BPEL. In May 2001, ebXML BPSS version 1.01 was jointly developed by OASIS and the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT). After UN/CEFACT announced the final release publication of UN/CEFACT ebXML BPSS version 1.1 in October 2003, the developers of the ebXML BPSS have decided to advance their work under the technical process of the ebXML Business Process Technical Committee, OASIS international standards consortium. The ebXML BPSS version 2.0.4 Committee Specification was unanimously approved in October 2006. The business process standards outlined by IBM's WSFL and Microsoft's XLANG have merged into the BPEL4WS. IBM, BEA, and Microsoft developed the first version of BPEL4WS in August 2002. Since then SAP and Siebel Systems have joined, which has resulted in several modifications and improvements and adoption of version 1.1 in March 2003. In April 2003, BPEL4WS was submitted to OASIS for standardization purposes where the WSBPEL TC (Web Services Business Process Execution Language Technical Committee) has been formed. Many vendors have joined the WSBPEL TC and this has led to even broader acceptance in industry. In November 2006, WS-BPEL version 2.0 is a popular OASIS Committee Draft for the specification of business processes and business interaction.

The site of BPMI.org, one of the organizations proposing a web services composition standard, state that BPMI.org defines open specifications such as the BPML and BPMN that will enable the standards-based management of e-business processes with forthcoming BPMS. The BPMI.org announced the public release of the BPML specification in March 2001 and the release of the final draft for the BPML version 1.0 in

November 2002. BPMN version 1.0 was developed under the leadership of Steven White in a working group at BPMI.org in May 2004 and is now being maintained by the Object Management Group (OMG) since their merger in 2005. OMG Final Adopted Specification which has been approved by the OMG board and technical plenaries, was developed in February 2006 and included the mapping BPMN to BPEL.

The W3C is a non-profit organization funded partly by commercial members and its activities remain vendor neutral. W3C defines open specifications such as the WSCL, WSCI, and WS-CDL. Web Services Conversation Language (WSCL) was derived from the Conversation Definition Language (CDL). W3C Published WSCL version 1.0 in March 2002. The Web Service Choreography Interface (WSCI) was submitted in June 2002 to the W3C by BEA Systems, BPMI.org, Commerce One, Fujitsu Limited, Intalio, IONA, Oracle Corporation, SAP AG, SeeBeyond Technology Corporation, and Sun Microsystems. W3C have released the WSCI version 1.0 to drive and ensure adoption of collaborative business applications in August 2002. It is the 4th specification dealing one way or another with Web Services Choreography after XLANG, WSFL, and WSCL. There is a substantial overlap between BPML and WSCI. Also, by leveraging the WSCI specification, BPML version 1.0 enables the modeling of end-to-end processes that can be translated into collections of private implementations executed as BPML processes and public interfaces defined using WSCI. WSCI has been superseded by the WS Choreography Definition Language (WS-CDL), which is substantially different. WSCI was, for all intents and purposes, an input to the W3C WS-CDL work from the standpoint of consideration in their work. Hence one may say that it has influenced the WS-CDL work. The WS Choreography WG has announced the release of the Candidate Recommendation for the WS-CDL version 1.0 in November 2005.

The WfMC is a non-profit, international organization of workflow vendors, users, analysts and university/research groups. WfMC developed open specifications such as the XPDL and Wf-XML. The WfMC announced the release of XPDL version 1.0 in December 2002. The current version is XPDL version 2.0, published in May 2005. XPDL

version 2.0 is compatible with XPDL version 1.0, with minor exceptions, and is intended to be used as a file format for BPMN. Also, Wf-XML is introduced to WfMC in April 1999 and the release of Wf-XML version 1.0 in May 2000 was a landmark achievement for the WfMC in that it represented the Coalition's initial entry into the XML arena. The draft for Wf-XML version 2.0 was developed in October 2004.

3) Business process collaboration

The most critical issue facing the standard organizations in business process today is the proliferation of competing standards. The overlap is confusing to business users and ultimately detrimental to standards in business process modeling and execution and the business community. If standards in business process modeling and execution are to prevail, vendors need to start working towards convergence and consolidate the number of standards in this space. Submitting BPEL to OASIS and the new Technical Committee are moves in the right direction.

The reasons for explosion of standards in business process modeling and execution are various. The typical examples are different initiatives and different origin of initiatives. Also, each initiative has limited awareness of other initiatives and not one standard fits all possible applications. Therefore, more and more standards are needed and emerged.

3.2. Characteristics of Standards in Business Process Modeling and Execution

In this section, the characteristics of standards in business process modeling and execution are defined based on three research axes. The standards such as BPMN, UML, BPML, XPDL, WS-BPEL, WSFL, XLANG, BPSS, WSCI, WSCL, WS-CDL, and PIP are analyzed in this section.

WSFL is an XML language for the description of Web Services compositions as

part of a business process definition [8]. It was designed by IBM to be part of the Web Service technology framework from the viewpoint of choreography and it is used in the phase of interaction definition in the business process development lifecycle. WSFL defines a specific order of activities and data exchanges for a particular process. Also, it defines both the execution sequence and the mapping of each step in the flow to specific operations. WSFL collaborations are a bit more useful than XLANG contracts since it enables mapping with bi-directional services.

XLANG is the XML business process language used in Microsoft's BizTalk Server. It focuses on the creation of business processes and message exchange behaviors among Web Services from the viewpoint of choreography. It also includes a robust exception-handling facility, with support for long-running transactions [9]. XLANG is used in the phase of interaction definition in the business process development lifecycle.

ebXML BPSS is a standard framework by which business systems may be configured to support execution of business collaborations consisting of business transactions [10]. It supports the specification of business transactions and the choreography of business transactions into business collaborations. BPSS determines the actual exchange of business documents and business signals between the partners to achieve the required electronic commerce transaction. It is used in the phase of interaction definition in the business process development lifecycle.

WS-BPEL is a specification that models the behavior of web services in a business process interaction published by OASIS [11]. Because WS-BPEL provides an XML based grammar for describing the control logic required to coordinate Web services participating in a process flow, it is used in the phase of process definition and interaction definition. Also, it provides support for both executable and abstract business processes from the viewpoints of orchestration.

BPMN is a standardization graphical notation for enterprise processes

published by BPMI [12]. It is used in the phase of business process modeling in the business process development lifecycle. The primary goal of BPMN is to support business process management by providing a notation that is readily understandable by all business users, from the business analysts who create the initial drafts of the processes, to the technical developers responsible for implementing the technology that will perform those processes, and finally, to the business people who will manage and monitor those processes. Thus, BPMN creates a standardized bridge for the gap between the business process design and process implementation.

BPML is a meta-language for the modeling of business processes, like XML, is a meta-language for expressing business processes and supporting entities published by BPMI. BPML defines a business process as an interaction between participants and the execution of activities according to a defined set of rules in order to achieve a common goal. BPML also provides a grammar in the form of an XML Schema for enabling the persistence and interchange of definitions across heterogeneous systems and modeling tools [13]. Just like XLANG, BPML relies on an XML data flow, which is fed by the message flow and supports the control flow decisions. It is used in the phase of definition of business process and interaction.

UML is OMG's most-used specification, and the way the world models not only application structure, behavior, and architecture, but also business process and data structure. It is used in the phase of business process modeling. UML provides a key foundation for OMG's Model-Driven Architecture, which unifies every step of development and integration from business modeling, through architectural and application modeling, to development, deployment, maintenance, and evolution [14].

WSCI is an XML-based interface description language that describes the flow of messages exchanged by a Web Service participating in choreographed interactions with other services [15]. It is proposed by W3C and is used in the phase of interaction definition in the business process development lifecycle.

WSCL from W3C outlines a simple conversation language standard for modeling the interaction sequences between Web services [16]. WSCL allows the business level conversations or public processes supported by a Web services to be defined. It specifies the XML documents being exchanged, and the allowed sequencing of these document exchanges from the viewpoint of choreography.

WS-CDL is an XML-based language that describes peer-to-peer collaborations of Web Services participants by defining their common and complementary observable behavior; where ordered message exchanges result in accomplishing a common business goal [17]. WS-CDL is targeted for composing interoperable peer-to-peer collaborations between Web Service participants regardless of the supporting platform or programming model used by the implementation of the hosting environment from the viewpoint of choreography. There is no way how the originating parties can be controlled. WS-CDL is for description, not for execution.

XPDL is the language proposed to interchange process definitions between different workflow products like modeling tools and workflow engines by the WfMC. The goal of XPDL is to specify the declarative part of workflow and define a XML schema for specifying business process definitions between different workflow products [5]. It is used in the phase of process definition in business process development lifecycle.

Wf-XML was produced by WfMC, and it provides an interoperability interface between multiple workflow systems. This means enabling organizations to communicate with other organizations via their respective automated workflow systems [4]. It is used in the phase of interaction definition in business process development lifecycle.

PIP is an XML specification designed to align a specific business process between trading partners developed by RosettaNet [18]. This initial test of a PIP, completed by IBM and Microsoft, allows manufacturers to seamlessly add new products – including standardized technical specifications and part numbers – into their partners'

catalogs.

3.3. Classification Result

In this section, the classification result is summarized in Table 2. Each standard is categorized based on three research axes. Rows denote the phase of business process development life cycle, and columns denote the viewpoint about message exchange. Grey boxes denote the publishing organizations.

Table 2. Classification result based on three research axes.

		Viewpoints about message exchange					
		Orchestration			Choreography		
Phase of business process development lifecycle	Process notation	<i>BPMI</i> BPMN	<i>OMG</i> UML	<i>RosettaNet</i> PIP	<i>BPMI</i> BPMN	<i>OMG</i> UML	<i>RosettaNet</i> PIP
	Process definition	<i>BPMI</i> BPML	<i>WfMC</i> XPDL		<i>RosettaNet</i> PIP		
	Interaction definition	<i>BPMI</i> BPML	<i>OASIS</i> WS-BPEL		<i>RosettaNet</i> PIP	<i>IBM</i> WSFL	<i>Microsoft</i> XLANG
					<i>WfMC</i> BPSS WSCL	<i>WfMC</i> WSCI WS-CDL	<i>WfMC</i> Wf-XML

4. Recent Challenges

4.1. Cooperation Efforts between Standard Organizations

Today, with the growth in e-commerce and the blurring of enterprise boundaries, many efforts have been dedicated to cooperate between standards in business process modeling and execution. The typical examples are cooperation between business process standard organizations.

1) Cooperation between OMG and BPMI

The BPMI and the OMG announced the merger of their Business Process Management (BPM) activities, to provide thought leadership and industry standards for this vital and growing industry in June 2005. The combined activities will continue BPMI's and OMG's ground-breaking work and focus on all aspects of Business Process Management, including the refinement and promotion of BPMI's BPMN as the basis for business modeling, and the delivery of the Enterprise Application Integration (EAI) and B2B collaboration within the broader business community. OMG will continue its tradition of innovation by integrating and reusing complementary business integration and web services standards such as WS-BPEL from OASIS, WSDL and XML Schema from W3C.

2) Connection between BPSS and BPMN

A business process specification may be modeled in BPMN or UML activity diagrams. BPMN and UML are both used to design the business processes and applications that run on a Business Process Management System (BPMS). Modeling with BPMN is essential to understanding and communicating business processes across the enterprise. BPMN provides a powerful augmentation to other modeling techniques. BPMN provides businesses with the capability of defining and understanding their internal and external business procedures through a business process diagram, which will

give organizations the ability to communicate these procedures in a standard manner. BPMN is focused on business process modeling for business analysts, using key transaction, task, activity, and pool constructs known by such experts. According to the latest version of BPSS, business process diagram used in BPSS was changed from using UML activity diagram to using BPMN. Also, BPSS Working Group and BPMI Working Group contact for obtaining feedback continuously.

3) Mapping between BPMN and other standards

BPMN is also supported with appropriate graphical object properties that will enable the generation of executable BPEL. Thus, BPMN creates a standardized bridge for the gap between the business process design and process implementation. BPMN points toward the convergence of open standards for business process management by enabling practitioners to more easily exchange business process models between different business process languages. Recently, BPMN Working Group studies about providing guidelines on how to jointly use the specification with other related standards. As a typical example, OMG Final Adopted Specification of BPMN includes the chapter of the mapping to BPEL4WS and presents a simple, yet instructive example of how a BPMN diagram can be used to generate a BPEL process. OMG Working Group and BPEL Working Group have joint meeting continuously.

In addition to these efforts, standard publishing organizations agree with the importance of sharing information and are moving toward the collaboration and interoperation between standards in business process modeling and execution.

4.2. Cooperation Efforts by Personal Research

Similarly, cooperation efforts by personal research are on the increase. The personal research are classified into two areas, comparison and transformation between standards. The typical examples of papers about comparison and transformation between

standards are following.

1) Comparison between standards in business process modeling and execution

There are some personal research that work on the comparative study of standards in business process modeling and execution. J. Mendling and M. Müller focus on a comparison of BPML and BPEL4WS. BPML and BPEL4WS are quite similar, however BPML supports advanced semantics such as nested processes and complex compensated transactions that are not addressed by BPEL4WS. A detailed comparison between BPML and BPEL4WS is given in [19]. In addition, Cape Visions focuses on a comparison of three XML business process languages. It compares the Business Process Management Initiative's BPML, XPD L proposed by the WfMC, and the BPEL4WS proposed by IBM, Microsoft and BEA [20].

2) Transformation between standards in business process modeling and execution

There are other studies of transformation between standards in business process modeling and execution. J. Kim and C. Huemer present when and why we need to transform between these two standards, BPSS and BPEL. For the transformation it examines the difference between them and suggests guidelines for a transformation from BPSS to BPEL [21]. The transformation algorithm from BPML into BPEL4WS in order to refer to a BPML-formatted executable business process is detailed in [22]. BPEL4WS and BPML may be used to describe an executable business process used in the internal enterprise system. J. Mendling and M. Hafner present the conceptual model for the mapping from WS-BPEL to WS-CDL. Additionally, a proof-of-concept implementation of the mapping was realized with the Extensible Stylesheet Language Transformations (XSLT), enabling the generation of BPEL stubs from WS-CDL documents [23]. The transformation from BPMN to XPD L for a Business Process is detailed in [24]. The BPMN-formed business process should be converted to its semantically equivalent

business process languages such as XPDL which can consequently be executed by business process engines. In this regard, the transformation mechanism from BPMN-formed business processes to corresponding XPDL processes is proposed.

4.3. Limitations

A business process is defined as a workflow or procedure made up of a series of steps, each of which comprises a number of activities. Each activity will be at its own point in the procedure and will have its own status. It is necessary to consider the different perspectives of the actors involved. The kernels of business process in B2B collaboration are how to have a relationship with actors involved in B2B collaboration and how to cooperate with them. Although they have to be dealt with for B2B collaboration, existing standards in business process modeling and execution just focus on the logical information such as business data, business logic, business event, and workflow. The limitation of B2B collaboration at a system level causes the huge effort to collaborate between heterogeneous B2B organizations in spite of no logical B2B collaboration conflict.

Another limitation of existing standards in business process modeling and execution is the lack of consideration for users. Most of the standards in this business process domain, at the moment, are IT standards. They are either designed to help IT professionals design and develop business process applications or designed to assure that organizations can store process information in a common data format or exchange informations between trading partners. There is a gap between IT perspective and user perspective on business process. Hence, organizations are facing a host of problems in mapping standards to their own business process. Also, they think that standards have no practical use. Because of dissociation between standards and real business, most people in most organizations do not care about standards. They simply do their jobs without thinking about the fact that their work is greatly simplified by the many conventions and agreements commonly understood and agreed. The increase of tremendous gap between

IT perspective and user perspective is possible to cause standard to become a useless thing.

5. Future Direction

5.1. Extension for Physical Information

As mentioned in Section 4.3, standards in business process modeling and execution have no concern about the physical information. From the B2B collaboration perspective, the extension to share the physical information for B2B collaboration is suggested as the future direction of standards. Precisely, the standards, including not only the logical information but also the physical information, can advance the collaboration between heterogeneous B2B organizations.

The physical information can be composed with the system information and the document information. Trading parties collaborate between their heterogeneous system executing business processes. Each time the procedure is invoked or business document is transferred, the physical system information needed is declared for B2B collaboration. The Open Software Description (OSD) format, is published by W3C and it includes the information to describe the system such as software information and development environment, can be applied to represent the system information [25]. The physical system information needed for B2B collaboration can be defined by referencing OSD. The physical system information involves the information of software package such as title and version, and the environment description for implementation such as platform, processor, language, memory size, and implementation type. In addition to system information, the document information is considerable. The business document exchanged between trading partners must be subordinate to the business organization. The information about the schema and the ontology data, which are the foundation of the business document, represent the heterogeneity between B2B organizations.

If the physical information about systems and documents can be expressed, it facilitates to cooperate between standards in business process modeling and execution and to consider the current status of organizations in B2B collaboration. Consequently, a standard which focuses on both logical and physical information can survive in future and

it is suggested to add the system information and document information needed for B2B collaboration to existing standards in business process modeling and execution.

5.1.1. Case Study

For a comprehensive study, this section illustrates an experimental scenario to verify the extension for B2B collaboration. To simulate an experimental scenario, this paper defines the collaboration between experimental companies, travel agent and airline, with a simple business transaction scenario between them.

In the B2B collaboration, organization opens its public process to the trading partner. The public process diagram denotes the public process, which includes mainly sending and receiving activities. The travel agent interacts and collaborates with airline services for confirming flight reservation as illustrated in Figure 5. The following BPMN diagram describes how the travel agent collaborates with the airline service from sending itinerary to receiving a ticket from the airline from the viewpoint of the public process. The travel agent sends itinerary received from its customer and receives the available flight schedule from the airline service. The travel agent requests the chosen airline to put the flight on hold, and then receives a confirmation number from the airline system. The travel agent looks for payment services available to build a list of options for the customer. If the travel agent receives a payment option list, it requests a payment and receives a ticket. As shown in this experimental scenario, existing standards in business process modeling and execution just focus on logical information.

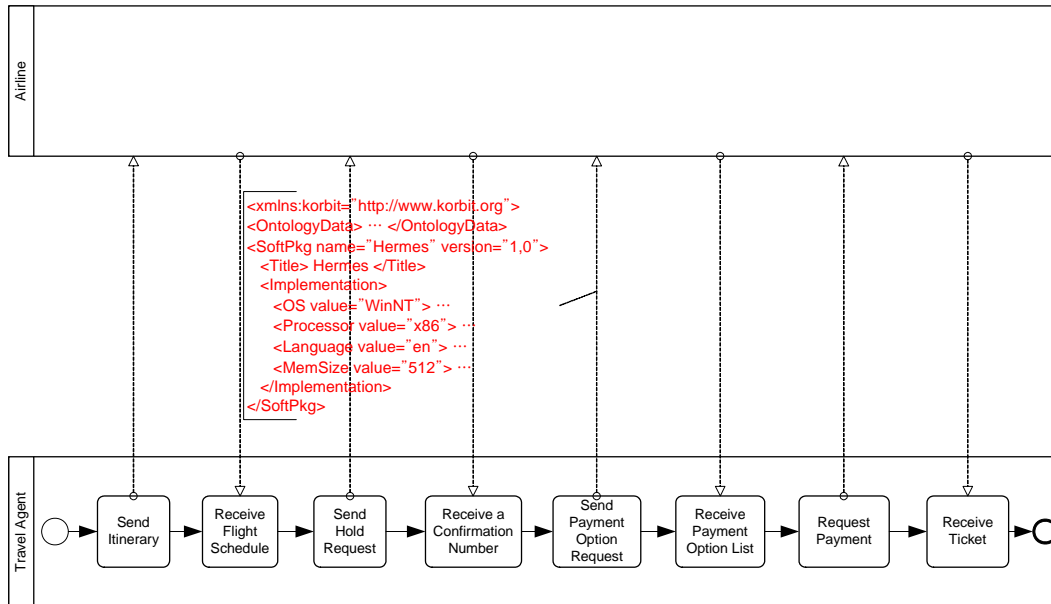


Figure 5. The extension for B2B collaboration

If a new airline system wants to collaborate with this travel agent, the system has to develop the system which can collaborate with the travel agent. For this, new airline system needs the physical information which is defined as annotation in Figure 5. Hence, if the travel agent opens its system information needed to collaborate to the candidate of its trading partner, collaboration and development process is easier than now.

5.2. Extension for Real Business

As mentioned in Section 4.3, standards in business process modeling and execution are IT standards with little consideration for users. One of the fundamental problems is the need to bridge the gap between the IT perspective and real business user perspective.

For this, one of the biggest challenges is maintaining alignment of IT with business requirements. When trying to understand the business perspective approach, several topics are especially noteworthy, including – open communication, business value

of IT, role of IT in the business value chain, understanding business impact.

Another challenge is maintaining alignment of various internal groups including real business user. The user perspective on business process can be represented through an affiliation between working group in the standard organizations and the executive level practitioners with a business oriented thought in operations, finance and information technology. Business requirement is reflected in business process standards through that real business group take part in business process initiatives.

What the business process standard aims at is a cleaner, more uniform way of describing business processes which will give organizations a practical language, a more agile way of dealing with B2B interactions. That in turn will help bring process coordination closer to the business user. By the extension of standards, business organizations are possible not only to automate individual processes, but also to integrate the processes and functions within IT, and to link together best practice processes.

6. Conclusion

In this paper, the history of standards in business process modeling and execution has been provided. Although few efforts have been dedicated to collaborate between standards to analyze the history and the relationship of these standards, they have a limited focus on the comparison of standards. Because they can not help to recognize the business process as a whole, clearing and refining the history of standards is very important in B2B collaboration.

From the historical perspective, this paper provided an overview of the state of the art in the past, present and future of standards in business process modeling and execution. The past standards in business process modeling and execution are analyzed with three research axes – the initiatives, the viewpoints about message exchange, and the phase of business process development lifecycle. As the present trends in standards, efforts to cooperate between diverse standards are focused. Finally, as the possible future direction of standards, standards which include both logical and physical information are envisioned. Also, for the extension of business process standards, it is needed to bridge the gap between the IT perspective and real business user perspective.

This paper can provide the outline for the standards in business process modeling and execution. This research will help potential organizations for B2B collaboration understand the history of related standards, and will also help them to select the standards or applications that is appropriate to their e-business environments. Building on the result of this work, it would be interesting and also desirable for the business process initiative to get the future direction with concepts identified here. This will be the subject of future research.

요 약 문

오늘날, 전자상거래의 발전과 더불어 기업 간 협업이 증가하고 있으며, 이로 인해 비즈니스 업계에서는 기업 간 비즈니스 프로세스의 연계와 통합이 성공의 필수적 요건으로 부각되고 있다. 이러한 연계와 통합이 원활하게 이루어지기 위해 기본적으로 기업의 비즈니스 프로세스 시스템 간의 상호운용성이 보장되어야 하며, 정보시스템 업계는 다양한 시스템 간의 상호운용성을 확보할 수 있는 표준화된 기술의 개발을 위해 많은 노력을 기울이고 있다. 대표적인 사례로 국제 표준화 기구들에서는 전세계적으로 다양한 산업분야에 적용될 수 있는 비즈니스 프로세스 표준들을 제안하고 있다. 그러나 비즈니스 프로세스 표준들은 단기간동안 매우 빠르게 발전하였기 때문에 표준들 간의 관계나 역사에 대한 연구는 전무한 실정이다.

본 논문에서는 비즈니스 프로세스 표준의 과거와 현재의 동향을 살펴보고 미래의 확장 가능한 대안을 제안한다. 우선, 비즈니스 프로세스 표준의 분석 기준으로서, 표준 제정 기관, 메시지 교환에 관한 관점, 비즈니스 프로세스 개발 단계의 세 가지 기준을 정의하였다. 이를 이용하여 과거 비즈니스 프로세스 표준의 동향을 분석하였으며, 주요 이벤트 발생 시점을 기준으로 비즈니스 프로세스 표준들의 역사를 도식화하였다. 다음으로, 현재에는 다양한 표준들 간의 통합을 위한 노력에 초점을 두고 연구가 진행되고 있으며, 이러한 연구는 표준 제정 단체들 간의 통합 움직임과 비즈니스 프로세스 표준들 간의 관계 정립을 위한 개인적인 연구로 구분된다. 그러나 이러한 노력에도 불구하고 비즈니스 프로세스 표준들은 첫째, 논리적인 흐름만 표현할 수 있으며, 둘째, 실제 비즈니스 기업에 대한 고려의 부족으로 인해 실사용도는 매우 낮은 한계를 가지고 있다. 따라서 미래에 비즈니스 프로세스 표준이 정착되기 위해서는 이러한 한계를 극복해야 한다. 첫번째 한계를 극복하기 위해서는 논

리적인 흐름 뿐만 아니라 이기종 시스템 간의 통합을 위해 필요한 시스템 정보까지 표현할 수 있는 표준으로의 확장이 하나의 방안이 될 수 있다. 두번째 한계를 극복하기 위해서는 표준 제정 시 비즈니스 기업의 요구사항을 반영할 수 있도록 표준 제정 단체 구조의 변화를 추구하는 것이 방안이 될 수 있을 것이다.

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감사의 글

2년이라는 길지 않은 시간이지만 논문을 마무리하는 시점에 뒤돌아보니 감사를 드려야 할 분들이 참으로 많습니다. 그동안 학교에서 그리고 지금까지 살아오면서 저에게 많은 도움을 주신 분들께 이 자리를 통해 감사의 말을 드리고 싶습니다.

우선, 26년의 삶동안 제게 많은 힘과 용기를 준 아버지와 어머니께 가장 먼저 감사드립니다. 막둥이라고 어리광만 부렸던 저를 항상 믿음으로 지켜봐주신 부모님, 감사드립니다. 그리고 나의 라이벌이자 제 2의 엄마로서, 언제나 많은 도움을 주는 언니와도 이 기쁨을 나누고자 합니다.

석사과정동안 부족한 저를 이끌어 주시고 많은 지도와 관심을 가져주신 조현보 교수님께 깊이 감사드립니다. 또한, 바쁘신 와중에도 귀중한 시간을 내주시어 논문에 대한 충고를 해 주신 김광수 교수님, 김수영 교수님께도 감사드립니다. 그밖에도 지난 4년 간의 학부시절과 2년 간의 석사시절동안 많은 가르침을 주신 산업경영공학과 모든 교수님들과 많은 도움을 주신 학과 사무실 선생님들께도 감사의 마음을 전합니다.

지난 2년 동안 함께 해 온 ISL 식구들에게도 감사의 말을 전합니다. 항상 흔들리지 않는 기준으로 많은 도움을 준 부환오빠, 멀리서 외로이 연구를 진행하고 있을 정엽오빠, 연구실을 항상 즐거운 분위기로 이끌어 준 태중오빠, 이제는 태중오빠를 능가하는 유머 감각을 지닌 인호오빠, 마실의 여왕 양선이 모두 고맙습니다.

설레이는 마음으로 대학 생활을 함께 시작했던 9분반 친구들과 지난 학부 4년동안 많은 정이 들었던 산업경영공학과 01학번 동기들, 자주 불

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6년 동안 함께 지낸 고마운 방순이 진희에게 앞으로 좋은 일들만 가득하길 바랍니다. 그리고 이제는 자주 볼 수 없지만 대학시절 친오빠처럼 믿고 의지할 수 있었던 경빈오빠와 기훈오빠에게도 고마움을 전합니다. 그리고 우리 왕클럽 패밀리에게도 감사의 마음을 전합니다. 사려깊은 왕언니 수연, 멋진 캐리어우먼으로 변신에 성공한 정영, 이제는 하얀 가운이 제법 잘 어울릴 듯한 정진, 웃음 많고 착한 영은, 가장 부러운 몸매를 지닌 선영, 가장 늦게 패밀리에 합류한 윤정이까지 오랜만에 만나도 익숙하고 푸근한 왕클럽 패밀리가 있어서 고맙고 행복합니다.

마지막으로 이제는 조금 멀리 떨어져서 지내야 할 태종오빠에게 진심으로 감사의 말을 전합니다. 항상 곁에서 내 편이 되어준 사랑하는 당신이 있어 고맙고 행복합니다. 포항에서의 많은 추억들과 함께 그 믿음 항상 간직하며 기대에 어긋나지 않도록 항상 노력하겠습니다.

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