

# BPMN Serialization - Step Toward Business & IT alignment

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**Abstract**—This paper points out the importance of using standardized tools for notation and exchange or execution of business processes. Presented service oriented platform enables business IT alignment and make companies open for collaboration in global business environment. Special attention is given to methods for serialization or converting notation of business processes to forms suitable for computer processing. This business-IT alignment enables the efficient use of all resources in order to achieve business goals in real time.

## I. INTRODUCTION

The need for alignment of business and IT domain is not a new need. Due to the growth of information systems in companies during the seventies and the eighties of the last century, the alignment of the possibilities of IT solutions with business requirements is becoming a key challenge. As a solution to this, many technologies of IT planning and development of information systems have been developed, such as Business System Planning [1], Information Engineering [2] and other technologies and studies. Since the main objective of these methodologies was to standardize the development of large information systems, the attention was mostly paid to the analysis of the data and their structure of the organization. A.J. Gilbert Silvius [3] found through the analysis of the main characteristics of the methodologies of that period that their rigid approach did not enable the harmonization of the business requirements and IT solutions in practice. Namely, these methodologies were primarily "Procedures of IT professionals by IT professionals" [4]. That approach resulted in the development of applications which primarily generate schedules, summaries and reports, but significantly limit the role of the user in defining the objectives of improving or further development.

Less formal approach to IT and business domains alignment originated during the mid-90s of the last century. This primarily involves focusing on business requirements and objectives and their conversion into innovative IT solutions. The reference model of the strategic harmonization was given by Henderson and Venktaman [5], Fig. 1.

The strategic model of alignment shown identifies two types of integration between business and IT domains. The first type, which is called strategic integration, represents the link between business and IT strategy and reflects the external components. More precisely, it represents the possibilities of the IT domain to shape and support the business strategy. Another type of integration, called functional integration, refers to the internal domains

and represents the link between organizational infrastructure and processes on one side, and IT infrastructure and IT processes on the other.

The modern approach to alignment of business and IT domain differs from the traditional one in the following aspects [6]:

- Focusing on strategy. Unlike the traditional methods which were focused on analysis of the data and their structure, modern technologies of IT planning are focused on the business strategy of the organization. This allows the "translation" of business strategy into measurable performance indicators (KPI – Key Performance Indicator) which show the relationship between business goals and IT solutions.
- Pragmatic approach. Planning of IT solutions is gradually becoming less formal in methodology and it is primarily oriented towards finding the applicable solutions.
- Modernization of existing solutions. Given that most companies have significant capacities of inherited hardware systems and software solutions, modern methodologies of development of IT infrastructure must be based on improvement of existing resources. This certainly includes the development of completely new IT solutions in line with business objectives.
- Continuous innovation. Due to the significant impact of IT domains on the overall business, it is of great importance to create such IT solutions which would support business innovation, and not just give solutions for production improvement. This implies the involvement of business professionals in the IT domain, as well as understanding of business objectives by IT professionals.

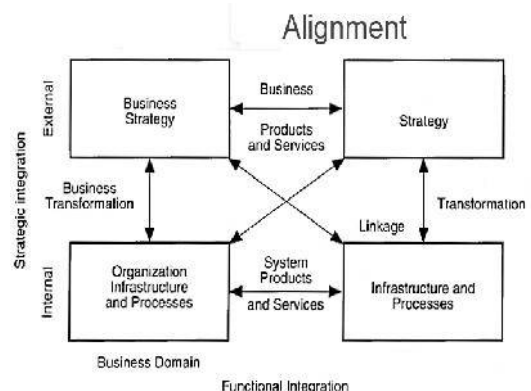


Figure 1. Functional integration

## II. BUSINESS PROCESSES AND SERVICE ORIENTED ARCHITECTURE

The term Business Process Modeling (BPM), or as it is also called Business Process Management, refers to the design, management and execution of business processes. According to OMG (Object Management Group) a process is a "flow of work and information in business." A business process is defined as a set of logically related tasks that are executed in order to attain a predefined business outcome. A process is a structured set of activities designed with the aim to produce a certain result for a customer or a market.

A business process can be very complex in its structure. It may have multiple participants, such as people, organizations and systems which perform multiple tasks. In order to accomplish the given task, the participants must perform defined tasks in coordinated manner, usually grouped into sub-processes. In some situations, the sub-processes are executed in parallel, in others they are sequential. Some processes require re-execution of sub-process. Most processes include decision points, which lead to the branching of the flow depending on the previously set, satisfied or not satisfied conditions. Within some processes, the participants must share certain information. The transfer of information can have the role of triggering or starting a new task. Some processes are ad-hoc processes, which means that their sub-processes do not have defined triggers. The participants do not have to complete all the defined tasks before they, or another participant, start the execution of another dependent sub-process. The business process consists of atomic steps, which are interconnected with business rules. A step in business process is a basic part which represents a unit of work and cannot be broken down into smaller steps. It is also called the activity or transaction, and since it is atomic, it uniquely identifies all the events in the process. The human participants are an integral part of any process which is not fully automated, so that non-automated steps have a user interface by which the process is monitored and controlled by the participants. The user interface allows the participant to input and modify attributes, as well as to initiate, suspend, establish, stop and end the processes. In addition, each process has access and the possibility to change the condition of any business entity which is linked to that process.

For business analysts, BPM means understanding the organization as a set of processes that can be defined, managed and optimized. Instead of the traditional orientation where the operations are divided by organizational units, BPM is oriented towards operations, regardless of the organizational unit they are executed in. For technical staff, BPM is a group of technologies focused on defining, executing and overseeing the process logic. Regardless of the different perspectives, both business analysts and technical staff have the objective to improve business processes.

Business process management is an evolutionary advance in alignment of business and IT domains. Full alignment of business and IT domain is possible only in a flexible and collaborative working environment. Technological basis of this paradigm are SOA (Service-oriented architecture) and semantic Web 2.0. Service-oriented architecture is a business-oriented approach to architecture of IT solutions, which enables the integration

of businesses in the form of related business services. At the same time, SOA is an evolutionary approach to building an integrated information system, which is focused on solving business problems [7].

In theory, BPM is a continuous process of information exchange and application of harmonized technologies through the stages of design, development and monitoring of the life cycle of a business process. However, in practice, the transition between phases is usually not continuous, primarily due to different methodologies, standards and languages used, which can cause semantic problems. These semantic differences primarily arise during the transition from the business domain to the IT domain, and vice versa, due to the different nature of BPMN (Business Process Model and Notation) and BPEL (Business Process Execution Language) standards. Business analysts tend to present business processes as business diagrams (workflow diagrams). On the other hand, in the IT sector, the existence of strictly defined procedures and formalized languages for their presentation is essential. This "conceptual mismatch" can cause problems during the transition from one phase of the life cycle of a business process to the other. A detailed identification of the origin of the conceptual inconsistency (conceptual mismatch) of the languages used for modeling business processes, as well as a generic solution to the problem was given by Recker and Mendling [8].

## III. BPMN

BPMN is an international standard for modeling and notation of business processes developed and controlled by the Object Management Group. BPMN is widespread both in practice and in academic circles, as evidenced by the large number of tools for BPMN modeling, as well as a number of academic articles on various aspects of the BPMN [9].

The first version of BPMN 1.0 by Stephen White of the IBM Company in 2004 primarily represents the standardization of a set of graphical forms for documentation and visualization of business processes. BPMN version 2.0 [10] was developed in order to provide notation for defining business processes, easily understandable by all business users, business analysts who need to outline the processes, IT and other technical staff who are responsible for implementing the technology for executing processes, and business people who will manage and monitor business processes. BPMN 2.0 enables simple and easily understandable way of creating business process models, without limiting the complexity of the process being modeled. These two contradictory demands were reconciled by defining only five basic categories of elements, which can be easily recognized in diagrams and their meaning can be intuitively understood. Within the basic category of elements (Flow Objects, Data, Connecting Objects, Swimlanes and Artifacts) there are additional variations. In addition, additional information can be defined in order to support complex business processes, without dramatic changes to the basic layout of the process model.

Business process modeling covers a very wide range of participants, information and ways of exchanging that information between the participants of the business process. BPMN 2.0 is designed to respond to these different requirements in modeling, and considering the

different objectives, the following BPMN models can be differentiated:

- Processes. This model represents the orchestration of activities and the data flow between the entities involved in the process. This model includes:
  - o Internal business processes which are not executed;
  - o Internal business processes which are executed;
  - o Public business processes.
- Collaboration. Collaboration describes the process of interaction between two or more business entities. The interaction is shown as a sequence of activities, that is, a set of messages exchanged between the participants. The activities for the participants in the collaboration can be seen as the point of separation or the point of merger. Therefore, this type of diagram shows that public aspect of the process, visible to each of the participants in collaboration.
- Choreography. Although the choreography is consisted of a network of basic BPMN elements, the same as the private business processes are, the main focus is on presenting the messages that the business entities interchange.

BPMN 2.0 offers dramatic improvements in (unfortunately non-formal) defining of the semantics for the automation of execution of business processes. Automation of execution of business processes can be implemented using any of the well-known programming languages (Java, C #, etc.). However, the use of programming languages for services orchestration, which are parts of the business processes, often has the effect of creating inflexible solutions. The main cause of the inflexibility of this approach is due to the unclear boundaries between the process flow and the business logic, which must not be firmly connected. The general need for creating solutions for the automation of business processes demands standards, as well as specialized language for the composition of services into business processes. BPEL is the kind of language which provides the possibility of executing business processes in a standardized way using the generally accepted language.

#### IV. BPEL

BPEL (short for BPEL4WS - Business Process Execution Language for Web Services) is a specification created as a synthesis of the positive sides of the past specifications, Microsoft's XLANG and IBM WSFL. BPEL4WS is in fact a convergence of the structural orientation of displaying business processes of XLANG and the graphical orientation of WSFL-in. With the acceptance of BPEL specification by the OASIS standards organization and the support of all the major software vendors (Oracle, Microsoft, IBM, SAP, Sun, BEA, etc.), BPEL specification became the standard model for linking individual Web services in order to create a reliable business solution [11]. Using the principles of the process oriented applications when connecting Web services and the business processes, it provides the portability and interoperability of the implemented business processes. Process oriented application structures have two strictly separated levels: the higher level of the business process, which represents the logic of the business process by using BPEL language, and the lower level of Web services, which represents the functionality of business

processes by using Web services. The basic concept of BPEL can be used in two ways:

- BPEL process can define business protocols. The business protocol specifies the potential sequence of messages exchanged between partners (Web services) in order to achieve a business objective. It also defines the order in which a particular partner sends and expects messages from others, in accordance with the specific business context. Since the business protocols are not executable, they are often called abstract business processes;
- BPEL specification can also define executable business processes. With the executable processes, the activities (messages that are exchanged) between the partners (Web services that participate in the implementation of the business process) are defined by logic and the current state of the business process. The access to a particular Web service is enabled by using portType element of the WSDL service.

In order to use the BPEL specification and execute business processes defined in BPEL specification, appropriate graphical tools for defining business process are necessary, as well as an efficient executive environment, that is, a BPEL server. BPEL servers provide the execution environment for performing BPEL business processes. BPEL is firmly connected with the XML Web services and modern software platforms which support the development of XML Web services, especially with Java Enterprise Edition and Microsoft .NET platforms. This connection allows BPEL servers to use the services, which are provided by the aforementioned platforms, such as security, transaction management and connection with databases [12].

#### V. BPMN SERIALIZAION

BPEL is the de facto standard for the implementation of business processes using Web services technology. There are many solutions which support the execution of BPEL processes, and many of these solutions include the possibility of graphic editing. However, all these tools do not support the higher level of abstraction necessary for the design process of business analysts. On the other hand, BPMN as a language for defining business processes provides certain interaction between business analysts and IT analysts. However, none of the ubiquitous tools that support BPMN allow the execution directly, but they support the translation from BPMN to BPEL. The main role of XPD (XML Process Definition Language) and BPEL languages is to enable the transition of the business process from the business domain to the IT domain, and vice versa, Fig.2.

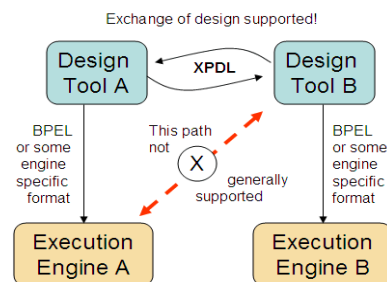


Figure 2. The roles of BPEL and XPD languages.

The problem of translation from BPMN to BPEL or XPD L is the translation from graph-oriented language to block-oriented language. Graph-oriented languages define the control flow by using the links which are the logical connection between nodes of different types. On the other hand, block-oriented languages define the control flow by using the commands and their structures for representing competitiveness, sequences, loops, etc. [13].

As shown in Fig.2. [14], on the top (development) level, there are various tools for designing business processes, while on the bottom there are the executable versions of the respective processes. The role of XPD L is to facilitate the exchange of design of business processes between different design tools, while the primary role of the BPEL is business process execution.

With the analysis of existing tools, Chum Quyang [15] found that none of the tools meets the following requirements:

- Completeness, that is, the possibility to be applied on any BPMN model;
- Automation, that is, the possibility of production of the final code without the human intervention in identifying and adapting parts of the source code;
- Clarity, that is, the possibility of producing the code which is understandable to humans as well. This requirement stems from the fact that BPEL definitions obtained by translation also require the definition of additional information.

Table 1 shows the characteristics and the purpose of certain languages in the design of systems for managing business processes [16].

## VI. CONCLUSIONS

The complexity of the modern business environment is characterized by an extremely strong causal connection of all the business activities, from the most general processes of long-term planning to the technological procedures. Timeliness and continuity of these activities are the basic conditions of successful overall business. In order to meet these conditions, their integration is necessary, and to the extent to which it is possible to achieve unobstructed communication between all relevant business functions. It is undisputed that the management of business processes is one of the most important aspects of integration of the organization. In addition, business processes are becoming a place where business and IT world meet. Therefore, the definition of the true notations and languages which are equally understandable to business managers and to IT personnel is of very great importance. The possibility of converting graphical representation of business processes to the BPEL language, which is standardized in the IT domain, is the first step in the integration of these two domains [17].

TABLE I. LANGUAGES CHARACTERISTICS

	<b>BPMN</b>	<b>BPEL</b>	<b>XPD L</b>
<b>Characteristics</b>	<b>Notation for drawing</b>	<b>Format to save processes</b>	<b>Format to save images</b>
<b>Primary Purpose</b>	<b>Visualization</b>	<b>Control over other systems</b>	<b>XMLization of BPMN diagrams</b>
<b>Diagram Information</b>	<b>Suitable</b>	<b>Impossible</b>	<b>Possible</b>
<b>Data Format</b>	<b>Image</b>	<b>XML</b>	<b>XML</b>

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