# Viewpoints on Business Process Models

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## INTRODUCTION

A business process is a standard way of organizing work in a business context (Rummler & Brache, 1995). Business processes cross functional boundaries in that they involve members of different departments; common examples are developing a new product, ordering goods from a supplier, and processing and paying an insurance claim (Davenport & Short, 1990).

Over the past few years a number of viewpoints have influenced the design of notations for business processes (Bruno, 2011). They emphasize the different elements (tasks, business entities and roles) that compose business process models; for this reason, they are referred to as activity-centric, data-centric, and role-centric viewpoints.

Probably, the most popular viewpoint is the activity-centric one, whose standard representative is BPMN (Business Process Model and Notation) (OMG-BPMN, 2011). It considers business processes essentially as orchestrators of operational activities, which encompass human tasks and automatic ones. Human tasks are carried out by participants by means of graphical interfaces, while automatic tasks are implemented with services. Orchestration is achieved through control flow elements, which enforce rigid precedence relationships: in this context, a business process is like a master distributing the work among the participants in the process.

When processes are meant to operate on the entities which form an information system, whose purpose is to enable human participants and/or machines to perform work using information (Alter 2008), focusing on the identification and the ordering of the activities may not be the right way to start with an investigation of the intended business.

The alternative solution proposed by data-centric approaches is to begin with the identification of the key business entities and their life cycles consisting of states and transitions (Hull, 2008). The term artifact has been introduced to designate a concrete and self-describing chunk of information used to run a business (Nigam & Caswell, 2003). The artifact types come from experience and are associated with business goals; the analysis of how to progress towards the goals determines the definition of their life cycles (Battacharya et al., 2005). The major benefit is the right level of granularity, which facilitates communication among the stakeholders and helps them focus on the primary purposes of the business (Chao et al., 2009).

An extension to data-centric approaches is the case-centric viewpoint, whose major purpose is to support knowledge workers in applications requiring the flexibility that cannot be provided by the approaches based on a rigid control flow (Marin, Hull and Vaculín, 2013). Flexibility implies that the participants in the process are no longer considered as mere resources needed to carry out tasks that are not automatable, but they can be involved in a number of choices, such as the selection of the input entities when a task needs more than one and the selection of the task with which to handle the input entities when two or more tasks are admissible (Bruno, 2014).

Human tasks are associated with roles, which represent the participants involved in the processes. However, if the process model shows the activity flows of the roles in a single view, it may be difficult for a participant to understand what their actual involvement is. The participation of users in processes is made more evident if the process is decomposed into several "role" components:

this is the essence of the role-centric viewpoint (Ould, 2005).

This article illustrates how the above-mentioned viewpoints can be extracted from a global model, which is based on a notation named iBPN (integrated Business Process Notation). This notation is inspired by high-level Petri nets so as to take advantage of their ability of being state and action oriented at the same time (Jensen, 1997). An example concerning the submission of papers to conferences will be used to illustrate the construction of the global process model and then the extraction of the data-centric viewpoint and the role-centric one.

This article is organized as follows. First it presents background information and the informal requirements of the example to be worked out. Then it illustrates the key modeling issues, the process model related to the example, and the automatic extraction of the above mentioned viewpoints; finally it makes some considerations on future research directions and provides the conclusion.

## BACKGROUND

The data-centric orientation is put into practice in two major ways depending on whether the life cycles are defined separately or are combined in a single model. In the first case, various techniques have been proposed to handle the interactions between the life cycles: events and rules in the Guard-Stage-Milestone approach (Hull et al., 2001), macro processes in PHILharmonicFlows (Künzle & Reichert, 2011), hierarchical relationships in COREPRO (Müller, Reichert & Herbst, 2007), and messages in Proclets (van der Aalst, Barthelmess, Ellis & Wainer, 2000). In the second case, the combination of the life cycles gives rise to a data flow which may play a part on the activation of the tasks. The data flow may be the only responsible for the activation of the tasks, as it happens with the iBPN notation presented in this article, or it may act as a complementary cause with respect to the control flow. The two approaches are referred to as dataflow-centric and extended activity-centric, respectively.

BPMN has been extended with dataflow-oriented features, such as data objects; however, the coexistence of the control flow and the data flow makes it difficult to handle the situations where a many-to-many mapping between entities of different types is needed. An example related to requisition orders and procurement orders is discussed by Meyer, Pufahl, Fahland & Weske (2013).

Extended activity-centric models include all the states of the artifacts involved; for this reason, the life cycles (made up of states and state transitions) can be extracted automatically. The main purpose is to verify the compliance with reference life cycles. Eshuis and Van Gorp (2014) present the extraction of life cycles from UML activity diagrams (OMG-UML, 2015), while the extraction from BPMN models is addressed by Cabanillas, Resinas, Ruiz-Cortés and Awad (2011). The opposite direction, i.e., the generation of process models from life cycles, has also been investigated (Küster, Ryndina & Gall, 2007). Roundtrip transformations between data-centric models and extended activity-centric ones are described by Meyer and Weske (2014).

The Guard-Stage-Milestone approach provided a good foundation for the recent standard CMMN (Case Management Model and Notation) (OMG-CMMN, 2014). Case management involves taking actions regarding a subject in order to achieve a desired outcome. The important issue is that the actions cannot be anticipated in a predefined sequence of tasks. In fact, the case workers may perform the run-time planning of the tasks to be carried out. A short history of the key concepts of CMMN is provided by Marin, Hull and Vaculín (2013). Various flavors of case management are illustrated by Marin, Hauder and Matthes (2015).

Human choices have been addressed by research on flexible processes based on declarative approaches. For example, in Declare any task of an ad-hoc process may be performed as long as

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