A Dataflow-Oriented Modeling Approach to Business Processes

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ABSTRACT

This paper presents a dataflow-oriented modeling approach (called DMA) targeted at business processes that operate on the entities forming an information system. The approach promotes the integration between business processes and information systems in that process models result from the interconnection of tasks and dataflow nodes. The latter denote flows of business entities of the same type and state. The entity types along with their relationships and attributes are shown in a companion information model. DMA leverages the dataflow to represent human decisions, which may concern 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. An example related to an order handling process illustrates the representation of human choices. DMA process models build on the artifact-oriented approach in that they combine the life cycles of the business entities involved. The life cycles can be separated and this facilitates the comparison with reference models. A major contribution of the paper is the presentation of the extraction algorithm which provides the separated life cycles.

KEYWORDS

Artifacts, Business Entities, Business Processes, Human Decisions, Life Cycles, Task Patterns, Tasks

INTRODUCTION

The purpose of this paper is to present a dataflow-oriented modeling approach (DMA) to the representation of business processes (BPs); DMA aims to overcome the limitations of the traditional activity-oriented perspective by leveraging the artifact-oriented approach introduced in recent years.

The emphasis of the activity-oriented perspective is put on the ordering of the units of work (tasks): when a task has been completed the control flow determines the next one to be performed. BPMN (Business Process Model and Notation) (OMG-BPMN, 2014) and UML Activity Diagrams (OMG-UML, 2015) are well known activity-oriented notations. In this perspective, the persons participating in the processes (referred to as participants) are mainly considered as resources needed to carry out tasks that are not automatable; human choices are limited and they are not explicitly represented in process models.

The artifact-oriented approach has shifted the focus to the business entities involved in the process; its roots can be found in past research on entity-based dynamic modeling (Sanz, 2011). The term artifact has been introduced to designate a concrete and self-describing chunk of information used to run a business (Nigam & Caswell, 2003). It encompasses both the informational aspects of an entity type and its life cycle consisting of states and transitions. 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).
However, the artifact-oriented approach does not pay more attention than the activity-oriented one to human tasks: the participants in the process continue to be considered as mere resources needed for tasks that are not automatable.

DMA considers both tasks and business entities as first-class citizens in BP models. The business entities form the dataflow that interconnects the tasks: tasks take the input entities from the input dataflow and deliver the output entities to the output dataflow. DMA promotes the integration between business processes and information systems: for this reason, the dataflow in process models is based on the entities of the underlying information systems, and process models are complemented by information models that show the types of the entities along with their relationships and attributes.

The notions of process instance and process variable, which are fundamental in the activity-oriented approach, are not needed in that all the information resides in the business entities. In this way, the difficulties that BPMN encounters when dealing with the selection of homogeneous entities to be processed in batches or with the many-to-many mapping between entities of different types, such as requisition orders and procurement orders, can be overcome. Such difficulties have been put in relation to the weakness of the notion of process instance (Sadiq, Orlowska, Sadiq & Schulz, 2005).

DMA leverages the dataflow to represent human decisions, which may concern 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. The ability of selecting the input entities is needed, for example, by an account manager who is in charge of producing a procurement order out of a number of requisition orders.

The dataflow in DMA shows the types of the entities involved in the process as well as their states; the states indicate the progress in their life cycles. DMA pays tribute to the artifact orientation in that not only the process models can be thought of as combinations of artifact life cycles but the life cycles can be separated by means of an extraction algorithm so they can be observed more easily and, therefore, the comparisons with reference life cycles are facilitated.

This paper is structured as follows. In the first part, it gives an overview of DMA with the help of a simple order-handling process, and illustrates the major features of tasks as well as the major task patterns. The second part of the paper addresses human decisions on the basis of an extended version of the order-handling process, and explains the extraction algorithm which provides the separated life cycles. Finally, the related work is discussed and the conclusion is presented.

OVERVIEW OF DMA

DMA integrates the notions of artifact and task: it is a dataflow language in that the activation of tasks depends on the availability of suitable input entities. On the contrary, in the activity-oriented approach, tasks are mainly activated on the basis of the completion events of the tasks previously performed.

DMA models are connected bipartite graphs made up of tasks and dataflow nodes. The symbols of tasks and nodes are the rectangle with rounded borders and the circle, respectively. Tasks and nodes are connected by means of oriented arcs: they establish input relationships from nodes to tasks and output relationships from tasks to nodes.

Nodes denote flows of business entities of the same type and state; their labels show the types and the states, separated by commas. The states indicate the progress of the entities in their life cycles.

If a node has two or more input tasks, it is a merge node; if it has two or more output tasks, it is a branch node. If a node has only one input task and only one output task, it may be absorbed in the arc connecting the source task to the destination one. This arc has the label of the included dataflow node and is called dataflow arc.

Tasks are divided into automatic tasks and human ones. The former are performed by services, and the latter are carried by the participants in the process. A human task is accompanied by a role denoting the participants entitled to perform it. The role is shown next to the task symbol.
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