A proposal of merging axioms between BPMN and DOLCE ontologies

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Abstract

In this paper we have proposed a set of merging axioms, in terms of Description Logics, between Business Process Modeling Notation(BPMN) ontology and Descriptive Ontology for Linguistic and Cognitive Engineering(DOLCE) ontology.

1 Introduction

The ontology `OntoBPMN.owl`[1] provides a clear semantic formalisation of the structural components of BPMN and the ontology `Dolce-Lite.owl`[2] is the first module of a Foundational Ontologies Library. In this paper we provide a textual description of the merging axioms between BPMN ontology and DOLCE ontology based on Description Logic.

Graphical Element is a part of the core component of `OntoBPMN.owl`. *graphical element* contains the main elements used to describe business processes, namely *flow object*, *connecting object*, *swimlane*, and *artifact*, then further specified in terms of sub-classes. On the other hand, the core component of `Dolce-Lite.owl` is *particular*, mainly devided in *endurant* and *perdurant*. *endurant* is devided in three classes *non-physical-endurant*, *physical-endurant* and *arbitrary-sum*. *Perdurant* is devided in two disjoint classes *event* and *stative*.

This is an important issue to specify the criteria for correct annotation in the development of business process. Semantic annotations can perform an early analysis of the correctly annotated process. So we need a set of statements, criteria for correct/incorrect annotation, that bridge the semantcs of BPMN and the semantics of the domain ontology. These criteria is represented here by inclusion `Merging Axioms`[3][2] between the concepts of an ontology formalizing BPD and the domain ontology.

2 The Merging Axioms

2.1 BPMN classes involved in the merging axioms

Class: DATA_OBJECT

Label: Data Object

Comments: A *data object* is considered as an *artifact* and they do not have any direct affect on the *sequence flow* or *message flow* of the *process*, but they do provide information about what the *process* does. *Data object* may imply an electronic document, they can be used to represent many different types of objects,

[1] Available for download at `dkm.fbk.eu/index.php/Resources`.

[2] Available for download at `loa-cnr.it/DOLCE.html`.

[3] Merging axioms state the correpondence between the domain ontology and the BPMN ontology. They formalise the criteria for correct/incorrect semantic annotations.

both electronic and physical[1].

AX_1 BPMN:DATA_OBJECT $\sqsubseteq$ DOLCE:ENDURANT

Class: CONNECTING_OBJECT

Label:Connecting Object

Comments: There are two ways of *connecting object*s in BPMN: a Flow, either sequence or message, and an association. For example, a *person* is an *endurant* can participate in a *discussion* which is *perdurant*. An *association* is used to associate information and *artifact*s with *flow object*s. Text and graphical non-flow objects can be associated with the *flow objects* and flow. An *association* is also used to show the activities used to compensate for an activity. A *message flow* is used to show the flow of messages between two entities that are prepared to send and receive them. A *sequence flow* is used to show the order that activities will be performed in a *process*.

AX_2 BPMN:CONNECTING_OBJECT $\sqsubseteq$ DOLCE:PERDURANT

Class: ACTIVITY

Label:Activity

Comments: An *activity* is a work that is performed within a business process. An *activity* can be atomic or non-atomic(compound). The types of activities that are a part of a Business Process Diagram are: *process, sub-process*, and *task*.

AX_3 BPMN:ACTIVITY $\sqsubseteq$ DOLCE:PROCESS

Class: EVENT

Label:Event

Comments: An *event* is something that happens during the course of a business process. These *event*s affect the flow of the *process* and usually have a cause or an impact. The term *event* is general enough to cover many things in a business process. The start of an activity, the end of an activity, the change of state of a document, a message that arrives, etc., all could be considered *event*s.

AX_4 BPMN:EVENT $\sqsubseteq$ DOLCE:EVENT

Class: SWIMLANE

Label: Swimlane

Comments: BPMN uses the concept known as *swimlanes* to help partition and/organize activities. It is possible that a BPMN diagram may depict more than one private process, as well as the processes that show the collaboration between private processes or participants. If so, then each private business process will be considered as being performed by different participants. Graphically, each participant will be partitioned; that is, will be contained within a rectangular box called a *pool*. *Pool*s can have sub-swimlanes that are called, simply, *lanes*. A *pool* or a *lane* is presenting specific agentive task of the business process model. For example, in several business processes a *pool* is annotated with *Customer* or *Receptionist* or *Manufacturer*.

That's why we tried to provide a merging axiom between *swimlane* and an agentive concept of DOLCE. DOLCE ontology has no concept like *agent* at all. However, there is an alignment between WordNet and DOLCE where an intermediate concept *agent* is used. Since in this alignment *agent* is made subclass of DOLCE *endurant*, we added the following merging axioms between BPMN concept *swimlane* and DOLCE concept *endurant*.

AX_5 BPMN:SWIMLANE $\sqsubseteq$ DOLCE:ENDURANT

2.2 BPMN classes not involved in the merging axioms

Class: GROUP

Label: Group

Comments: To annotate *group* with a concept of any domain ontology is not meaningful. Becasue the *group* object is an *artifact* that provides a visual mechanism to group elements of a diagram informally. The grouping is tied to the category supporting element(which is an attribute of all BPMN elements). That is, a *group* is a visual depiction of a single category. The graphical elements within the *group* will be assigned the category of the *group*. As an *artifact*, a *group* is not an activity or any *flow object*, and, therefore, cannot connect to *sequence flow* or *message flow*. In addition, *group*s are not constrained by restrictions of *pool*s and *lane*s. This means that a *group* can stretch across the boundaries of a *pool* to surround diagram elements, often to identify activities that exist within a distributed business-to-business transaction. *Group*s are often used to highlight certain sections of a diagram without adding additional constraints for performance, as a sub-process would. The highlighted(grouped) section of the diagram can be separated for reporting and analysis purposes. *Group*s do not affect the flow of the process.

Class: GATEWAY

Label: Gateway

Comments: *Gateway*s are modeling elements that are used to control how *sequence flow* interact as they converge and diverge within a *process*. If the flow does not need to be controlled, then a *gateway* is not needed. The term *gateway* implies that there is a gating mechanism that either allows or disallows passage through the *gateway* that is, as tokens arrive at a *gateway*, they can be merged together on input and/or split apart on output as the *gateway* mechanisms are invoked. To be more descriptive, a *gateway* is actually a collection of *gate*s. Although the *gate*s are not graphically depicted, the *gate*s are used by the *sequence flow* to connect to or from the *gateway*. In addition to this we can say that *gateway* is acting here as a decision maker, and sometimes we annotate *gateway* with some simple text which have no semantics at all. For this reason we keep *gateway* under not mapping to DOLCE.

Class: ANNOTATION

Label: Annotation

Comments: Text *annotation*s are a mechanism for a modeler to provide additional information for the reader of a BPMN Diagram. The text *annotation* object can be connected to a specific object on the Diagram with an Association. Since *annotations* are used to store the information about the annotation of BPMN concepts, it is very unlikely that *annotations* themselves get annotated. However, since this is not a DOLCE specific argumentation, we prefer not to add a BPMN-DOLCE mapping restriction to BPMN concept ANNOTATION.

References

[1] Business process modeling notation (bpmn) version 1.2. Technical report, January 2009.

[2] Chiara Di Francescomarino, Chiara Ghidini, Marco Rospocher, Luciano Serafini, and Paolo Tonella. Reasoning on semantically annotated processes. In *6th International Conference on Service Oriented Computing (ICSOC'08)*, volume Volume 5364/2008 of *LNCS*, pages 132–146, Sydney, Australia, 2008. Springer Berlin / Heidelberg.