Aligning the Elements of the RUP/UML Business Use-Case Model and the BPMN Business Process Diagram

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Abstract. *Context and Motivation*: The *Business Use Case Model* (*BUCM*) formalized in the *Rational Unified Process* (*RUP*) defines stereotypes of elements refining the UML *Use Case Model* for coarse-grained business processes modeling (BPM). The *Business Process Model and Notation* (*BPMN*) *Business Process Diagram* (*BPD*) is designed for workflow-based (i.e. fine-grained) BPM. These are frameworks that can possibly be complementary for enterprise modeling. *Question/Problem*: The semantically richer BPMN BPD can be used instead of UML activity diagrams for operational BPM when the BUCM is used for tactical BPM. *Principal ideas/results*: The common use of the BUCM and BPMN BPD requires anchoring of elements in between the frameworks to ensure traceability. Traceable models increase their overall consistency. *Contribution*: The paper allowed to set up traceability rules for the combined use of these frameworks.

Keywords: RUP/UML Business Use-Case Model · Business modeling · BPMN

1 Introduction

Within the *Rational Unified Process* (*RUP*) [3], the *Business Use-Case Model*[1] (*BUCM*) offers a syntax and semantic to represent business processes at tactical and strategic[2] levels. The BUCM is an extension of the *Unified Modeling Language* (*UML*) [8] UCM supported by RUP and many *Computer Aided Software Engineering* (*CASE*) tools. In RUP, operational workflows are represented with Activity Diagrams (AD) [8].

The RUP/UML BUCM and the *Business Process Modeling Notation* (*BPMN*) [1,7] *Business Process Diagram* (*BPD*) have in common that they are targeted to pure business process modeling so that they dispose of a rich set

[1] We do not refer here to the Use Case Model (UCM) as defined by the OMG in [8] but to the refinement proposed in the business modeling discipline from the RUP (see [3,6]).

[2] The only strategic elements within the BUCM are the business goal and objectives.

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of elements associated with precise semantics for this purpose. Even if they come from different semantic domains, some elements are semantically close enough that they can be used for anchoring (and traceability) among representation levels; this paper studies this.

Once correctly integrated, the BUCM allows to represent the strategic and tactical levels and BPMN BPD to represent the operational level of a business process set; traceability between knowledge representation levels is ensured. The conjunct use of these two frameworks is supported by CASE tools like *Visual Paradigm* [9] (e.g. [11]).

2 Related Work and Positioning

Process Maps (PM) are included in BPMN. A PM is a tactical level model (made of coarse-grained elements) but with limited expressiveness. PM are only constituted by a set of elements representing sets of business processes and the triggering actors represented as lanes. A PM is comparable to a classical use-case model. UML AD define a set of elements for operational level (workflow) modeling but the set of available elements is much poorer for pure business (enterprise) modeling than the ones of BPMN's BPD. AD are mostly oriented on representing software system behavior with user interaction.

[2] suggests to use BPMN BPD instead of UML activity diagrams in the RUP process. Their study showed that the perceived complexity of the BPMN BPD is lower than the one of the activity diagrams. The only guideline given in the paper is the use of one BPMN BPD to depict one particular use-case; no further traceability rules are given. We define anchoring points for traceability between the representation levels.

3 Research Method

We distinguish groups of elements both within the ones defined by the RUP/UML BUCM and BPMN BPD. As presented in Table 1, three categories of elements are distinguished within the RUP/UML BUCM on the basis of the study of the RUP knowledge base (see [4–6]). The business objective and goal have been left out because they are strategic elements and we focus here on the mapping of tactical elements to operational ones. Similarly, as presented in Table 2, four categories of elements are distinguished within the BPMN BPD on the basis of a study of [7].

We start from the categories established for the RUP/UML BUCM to evaluate the semantic mapping to BPMN BPD elements. We take each category of the RUP/UML BUCM and, within these categories, we firstly evaluate the relevance of each element for business process modeling. Once an element of a category is considered relevant, its possible alignment with elements of the BPMN BPD is overviewed on a pure semantic basis. Possible maps are identified and evaluated in practice before being adopted.

Table 1. RUP/UML business use case elements

Inheriting from Use Case (IUC)	Inheriting from the Actor (IA)	Links (UMLLink)
Use case	Business actor	Association
Use case realization	Business worker	Include
Business Use Case (BUC)	Business entity	Extend
BUC realization	Business event	Generalization or specialization

Table 2. Business process modeling notation elements

Events (Evt)	Activity (Act)	Gateway (Gwy)	Connections (Cnt)	Swimlanes and Artifacts (SwA)
Start event	Task	Exclusive	Sequence flow	Pool
Intermediate event	Sub-process	Event based	Message flow	Lane
End event	Transaction	Parallel	Association	Artifacts
	Call activity	Inclusive		Data objects
	Actor boundary	Exclusive event based		Group
		Complex		Annotation
		Parallel event based		

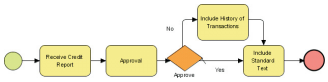
4 Studying the Alignment Between the RUP/UML BUCM's Elements and BPMN BPD's Ones

4.1 Elements of the Use Case Category

The four elements defined in IUC category are the *Use Case* (*UC*), *Business Use Case* (*BUC*), *Business Use Case Realization* (*BUC Realization*) and *Use Case Realization* (*UC Realization*). Only the BUC and BUC Realization are relevant in the context of general business process modeling since we do not want to describe behavior with respect to a potential system *to-be*. Following the RUP knowledge base, *a Business Use Case (instance) is a sequence of actions that a business performs that* ***yields an observable result of value*** *to a particular business actor*. The notion of sequence of actions explicitly refers to a notion of (business) process and to the (added) value it provides to a business actor (i.e. an actor outside the organization interacting with it). Let us further study the *BUC Realization* element; following the RUP knowledge base, *a Business Use-Case Realization describes* ***how*** *business workers, business entities, and*

business events collaborate ***to perform a particular business use case***. If we compare both elements, we notice that they refer to business processes but the BUC focuses on a *prescriptive* level – *WHAT is done to obtain value* – while the BUC Realization is on a *descriptive* level *HOW value is achieved*.

Alignment with BPMN BPD Element: Typically, a BPMN BPD represents the description of a business process and the alignment can then be envisaged with the BUC Realization. The latter is a coarse-grained element representing the business process while the BPMN BPD is a fine-grained representation of a process. As illustrated in Fig. 1, a BPMN BPD (as a whole) can thus be encapsulated in a BUC realization for fully documenting how value is achieved so that we dispose of a *tactical* representation – the BUC Realization – and an *operational* one – the BPMN BPD.



actor can thus be[3] a black box. The left part of Fig. 2 shows an example of how the organization and its identified business actor(s) is/are traced and modeled when interacting with the organization in a *Collaboration* context.

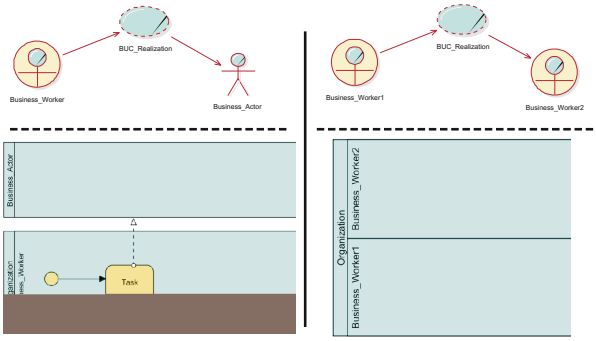


Fig. 2. Business actor interacting with the organization and business workers within it.

The Business Worker. The RUP knowledge base defines a business worker as *... a role or set of roles in the business. A business worker interacts with other business workers and manipulates business entities while participating in business use-case realizations.*

Alignment with BPMN BPD Element: Following [7], a Lane is *a partition that is used to organize and categorize activities within a Pool*; it then further argues that *Lanes are often used for such things as internal roles (e.g., Manager, Associate), systems (e.g., an enterprise application), or an internal department (e.g., shipping, finance)*. Similarly, [10] argues that lanes are *often assumed to represent internal business roles within a Process ....* Since the lane refers to internal roles, each business worker can be envisaged as a lane within the pool representing the modeled organization; this is the closest semantic map we were able to achieve with BPMN BPD elements. The right part of Fig. 2 shows an example of how the organization and its identified business worker(s) is/are traced and modeled within the organization.

The Business Entity. Following the RUP knowledge base, the business entity is *a piece of information that is manipulated by business actors and business workers*. Furthermore, *business entities represent an abstraction of important persistent information within the business. Stakeholders use business entities to*

[3] It depends if, from the point of view of the modeler's organization, the business actor is involved in a private or public workflow. Indeed, a process purely within the business actor's organization is private and not documented (this is known as *Collaboration*); a process where realization requires coordination is partially public because the information and objects needed to be exchanged should be documented (this is known as *Choreography*), see [7].

Generalization. The RUP knowledge base emphasizes that *A parent use case may be specialized into one or more child use cases that represent more specific forms of the parent. Neither parent nor child is necessarily abstract, although the parent in most cases is abstract. A child inherits all structure, behavior, and relationships of the parent. Children of the same parent are all specializations of the parent.*

Alignment with BPMN BPD Element: A generalization can take place both between elements of IA category or the IUC one in the RUP/UML BUCM. Between 2 elements of the IA category, it cannot be traced at the level of the BPMN BPD. When there is one between two elements of the IUC category and the parent is abstract, only a BPMN BPD is build for the realization of the child IUC category element. If it is not abstract, a BPMN BPD is also associated with the parent IUC category element.

5 Conclusion and Future Work

The BUCM (part of RUP) allows to model business processes at strategic and tactical levels. The operational level – which is represented using UML AD – however fails to furnish anchoring points to ensure traceability with the upper level. For integrated business process modeling – so to increase consistency between modeling levels by giving modeling guidelines – we have envisaged to use the BPMN BPD at operational level instead of UML AD. Even if we face different semantic domains, the RUP/UML BUCM and the BPMN BPD are both made for enterprise modeling; elements constituting the two frameworks have been easily aligned on the basis of their semantic. This allows to build a set of rules to ensure traceability between tactical and operational levels.

The mapping proposal will be further validated in the coming months. Validation will be performed longitudinally and cross-sectionally. Students of a master level project-based course will be made familiar with the traceability rules and apply them onto a real life case. The same case has already been solved by a cohort of former students, 3 years ago. These students were made aware of the importance of traceability, but were not given the specific rules presented in this paper. Students reports will be given a score in function of the (i) the quality of the application of traceability in particular (including the cohort not familiar with the developed rules), and (ii) on the general structural quality and completeness of the models produced. We will then compare the results of the 2 cohorts (without and with knowledge of the transformation rules). Across the cohorts, traceability scores will also be correlated to the general scores.

References

1. Chinosi, M., Trombetta, A.: BPMN: an introduction to the standard. Comput. Stan. Interfaces **34**(1), 124–134 (2012)
2. Herden, A., Farias, P.P.M., Albuquerque, A.B.: An approach based on BPMN to detail use cases. In: Elleithy, K., Sobh, T. (eds.) New Trends in Networking, Computing, E-learning, Systems Sciences, and Engineering, pp. 537–544. Springer, Cham (2015)

3. IBM: The Rational Unified Process, Version 7.0.1 (2007)
4. Johnston, S.: Ration®uml profile for business modeling. Technical report (2004)
5. Kruchten, P.: The rational unified process: an introduction. Longman/Addison-Wesley, Wokingham (2003)
6. Nailburg, E.J., Maksimchuk, R.A.: UML for Database Design, 1st edn. Addison-Wesley Longman Publishing Co., Inc., Boston (2001)
7. OMG: Business process model and notation (BPMN). Version 2.0.1. Technical report (2013)
8. OMG: OMG unified modeling language (OMG UML). Version 2.5. Technical report (2015)
9. Oscar, S.: Visual Paradigm for UML. International Book Market Service Limited, Beau-Bassin Rose-Hill (2013)
10. White, S.A., Miers, D.: BPMN Modeling and Reference Guide. Future Strategies Inc., Lighthouse Point (2008)
11. VisualParadigm: from use case to business process (2012). https://www.youtube.com/watch?v=jkIZuBZ876c