

A Visual Language for Modeling Multiple Perspectives of Business Process Compliance Rules (Extended Abstract)

David Knuplesch¹ und Manfred Reichert¹

Abstract: A fundamental challenge for enterprises is to ensure compliance of their business processes with imposed compliance rules stemming from various sources, e.g., corporate guidelines, best practices, standards, and laws. In general, a compliance rule may refer to multiple process perspectives including control flow, time, data, resources, and interactions with business partners. On one hand, compliance rules should be comprehensible for domain experts who must define, verify and apply them. On the other, these rules should have a precise semantics to avoid ambiguities and enable their automated processing. Providing a visual language is advantageous in this context as it allows hiding formal details and offering an intuitive way of modeling the compliance rules. However, existing visual languages for compliance rule modeling have focused on the control flow perspective so far, but lack proper support for the other process perspectives. To remedy this drawback, we introduce the extended Compliance Rule Graph language, which enables the visual modeling of compliance rules with the support of multiple perspectives. Overall, this language will foster the modeling and verification of compliance rules in practice.

The work summarized in this extended abstract has been published in [KR16]

Keywords: business process compliance, extended compliance rule graphs, business process modeling, smart processes

1 Motivation

During the last decades a variety of techniques for verifying the correctness of business process models were proposed. While early approaches focused on issues related to structural and behavioral model correctness (e.g., absence of deadlocks and livelocks) [vdA97], the semantic correctness of process models with respect to imposed compliance rules (i.e., business process compliance) has been subject to recent works [GMS06, LRD08, AWW09, Kn10]. Compliance rules constrain the execution order (i.e. control flow) of tasks and may originate, for example, from security constraints, domain-specific guidelines, corporate standards, and legal regulations. Besides the control flow perspective, other fundamental perspectives relevant in the context of business process compliance refer to time, data, and resources as well as the interactions a business process has with partner processes [CRRC10, Ra12, Kn13a].

¹ Ulm University, Institute of Database and Information Systems,
James-Franck-Ring, 89081 Ulm, Germany,
{david.knuplesch,manfred.reichert}@uni-ulm.de

2 Problem Statement and Contribution

In practice, compliance rules are represented in a rather verbose and ambiguous way. To enable the computer-based verification of business process compliance, i.e., to verify that a particular business process meets imposed compliance rules, subject matter experts and business analysts should provide unambiguous descriptions of compliance rules, which then can be translated into a machine-readable representation by IT experts. For the latter purpose, several approaches for the formal specification of compliance rules exist, e.g. applying linear temporal logics (LTL) [GK07] or using the formal contract language (FCL) [GS09]. As formal rule languages would be too intricate for subject matter experts and business analysts, rule patterns hiding formal details and providing informal explanations were suggested [DAC98, Tu12, Ra13]. Although few approaches exist that not only consider the control flow perspective, but also the data, time and resource perspectives, these approaches only support a pre-specified set of rule patterns.

Empirical studies show that business process modeling as well as compliance rule description languages, which both employ visual notations, offer advantages compared to purely text-based specifications [Ot12, HZ14]. Examples of visual notations for compliance rules include Compliance Rule Graphs [LRMD10], BPMN-Q [ADW08], and BPSL [LMX07]. Like visual process modeling languages, these approaches combine an intuitive notation with the advantages of a formal language. Existing visual compliance rule languages, however, lack a comprehensive support of the time, data, resource, and interaction perspectives of a business processes, which hinders their use in more sophisticated scenarios.

To remedy this drawback, we provide an approach for the visual modeling of compliance rules in [KR16] referring to these perspectives as well as to the interactions a business process may have with partner processes. In particular, we show how the various perspectives can be visually represented with the *extended Compliance Rule Graph* (eCRG) language. For this purpose, [KR16] introduces all elements of the eCRG language step-by-step and along various examples. We evaluate the expressiveness of the eCRG language based on well-known patterns and its application to a real-world healthcare scenario. Furthermore, understandability issues are considered in an empirical study that confirms that Management Scientists are able to understand eCRGs and that their eCRG understanding can reach a level not largely differing from the one of Computer Scientists. Finally, [KR16] presents two proof-of-concept prototypes, which support the modeling of eCRGs as well as their verification against process logs.

Altogether, the eCRG language allows domain experts to capture compliance requirements at both an abstract and a visual level, while enabling the specification of verifiable compliance rules that consider the various perspectives.

Note that [KR16] significantly extends previous work, which introduced fundamentals of the eCRG language [Kn13b, SKR14]. In addition to these preliminary works, [KR16] provides the first detailed presentation of the eCRG elements and an empirical study on the understandability of the eCRG language. Furthermore, [KR16] introduces a proof-of-concept prototype, which comprises a modeling environment, as well as an eCRG com-

pliance checker verifying the compliance of given process execution logs with a set of eCRGs, and provides a more profound discussion of related work.

3 Outlook

Our overall aim is to ensure multi-perspective compliance for all phases of the process life cycle. Hence, there is ongoing work applying the *extended Compliance Rule Graph* (eCRG) language for runtime compliance monitoring [KRK15] as well as for compliance checking in the context of process changes [Kn15]. Furthermore, we plan to compare the eCRG language with pattern- and logic-based approaches in another empirical study.

Literatur

- [ADW08] Awad, Ahmed; Decker, Gero; Weske, Mathias: Efficient Compliance Checking Using BPMN-Q and Temporal Logic. In: BPM'08. Jgg. 5240 in LNCS. Springer, S. 326–341, 2008.
- [AWW09] Awad, Ahmed; Weidlich, Matthias; Weske, Mathias: Specification, Verification and Explanation of Violation for Data Aware Compliance Rules. In: ICSOC'09. Jgg. 5900 in LNCS. Springer, S. 500–515, 2009.
- [CRRC10] Cabanillas, Cristina; Resinas, Manuel; Ruiz-Cortés, Antonio: Hints on how to face business process compliance. In: JISBD'10. S. 26–32, 2010.
- [DAC98] Dwyer, Matthew B.; Avrunin, George S.; Corbett, James C.: Property Specification Patterns for Finite-state Verification. In: FMSP'98. ACM, S. 7–15, 1998.
- [GK07] Ghose, A. K.; Koliadis, G.: Auditing Business Process Compliance. In: ICSOC'07. Jgg. 4749 in LNCS. Springer, S. 169–180, 2007.
- [GMS06] Governatori, G.; Milosevic, Z.; Sadiq, S.: Compliance checking between business processes and business contracts. In: EDOC'06. IEEE, S. 221–232, 2006.
- [GS09] Governatori, Guido; Sadiq, Shazia: The Journey to Business Process Compliance. In: Handbook of Research on BPM, S. 426–454. IGI Global, 2009.
- [HZ14] Haisjackl, Cornelia; Zugal, Stefan: Investigating Differences between Graphical and Textual Declarative Process Models. In: CAiSE'14 Workshops, Jgg. 178 in LNBIP, S. 194–206. Springer, 2014.
- [Kn10] Knuplesch, D.; Ly, Lin T.; Rinderle-Ma, S.; Pfeifer, H.; Dadam, P.: On Enabling data-aware Compliance Checking of Business Process Models. In: ER'2010. Jgg. 6412 in LNCS. Springer, S. 332–346, 2010.
- [Kn13a] Knuplesch, D.; Reichert, M.; Mangler, J.; Rinderle-Ma, S.; Fdhila, W.: Towards Compliance of Cross-Organizational Processes and their Changes. In: BPM'12 Workshops. Jgg. 132 in LNBIP. Springer, S. 649–661, 2013.
- [Kn13b] Knuplesch, David; Reichert, Manfred; Ly, Linh Thao; Kumar, Akhil; Rinderle-Ma, Stefanie: Visual modeling of business process compliance rules with the support of multiple perspectives. In: ER'2013. Jgg. 8217 in LNCS. Springer, S. 106–120, 2013.

-
- [Kn15] Knuplesch, David; Fdhila, Walid; Reichert, Manfred; Rinderle-Ma, Stefanie: Detecting the Effects of Changes on the Compliance of Cross-organizational Business Processes. In: ER'15. Jgg. 9381 in LNCS. Springer, S. 94–107, 2015.
- [KR16] Knuplesch, David; Reichert, Manfred: A visual language for modeling multiple perspectives of business process compliance rules. *Software & Systems Modeling*, S. (Online), 2016.
- [KRK15] Knuplesch, David; Reichert, Manfred; Kumar, Akhil: Visually Monitoring Multiple Perspectives of Business Process Compliance. In: BPM'15. Jgg. 9253 in LNCS. Springer, S. 263–279, 2015.
- [LMX07] Liu, Y.; Müller, S.; Xu, K.: A static compliance-checking framework for business process models. *IBM Systems Journal*, 46(2):335–261, 2007.
- [LRD08] Ly, Linh Thao; Rinderle, Stefanie; Dadam, Peter: Integration and verification of semantic constraints in adaptive process management systems. *Data & Knowledge Engineering*, 64(1):3–23, 2008.
- [LRMD10] Ly, Linh Thao; Rinderle-Ma, Stefanie; Dadam, Peter: Design and Verification of Instantiable Compliance Rule Graphs in process-aware Information Systems. In: CAiSE'10. Jgg. 6051 in LNCS. Springer, S. 9–23, 2010.
- [Ot12] Ottensooser, Avner; Fekete, Alan; Reijers, Hajo A.; Mendling, Jan; Menictas, Con: Making sense of business process descriptions: An experimental comparison of graphical and textual notations. *Journal of Systems and Software*, 85(3):596–606, 2012.
- [Ra12] Ramezani, Elham; Fahland, Dirk; van der Werf, Jan Martijn; Mattheis, Peter: Separating compliance management and business process management. In: BPM'11 Workshops. Jgg. 100 in LNBIP. Springer, S. 459–464, 2012.
- [Ra13] Ramezani Taghiabadi, Elham; Fahland, Dirk; van Dongen, Boudewijn F.; van der Aalst, Wil M. P.: Diagnostic Information for Compliance Checking of Temporal Compliance Requirements. In: CAiSE'13. Jgg. 7908 in LNCS. Springer, S. 304–320, 2013.
- [SKR14] Semmelrodt, Franziska; Knuplesch, David; Reichert, Manfred: Modeling the Resource Perspective of Business Process Compliance Rules with the Extended Compliance Rule Graph. In: BPMDS'14. Jgg. 175 in LNBIP. Springer, S. 48–63, 2014.
- [Tu12] Turetken, Oktay; Elgammal, Amal; van den Heuvel, Willem-Jan; Papazoglou, Mike: Capturing Compliance Requirements: A Pattern-Based Approach. *IEEE Software*, S. 29–36, 2012.
- [vdA97] van der Aalst, Wil M. P.: Verification of Workflow Nets. In: ICATPN'97. Jgg. 1248 in LNCS. Springer, S. 407–426, 1997.