ISBN: 978-80-245-2125-1

DOI: 10.18267/pr.2015.pav.2125.2

COMPARISON OF COMPLIANCE REQUIREMENTS FORMALIZATION APPROACHES

DOI: 10.18267/pr.2015.pav.2125.2

Ing. Ivana ŠABATOVÁ

University of Economics in Prague

Faculty of Informatics and Statistics, Department of Systems Analysis

sabi@sabi.cz

ABSTRACT

Compliance with regulatory requirements is a crucial task for contemporary organizations operating in highly regulated and dynamically changing environments. Regulatory compliance achievement and assurance represent work intensive and expensive exercises. Therefore already a few endeavors to develop methodologies and deploy recent technologies to enable their automation have been initiated. In the most cases compliance management relates to business processes that have to conform to a set of certain quality, performance, security and other types of requirements. If we want to automate particular business process and at the same time to automate the compliance enforcement measures as well as the compliance assurance procedures, first of all we have to formulate the regulatory compliance requirements using modeling language that can be easily transformed to machine readable expressions. The measures for compliance achievement and assurance called controls are derived from risk analysis of threads of the non-compliance of particular business process, i.e. non-conformity with established control goals. Controls can be realized in the form of control processes; in simple cases control can be realized by single activity which is then called control activity. The business process enhanced with control process that is acknowledged as compliant with respective requirement is called ideal process. This paper focuses on comparison of two different possible approaches to model compliance requirements on business processes based on literature search and on experience resulting from compliance management systems' design and verification. It brings the reasoning why formulation of set of constrains is preferable to set of compliant ideal process sequences limitation for this purpose.

KEY WORDS

Compliance Algorithm, Business Process Management, Business Rules Management, Control Process, Ideal Process, Compliance Management System, Busness Process Model and Notation (BPMN), Business Process Execution Language (BPEL), Petri net, Finite State Machine, Property Specification Language (PSL).

INTRODUCTION

The approach to compliance algorithm definition published in Journal of System Integration (Šabatová, 2015) uses combination of Business Process Model and Notation (BPMN) introduced by Object Management Group (OMG, 2013), for business process modelling and a set of constraints representing the respective regulatory compliance policy modelled using Property Specification Language (Accellera, 2004). This methodology was applied following discussions with logical modelling experts, literature search as well as based on validation proving its applicability and viability. Nevertheless the reasoning for this decision seemed to me not sufficiently convincing and therefore I searched for experience with other possible regulatory requirements formalization methods. Also, my later deeper experience with Business Process Management Systems' implementations brought me to new ideas and aspects to be explored.

ISBN: 978-80-245-2125-1

DOI: 10.18267/pr.2015.pav.2125.2

The original idea to use PSL language for compliance policy definition came from Sinclaire (Sinclair et al., 2009). Some experts recommended definition of a set of ideal process sequences that will be confirmed as compliant by an auditor. Then all the business process instances conforming to any of these "allowed" sequences will be acknowledged as compliant instances. Petri nets seemed to provide an efficient mathematical apparatus to be applicable for this purpose.

We are facing the problem how to formulate something, what is "well understood" in human language and often depends on certain experience and specific knowledge of the domain expert and/or auditor in an exact computable form. This is a common issue that I always meet during Business Rules Management Systems (BRMS) implementations.

ALGORITHMICAL APPROACHES TO BP DESIGN

What is the best approach to business process design? This question was explored already in 2000 and the results were published by two Austrian researchers in 2001 (Hofacker, Vetschera, 2001). Their work was motivated by disputable and not convincing results of vast application of Business Process Reengineering methods in later 90's. They critically examined various algorithmical approaches to business process modelling and analyzing. First of all they studied Petri nets and their various modifications like Management Petri Nets (MPN). They identified their high potential in analysis of certain process characteristics; but they missed capability for process optimization in them.

Another approach studied by Hofacker and Vetschera was "resource-constrained project scheduling problem" (RCPSP) methodology. Application of project optimization methods for process optimization seemed to be an effective way; however they identified important deficiencies in it. First of all the complexity of activities sequence flow is much higher in processes than in projects. When sub-processes are present, the task becomes even more complex.

Third approach studied the genetic algorithms and their application to optimization problems in scheduling. This modelling framework allows parallel possible solutions i.e. high level of flexibility that is perceived to be an advantage. Genetic models were originally developed to formalize the genetic evolution including mutations.

The second part of their paper presents results of comparison of mathematical programming and branch and bound methods. They undertook a set of preliminary tests to verify the hypothesis, that there is a difference between times of computation of identical process optimization problems using different process models, which wasn't verified even with very complex and extensive processes. For me the most interesting finding in their work is the test of feasibility used for process model comprehensiveness verification.

In relation to my own research this work was inspiring, but doesn't give full answer to the original question: would Petri nets be ideal method for ideal business process modelling with regards to future usage for compliance assurance automation? The feasibility tests imply that it is not viable direction, as described further in this paper in the chapter "Set of sequences vs. set of constraints".

BPEL AND PSL FOR COMPLIANCE ANALYSIS

Even if I haven't found sufficient answer to my initial question whether the Petri nets or another similar method could formally describe a set of approved ideal process sequences, I discovered another interesting paper that supports my heuristic approach to compliance algorithm design (Šabatová, 2011b, 2015). That paper was published in IBM Systems Journal in 2007 (Liu et al., 2007) and introduces a comprehensive methodology for compliance checking for business process models. The authors use different terminology and already obsolete notations than newer resources, especially the documents introducing "Protection and Assessment Model" (Julisch et al., 2010, 2011), but they are much more factual and closer to my own findings. The philosophy and procedures are very much similar to the concept that I developed and verified.

ISBN: 978-80-245-2125-1

DOI: 10.18267/pr.2015.pav.2125.2

The authors (Liu et al., 2007) strictly segregate the business process model and the compliance rules model. To be able to compare the process instance record against the respective compliance rule, they transform the models as depicted in the figure 1. In spite of my concept they use Business Process Execution Language (BPEL) for business process topology modelling introduced e.g. by Juřič et al. (Juřič et al., 2006), which was widely replaced by using BPMN notation (OMG, 2013) during last few years resp. since the time of publication. From this point of view the introduced framework became obsolete very quickly. Also the π-calculus tool for understandable business process flow visualization is replaced by BPMN. Using latest BPMS platforms allows significant simplification in compare to Liu et al. (Liu et al., 2007). Thanks to information model related to the process topology in BPMN we don't need Finite State Machine for process instance modelling. The business object and its attributes' values records including process instance detailed parameters allow assessment against variety of constraints formulated in PSL language, or, in the nearest future, in an integrated Business Rules Management System.

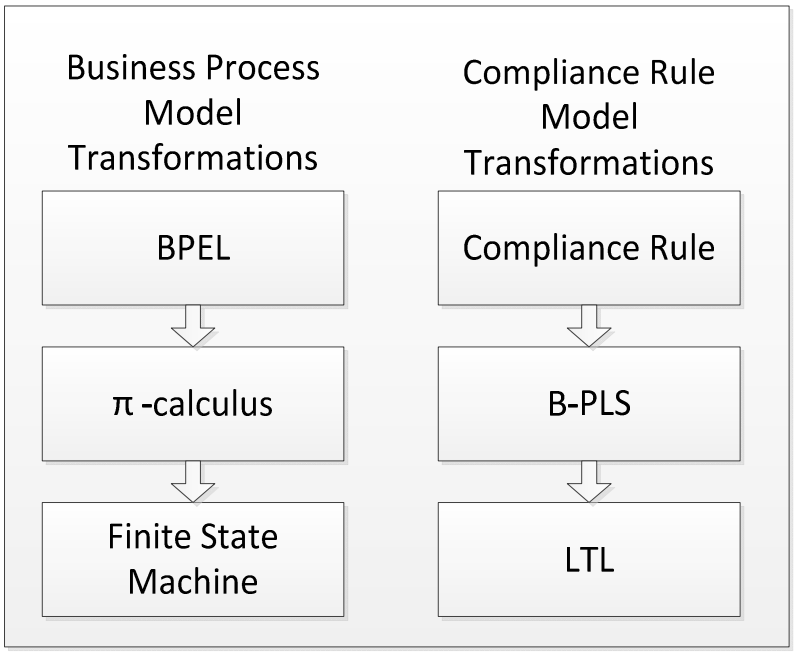

Figure 1: Transformations of Business Process Model and Compliance Rule Model.
Source: Author based on (Liu et al, 2007)

ALL POSSIBLE BP SEQUENCES IDENTIFICATION

Let's return to the question whether all possible business process sequences can be identified. It is possible in simple business processes, cycle-less and without any sub-processes instantiated repeatedly and without activities triggered by an event or by business rule expression evaluation. Savvion BPM system provides process analysts and designers with a patented technology called 360 degree view on a process invented by Jambor-Sadeghi (Jambor-Sadeghi, 2015). The construction of such view is assumed in figure 2; the center of this "dartboard" schema represents the first activity after triggering the process, then the second annulus one or more following activities and so on to the most outer annuluses that represent all the possible ends of this particular business process. The depicted process of DVD production comes from Progress Software document (Progress Software, 2011).

Even if this algorithm is a real advance in BP analysis, it neither resolves the problems of cyclic activities and sub-processes nor the cases of by event and/or rule repeatedly triggered activities. Each correctly run process instance has a finite number of sequenced activities. The issue is that in a complex process we never know in advance how many activities will be performed in a particular instance, because the

ISBN: 978-80-245-2125-1

DOI: 10.18267/pr.2015.pav.2125.2

environment is dynamic a and the conditions ruling the course of the process instance are changing even during it starts. In the patent description (Jambor-Sadeghi, 2015) the inventor describes his approach to visualize recurring activity, however the 360 degree view can only display activity iterations encapsulated in single angular sector and it can't display activities and/or sequences triggered by events or rules. This fact represents a substantial limitation preventing usage of this „dartboard" for ideal process modelling for real world complex business processes.

Figure 2: 360 degree view of Business Process Model in an angular graph created by Savvion BPMS. Source: Progress Software Corporation (2011)

SET OF SEQUENCES VS. SET OF CONSTRAINTS

None of the considered business process topology models e.g. BPEL, BPMN, Petri nets, Finite State Machine etc. resolves the issue with iterated activities and by event/rule triggered activities or process sequences. Therefore ideal process modelling using such apparatuses can be used exclusively for simple business processes where iterated and/or by event triggered elements/sequences not occur. For real world complex processes we can't identify the finite set of possible process flow sequences to be able to acknowledge a subset of them as compliant to particular regulatory requirement. This restriction implies that the identification and formulation of set of constraints is better approach to compliance assessment because it is generally applicable.

CONCLUSIONS

The findings from presented resources search, expert discussions and considerations didn't convince me that the definition of ideal process by set of acknowledged sequences could be generally applicable. I haven't found any methodology that would resolve the problem described in the previous chapter. On the contrary the study of static compliance checking framework (Liu et al., 2007) supports my approach

ISBN: 978-80-245-2125-1

DOI: 10.18267/pr.2015.pav.2125.2

to design compliance algorithms in dynamic service oriented environment using modelling the processes in BPMN (OMG, 2013) and modelling the compliance assessment policy using PSL (Accelera, 2004). Detailed description of compliance algorithm modeling methodology was published in Journal of System Integration (Šabatová, 2015). This methodology guides the compliance analyst through the entire procedure beginning with identification of the relevant control objectives, following with risk analysis, design of control processes to the formulation of compliance assessment policy.

ACKNOWLEDGEMENTS

The motivation for research done and presented in this paper resulted from my work and experience in MASTER FP7-216917 the research and development project financed by the European Commission's Seventh Framework Programme.

REFERENCES

Accellera (2004). Property Specification Language Reference Manual Version 1.1. URL: http://www.eda.org/vfv/docs/PSL-v1.1.pdf

Hofacker I., Vetchera R. (2001). Algorithmical approaches to business process design. Computers and Operations Research 28, pages 1253-1275.

Jambor-Sadeghi K. (2015). Software with Improved View of Business Process. US Patent: US 2015000623 A1. URL: http://www.google.as/patents/US20150006238?cl=en

Julisch K., Miseldine P., Lim H.W., Bielova N., Neuhaus S., Refsdal A., Presenza D., Gallego-Nicasio Crespo B.. Kearney P. (2010). D2.1.2 Protection and Assessment Model for Multiple Trust Domain. Official public deliverable of MASTER FP7-216917.

Julisch K., Miseldine F., Lim H.W., Bielova N., Neuhaus S., Refsdal A., Presenza D., Gallego-Nicasio Crespo B., Kearney P., Sinclair D., Neisse R. (2011). D2.1.3: The MASTER Final Protection and Assessment Model. Official public deliverable of MASTER FP7-216917.

Jurič M.B., Mathew Benny, Sarang P. (2006). Business Process Execution Language for Web Services. Packt Publishing Ltd. ISBN 1-904811-81-7.

Liu A.Y., Müller S., Xu K. (2007),: A Static Compliance Checking Framework for Business Process Models. IBM Systems Journal Volume 46, No.2.

OMG (2013). Business Process Model and Notation (BPMN) Version 2.0.2. OMG Document Number: dtc/2009-08-14. URL: http://www.omg.org/spec/BPMN/2.0

Progress Software Corporation (2011). Business Process Analysis with Progress® Savvion Business Manager™. Progress Software document Rev. 07/11 | 6525-129663.

Šabatová I. (2011). Kontinuální řízení shody v servisně orientovaných systémech. Sborník prací účastníků vědeckého semináře doktorského studia 17. února 2011. Vysoká škola ekonomická, Fakulta informatiky a statistiky. Nakladatelství Oeconomia, 2011. ISBN 978-80-245-1761-2

Šabatová I. (2015). Building Assurance of Regulatory Compliance in Dynamic Service Oriented Systems. Journal of Systems Integration Vol 6, No 2. ISSN: 1804-2724.

Sinclair D., Neuhaus S., Gallego-Nicasio-Crespo B. (2009). D3.3.1: Specification of PRM property language and semantic model for verification and validation. Official deliverable of MASTER FP7-216917.