12-12-2021

What Benefits Can Subject-Oriented Process Modeling Bring to the Design of Big Data Applications?

Udo Kannengiesser

Matthes Elstermann

What Benefits Can Subject-Oriented Process Modeling Bring to the Design of Big Data Applications?

Udo Kannengiesser
Institute of Business Informatics – Communications Engineering, Johannes Kepler University Linz
Altenberger Str. 69, 4040 Linz, Austria
udo.kannengiesser@jku.at

Matthes Elstermann
Institute for Information Management in Engineering, Karlsruhe Institute of Technology
Zirkel 2, 76131 Karlsruhe, Germany
matthes.elstermann@kit.edu

Abstract

Big data applications usually entail the development of complex IT-systems that collect, combine, analyze, communicate and use large amounts of data from different sources. The interactions between system components can be difficult to understand and describe, due to their large number, heterogeneity, and concurrency (e.g. continuous and discrete processes, or different technologies, may interact). In addition, system changes may occur as a result of new requirements or constraints during the lifecycle of any data processing system.

In the system design process, multiple stakeholders need to collaborate and align their individual views of the system, e.g. sensor specialists, hardware designers, IT integrators, operational departments, etc. This alone can be a challenge because different domain experts often have different concerns and use different terminologies and abstraction concepts. Only few of these experts have a system design or modeling background, which can make the elicitation and capture of system knowledge difficult and error-prone.

Our research is concerned with the subject-oriented approach to process modeling (S-BPM) (Fleischmann et al. 2012). We argue that it can address the various design challenges arising from the high complexity of big data systems. It has four foundational characteristics that distinguish it from other approaches (Kannengiesser 2017), Figure 1: 1. notational simplicity, 2. widely-shared, intuitive semantics, 3. encapsulation and 4. seamless integration.

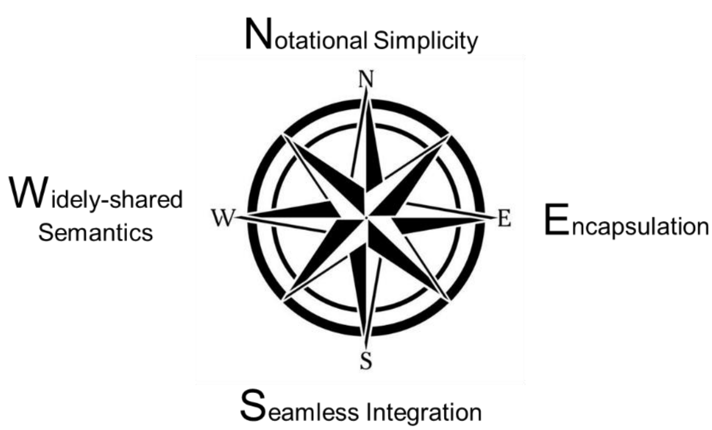

Figure 1. Four key characteristics of S-BPM as a basis for modeling complex systems (adapted from Kannengiesser (2017))

Notational simplicity and widely-shared semantics are provided by the basic building blocks of S-BPM, oriented towards a first-person perspective: *Do* states ("What tasks do I perform"), *Send* states ("What outputs do I provide to others") and *Receive* states ("What inputs do I need from others"). These states can be connected to form the behavior model for a distinct piece of functionality (e.g. of a system component). The simplicity and intuitive semantics allow any domain experts to model their individual views of (sub-)system behavior after only a few minutes of training in the S-BPM approach (Moser et al. 2022).

Encapsulation is realized by the loose coupling of different active entities (called "subjects") via messages. Messages can be seen as data objects connecting the corresponding inputs and outputs of different subjects, and can be exchanged synchronously or asynchronously, as needed. Such a loose coupling supports modularity and thus higher changeability of the system (Kannengiesser et al. 2015). Furthermore, it allows the modeling of different modules to occur largely independently of each other, resulting in parallel ways of working in system design. In a recent experimental study by Moattar et al. (2022), efficiency gains of around 40% on average were observed compared to traditional modeling approaches.

Seamless integration is achieved by the formal execution semantics (based on abstract state machines) underpinning the S-BPM notation (Fleischmann et al. 2012). This means that models can be directly transformed into an executable workflow or control program, corresponding to rapid prototyping of system models. Iterative and incremental modeling strategies therefore become possible, so that feedback can be provided for early validation of modeling decisions.

S-BPM has been applied commercially across a wide range of industries, including automotive, manufacturing, telecommunication and insurance industries (Fleischmann et al. 2015; Fleischmann et al. 2020; Moser et al. 2022; Neubauer and Stary 2017). Our current research focuses on using S-BPM as a modeling approach for cyber-physical production systems, data mining, and service prototyping.

Keywords: S-BPM, Process modeling, Big data, Complex systems

References

Fleischmann, A., Oppl, S., Schmidt, W., and Stary, C. 2020. *Contextual Process Digitalization: Changing Perspectives – Design Thinking – Value-Led Design*, Cham: Springer Nature.

Fleischmann, A., Schmidt, W., and Stary, C. 2015. *S-BPM in the Wild: Practical Value Creation*, Cham: Springer.

Fleischmann, A., Schmidt, W., Stary, C., Obermeier, S., and Börger, E. 2012. *Subject-Oriented Business Process Management*, Berlin Heidelberg: Springer.

Kannengiesser, U. 2017. "The future: Obstacles and opportunities," in *S-BPM in the Production Industry: A Stakeholder Approach*, M. Neubauer, and C. Stary (eds.), Cham: Springer Nature, pp. 209-230.

Kannengiesser, U., Neubauer, M., and Heininger, R. 2015. "Subject-Oriented BPM as the Glue for Integrating Enterprise Processes in Smart Factories," in *On the Move to Meaningful Internet Systems: OTM 2015 Workshops*, I. Ciuciu et al. (eds.), Cham: Springer, pp. 77-86.

Moattar, H., Bandara, W., Kannengiesser, U., and Rosemann, M. 2022. "Control Flow versus Communication: Comparing Two Approaches to Process Modelling," *Business Process Management Journal*.

Moser, C., Kannengiesser, U., and Elstermann, M. 2022. "Examining the PASS Approach to Process Modelling for Digitalised Manufacturing: Results from Three Industry Case Studies," *Enterprise Modelling and Information Systems Architectures* (17:1).

Neubauer, M., and Stary, C. (eds.) 2017. *S-BPM in the Production Industry: A Stakeholder Approach*, Cham: Springer Nature.