

# Developing and Evolving a DSL-based Approach for Runtime Monitoring of Systems of Systems

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**Abstract:** This is a summary of an article [Ra18] published in the Automated Software Engineering Journal in 2018 describing our experiences in developing and evolving a domain-specific language-based approach for runtime monitoring of systems of systems.

**Keywords:** Systems of systems; Requirements monitoring; Domain-specific languages; DSL evolution

## 1 Summary

Monitoring is needed to detect deviations from requirements in the context of complex software-intensive systems such as systems of systems [Ni15], because their behavior is only fully understandable during operation, when heterogeneous systems interact with each other and their environment. While many monitoring approaches exist [Ra17], they typically do not support dynamically defining and deploying diverse checks across multiple systems. In our article [Ra18], we report on our experiences of developing, applying, and evolving a domain-specific language (DSL)-based approach for monitoring a system of systems in the domain of industrial automation software. Specifically, we first developed a tool-supported approach to dynamically define and check constraints in systems of systems at runtime and later evolved this approach driven by requirements elicited in an industry collaboration project. In the article we describe how we evaluated the expressiveness and scalability of our DSL-based approach using an industrial system of systems and report the lessons we learned. For instance, while developing a DSL-based approach is a good solution to support industrial users, one must prepare the approach for evolution, e.g., support automated (re-)generation of tools and code after changes and automated testing.

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## References

- [Ni15] Nielsen, Claus Ballegaard; Larsen, Peter Gorm; Fitzgerald, John; Woodcock, Jim; Peleska, Jan: Systems of Systems Engineering: Basic Concepts, Model-Based Techniques, and Research Directions. *ACM Computing Surveys*, 48(2):18:1–18:41, 2015.
- [Ra17] Rabiser, Rick; Guinea, Sam; Vierhauser, Michael; Baresi, Luciano; Grünbacher, Paul: A Comparison Framework for Runtime Monitoring Approaches. *Journal of Systems and Software*, 125:309–321, 2017.
- [Ra18] Rabiser, Rick; Thanhofer-Pilisch, Jürgen; Vierhauser, Michael; Grünbacher, Paul; Egyed, Alexander: Developing and evolving a DSL-based approach for runtime monitoring of systems of systems. *Automated Software Engineering*, 25(4):875–915, 2018.